Flowering native weeds for the conservation of wild pollinators in agroecosystems

by

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FLOWERING NATIVE WEEDS FOR THE CONSERVATION OF WILD POLLINATORS IN AGROECOSYSTEMS

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Summary

Concerns about a global decline in pollinators have called for more knowledge about the drivers of wild pollinator abundance and diversity in agroecosystems. Agricultural intensification has been identified as the main cause of this "global pollinator crisis", particularly, due to reductions in natural areas holding critical floral and nesting resources. Maintaining flowering weeds in agricultural field margins is often recommended as a cost-effective and efficient method of offering natural or semi-natural habitats for wild pollinator conservation.

In this study, the role of flowering weeds in supporting wild bees and other flower visiting insects in Mediterranean cereal agroecosystems was investigated. This research involved a three-year, multi-farm study (Part A) which compared field margin characteristics, including the functional constitution of their floral communities, with wild bee community composition and functional structure, from sites with landscapes of varying agricultural intensity in Catalonia, Spain. The aim of this work was to investigate the value of field margins in differing landscapes and determine which biotic and abiotic margin characteristics, and which functional attributes of margin plant communities, were important for sustaining wild bee abundance and diversity. This work also involved a two-year field trial (Part B) to compare five native flowering weed species common in Catalan cereal agroecosystems: *Convolvulus arvensis*, *Daucus carota*, *Malva sylvestris*, *Papaver rhoeas* and *Sonchus oleraceus*. The goal was to compare the attractiveness of these species to different flower visiting insect groups, assess their value in supporting wild pollinators and analyze relationships between particular floral characteristics and insect visitation rates.

Overall, more than 4000 bees were collected and identified to genus and a database was compiled listing the morpho-physiological features and behaviours of the observed genera. A large database was also compiled of all the flowering plant species observed in Part A, documenting the trait values relevant for this work. In Part A, generalized linear models indicated a strong inverse relationship between surrounding landscape diversity and wild bee abundance. The proportion of Halictidae bees (common generalists) increased with decreasing landscape complexity. Floral richness exhibited a positive association with number of foraging bees and morphospecies richness, and was positively correlated with the proportion of shrubs and trees represented in the margins. It was observed that wider margins held a higher proportion of perennial plants and a lower proportion of Halictidae bees. The functional attributes of margin plant communities that were observed to promote wild bee community robustness included: high nectar availability, diversity in flower colour, diversity in flower morphology and diversity in vegetation height. In Part B, the most visited species were *P. rhoeas* and *D. carota* (more visits to *P. rhoeas* in 2015 and more visits to *D. carota* in 2016), followed by mixed plots, *M. sylvestris*, *C. arvensis* and *S. oleraceus.* The influence of the specific floral traits of the studied species on visitation rates, calculated using general linear models, varied depending on the insect group.

This study suggests that field margins are more crucial in intensively farmed areas than in heterogeneous landscapes where foraging resources are more abundant. Maintaining wide

margins with high flowering plant richness, comprising perennial and shrub species, best supports a dense and diverse bee community. If necessary, it is recommended that margins be sown with native perennial flowers, with differing and overlapping flowering periods, high in nectar and pollen, with a diverse assortment of colours, shapes and plant heights, and that they be managed so that a diversity of nesting features are offered. Based on their overall attractiveness to flower visiting insects, in addition to other positive attributes, *P. rhoeas, D. carota* and *M. sylvestris* could contribute to the sustainability of agroecosystems.

Resumen

La creciente preocupación sobre la disminución global de polinizadores exige un mayor conocimiento de los factores que influyen sobre la abundancia y diversidad de polinizadores en los agroecosistemas. La intensificación agrícola ha sido identificada como la causa principal de esta "crisis global de polinizadores", particularmente, debido a la reducción de las áreas naturales con recursos florales y de nidificación. El mantenimiento de "malas" hierbas con flores en los márgenes de los campos agrícolas se ha recomendado como un método rentable y eficiente de ofrecer hábitats naturales para la conservación de polinizadores silvestres.

En este trabajo se ha estudiado el papel que pueden tener las "malas" hierbas con flores en el apoyo de las abejas silvestres y otros polinizadores en agroecosistemas de cereales mediterráneos. Por un lado, se ha realizado un estudio de tres años (Parte A) consistente en comparar las características de márgenes de campos de cereales en Cataluña, incluida la caracterización funcional de la comunidad floral, con la composición y estructura funcional de la comunidad de abejas. El objetivo de este trabajo fue determinar las características y atributos funcionales del margen qué respaldan mejor el mantenimiento de la comunidad de abejas silvestres en diferentes paisajes. Por otro lado, también se realizó una prueba de campo de dos años (Parte B) para comparar cinco especies nativas consideradas malas hierbas, con flores, comunes en los agroecosistemas de cereales de Cataluña: *Convolvulus arvensis*, *Daucus carota*, *Malva sylvestris*, *Papaver rhoeas* y *Sonchus oleraceus*. El objetivo fue comparar el atractivo de estas especies para diferentes grupos de insectos, evaluando sus valores para mantener a los polinizadores silvestres, y analizando las relaciones entre sus características florales y las visitas de estos insectos.

En total se recolectaron más de 4.000 abejas. Éstas se identificaron a nivel de género y se compiló una base de datos que enumera las características de los géneros observados. Además, se compiló una base de datos de todas las especies de plantas con flores observadas, cuantificando los rasgos relevantes para este trabajo. En la Parte A, los modelos lineales generalizados indicaron una fuerte relación inversa entre la diversidad del paisaje circundante y la abundancia de abejas silvestres. La proporción de abejas Halictidae aumentó con la disminución de la complejidad del paisaje. La riqueza floral mostró una asociación positiva con el número de abejas de forrajeo y la riqueza de morfoespecies. Se observó que los márgenes más amplios contenían una proporción mayor de plantas perennes y una proporción menor de abejas Halictidae. Los atributos funcionales de las comunidades de plantas de los márgenes que promovieron la robustez de la comunidad de abejas silvestres fueron la alta disponibilidad de néctar, diversidad en el color de las flores, diversidad en la morfología de las flores y diversidad en la altura de la vegetación. En la Parte B, las especies más visitadas fueron *P. rhoeas* y *D. carota*, seguido de parcelas mixtas, *M. sylvestris*, *C. arvensis* y *S. oleraceus*. La influencia de los rasgos florales de las especies estudiadas en las tasas de visita, calculado usando modelos lineales generales, variaba dependiendo del grupo de insectos.

Este estudio sugiere que los márgenes de campo son más cruciales en áreas de cultivo intensivo que en paisajes heterogéneos. El mantenimiento de amplios márgenes con alta

riqueza de plantas con flores, con especies perennes y arbustivas, es la mejor manera de apoyar una comunidad de abejas densa y diversa. Si es necesario, se recomienda que los márgenes se siembren con flores perennes nativas, con períodos de floración diferentes y superpuestos, que posean alto contenido en néctar y polen, con una diversidad de colores, formas y alturas de plantas, y que se distribuyan de modo que se facilite la anidación de insectos. En función de su atractivo general para los insectos, además de otros atributos positivos, la presencia de *P. rhoeas*, *D. carota* y *M. sylvestris* puede contribuir a la sostenibilidad de los agroecosistemas.

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Chapter 1. Introduction

1.1. Agricultural intensification and pollinator declines

In recent years, grave concerns have been voiced about a potential global decline in pollinators, both in terms of species richness and abundance, as a result of intensive agricultural practices (Nielsen et al., 2011; Westphal et al., 2008). In fact, it has been called a "global pollinator crisis" (Brosi et al., 2007). In particular, concerns has been directed towards wild bees (Hymenoptera: Apiformes), important pollinators due to their efficiency (Ricketts and Lonsdorf, 2013). Decreasing native bee populations have been reported in several regions across the world (Koh et al., 2016; Ricketts et al., 2008), but in order to fully comprehend the magnitude of the issue, more congruent studies of bee community data are needed, covering a greater geographic scope (Bartomeus et al., 2013; Westphal et al., 2008). The Mediterranean is thought to be a region of high bee diversity (Michener, 2007), but community composition trends have been poorly studied (Nielsen et al., 2011).

Maintaining a diverse and abundant community of effective pollinators is crucial for sustaining native plant species diversity and the efficiency and stability of agricultural production (Balzan et al., 2014). Consequently, it is important for the global economy (McKechnie et al., 2017). Thirty-five percent of global food production (including more than 800 cultivated plants) depends on agricultural crops which rely on animal-mediated pollination (Nicholls and Altieri, 2013), bees being considered the most important taxon of pollinators (Hopwood, 2008). The effects of the global decline in pollinators have already begun to be documented: a lower plant growth rate has been detected in highly pollinator-dependent crops compared to non- or low-dependent crops (Nicholls and Altieri, 2013).

The transformation of agricultural landscapes in the past half-century that has triggered this decline in bees and other pollinators (Nicholls and Altieri, 2013) has involved the conversion of forests into fields and pastures (Marshall and Moonen, 2002) and the expansion and amalgamation of pre-existing fields in order to enhance farming efficiency (Tscharntke et al., 2005). These changes have resulted in more homogeneous landscapes with a greater fragmentation of natural habitats. The expansion of agricultural land devoted to wind-pollinated grain crops has greatly reduced the forage options for wild bees in these environments (Cane and Tepedino, 2001). Furthermore, according to research (Nicholls and Altieri, 2013), during this era of agricultural intensification, the proportion of pollinator-dependent crops has increased more quickly than that of non-pollinator-dependent crops. This means that, while pollinator populations are in decline, there is an increasing demand for animal pollination services. Large monocultures of pollinator-dependent crops (e.g., almond, canola or watermelon) provide only a few weeks of abundant food. Without nearby nesting areas or floral resources which bloom before and after the main crop, pollinators will continue to be negatively affected (Nicholls and Altieri, 2013).

When an undisturbed landscape is transformed into an agroecosystem, weed flora changes are exhibited at the field scale (Romero et al., 2008; Mas et al., 2007; Dorado and López-Fando, 2006). Once a species is removed from a landscape it is possible that is never becomes re-established, or that it takes many years (Firbank, 1999). Reduced weed diversity and richness have been reported in Spain in the last decade, as well as throughout Europe (Cirujeda et al., 2011; Chamorro et al., 2007). According to Gerowitt et al. (2003), in intensive agriculture, the main causes of diminished plant species diversity are the extended application of herbicides, short crop rotations and high nitrogen levels. Likewise, organic farming systems have been shown to have higher weed diversity than conventional farming systems (Marshall et al., 2003).

The negative effects of agriculture on bee and other pollinator populations have been well documented (Koh et al., 2016; Le Féon et al., 2010). Wild pollinators (as well as other insects and animals) displaced by land transformations must now find shelter at field boundaries and in remaining, small and fragmented patches of semi-natural land, and must travel to find appropriate floral resources (Marshall and Moonen, 2002). Wild bee pollination services have been shown to have a negative relationship with distance from natural habitat (Kwaiser and Hendrix, 2008). Likewise, Kremen et al. (2004) found that on organic farms near natural areas, native bee communities could provide full pollination services, even for crops with high pollination requirements. Conversely, they found that on conventional farms far from natural habitats, pollination by native bees alone was insufficient. According to Nicholls and Altieri (2013), several entomologists and ecologists have hypothesized that this separation from critical floral and nesting resources is likely the main cause of wild bee declines and consequently, reduced pollination services. In addition to loss of habitat and reduced floral resources (i.e., lower floral diversity and abundance with greater fragmentation), intensively managed agriculture has also had a negative effect due to increased agrochemical use and introduced species (Koh et al., 2016; Hopwood, 2008).

While the trend has been to simplify agricultural production systems, it is now becoming clear that heterogeneous agroecosystems connected with diverse habitats are more sustainable than simple, homogeneous landscapes and provide more resilient ecosystems (Tscharntke et al., 2005). Thus, pollinator declines can be counteracted by properly managing farms (Ricketts et al., 2008). In order for wild bees and other pollinators to thrive in agroecosystems, they require a certain level of suitable nesting sites and materials (e.g., tree cavities, soil substrates and vegetation), sufficient and continuous floral resources within flight range (e.g., pollen, nectar and floral oils) and, if necessary, stable sites for overwintering (Le Féon et al., 2016; Hannon and Sisk, 2009). Because bees return to fixed nest sites after foraging, proximity of nesting habitats relative to agricultural fields is critical for maintaining pollinated crops (Ricketts et al., 2006). While it is common knowledge that pesticides should not be applied to pollinator-dependent crops while they are flowering, pesticides applied outside of this window should still be used cautiously in order to avoid the contamination of weed flowers (Nicholls and Altieri, 2013). In general, an overall more restricted usage of agrochemicals should be enforced.

1.2. Field margins

Numerous studies have shown that maintaining a matrix of natural or semi-natural land amongst crops results in more abundant and diverse native bees species (Morandin and

Kremen, 2013). Accordingly, the European Union Common Agricultural Policy (CAP), for 2014-2020, requires that ecological focus areas comprise at least 5% of farms where arable land covers more than 15 hectares (Balzan et al., 2014). A cost-effective, minimally invasive and efficient conservation approach is to set aside field margins, or enlarge existing margins, creating a network of permanent vegetation over the landscape (Lagerlöf et al., 1992). In Mediterranean agricultural regions, well-established field margins with diverse assemblages of plant communities are already common features (Bassa et al., 2012). In Europe as a whole, field margins are already being utilized specifically to help improve ecosystem diversity (Norris and Kogan, 2005).

The precise definition of field margins varies across the literature, but here they are defined as linear zones of semi-natural vegetation located at field boundaries. Depending on their features, they may also be referred to as field edges or field boundaries, fencerows or fence lines, conservation headlands, hedgerows, greenlanes, rights of way, grassy strips, etc. (Nicholls and Altieri, 2013; Hannon and Sisk, 2009; Pywell et al., 2005; Feber et al., 1996); they could also include a fence or wall, or be associated with a watercourse (Marshall and Moonen, 2002).

Setting aside field margins has long been recognized as an effective conservation strategy for enhancing plant species richness (including rare weed species) (Ryszkowski, 2001), biodiversity (Lagerlöf et al., 1992) and ecosystem services (Balzan et al., 2014). Field margins are understood to be attractive nesting habitats for pollinators, as well as beneficial predators and parasitoids of pests, by providing potential refuge from pesticides and other agrochemicals, and continuity of floral resources (Requier et al., 2015; Nicholls and Altieri, 2013). Common substrates found in margins (e.g., bare ground, dry branches, hollow logs and earth banks) provide ideal nesting sites for various pollinator species (Nicholls and Altieri, 2013). Leaving field margins uncropped can be viewed as an advantageous trade-off for farmers as these areas are typically less fertile and more prone to drought, shading and lower yields than other parts of the field (Pywell et al., 2005). In addition to pollinator refuge, field margins can help maintain field boundaries, serve as windbreaks, prevent soil erosion, create microclimates and provide organic matter (Hannon and Sisk, 2009; Altieri, 1995). Margins can also be sown with plant species known to support specific beneficial insects or wildlife species, or those in need of conservation (Norris and Kogan, 2005).

The capacity of margins to help preserve honeybees, bumblebees, butterflies and bird species within agroecosystems has been widely documented (Hannon and Sisk, 2009; Carvell et al., 2006; Pywell et al., 2005). Furthermore, margins and other semi-natural habitats in the landscape surrounding crops have been found to support pollinator diversity and pollinator services in general (Marini et al., 2012). However, only a few studies have examined the value of field margins for all wild bee species (Morandin and Kremen, 2013; Hannon and Sisk, 2009) and very little is documented about their role in Mediterranean cereal agroecosystems. Considering the high monetary emphasis placed on habitat restoration in the European Union and United States (Morandin and Kremen, 2013), studies are needed which focus on the specific margin characteristics that are important and what constitutes a good quality habitat for wild bees in agricultural areas (McKechnie et al., 2017).

1.3. Importance of weeds for pollinators

Weeds have the reputation of being destructive in agriculture and studies rarely attempt to establish the beneficial contributions of weeds. However, weeds are becoming more appreciated, especially in Europe, for their significant role in supporting biodiversity and ecosystem services (Norris and Kogan, 2005). More specifically, maintaining a diversity of weeds in agroecosystems is considered to be one strategy for curtailing the global decline of pollinators (Legere et al., 2005). A quantification of their role (i.e., by attracting pollinators) could help to enforce a new paradigm for agricultural management and biodiversity conservation.

Weeds, such as those found in field margins, offer several ecosystem services. Firstly, weeds are important hosts of pollinators: providing continuous nesting and floral resources. A diversity of flowering weeds provides pollinators with a stable supply of pollen, nectar and floral oils; for example, when the main crop is not in bloom (Hannon and Sisk, 2009). A consistent floral supply is especially critical early and late in the year. For example, most solitary bee species hibernate over winter and need food sources immediately upon emerging in the spring. Similarly, bumblebee queens require late-season floral resources to build up their reserves before hibernating (Nicholls and Altieri, 2013). Because different bee species have different floral preferences, a year-round (or as close as possible depending on the climate), high diversity of flowering plant species is required to support a high diversity of native bee species (Nicholls and Altieri, 2013).

In addition to helping to conserve pollinators, weeds may provide support for beneficial insects (e.g., natural enemies of pests) or attract pest insects or pathogens away from the crop (Altieri, 1995). Weeds help to maintain or augment populations of beneficial insects by providing shelter, breeding sites and food, either directly (i.e., with plant matter, pollen or nectar), or by hosting certain insects which are their preferred food source (Norris and Kogan, 2005). Again, weeds provide shelter during times of the year when the crop is absent or inhospitable (Norris and Kogan, 2005). Furthermore, when used as a cover crop, they have value as a green manure (Carreck and Williams, 2002). Flower species differ in their potential contribution to ecosystem services, so increasing the diversity of weed species would enhance the general functioning of the margin community (Tscharntke et al., 2005).

1.4. Biodiversity, functional diversity and ecosystem stability

The ecological and economic importance of weeds and pollinators also hinges upon their role in enhancing overall biodiversity (Forrest et al., 2015). Biodiversity conservation is a key factor in sustainable agricultural planning. Maintaining biodiversity in agroecosystems is so important because poor biological diversity could affect ecosystem functioning and yield (Tscharntke et al., 2005). Biodiversity is responsible for a variety of ecological services, including: pollination, nutrient cycling, pest control and detoxification from toxic chemicals (Altieri, 1995). In addition to the ecological and economic arguments for biodiversity conservation, it also promotes social, moral and aesthetic values (Marshall et al., 2003).

The strain of agricultural intensification on biodiversity is significant and is said to act on different spatial scales (Petit et al., 2011). Several studies have highlighted the potential influence of the surrounding landscape on the abundance and diversity of weeds at a given field (Marshall, 2009; Sosnoskie et al., 2007; Gabriel et al., 2005). As such, it has been suggested that conservation of biodiversity and ecosystem services in agricultural systems requires a landscape perspective (Tscharntke et al., 2005).

One can better understand ecosystem synergies and services by looking at functional diversity, which is assessed by the distribution of traits in a community (Navas, 2012). In theory, functional diversity should be able predict the functioning capacity of an ecosystem more accurately than species richness (Lavorel et al., 2013). For example, according to Lavorel et al. (2013), there is evidence that increased functional diversity within communities of pollinators increases pollination success. The ecosystem services provided by a weed community depend on which species are present and in what proportions (Petit et al., 2011). However, interactions among species create a variable relationship between diversity and functioning – adding a new species could enhance an ecosystem service, have no effect or even reduce it (Tscharntke et al., 2005). By using functional traits and grouping, as opposed to species-specific data, scientists can develop more general principles that can be applied to different situations and simplify modeling processes (Booth and Swanton, 2002).

Increased biodiversity only enhances ecosystem functioning if new species add unique and complementary traits to the community (Tscharntke et al., 2005). However, a community with functional trait redundancy is more stable and able to reorganize more effectively after a disturbance. For example, plant communities with poor diversity, as a result of anthropogenic disturbance, often face pest infestations, and usually, the more intense the disturbance, the more serious the problem (Altieri, 1995). Furthermore, if an animal-pollinated crop depends solely on one pollinator species, it is particularly at risk because if that species is targeted by a parasite or disease, the whole crop may be compromised (Marini et al., 2012). High biodiversity and structural complexity allow an agroecosystem to maintain an innate state of natural sustainability, even in a fluctuating environment (Altieri, 1995).

With the ongoing and future threats of environmental instability, maintaining functionally diverse natural communities is extremely important. One aspect that is still unclear is how to measure the ecological benefits of biodiversity conservation. Some studies have suggested that ecological benefits are directly proportional to the degree of biodiversity achieved and that a good indicator of biodiversity is an estimation of weed diversity, because of its close relationship with other living organisms within the system (Gerowitt et al., 2003).

1.5. Importance of wild bee diversity

In many circumstances, wild bees are key for stable crop pollination or are an important supplement to managed honeybees. For example, buzz-pollinated crops, which include species from 65 families and comprise tomatoes and potatoes, cannot be pollinated by honeybees and rely on certain wild bee species with the ability to use vibration to extract pollen from the anthers (De Luca and Vallejo-Marín, 2013). For seed production, specialist bees or bees with preferred diets may be required, such as *Megachile rotundata* which is used extensively to pollinate alfalfa (Goettel et al., 1991). In general, because of the instability of honeybee colonies in recent decades as a result of *Varroa* mites, high viral incidences and Colony Collapse Disorder, the importance of wild pollinators for stable crop pollination has become increasingly evident (Drummond, 2012).

Field research with a range of crops has suggested that abundant and diverse native bee communities can compensate for declining honeybee populations (Hannon and Sisk, 2009). However, Hannon and Sisk (2009) believe that the species composition of a wild bee community is highly affected by fine-scale habitat variations (e.g., the presence or absence of a particular flower species). Compared to honeybees, solitary bees do not travel nearly as far and have inherent survival challenges in agricultural landscapes, such as reduced spatial flexibility and recolonization ability, and the incapacity to forage resources at larger spatial scales (Tscharntke et al., 2005).

1.6. Important floral traits for wild pollinators

Flowering plant species possess particular morphological and physiological characteristics that attract certain groups of floral visitors over others (Bosch et al., 1997). In order to examine the capacity of certain flower species to attract pollinators, it is essential to consider which floral traits are important. The most obvious resources that flowering plants provide for pollinating species are nectar (for carbohydrates) and pollen (for protein, vitamins and minerals) (Sammataro and Yoder, 2011). The quantity and accessibility of these resources vary depending on the flower species, for example, perennials with long-corollas tend to have more nectar than annuals (Nicholls and Altieri, 2013). Furthermore, how accessible the nectar is for the insect is based on the architecture of the flower, the concentration of the nectar, and the morphology of the insect and its individual mechanism to extract nectar (Wäckers, 2004). Thus, floral traits that are important for the extraction of nectar and/or pollen include: nectar/pollen quantity, nectar concentration and availability (i.e., is it exposed or concealed?), flower morphology, corolla size and sexual organ structure (e.g., the number of stamens and stigmata). Bosch et al. (1997) conclude that, based on many studies, the floral rewards offered by particular species are important in determining how flower visiting insects partition themselves among available flowering plants.

The above mentioned floral rewards are usually considered as the ultimate attractive force driving insect visitors, whereas colour, odour and shape act more like “cues” to help insects discriminate between the variety of reward sources available (Real, 2012). When considering the visibility of flowers to insects, plant height is an important discerning factor. Also, many pollinating insects, including bees, attempt to fly and forage at a constant height in order conserve energy (Dafni and Potts, 2004). Hegland and Totland (2005) point out that flower visiting insects do not choose a flower species based on any one floral trait. Their research has shown that flower species with similar combinations of traits have a comparable attractiveness to insect visitors, indicating that several floral traits can affect the flower choice of insects. Aside from floral traits, one important aspect to consider when examining the relationships between flower species and their visitors is the overlap between the flowering period of the species and the activity periods of insects (Bosch et al., 1997).

1.7. Selected flowering plant species

Homogeneous landscapes can be enriched by encouraging the presence of common plant species (Tscharntke et al., 2005). The following five flowering plant species, common native plants in Catalonia, were selected for a more in-depth analysis of their attractiveness to wild pollinators (**Figure 1**; see ***Section 3.2.1*** for details on species selection criteria). These plants are usually considered to be weeds, wild plants growing unprompted and potentially in competition with cultivated plants (Oxford University Press, 2017). Crop/weed interactions are site- and season-specific and vary according to: the geographic region, the crop and weed species involved, plant densities, management practices and environmental factors (Altieri, 1995). In order to keep naturally occurring plants under control and avoid negative impacts to crops, it is useful to understand the mechanics of each plant, their capacity for invasiveness and strategies for their management.

Figure 1. Selected flowering plant species. a) *Convolvulus arvensis* (photo by: Hilty, 2017), b) *Daucus carota* ("MinneFlora," 2012), c) *Malva sylvestris* (photo by: Kopp, 2017), d) *Papaver rhoeas* (photo by: Kopp, 2017) and e) *Sonchus oleraceus* ("Online virtual flora of Wisconsin," 2017).

1.7.1. Convolvulus arvensis

Convolvulus arvensis, commonly known as field bindweed, is an herbaceous perennial in the family Convolvulaceae. It has large funnel-shaped white and/or pink flowers with concealed nectar (Kattge et al., 2011; Kühn et al., 2004). In Catalonia, it can be found in bloom between April and October (Bolòs et al., 2005). It is native to continental Europe and Asia but has spread to many parts of the world (Weaver and Riley, 1982). It is found in many types of climates including, temperate, tropical, and Mediterranean (Holm et al., 1991). *C. arvensis* is found primarily in abandoned fields, cultivated fields (including cereal crops), orchards, pastures, gardens, lawns, waste places and along roadsides, railways, streambanks and lakeshores (Weaver and Riley, 1982; Alcock and Dickinson, 1974).

In Spain, *C. arvensis* is known as a weed to cereals and sunflowers (Jurado-Expósito et al., 2004). Although *C. arvensis* is a relatively poor competitor for light, it competes effectively for soil moisture due to its extensive root system (Weaver and Riley, 1982). The underground network of roots of *C. arvensis* is said to reduce crop yields and interfere with harvesting operations (Liebman et al., 2001). Furthermore, it has been known to climb crop plants and knock them over (taller crops are considered to be less at risk) (Cox, 1915).

C. arvensis is difficult to control due to this twining growth mechanism and extensive root and rhizome system. It spreads by both seeds and root or rhizome fragments. *C. arvensis* could be considered a more serious weed because its extensive root system allows it to persist even after cultivation and other forms of disturbance (Weaver and Riley, 1982). Furthermore, seeds can remain viable in the soil for up to 2 decades (Lusweti et al., 2011). Weaver and Riley (1982) state that, previously, exhaustive tillage was the primary means of *C. arvensis* control. However, in recent decades reduced and no-tillage production has increased in Spain (Jurado-Expósito et al., 2004). Under this new regime, perennial weeds, like *C. arvensis*, are no longer controlled by repeated tillage and could potentially become increasingly problematic in wheat and sunflower crops in Spain (Liebman et al., 2001). Weaver and Riley (1982) further state that the most effective strategy for controlling *C. arvensis* would be to combine cultivation and crop rotation with the use of herbicides. Wiese and Rea (1959) found winter wheat to be a good competitor for *C. arvensis* because it grows during the early spring when *C. arvensis* is not using soil moisture. They found that competitive crops, such as winter wheat and also perennial forages, were able to reduce *C. arvensis* populations significantly after several years.

C. arvensis is occasionally grown as an ornamental plant in the Mediterranean region (Weaver and Riley, 1982). Additionally, some medicinal properties have been suggested for *C. arvensis*, however, Lusweti et al. (2011) assert that these uses cannot compensate for its overall negative impacts. It has been reported to be a good fodder plant willingly eaten by cattle (Weaver and Riley, 1982), although Lusweti et al. (2011) claim that it is mildly toxic to animals.

1.7.2. Daucus carota

Daucus carota, commonly known as wild carrot or, in North America, Queen Anne's lace, is an herbaceous plant and can be annual, biennial or perennial. It belongs to the family Apiaceae (= Umbelliferae). It has large disk-shaped inflorescences comprised of small white florets with exposed nectar (Kattge et al., 2011; Kühn et al., 2004). In Catalonia, it can be found in bloom between April and November (Bolòs et al., 2005). It is native to temperate regions of Europe and Southwest Asia, and has become naturalized in North America and Australia (Eckardt, 2014). *D. carota* is commonly found in fields, grasslands, wastelands and roadsides (Lamborn and Ollerton, 2000; Westmoreland and Muntan, 1996). *D. carota* can be found in a wide range of conditions, but it has been reported to thrive in sun or partial shade (NC State University, 2017), and in calcareous soil or fine-particled soil with high nutrient levels (Eckardt, 2014).

The seeds of *D. carota* can reportedly persist in the soil seed bank for two to five years (Clark and Wilson, 2003) and seedlings can emerge and survive in several types of ground cover, including thick vegetation (Eckardt, 2014). *D. carota* is not usually considered a high priority for management efforts, nevertheless, it can be persistent and require more active management on soils with a high clay content (Eckardt, 2014). Eckardt (2014) also claims that it is a threat to recovering grasslands and prairies because it matures faster and grows taller than many of the native species. Indeed, the United States Department of Agriculture (2017) has listed it as a noxious weed in four states (Iowa, Michigan, Ohio and Washington). Eckardt (2014) recommends that *D. carota* be controlled by hand cultivation or mowing close to the ground before seed set (mid- to late-summer) or when plants are seven to ten inches high. *D. carota* has also been classified as a beneficial weed and a good companion plant to crops. It has been documented to support tomato plant production and has been said to support lettuce by providing a microclimate of cooler, moister air (Philbrick and Gregg, 1996).

1.7.3. Malva sylvestris

Malva sylvestris, commonly known as common mallow, is an herbaceous biennial or perennial from the family Malvaceae. It has pinkish purple disk flowers with concealed nectar (Kattge et al., 2011; Kühn et al., 2004). In Catalonia, it can be found in bloom between March and October (Bolòs et al., 2005). It is native to Europe, Asia and North Africa (Gasparetto et al., 2012), and has been introduced into Eastern Australia and North and Central America (Mitchell and Norris, 1990; Castroviejo and (coord. gen.), 1986). *M. sylvestris* grows prolifically in fields, wastelands, hedgerows, roadsides and railways (Stace, 2005; Grieve, 1931). It can grow in a wide range of soil types, including rocky soils, soils with different pH levels and soils with different amounts of phosphorus, nitrogen and organic carbon (Gasparetto et al., 2012).

Although many authors have referred to *M. sylvestris* as a weed (Gasparetto et al., 2012), and it is a known virus carrier (Smith, 2012), Dutoit et al. (2007) have not found it to be invasive in cereal crops. *M. sylvestris* can be easily controlled with herbicides (Gasparetto et al., 2012; Zand et al., 2010), but otherwise, no information about specific management strategies for *M. sylvestris* could be found. In fact, it has also been reported to have many beneficial qualities including: medicinal, culinary, ornamental and nutrient storage (Kumar et al., 2014; Gasparetto et al., 2012). For example, studies have shown its potential for treating inflammation, gastric ulcers and skin conditions (Gasparetto et al., 2012). Furthermore, its young leaves are edible and can be used in salads or as a garnish on plates (Kumar et al., 2014).

1.7.4. Papaver rhoeas

Papaver rhoeas, commonly known as common poppy or corn poppy, is an herbaceous annual in the family Papaveraceae. It has large bowl-shaped red flowers with no nectar (Kattge et al., 2011; Kühn et al., 2004). In Catalonia, it can be found in bloom between March and August (Bolòs et al., 2005). It is believed to be native to Southern Europe, North Africa and temperate Asia, and has become naturalized throughout most of Europe, Asia and North America (Royal Botanic Garden, 2017). *P. rhoeas* is characteristic of disturbed habitats, particularly tilled arable lands (Mcnaughton and Harper, 2012). It is also found alongside roads and in grasslands and wastelands (Mitich, 2000). *P. rhoeas* thrives in well-drained soils and full sunshine (Huxley, 1992).

P. rhoeas is frequently referred to as a weed of cereals. In Spain specifically, it is reported as a principal weed of barley and wheat. In various countries it has also been presented as a problem weed for alfalfa, oil seed rape, lentil, pea and sugar beet (Mitich, 2000). Its seeds can lie dormant in the soil for over 80 years (Royal Botanic Garden, 2017). However, the "Plantwise Knowledge Bank" (2017) classifies *P. rhoeas* as only moderately competitive against wheat and reported that biomass and seed production were significantly reduced by increasing crop densities. In addition to herbicides and maintaining high crop densities, they proposed integrated weed management strategies for *P. rhoeas* such as: mechanical weed control, choosing competitive varieties and reduced fertilizer inputs (because high levels of NPK fertilizer promote a greater development of *P. rhoeas*). On the positive side, in addition to providing insects with pollen, *P. rhoeas* can act as an alternative host to a range of economically important crop pathogens ("Plantwise Knowledge Bank," 2017). There are also claims that is possesses medicinal benefits (Royal Botanic Garden, 2017).

1.7.5. Sonchus oleraceus

Sonchus oleraceus, commonly known as common sow thistle or annual sow thistle, is an herbaceous annual or biennial in the family Asteraceae (= Compositae). It has yellow ray flowers with concealed nectar (Kattge et al., 2011; Kühn et al., 2004). In Catalonia, it can be found in bloom between February and December and is quite common below an altitude of 1500 a.s.l. (Bolòs et al., 2005). It is native to North Africa, Asia and Europe (Hilty, 2017). *S. oleraceus* is found in ploughed fields or in any relatively fertile open habitat, such as pastures, vacant lots, roadsides, wastelands and gardens (Major et al., 2016; Clapham et al., 1962; Lewin, 1948). It thrives in disturbed sites (i.e., resulting from overgrazing or cultivation) (Major et al., 2016), arising only where new soil is exposed and not in undisturbed grasslands or forests (Lewin, 1948). *S. oleraceus* requires good illumination for full growth (Lewin, 1948), thrives where moisture is available (Major et al., 2016) and avoids acid soils (Chittendon, 1951).

S. oleraceus has the potential to compete with desirable, cultivated plant species (Major et al., 2016). According to the US Forest Service (2011), it is considered to be invasive in several countries. The government of Queensland, Australia, states that *S. oleraceus* is the fifth most difficult weed to control in winter crops (Widderick and Walker, 2009). Furthermore, Weber (2003) claims that its large stature and high nutrient uptake could cause soil impoverishment in heavily infested sites. However, it is not known to significantly invade high quality natural areas (Hilty, 2017).

S. oleraceus does not regenerate from root fragments and thus can be managed by cutting or mowing (Weber, 2003), or if necessary, by tilling or herbicides (Major et al., 2016). Widderick and Walker (2009) attribute the increase in *S. oleraceus* populations in Australia to the growing trend for farmers to reduce tillage and rely more on herbicides for weed control. On the other hand, they point out that tilling could result in an ongoing problem: although tillage reduces the number of emergences, it also buries seeds deeper into the soil where they can persist for long periods and be brought back near the soil surface with subsequent tilling, and later emerge. According to Widderick and Walker (2009), the best long-term management strategy for *S. oleraceus* is to stop plants from setting seed, thus reducing the soil seed bank. They further recommend that crop rotations or planting configurations be applied in a way that maximizes competition against *S. oleraceus* in order to reduce its growth and seed production. For example, they state that *S. oleraceus* biomass production is greatly reduced under dense wheat populations and that barley is eight times more competitive than wheat in suppressing the weed. *S. oleraceus* has been reported as a good supporter of beneficial insects, holding the 2nd highest number of natural enemies of pests out of 25 different weeds in an experiment in Brazil (Amaral et al., 2013). There have also been claims in regards to its culinary (Cooper et al., 1991) and medicinal capacities (Duke and Ayensu, 1985). It is sometimes used as fodder for large mammals (Everitt et al., 1999).

1.8. Reasons for doing this study

The previously mentioned concerns about pollinator declines have sparked new interest in research aimed at protecting pollinator communities. Hence, further knowledge is required about the drivers of wild pollinator diversity and abundance in agroecosystems. This research is especially relevant under the reformed CAP to be implemented in Europe from 2014 to 2020 which aims to preserve the natural resources that agricultural productivity depends upon (European Commission, 2013). The knowledge obtained during this work will hopefully help in establishing effective ways of managing agricultural landscapes in order to provide efficient and sustainable food production while maintaining levels of biodiversity that are sufficient to guarantee the continued ecological functioning of the agroecosystem. The hope is that this project will generate novel research which may aid in the shift of agricultural paradigms in order to create more robust agroecosystems.

This study considered the greater landscape perspective because insect pollinators respond to spatial and temporal alterations in resource supply on a scale greater than a single farm (Pywell et al., 2005), and past studies have indicated that habitat conservation strategies should be targeted at the regional level. McKechnie et al. (2017) suggest that to properly advise on land management, in order to maximize the retention of wild pollinators, studies are needed in regions representing a range of agricultural intensities and habitat types. Accordingly, Catalonia is an ideal region to study the efficacy of field margins because, although agriculture is one of the main economic activities (Aran et al., 2011), approximately 60% of the region is covered by shrub-land and forests (Díaz-Delgado et al., 2004) and farms have remained relatively small-scale (Garrabou et al., 2001).

Rarely studies attempt to establish the beneficial relationship between weed diversity and pollination. Nicholls and Altieri (2013) claim that managing weeds with the specific goal of enhancing wild pollinator populations is currently largely based on educated guesswork. The value of many wild flower species for pollinators has never been studied in detail or the research is incredibly out of date. This work will help with the acquisition of knowledge necessary for identifying beneficial weed species and promoting them in a way that attracts pollinators, while being mindful of the possible negative impacts on crop yields.

Chapter 2. Objectives

The general objective of this work is to further understand the role of flowering weeds in Mediterranean cereal agroecosystems, and how they support pollinator diversity and thus, pollination. To achieve this objective, pollinator foraging activity on native weeds was observed in existing field margins of farms and in manufactured field trials. This work also involved the trapping and identification of pollinator species. Analyses examined if increased plant species diversity, and what species and floral traits specifically, may help to improve pollinator diversity and abundance, and conserve specialist wild bee species. Using a variety of approaches, the aim was to determine which factors had a statistically significant impact on wild pollinator abundance and diversity, and how this information could be applied to help conserve pollinator populations and foraging activity in agroecosystems.

2.1. Part A – The role of field margins in supporting wild bees

In Part A, the role of agricultural field margins in supporting wild bees and other flower visiting insects in cereal agroecosystems was investigated. In this three-year study, general margin characteristics and the functional constitution of their floral communities were compared with wild bee community composition and functional structure, from sites with landscapes of varying agricultural intensity, in order to: (i) establish which native flowering plant species were most attractive to which pollinators; (ii) investigate if field margins were valuable for wild bee conservation in all types of landscapes; (iii) determine which biotic and abiotic margin characteristics best supported wild bee communities; and (iv) identify which functional attributes of margin plant communities (based on floral traits) were important for sustaining wild bee populations.

2.2. Part B – Attractiveness of common flowering weeds to flower visiting insects

In Part B, the attractiveness of five native flowering weed species, common in Catalonia, to flower visiting insects was examined. In this two-year field trial, *C. arvensis*, *D. carota*, *M. sylvestris*, *P. rhoeas*, *S oleraceus*, and a mixture of all five, were compared in order to: (i) assess the most frequent visitors to each species (and mixed plots) and each species' value in supporting wild pollinators; (ii) determine the flower species preferences of distinct flower visiting insect groups; and (iii) analyze relationships between particular floral characteristics and insect visitation rates.

Chapter 3. Methodology

3.1. <u>Part A</u> – The role of field margins in supporting wild bees

3.1.1. Study sites and sampling design

The experiment was carried out during three years, from 2014 to 2016, at 27 cereal field margins in Catalonia, Spain. Catalonia is located in the northeastern corner of the Iberian Peninsula, on the Mediterranean coast (**Figure 2**). The climate throughout Catalonia is predominantly Mediterranean with moderate temperatures (Bassa et al., 2012). The mean monthly temperature in Catalonia from 2014 to 2016 was 18℃ and mean yearly rainfall was 671 mm ("World weather online," 2017).

Figure 2. (a) Location of Catalonia in Spain. (b) Location of the 27 sampled margins (black dots) in Catalonia.

Margins were selected based on the following criteria: (i) Margins had naturally diverse flora and were not treated with herbicides nor sown with supplementary flowers. (ii) Margins were greater than 1 m wide. (iii) Margins were located between two crops, or between a crop and a low traffic country road. For consistency, adjacent fields were restricted to cereal crops or fallow land. (iv) Because the typical foraging range of most bee species collected in pan traps is less than 1 km (Greenleaf et al., 2007), the distance between sampled margins from one year was greater than 2 km, ensuring that the bee community sampled at each site was distinct (Riedinger et al., 2015). (v) The landscapes surrounding margins represented a gradient in proportion of surrounding arable land. The selected margins, as well as the year they were sampled, their coordinates, altitude, mean width, adjacent land uses, direction facing (if the margin is sloped) and orientation are listed in **Table 1**. Photos can be found in the ***Supplementary Material – Appendix A***. The width of each margin was calculated as the mean of two measurements, one at the widest portion of the margin and one at the narrowest portion. The mean width of all margins ranged from 1.3 to 24.0 m (mean = 5.0 m).

Table 1. Margin characteristics at each site.

Site	Year Sampled	Coordinates	Altitude (m a.s.l.)	Mean width (m)	Adjacent land uses	Facing (if sloped)	Orientation
A1	2014	41°48'35" N, 1°07'01" E	352	4.0	wheat field, barley field	/	north-south
A2	2014	41°48'05" N, 1°08'10" E	355	3.5	wheat field, barley field	/	north-east to south-west
A3	2014	41°47'24" N, 1°07'26" E	340	7.0	wheat field, road	south	west-east
CA	2014	41°36'43" N, 2°09'55" E	185	1.3	barley field, road	/	west-east
CO	2014	41°49'17" N, 2°09'58" E	864	7.0	wheat field, road	/	north-south
G1	2014	41°48'20" N, 1°19'18" E	455	4.0	two wheat fields	north-west	north-east to south-west
G2	2014	41°46'26" N, 1°16'27" E	480	4.0	two barley fields	south-west	north-west to south-east
G3	2014	41°45'11" N, 1°18'59" E	534	4.0	wheat field, road	south	west-east
G4	2014	41°46'20" N, 1°20'06" E	590	3.5	barley field, road	east	north-south
G5	2014	41°46'48" N, 1°20'59" E	555	5.0	two barley fields	north-east	north-west to south-east
G6	2014	41°47'54" N, 1°21'13" E	491	9.5	barley field, fallow land	south-west	north-west to south-east
G7	2014	41°48'32" N, 1°23'49" E	432	7.0	two barley fields	south-west	north-west to south-east
G8	2014	41°48'41" N, 1°22'06" E	441	5.0	barley field, fallow land	north	west-east
G9	2014	41°49'22" N, 1°21'11" E	432	2.0	two wheat fields	north-west	north-east to south-west
M	2014	41°47'57" N, 2°03'45" E	681	4.0	two wheat fields	south	west-east
P1	2014	42°01'01" N, 2°01'30" E	726	2.5	two wheat fields	/	north-south
P2	2014	42°01'59" N, 2°01'37" E	743	3.0	two wheat fields	north-west	north-east to south-west
S1	2015	41°49'33" N, 2°10'19" E	891	2.5	two wheat fields	south-west	north-west to south-east
S2	2015	41°50'40" N, 2°10'48" E	991	1.5	two wheat fields	south-west	north-west to south-east
S3	2015	41°49'15" N, 2°06'18" E	736	7.5	two wheat fields	west	north-south
S4	2015	41°47'28" N, 2°04'14" E	759	24.0	two fallow fields	east	north-south
S5	2015	41°48'06" N, 2°03'37" E	723	4.5	wheat field, road	south	west-east
SA	2016	41°49'37" N, 2°10'49" E	899	5.3	two wheat fields	south	west-east
SB	2016	41°50'58" N, 2°10'35" E	974	3.8	two barley fields	west	north-south
SC	2016	41°49'03" N, 2°06'09" E	719	2.8	two wheat fields	east	north-south
SD	2016	41°47'48" N, 2°06'24" E	664	4.0	barley field, road	/	west-east
SE	2016	41°48'03" N, 2°03'22" E	703	3.8	two barley fields	north	west-east

Each year, the study comprised four days of sampling per margin, dispersed evenly throughout the highest period of bee activity, May through July. In most cases, by late July open flowers had significantly decreased as well as pollinator foraging activity. Sampling consisted of (i) bee trapping, (ii) observations of foraging activity and (iii) plant inventory. Each round of sampling occurred within the same week for all margins. Sampling only took place in ideal weather conditions: temperatures of at least 13°C in 60% clear sky or 17°C in any sky, low wind velocity and no rain (Pywell et al., 2005).

3.1.2. Bee trapping

Bee trapping followed the standard methodology for passive sampling with pan traps (Westphal et al., 2008). Pan trapping is recognized as the most efficient and least biased method of sampling bee diversity (Westphal et al., 2008), although it does tend to underestimate certain wild bee genera, such as Colletes (Colletidae) and Bombus (Apidae), while catching bees from the Halictidae family in high abundance (Roulston et al., 2007). Nevertheless, pan traps were determined to be adequate for the purpose of this study as bee captures would be compared among margins, and the bias would be uniform at all sites (McKechnie et al., 2017; Russell et al., 2005). Gezon et al. (2015) reassured that lethal sampling of bees using pan traps does not have a lasting negative affect on bee populations.

Five trap posts were placed in each margin, approximately 10 m apart. Trap posts were constructed with rebar and three adjustable metal rings, designed to hold three 500 mL plastic bowls (**Figure 3**). Bowls were painted fluorescent blue, yellow and white with special UV-bright paint (Spray-Color GmbH, Merzenich, Germany) in order to increase efficiency (Westphal et al., 2008). On each day of sampling, bowls (half-filled with water plus a few drops of liquid detergent) were placed in the morning before 10h and removed in the afternoon after 17h. The bowls were consistently placed in the same colour configuration and the metal rings were adjusted so bowls would be situated just above the height of the predominant vegetation. The order of margin sampling varied systematically and traps were collected in the same order they were placed. At the end of the sampling day bowls were filtered and the contents of the bowls were temporarily stored in sampling jars containing 70% ethanol. Temperature and wind speed for each sampling day, for the period that traps were in place, were later recorded based on data from the weather station located closest to each margin and at a similar altitude (Ruralcat, 2017).

Figure 3. Trap configuration.

3.1.3. Observations of the foraging activity of flower visiting insects

Frequently, similar studies perform a modest amount of observational sampling of bee foraging activity or netting in order to supplement pan trap data and potentially account for experimental shortcomings (Gezon et al., 2015; Mandelik and Roll, 2009; Roulston et al., 2007). In this study, observational sampling was performed in order to obtain additional information about the floral preferences of foraging insects.

Visual observations of insect foraging activity took place on pan trap sampling days between 10h and 17h. The order and time of day that each margin was observed varied systematically. In each margin, observation plots, 2x5 m^2, were set surrounding each trap post (**Figure 4**). During a five-minute period for each observation plot (25 minutes/margin), each insect making contact with the sexual organs of a flower was recorded, as well as the species of the flower. For bees, the size of the bee was approximated (small < 1.5 cm, medium ≈ 1.5-3.0 cm or large > 3.0 cm) and it was noted if the bee belonged to the genera Bombus or Xylocopa. Other flower visiting insects were identified according to the taxonomical rank of order, or more precisely when possible. Temperature and wind speed for the specific times that observations were made were later recorded based on weather station data (Ruralcat, 2017).

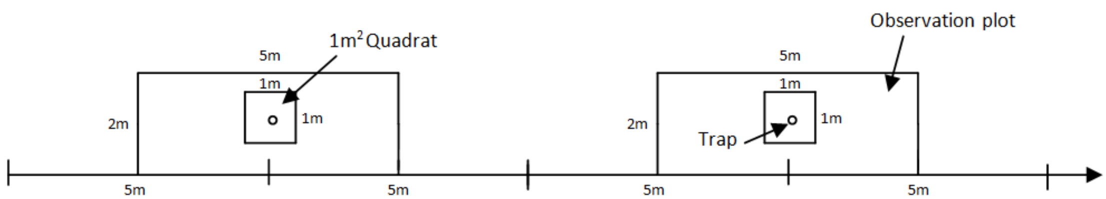

Figure 4. Experimental setup: trap placement, 1 m^2 plant inventory quadrats and 2x5 m^2 visual observation plots.

3.1.4. Plant inventory

Each year, at the beginning of the sampling season, a 1 m^2 quadrat was set surrounding each trap post (**Figure 4**) where all living plant species were recorded and the coverage of each species was estimated visually as a percentage. Tree or shrub species were recorded if the canopy was present vertically over the quadrat. On each day of sampling in each quadrat, flower abundance (the number of open floral units) was counted, the mean height of vegetation was measured and the plant species inventory was updated if necessary. One floral unit was defined as a single flower, inflorescence or bundle of flowers that an average-sized insect could traverse by walking, without needing to fly (Grass et al., 2016). Plants were identified according to Flora Europaea (Tutin, 1964-1993).

At the end of the sampling season, mean vegetation height and total flower abundance were established for each margin. Total floral richness was calculated as the total number of plant species present in each margin, omitting species belonging to the family Gramineae. The total proportion of herbaceous vegetation versus shrubs and trees, as well as the proportion of annuals versus perennials, were also calculated.

3.1.5. Landscape structure

The surrounding landscapes of the selected margins were characterized using the geographic information system program, SIGPAC ("Sistema de Información Geográfica de Parcelas Agrícolas," 2017). This program, combined with Adobe Photoshop (version 17.0.1, Adobe^{TM}), allowed us to determine the proportions of various land uses within a circular zone of a 1 km radius defined from the center of each margin. This radius was chosen in order to capture an area greater than the average foraging range of most native bee species collected in the pan traps (McKechnie et al., 2017). Land use was grouped into seven categories, as defined by SIGPAC: arable land, vineyard or orchard, forest, shrub pasture, tree pasture, grass pasture and other (e.g., water, roads, urban zones, etc.). Subsequently, considering the relative abundance of each land use, a landscape diversity index was calculated for each margin using the Shannon index of diversity (in nats) (Nagendra, 2002; Shannon and Weaver, 1949).

3.1.6. Bee identification and grouping

Bees were pinned into entomological boxes and identified to genus using the Discover Life online taxonomic identification key (Ascher and Pickering, 2012). The body size of each bee specimen was estimated by measuring the inter-tegular distance (ITD), the minimum distance between the wing tegulae across the thoracic dorsum (Cane, 1987). Honeybees, *Apis mellifera* L., were not included in this study as they were likely managed and dependent on external bee keeping factors (Riedinger et al., 2015).

Identifying bees to genus level, known as the higher taxa approach, is an alternative method for predicting patterns of species richness and community composition (van Rijn et al., 2015; Gaston and Williams, 1993) and has been widely applied in similar studies (Droege et al., 2010; Mandelik and Roll, 2009; Russell et al., 2005). Van Rijn et al. (2015) found that subdividing genera into morphospecies according to body size contributed to the overall performance of this approach, improving the correlation to species level data and explaining an additional 16% of the variation in species composition compared to using genus data only. In this study, morphospecies were therefore established by subdividing specimens from each genus into up to seven discrete size categories: ITD < 1 mm, 1–1.5 mm, 1.5–2 mm, 2–2.5 mm, 2.5–3 mm, 3–3.5 mm and ≥ 3.5 mm.

3.1.7. Functional trait analysis

3.1.7.1. Vegetation

All recorded non-Gramineae plant species from all margins were compiled and an extensive database was created, cataloguing the important functional floral trait values of each species (see ***Supplementary Material – Appendix B***). These traits (**Table 2)** were selected based on their significance for flower visiting insects and pollination. Trait values were collected from several plant databases, encyclopedias, textbooks and scientific articles (Bayer et al., 1990; Bhattacharyya and Johri, 1998; Bolòs et al., 2005; Burnie, 1995; Castro, 2015; Fitter and Peat, 1994; "Flora von Bayern," 2013; Gachet et al., 2005; Green, 2009; Heywood, 1985; Kattge et al., 2011; Kühn et al., 2004; Michalcová, 2013; Modzelevich, 2017; Tutin, 1964-1993). All qualitative floral traits were organized into distinct categories, enabling them to be further analyzed with functional indices.

Table 2. Functional plant/floral traits and their value categories.

Trait	Categories
Colour	blue/purple, green, orange/red, pink/purple, white/cream, yellow
Morphology	bell, disk, flag, funnel, lip, ray, ray & disk
Life form	chamaephyte, geophyte, hemicryptophyte, phanerophyte, therophyte
Nectar availability	none, concealed, partly exposed, fully exposed
Number of flowering months	1-12
Number of petals	continuous
Number of stamens	continuous
Number of stigmata	continuous
Corolla size – mean radius (cm)	continuous
Typical mean height (cm)	continuous

In order to characterize the plant community of each margin, the functional dispersion (FDis; Laliberté and Legendre, 2010) and community-weighted mean (CWM; Lavorel et al., 2008) of each trait were calculated at each margin using the function dbFD from package FD in R version 3.2.2 (R Development Core Team, 2015), omitting any 'NA' values. CWM and FDis are two different ways of characterizing communities in terms of their functional attributes. Here, FDis calculates the mean distance of the trait value of each plant species to the centroid of that value for all species in the margin. The abundance of each plant species is taken into account by shifting the position of the centroid towards the trait value of the more abundant species and by weighting the distances to the centroid of individual species by their relative abundances (Laliberté and Legendre, 2010). For continuous traits or categorical traits with a logically increasing succession (e.g., nectar availability), CWM is the mean trait value of all species present in the margin, weighted by the relative abundance of each species (Lavorel et al., 2007). For nominal traits, categorical traits without any numerical significance, CWM is represented as the most dominant trait category.

3.1.7.2. Bee genera

Using the model developed by Greenleaf et al. (2007) in package BeeIT, R version 3.2.2 (R Development Core Team, 2015), maximum foraging distance and tongue length were estimated for all captured specimens. Foraging distance is based on the ITD of each bee specimen and derived by homing distance, the distance at which bees are able to return to their nest after being released in an unknown location. Tongue length is based on ITD and family membership. Due to a limitation in the model, tongue length could not be calculated for bees from the family Melittidae (1.5% of specimens).

A database was also created for all identified bee genera and the significant functional trait values shared among each genus (see ***Supplementary Material – Appendix C***). All functional traits related to how bees survive and function as pollinators in agroecosystems, for which data was available, were included in the database (**Table 3**). For this exercise, body size and tongue length were inputted as the median values of all collected specimens of that genus; although these factors were interpreted with caution as ITD (used to estimate both factors) can vary greatly across a genus. All other trait values were collected from entomological literature (University of Minnesota, 2017; Le Féon et al., 2016; Forrest et al., 2015; Wilson and Messinger Carril, 2015; Prager, 2014; Fortel et al., 2014; Bartomeus et al., 2013; Allen et al., 2012; Ascher and Pickering, 2012; Dumesh and Sheffield, 2012; "SaveNature.Org," 2009; Buschini et al., 2009; Michez, 2008; Müller and Kuhlmann, 2008; Almeida, 2008; Michener, 1999, 2007; Cane et al., 2007; Michener, 1974; Michez et al., 2004; Raw, 2004; Iowa State University, 2003; LeBuhn et al., 2003; Danforth, 2002; University of New Hampshire, n.d.). In cases where these traits could not be generalized to the genus level, bees were categorized according to the properties of the great majority of species within the genus; or when no great majority was present, labelled as such or multiple categories were listed (Russell et al., 2005).

Table 3. Functional bee traits and their value categories. (*Social includes eusocial and semi-social species (Williams et al., 2010). **Includes oil preference and refers only to nectar for cleptoparasites.)

Trait	Categories
Sociality	solitary, social*, both
*Lecty (diet specialization)***	polylectlic, oligolectic, both
Parasite	cleptoparasitic, non-cleptoparasitic
Pollen organ	scopa (leg), scopa (abdomen), scopa (leg and gaster), scopa (leg and propodeum), corbicula, floccus, crop, none
Nest location	above-ground, below-ground, both
Nest substrate	soil, vegetation, wood
Nesting behaviour	excavate, rent, both or cleptoparasite
Body size (mm)	continuous
Tongue length (mm)	continuous

The functional structure of bee assemblages was described by again computing the mean value (CWM) and dispersion value (FDis) of each trait at each margin. Because the ultimate goal was to examine relationships between the functional characteristics of bee assemblages and the vegetation community in each margin, only bee traits of potential importance for pollination were included: sociality, lecty, parasitic behaviour, pollen organ type, body size and tongue length. In order to calculate these indices there could only be one value per trait. Therefore, lecty and sociality were treated as quantitative traits whereby genera with both polylectic and oligolectic species were considered 50% oligolectic and genera that comprised both solitary and social species were considered 50% social (Forrest et al., 2015).

3.1.8. Statistical analysis

Wild bee community composition at each margin was established by combining data from all pan traps within each margin, from all sampling days. Total wild bee abundance (total number of specimens captured in traps), median body size (ITD), and morphospecies richness, diversity (Shannon index) and evenness (Pielou, 1975) were calculated for each margin. The proportion of bee captures belonging to the family Halictidae was also calculated for each margin because these bees are common, mostly pollen generalists

(Michener, 2007), and a high proportion could indicate a pauperized bee community (Le Féon et al., 2016). Total visual bee abundance was included as the total number of bees observed foraging on open flowers in each margin, throughout all sampling days.

Generalized linear models were used to assess (i) which general margin and landscape characteristics may be driving the variation in wild bee community composition and functional structure across sites, and (ii) possible relationships between the functional structure of plant communities in field margins and the community composition and functional structure of wild bee assemblages. This type of model was ideal as it did not require response variables to be normally distributed.

Both sets of models were further divided into three categories, depending on the response variables: (a) wild bee community composition variables (trap abundance, morphospecies richness, morphospecies diversity, morphospecies evenness, median body size, proportion of Halictidae bees and visual abundance); and wild bee community functional structure variables, which include: (b) the CWM of functional bee traits (sociality, lecty, body size, tongue length and parasitic behaviour) and (c) the FDis of functional bee traits (sociality, lecty, body size, tongue length, parasitic behaviour and pollen organ type). See **Figure 5** for a visual flowchart of the analysis structure and the six different analyses: 1a, 1b, 1c, 2a, 2b and 2c.

The first step was to test both sets of potential predictor variables for any linear correlations using a Pearson correlation analysis. Predictor variables used in the generalized linear models were chosen such that none were significantly correlated. For general margin and landscape characteristics, the potential predictor variables were: proportion of surrounding arable land (%), landscape diversity index (nats), mean margin width (m), mean vegetation height (cm), total flower abundance (floral units/m^2), floral richness, proportion of vegetation classified as shrubs or trees (%) and proportion of perennial plant species (%).

For the functional structure of plant communities in field margins, the potential predictor variables were the CWM or FDis of plant traits: colour, morphology, life form, nectar availability, number of flowering months, number of petals, number of stamens, number of stigmata, corolla size and typical mean height. A trait was represented by either CWM or FDis depending on which was more logical or interesting for the analysis. It was more logical to consider the CWM for the number of flowering months because the FDis has no relevant significance – a margin could have low dispersion for this trait with most plants flowering for 12 months, whereas another margin could have high dispersion, but mostly plants flowering for a shorter period. Likewise, nectar availability was represented by CWM because it can be assumed that a high dispersion of nectar availability provides no benefit to the pollinator as greater nectar availability would mostly always be preferred. Nominal traits (colour, morphology and life form) were always expressed as FDis. The five remaining traits (typical mean height, corolla size, number of petals, number of stamens and number of stigmata) could logically be represented by both CWM and FDis. For example, it would be interesting to see how overall mean corolla size affected the bee community; it would also be interesting to see how dispersion in corolla sizes affected the bee community. In these cases, FDis was initially considered and linear relationships between the CWM and FDis of individual traits were analyzed and taken into consideration for the interpretation of results. Thus, the chosen potential predictor variables were: CWM number of flowering months, CWM nectar availability, FDis colour, FDis morphology, FDis life form, FDis mean height, FDis corolla size, FDis number of petals, FDis number of stamens and FDis number of stigmata. The proportion of surrounding arable land was also included as the first predictor variable in this set of models, as this was a variance that needed to be accounted for, but landscape level trends were only analyzed as part of the first analysis.

Models were fitted using a normal error distribution for continuous response variables (this comprised all variables except for morphospecies richness and proportion Halictidae bees); and a Poisson error distribution (log link function) for count response variables (morphospecies richness and proportion Halictidae bees). Before running the models, it was ensured that all variables were of a standardized scale. The significance of predictor variables was assessed using an F-test for continuous response variables and a chi-squared test for count response variables. One margin with overall high flower abundance and richness yet low bee abundance and richness in traps, site CO, was consistently an outlier in the models (potentially due to its dense tree canopy which created a lot of shade throughout the margin) and was thus omitted from all generalized linear models. All analyses were done in R version 3.2.2 (R Development Core Team, 2015).

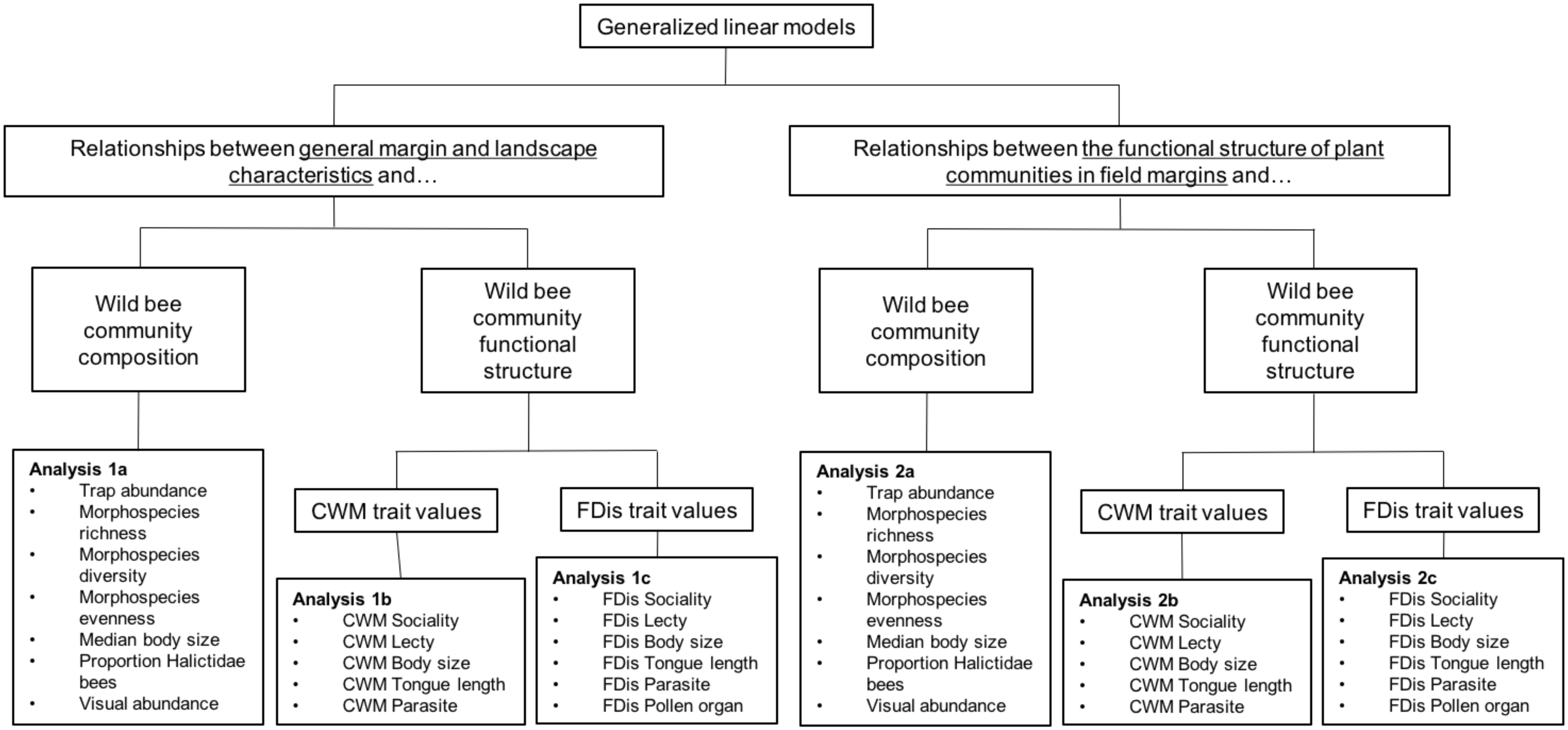

Figure 5. Data analysis structure.

3.2. <u>Part B</u> – Attractiveness of common flowering weeds to flower visiting insects

3.2.1. Study site and experimental design

This experiment was carried out during two years, 2015 and 2016, at Agropolis, the research station of the School of Agriculture (UPC), located in Viladecans, Barcelona, in a flat, highly agricultural area. The experimental site was constructed on a vacant field with coordinates, 41°17’24”N 2°02’43”E, at sea level (0 m a.s.l.) (**Figure 6**). The mean monthly temperature in Viladecans from 2015 to 2016 was 17℃ and mean yearly rainfall was 416 mm (Ruralcat, 2017). The landscape in the circular region of 1 km radius surrounding the experimental site was 45% arable lands and orchards, 20% pasture and 35% urban and unproductive lands (“Sistema de Información Geográfica de Parcelas Agrícolas,” 2017).

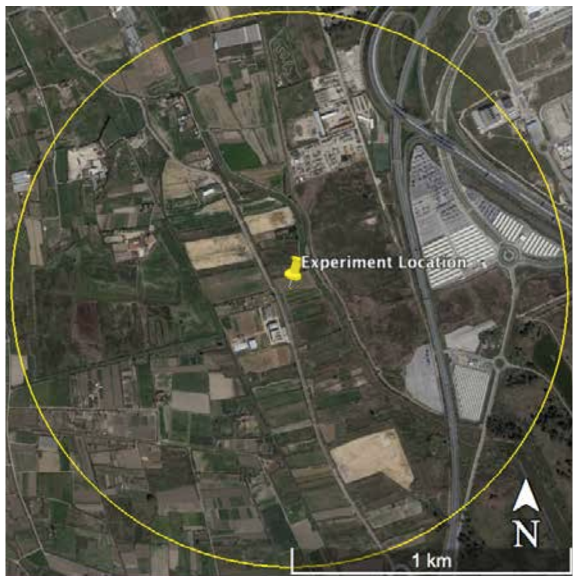

Figure 6. Experiment location and surrounding landscape (1 km radius).

The total dimensions of the experimental area were 35.5 m x 10.5 m comprising three repetitions, each 10.5 m x 10.5 m with a 2 m space in between them (**Figure 7** and **Figure 8**). Each repetition comprised nine plots, each 2.5 m x 2.5 m with a 1.5 m space in between them, where six of the nine plots were planted with carefully selected flowering plant species and three plots were left empty. Of the six plots planted with flower species, five were planted with a different species in monoculture (one species per plot) and one was planted with a mixture of all five species randomly and equally distributed throughout the plot. The plots within each repetition were organized randomly such that each arrangement was unique, avoiding any influence from neighbouring species.

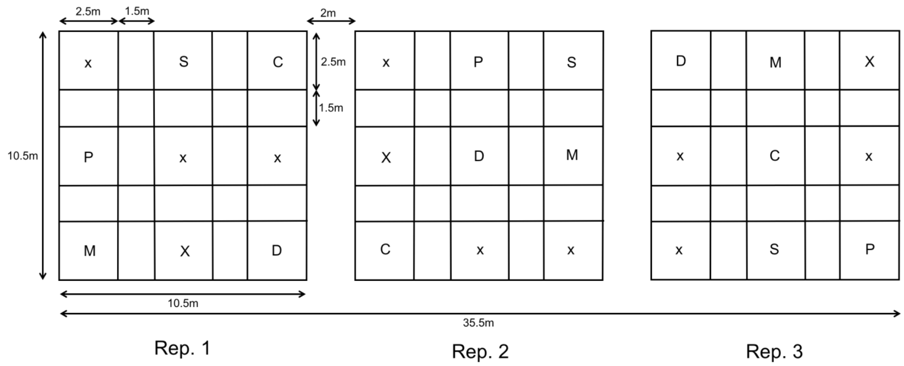

Figure 7. Diagram of experimental layout. (C = *C. arvensis*, D = *D. carota*, M = *M. sylvestris*, P = *P. rhoeas*, S = *S. oleraceus*, X = mixed plot, x = vacant plot.)

Figure 8. Photo of experimental layout.

The desire was to study flowering ruderal species common in Catalonia, with some known attractiveness for wild pollinators. Therefore, in order to choose the species for the experiment, the foraging activity of flower vising insects was analyzed from the first year of the experiment in Part A (see ***Section 3.1.3***). For all the floral species that were visited by wild bees, the total number of bee visits per species was divided by the occurrence of that plant species (the number of quadrats in which that species was present) in order to see how attractive each species was relative to its abundance. Among the species with the highest bee visits to plant occurrence ratios, the top five were chosen for which plants were known to be common in the region and seeds could be purchased from a trusted distributor. The selected species were: *M. sylvestris* (bee visits/plant occurrence = 30.0), *S. oleraceus* (bee visits/plant occurrence = 1.9), *D. carota* (bee visits/plant occurrence = 1.6), *C. arvensis* (bee visits/plant occurrence = 0.9) and *P. rhoeas* (bee visits/plant occurrence = 0.8) (see **Figure 1**).

3.2.2. Experimental preparation

In preparation for the first year of sampling, the seeds of the selected species were sown in the greenhouse in early 2015. When ready, seedlings were transplanted to the experimental site. For *S. oleraceus*, *D. carota* and *P. rhoeas*, 64 plants were planted per plot (eight rows of eight plants). For *M. sylvestris*, only 32 plants were planted per plot (four rows of four plants) because of the large canopy of each individual plant. *C. arvensis* was already an abundant species in this field and was simply allowed to remain in its designated plots. Mixed plots were made up of 20% of each species: 13 plants of *S. oleraceus*, *D. carota* and *P. rhoeas*, 6 plants of *M. sylvestris* and approximately 20% of the plot was allowed to remain with *C. arvensis*. A second round of transplanting replaced any seedlings that did not survive to maturity. Ultimately, results were analyzed based on the relative visitation rate of insects per plant, thus variations in the exact number of plants or coverage were accounted for.

At the end of the first season, plots of annuals (*S. oleraceus* and *P. rhoeas*) were tilled by hand in order to incorporate seeds and attempt to establish plots for the upcoming year. Biennials and perennials (*D. carota* and *M. sylvestris*) were trimmed down and preserved for the following year. It was clear that *C. arvensis* would again be a prevalent weed with no need to sow or incorporate seeds. In early 2016, more seeds of all species (except *C. arvensis*) were sown in the greenhouse and later transplanted in order to supplement what had regrown from the previous year, filling any holes in the coverage. The goal was to establish an even coverage in each plot. In a couple of cases the positioning of plots was changed in the second year in order to optimize coverage.

During both summers, the site was irrigated one to two times a week and all undesirable plant species were removed regularly. Borders and walkways were cut down and sprayed with herbicide (Glyphosate 36%) in order to avoid any external interferences. In **Figure 9** an overview of the experiment is shown, with some species in bloom; at the forefront, there is a mixed plot, behind and to the left, a *C. arvensis* plot and behind and to the right, a *M. sylvestris* plot.

Figure 9. Overview of the experiment in progress.

3.2.3. Sampling insect visits

Observations of insect visits to flowers were carried out twice a week on days when temperatures were at least 17°C with no rain (Pywell et al., 2005). Observations were conducted in the morning, between 8h and 12h30, when wind was at its lowest. For each plot, the sampling season began when there were at least five open flowers. For the mixed plot, sampling began when there were at least two species with five or more open flowers. Likewise, the sampling season ended when there were less than five open flowers per plot, or for the mixed plot, less than two species with five or more open flowers.

Sampling methodology was based on that of Barbir et al. (2014). On sampling days, the order in which the repetitions were sampled alternated systematically. At each plot, first the open flowers were counted and the coverage was estimated as a percentage of the whole plot. For *D. carota*, each inflorescence was considered as one floral unit. During a five-minute period per plot, all insect visits were recorded where the insect made direct contact with the reproductive organs of a flower (i.e., stamens and pistils). When there was a high density of open flowers in a plot, the plot was divided in half and two observers each observed one half of the plot. Customized field tables were utilized such that each insect visit could be quickly recorded, also noting the type of insect and details in regard to size, shape, colour and other distinguishing features. Insects were divided into the following groups: bees (order: Hymenoptera, clade: Anthophila), beetles (order: Coleoptera), hoverflies (order: Diptera, family: Syrphidae), butterflies and moths (order: Lepidoptera), true bugs (order: Hemiptera, suborder: Heteroptera), wasps (order: Hymenoptera, suborder: Apocrita) and other. Infrequent visitation by honeybees and bumblebees made it necessary to pool these genera into one category with wild bees. The most commonly observed species were specifically listed on the field table, and updated throughout the season, so they could be easily recorded.

During the first year it was observed that the flowers of *S. oleraceus* were only open for a short period early in the morning and closed by mid-morning. In order to account for this, in the second year *S. oleraceus* was always sampled first (the order of the repetitions following the same alternating schedule as the remainder of the plots).

3.2.4. Insect identification with traps

Traps were only utilized to measure the local bee community composition and to taxonomically identify common species frequently observed during sampling, not to analyze differences in the insect captures for each plot. In the context of this experiment, the latter approach would not be accurate due to the proximity of neighbouring flower species and the attractive power of the coloured bowls.

Traps were only set the first year. They were placed once per week after visual observations. Trap design and methodology followed that of ***Section 3.1.2***, except they were left for 24 hours and collected the next day. One trap was placed in each type of plot, spread across all three repetitions and greater than 10 m apart from one another.

All captured insects were pinned into entomological boxes. Bees were identified to genus using the Discover Life online taxonomic identification key (Ascher and Pickering, 2012) and the body size of each bee specimen was estimated (very small < 5 mm, small ≈ 5-10 mm, medium ≈ 10-12 mm, large ≈ 12-15 mm and extra-large > 15 mm). Other insects were identified by order and size (very small < 5 mm, small ≈ 5-8 mm, medium ≈ 8-12 mm and large > 12 mm). Furthermore, all species that were observed repeatedly visiting flowers during timed observations were located amongst the trap captures and identified to family (and species when possible) using a local field guide (Pujade and Sarto, 1986).

3.2.5. Flower characteristics

In order to discuss why the different flowers may be attractive to different insects, the morphological and physiological features of the flowers were taken into consideration. Floral characteristics and traits for the studied species were retrieved from the database compiled in Part A, see ***Section 3.1.7.1*** and ***Supplementary Material – Appendix B***. In addition, each year flower measurements were performed in the field. At the full bloom phenological stage for each species, ten randomly chosen flowers per species were cut and measured using a Vernier caliper. Calculations were made immediately after cutting the flower and comprised flower height and flower width (**Figure 10**). The mean value for each component was calculated from all ten flowers. For *D. carota*, the whole inflorescence was measured as it is the entire floral unit that is visible to flower visiting insects; and during field observations it was the visitation rate to the whole inflorescence that was measured.

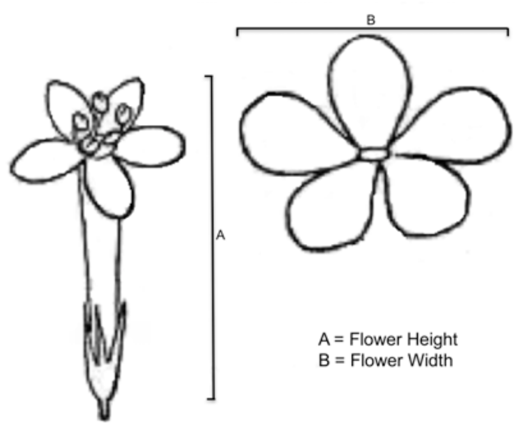

Figure 10. Measured flower components.

3.2.6. Data analysis

At the end of each sampling season, the flowering period of each plot (one value for each repetition) was calculated as the number of flowering days (i.e., the number of days in which more than five flowers were in bloom in a single plot). Meteorological data (hourly temperature and wind speed) for each observational sampling period were obtained from the Viladecans weather station, located approximately 1.2 km away from the site (Ruralcat, 2017).

For each five-minute sampling period at each plot, a visitation rate was calculated (number of insect visits to flower sexual organs, per minute) for each insect group individually as well as for all insects combined. Flower coverage invariably ranged across plots, therefore in order to compare the attractiveness of each flower species, a relative visitation rate was calculated by dividing the visitation rate by the number of open flower units in the plot. For *D. carota*, the number of open inflorescences was considered.

3.2.6.1. Visitation rates throughout seasons

Visitation rate versus time graphs were prepared in order to visualize insect activity throughout the season. One graph was created for the total visitation rates of all plots combined, plus temperature data, for each year side-by-side on one graph in order to generally compare both sampling seasons. In order to provide additional comparative information, another graph showing the total number of open flowers throughout seasons, for both years side-by-side was prepared. Furthermore, mean relative visitation rates of all flower visiting insects were portrayed for each flower species (including mixed plots) individually, with temperature data, throughout the 2015 and 2016 sampling seasons separately. The total number of open flowers was also portrayed for each flower species individually, throughout each season separately. Finally, individual graphs were created for each flower species (including mixed plots), separately for each year, depicting the relative visitation rates of all flower visiting insects for each repeated plot during its flowering period, with temperature data.

The aim here was to observe how visitation rates varied throughout the season (and amongst the repeated plots), if there were one or more peaks in visitation rate, when possible peaks occurred and if this was consistent over both years. Hourly mean temperatures were added to the plots in order to take into consideration how temperature may have affected visitation rates.

3.2.6.2. Difference of means

In order to compare visitation frequencies among the different flower species for each year, overall mean relative visitation rates were calculated for each insect group. These values were the means of all observation data for each flower species (or mixed plot) throughout the flowering period, comprising three separate values for each flower species per day (assuming all three replicate plots were in bloom). Standard deviation was then calculated from the overall mean relative visitation rates of the three repetitions of each flower species (or mixed plot) for each year.

Next, a difference of means test was employed in order to test whether the differences in these means were significant. Welch's t-test for unequal variances (Welch, 1947) was chosen as the most appropriate test because each flower species had a different flowering period, resulting in a different sample sizes over the season. All count data were first square root transformed to meet the assumption of normality. All analyses were done in R version 3.2.2 (R Development Core Team, 2015).

The data were then organized and graphs were prepared in two different ways: (i) to display the differences between years and (ii) to display the differences between flower species. For (i), first, all insect visits to all flower species were generally compared for both years. Next, for each flower species (or mixed plot), graphs were prepared to demonstrate which insect group visited most frequently, and how these visitation rates varied over both years.

For these analyses, differences of means were calculated between the mean relative visitation rates from each year. For (ii), for each insect group, graphs were prepared to show which flowers were visited most frequently. Here, differences of means were calculated between the mean relative visitation rates to each flower species, calculated separately for each insect group and then for all flower visiting insects combined. Data from each year was analyzed independently and due to statistical noise, mixed plots were not included.

3.2.6.3. Attractiveness efficiency

Attractiveness efficiency is a measure used to compare the attractiveness of each flower species to flower visiting insects, taking into account the flowering period. This is an important measure because a long blooming period adds a great deal of conservation value to a ruderal plant, especially in the context of agroecosystems (Barbir et al., 2014). Attractiveness efficiency was assessed using a scatter plot for each type of insect, plotting for each flower, mean relative visitation rate on the y-axis (with standard deviation) and flowering period on the x-axis (with standard deviation). The plot area was divided into four quadrats, whereby flowers with high attractiveness efficiency are found in the top right quadrat (highest visitation rates and longest flowering period), flowers with low attractiveness efficiency are found in the bottom left quadrat (low visitation rates and short flowering period) and flowers with medium attractiveness efficiency are found in the top left quadrat (high visitation rates and short flowering period) and bottom right quadrat (low visitation rates and long flowering period). Results from both years were included in each plot. Attractiveness efficiencies are not absolute, they are only relative to the other flower species in the study. Again, mixed plots were not included as they could not be directly compared to single species plots with statistical robustness.

All graphs were created using R version 3.2.2 (R Development Core Team, 2015).

3.2.6.4. Statistical analysis

General linear models were used to answer two questions: (i) Are there overall trends in insect visitation rates to the selected flower species over the two years? And (ii) What floral characteristics had a significant effect on insect visitation rates? Due to statistical noise, mixed plots were not included. These models were only performed for bees, beetles and all flower visiting insects combined due to overall low visitation rates from other insect groups. All analyses were done in R version 3.2.2 (R Development Core Team, 2015).

In order to answer question (i), a simple general linear model was performed to see if there were clear flower preferences among insect groups, and if these preferences were consistent over the two years of sampling. For this simple model, the predictor variables were: flower species, year and an interaction term between flower species and year. Response variables were the mean relative visitation rates of each replicated plot, for both years in the same model, resulting in a sample size of 30 (five flower species x three replicated plots x two years). These models were fitted using a normal error distribution for continuous response variables and the significance of predictor variables was assessed using an F-test.

To answer question (ii), the first step was to choose potential predictor variables from the floral characteristic data measured in the field (see ***Section 3.2.5***) and from the functional flowering plant trait database compiled in Part A (***Supplementary Material – Appendix B***). The criteria for choosing predictor variables was based on data availability (i.e., some variables in the database were not available for one or more of the sampled flower species) and relevancy. Variables were deemed relevant in regards to insect pollination if they were related to either visibility to insect (e.g., flower size, plant height, etc.) or capacity to provide a reward (e.g., nectar availability, number of stamens, etc.). Categorical traits (e.g., flower morphology and colour), were not considered because the sample size was not large enough to draw statistically robust conclusions from the information available. In order to narrow down the variables to be used in the models, potential predictor variables were tested for any linear correlations using a Pearson correlation analysis. This test was performed twice, once for each year's results.

Response variables were the mean relative visitation rates of each replicated plot. Because of possible inconsistences between years, these models were run for each year separately, resulting in a sample size of 15 (five flower species x three replicated plots) and two sets of models. It was ensured that all variables were of a standardized scale. Models were fitted using a normal error distribution for continuous response variables and the significance of predictor variables was assessed using an F-test.

Chapter 4. Results

4.1. Part A – The role of field margins in supporting wild bees

4.1.1. Plant community

The plant community characteristics of each margin are listed in **Table 4**. The average height of vegetation ranged from 45.0 to 99.3 cm (mean = 63.3 cm). Total flower abundance was highly variable and ranged from 2 to 1305 floral units/m^2 (mean = 330 floral units/m^2). Across all margins, floral composition was also highly variable; floral richness ranged from 4 to 27 (mean = 15). The proportion of herbaceous plants ranged from 33 to 100% (mean = 83%), while the proportion of shrubs and trees ranged from 0 to 66% (mean = 17%). The proportion of annuals ranged from 0 to 95% (mean = 51%) and perennials ranged from 5 to 100% (mean = 49%).

Table 4. Margin plant community characteristics. (See **Table 1** for site information.)

Site	Mean Vegetation Height (cm)	Total Flower Abundance (floral units/m^2)	Floral Richness	Proportion Herbaceous Plants (%)	Proportion Shrubs and Trees (%)	Proportion Annuals (%)	Proportion Perennials (%)
A1	79	13	7	95	5	9	91
A2	58	6	4	100	0	36	64
A3	49	158	17	85	15	39	61
CA	59	240	9	100	0	80	20
CO	69	611	27	75	25	37	63
G1	63	285	18	100	0	82	16
G2	70	60	12	95	5	80	21
G3	45	2	7	85	15	95	5
G4	57	29	14	90	10	88	12
G5	66	70	19	50	50	12	88
G6	66	204	22	65	35	68	33
G7	47	319	14	70	30	22	78
G8	62	580	19	90	10	25	75
G9	51	26	8	100	0	93	7
M	78	422	17	60	40	48	52
P1	59	33	6	100	0	15	86
P2	70	307	27	33	66	33	67
S1	61	126	10	100	0	93	7
S2	71	391	15	94	6	57	43
S3	62	629	18	85	15	32	68
S4	47	164	18	65	35	0	100
S5	67	25	16	69	31	52	50
SA	74	757	11	100	1	92	8
SB	76	892	19	81	30	30	70
SC	49	603	17	70	30	60	39
SD	57	640	16	93	7	9	91
SE	99	1305	12	90	10	89	11

In all three years, a total of 182 different plant species were identified, from 50 different families (see ***Supplementary Material – Appendix D***). Eight plants could only be identified to genus. Of the plants identified, 155 were flowering (non-Gramineae) species. The flowering species found most frequently were: *P. rhoeas* (found in 59% of the margins), *Galium aparine* L. (52%), *Fumaria officinalis* L. (48%), *C. arvensis* (44%) and *Lactuca serriola* L. (41%) (**Figure 11**).

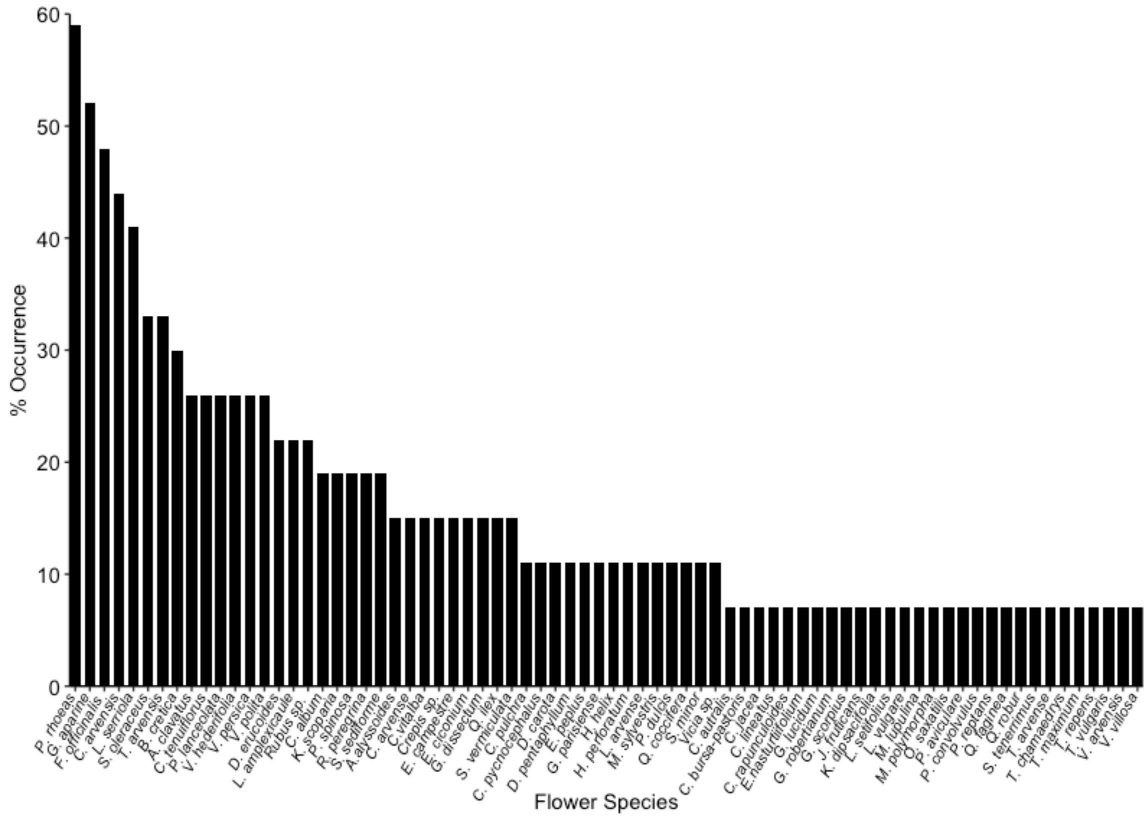

Figure 11. Percent occurrence of flower species in all margins (for species present in more than one margin).

4.1.2. Landscape structure

The surrounding landscape structure of each margin is listed in **Table 5**. Diagrams depicting landscape structure for all margins are found in ***Supplementary Material – Appendix E***. Landscape diversity ranged from 0.52 to 1.57 nats (mean = 1.13 nats). Indeed, the elected margins represented a gradient in proportion of surrounding arable land, from 11 to 87% (**Figure 12**).

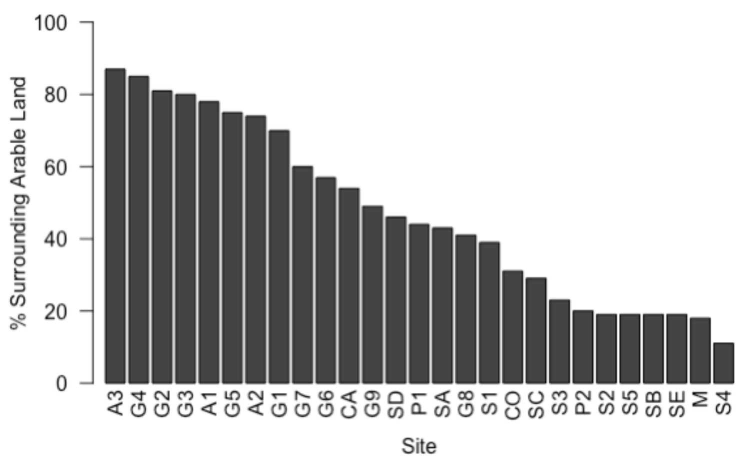

Figure 12. Proportion of surrounding arable land per site (1 km radius). (See **Table 1** for site information.)

Table 5. Surrounding landscape structure per margin (1 km radius). (See **Table 1** for site information.)

Site	Proportion Surrounding Arable Land (%)	Landscape Diversity (nats)
A1	78	0.78
A2	74	0.95
A3	87	0.52
CA	54	1.28
CO	31	1.52
G1	70	0.89
G2	81	0.67
G3	80	0.77
G4	85	0.58
G5	75	0.89
G6	57	1.01
G7	60	1.05
G8	41	1.06
G9	49	1.03
M	18	1.26
P1	44	1.44
P2	20	1.21
S1	39	1.44
S2	19	1.52
S3	23	1.57
S4	11	1.17
S5	19	1.25
SA	43	1.44
SB	19	1.33
SC	29	1.49
SD	46	1.26
SE	19	1.21

4.1.3. Pan traps

A total of 3489 wild bee individuals were collected in the pan traps during the two-year experiment and identified to the level of genus (see ***Supplementary Material – Appendix F***). Data collected from bee traps, pertaining to each margin, are listed in **Table 6**. The total abundance of bee specimens captured in the traps of each individual margin ranged from 38 to 295 (mean = 129), genus richness ranged from 6 to 14 (mean = 10), morphospecies richness ranged from 9 to 31 (mean = 21), morphospecies diversity ranged from 1.16 to 2.88 nats (mean = 2.34 nats), morphospecies evenness ranged from 0.45 to 0.93 (mean = 0.78), proportion of Halictidae bees ranged from 27 to 97% (mean = 66) and median body size (ITD) ranged from 1.3 to 2.3 mm (mean = 1.7 mm). The mean numbers of captured specimens per day, in descending order, compared to genus richness, per site, are displayed in **Figure 13**.

Table 6. Wild bee captures from pan traps, per margin. (See **Table 1** for site information.)

Site	Total Wild Bee Abundance	Genus Richness	Morpho-species Richness	Morpho-species Diversity (nats)	Morpho-species Evenness	Proportion Halictidae (%)	Median Body Size (ITD; mm)
A1	247	10	20	1.77	0.59	95	1.5
A2	232	7	15	1.75	0.65	95	1.3
A3	295	10	19	1.79	0.61	89	1.5
CA	222	7	13	1.16	0.45	97	1.5
CO	70	6	12	1.90	0.77	81	1.5
G1	159	12	24	2.47	0.78	58	1.9
G2	114	7	20	2.26	0.76	83	1.9
G3	136	14	27	2.55	0.77	70	2.2
G4	127	10	23	2.57	0.82	69	2.0
G5	136	12	25	2.79	0.87	57	1.7
G6	59	10	25	2.88	0.89	54	2.1
G7	102	8	20	2.60	0.87	60	2.2
G8	285	12	31	2.69	0.78	74	1.9
G9	207	12	26	2.69	0.83	71	1.9
M	120	12	23	2.45	0.78	65	1.6
P1	77	8	18	2.43	0.84	65	1.9
P2	95	13	24	2.67	0.84	56	1.7
S1	39	6	9	1.89	0.86	69	1.3
S2	85	12	19	2.08	0.71	80	1.6
S3	90	11	19	2.46	0.84	66	1.6
S4	80	12	23	2.75	0.88	44	1.8
S5	94	12	26	2.85	0.87	49	1.6
SA	56	10	18	2.11	0.73	68	1.5
SB	92	12	22	2.54	0.82	46	1.8
SC	182	12	29	2.27	0.67	27	1.7
SD	50	10	15	2.13	0.79	66	1.5
SE	38	12	19	2.73	0.93	32	2.3

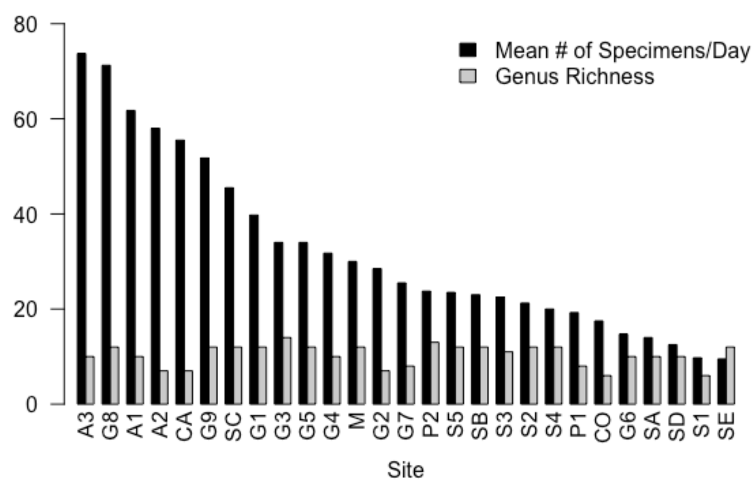

Figure 13. Mean number of specimens per day and genus richness, per site. (See **Table 1** for site information.)

Overall, bees represented six different families (**Figure 14**) and 26 different genera (**Figure 15**). A large majority of the bees collected belonged to the family Halictidae (2470 specimens, 71% of all captures), the second most abundant family was Andrenidae (492 specimens, 14%), followed by Apidae (386 specimens, 11%). The most abundant genera were Halictus (1805 specimens, 52% of all captures), Lasioglossum (661 specimens, 19%), Andrena (247 specimens, 7%), Panurgus (245 specimens, 7%) and Eucera (149 specimens, 4%).

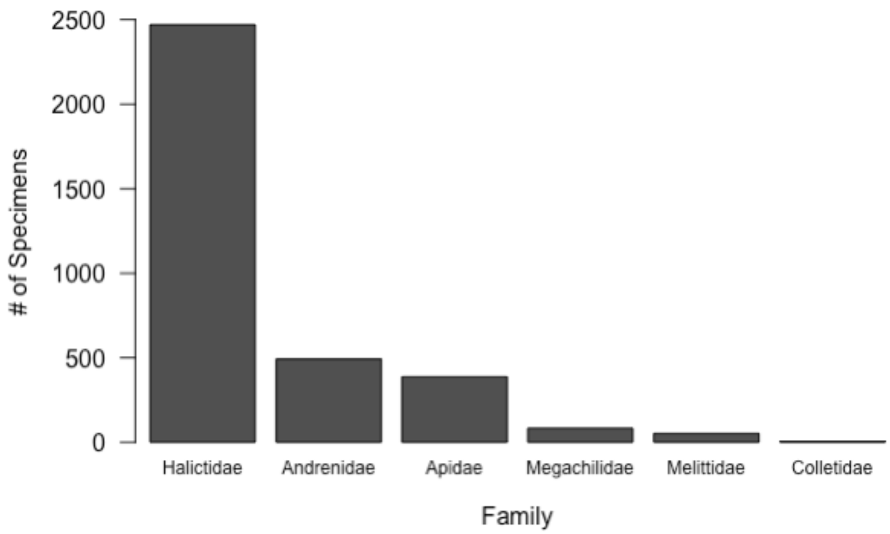

Figure 14. Number of specimens belonging to each family.

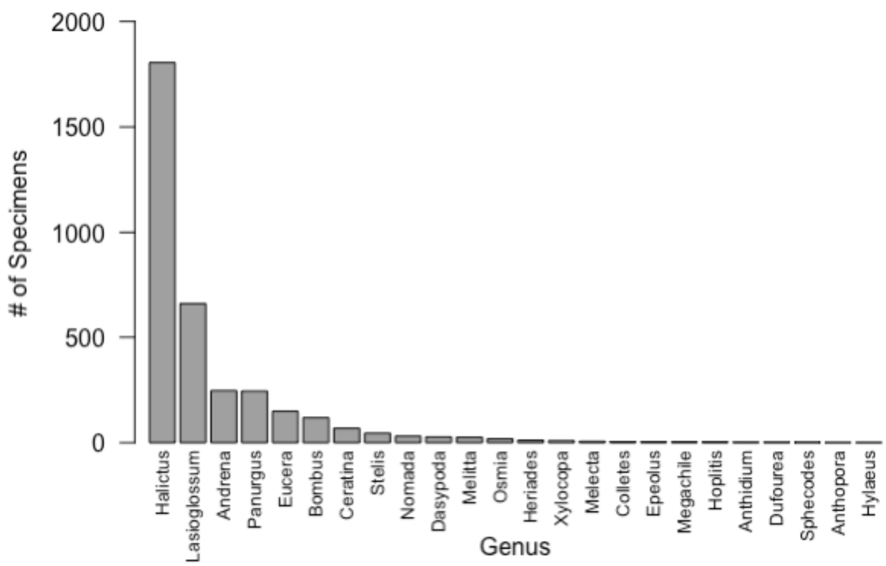

Figure 15. Number of specimens belonging to each genus.

Overall, from all captured specimens, body size (ITD) ranged from 0.4 to 7.7 mm (mean = 1.8 mm). The distribution of body sizes among all captures are listed in **Figure 16**. The majority of bee specimens had an ITD in the range of 1.5 to 2 mm (32% of all captures), followed by 1 to 1.5 mm (24%) and 2 to 2.5 mm (20%). Based on ITD, the overall average maximum foraging distance was calculated to be 0.59 km (confirming the validity of the assumption that the typical foraging range was less than 1 km).

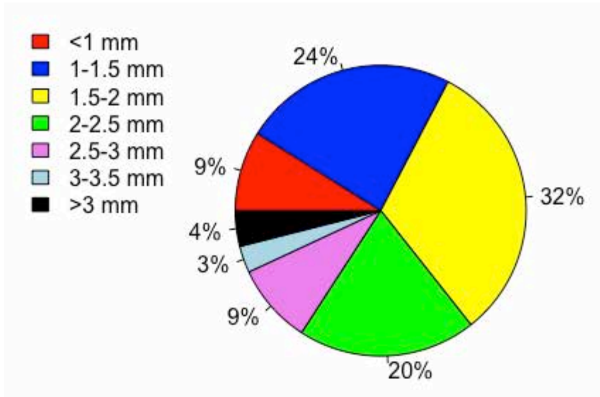

Figure 16. Bee body sizes (ITD), proportion of total captures.

According to bee trait data, only 3% of all captured bees were cleptoparasitic. In terms of sociality, 17% of bees belonged to genera which were strictly solitary, 3% belonged to genera which were strictly social and 80% could be both. For lecty, 78% of the bees belonged to genera known to be polylectic (pollen generalists), while only 2% were oligolectic (pollen specialists) and 20% could not be generalized to just one category. For pollen organ type, 71% of bees collected pollen using scopae situated on both the legs and the fringes of the underside of the gaster, 15% used scopae situated only on the legs, 7% used flocci (plural of floccus, a special, well-developed corbiculae), 1% used a scopa situated only under the abdomen, 3% used corbiculae (pollen baskets) situated on the legs, 3% had no pollen carrying organ (e.g., cleptoparasitic species) and < 1% used scopae situated on both the legs and the propodeum or carried pollen in an internal crop (to later regurgitate). For nesting location, 92% of bees nested strictly below ground, while only 3% nested strictly above ground and 5% could be either. Several bee genera were known to utilize more than one type of nest substrate: 98% of bees utilized soil, 20% wood and 6% vegetation. Of all the non-parasitic bees, 95% excavated their nests, 4% rented and 1% could be either.

4.1.4. Visual observations

Overall, a total of 1988 wild flower visiting insects, including 542 bees, were observed foraging on margin flora (see ***Supplementary Material – Appendix G***). The total number of bees and overall number of flower visiting insects (including bees) observed foraging within each margin are depicted graphically, from the highest number of observed bees to the lowest, in **Figure 17**. The total number of observed bees ranged from 0 to 104 (mean = 20) and all observed flower visiting insects ranged from 3 to 193 (mean = 74). There was significant correlation between margins with high bee visits and margins with high overall insect visits ($P \leq 0.001$).

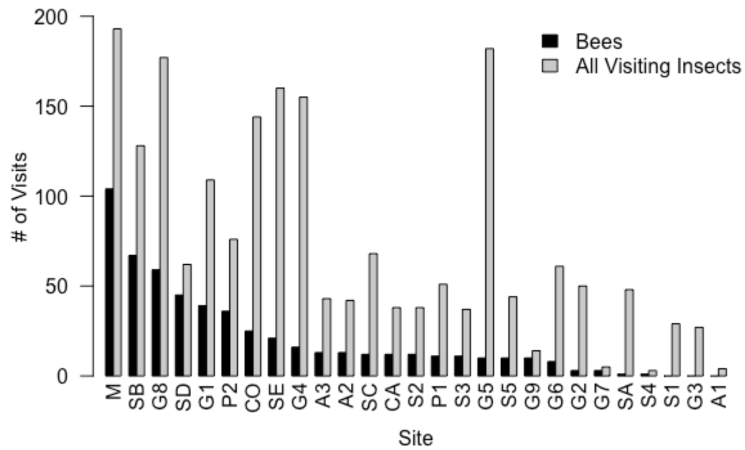

Figure 17. Number of visits of bees and all flower visiting insects per site. (See **Table 1** for site information.)

The floral species visited most frequently by insects were: *P. rhoeas* (251 unique insect visits), *Torilis arvensis* (Huds.) (229 visits), *M. sylvestris* (141 visits), *Quercus ilex* L. (110 visits) and *Euphorbia serrata* L. (108 visits) (**Figure 18**). The most visited species for bees were: *M. sylvestris* (70 visits), *Ligustrum vulgare* L. (56 visits), *Vicia villosa* (Roth.) (54 visits), *Rubus* sp. L. (38 visits), *P. rhoeas* (30 visits) and *T. arvensis* (30 visits) (**Figure 19**). The most visited species for beetles and true bugs were: *P. rhoeas* (201 visits), *Q. ilex* (109 visits), *T. arvensis* (73 visits), *M. sylvestris* (55 visits) and *Erucastrum nasturtiifolium* (Poiret) (51 visits). Finally, the most visited species for hoverflies were: *T. arvensis* (45 visits), *Diplotaxis erucoides* L. (28 visits), *E. nasturtiifolium* (21 visits), *P. rhoeas* (16 visits) and *Anacyclus clavatus* (Desf.) (9 visits).

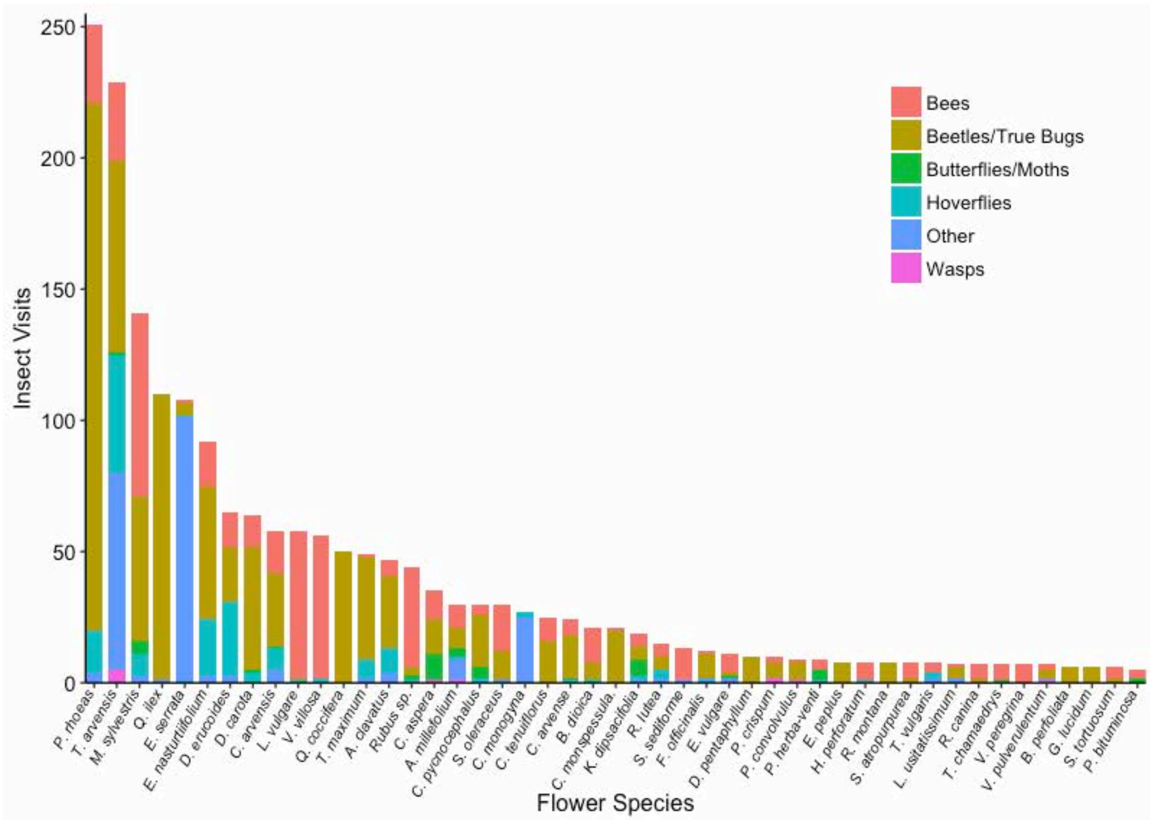

Figure 18. Total number of visits from foraging insects per flower species (for species with more than five visits).

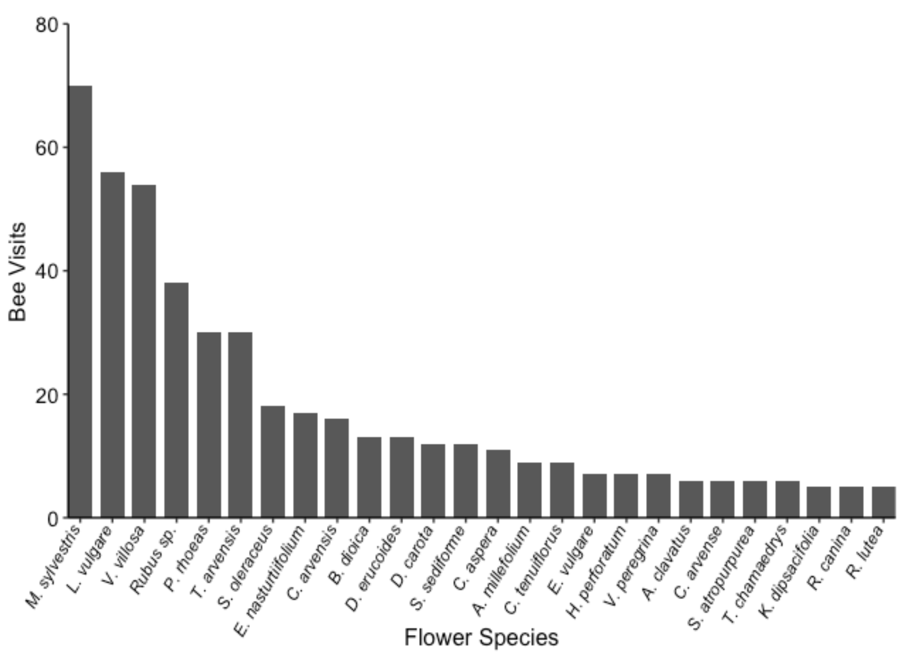

Figure 19. Total number of visits from foraging bees per flower species (for species with more than five visits).

4.1.5. Relationships between general margin/landscape characteristics and wild bee community composition/functional structure

The Pearson correlation analysis revealed that proportion of arable land was significantly inversely correlated with landscape diversity, as well as flower abundance and floral richness (**Table 7**). Flower abundance was also significantly positively associated with landscape diversity and vegetation height. Furthermore, proportion of shrubs and trees was significantly positively correlated with floral richness and proportion of perennials, and proportion of perennials was also significantly positively correlated with margin width. Therefore, in order to disentangle the relative importance of each predictor, proportion arable land, flower abundance, proportion shrubs and trees and proportion perennials were excluded from the analysis. All remaining variables (landscape diversity, margin width, vegetation height and floral richness) were weakly correlated ($P > 0.05$) and included in the model.

Table 7. Pearson correlation coefficients among predictor variables for general margin and landscape characteristics. Significant P values ($P \leq 0.05$) are in bold. (n.s.: $P > 0.05$; *: $0.01 < P \leq 0.05$; **: $0.001 < P \leq 0.01$; ***: $P \leq 0.001$.)

	Proportion Arable Land	*Landscape Diversity*	*Margin Width*	*Vegetation Height*	*Flower Abundance*	*Floral Richness*	*Proportion Shrubs/ Trees*	*Proportion Perennials*
Proportion Arable Land		*** **-0.82**	n.s. -0.20	n.s. -0.32	** **-0.56**	* **-0.39**	n.s. -0.34	n.s. -0.17
Landscape Diversity	*** **-0.82**		n.s. -0.04	n.s. 0.21	** **0.51**	n.s. 0.19	n.s. 0.06	n.s. 0.10
Margin Width	n.s. -0.20	n.s. -0.04		n.s. -0.26	n.s. -0.03	n.s. 0.31	n.s. 0.31	* **0.40**
Vegetation Height	n.s. -0.32	n.s. 0.21	n.s. -0.26		** **0.53**	n.s. 0.13	n.s. 0.05	n.s. -0.09
Flower Abundance	** **-0.56**	** **0.51**	n.s. -0.03	** **0.53**		n.s. 0.33	n.s. 0.05	n.s. -0.03
Floral Richness	* **-0.39**	n.s. 0.19	n.s. 0.31	n.s. 0.13	n.s. 0.33		*** **0.71**	n.s. 0.28
Proportion Shrubs/ Trees	n.s. -0.34	n.s. 0.06	n.s. 0.31	n.s. 0.05	n.s. 0.05	*** **0.71**		* **0.39**
Proportion Perennials	n.s. -0.17	n.s. 0.10	* **0.40**	n.s. -0.09	n.s. -0.03	n.s. 0.28	* **0.39**	

The results from the generalized linear models for the relationships between general margin and landscape characteristics and wild bee community composition response variables (Analysis 1a) are listed in **Table 8**.

Table 8. *Analysis 1a:* Relationships between general margin and landscape characteristics and the composition of the wild bee community in field margins. Summary of F-test on generalized linear models for continuous response variables and chi-squared test for count response variables. Df = 1 in all cases and n = 26. Significant *P* values ($P \leq 0.05$) are in bold; (+) = a positive relationship and (-) = a negative relationship.

	Continuous response Variables										Count response variables	
Predictor Variables	**Wild Bee Abundance**		**Morpho-species Diversity**		**Morpho-species Evenness**		**Median Body Size**		**Visual Abundance**		**Morpho-species Richness**	**Proportion Halictidae**
	F	***P***	***F***	***P***	***F***	***P***	***F***	***P***	***F***	***P***	***P***	***P***
Landscape Diversity	7.8	**0.011 (-)**	0.0	0.905	0.6	0.454	1.9	0.178	0.6	0.457	0.217	**0.000 (-)**
Margin Width	1.1	0.299	2.9	0.101	2.4	0.133	0.6	0.441	0.8	0.393	0.465	**0.000 (-)**
Vegetation Height	2.3	0.147	0.8	0.389	1.0	0.318	0.2	0.648	2.2	0.157	0.799	0.114
Floral Richness	0.1	0.822	4.6	**0.043 (+)**	1.5	0.230	0.1	0.739	5.4	**0.030 (+)**	**0.013 (+)**	**0.000 (-)**

The model indicated a negative relationship between the total abundance of wild bees captured in pan traps and surrounding landscape diversity ($P = 0.011$), but no relationship between trap abundance and local margin characteristics: mean margin width, mean vegetation height and floral richness. Morphospecies diversity and richness were both significantly positively related to floral richness ($P = 0.043$ and $P = 0.013$, respectively), while morphospecies evenness showed no significant relationships to any of the predictor variables. Median body size was not significantly affected by any predictor variables either. Total abundance of bees visually observed foraging in the margins was significantly positively affected by floral richness ($P = 0.030$). Finally, proportion of Halictidae bees had a strong significant negative relationship with landscape diversity ($P = 0.000$), mean margin width ($P = 0.000$) and floral richness ($P = 0.000$).

The results from the general linear models for the relationships between general margin and landscape characteristics and wild bee community functional structure response variables are listed in **Table 9** for CWM trait response variables (Analysis 1b) and **Table 10** for FDis trait response variables (Analysis 1c).

Table 9. ***Analysis 1b:*** Relationships between general margin and landscape characteristics and the functional structure of the wild bee community in field margins. Summary of F-test on general linear models for CWM trait response variables. Df = 1 in all cases and n = 26. Significant *P* values ($P \leq 0.05$) are in bold; where (+) = a positive relationship and (-) = a negative relationship.

Predictor Variables	Response Variables: CWM Sociality		CWM Lecty		CWM Body Size		CWM Tongue Length		CWM Parasite	
	F	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
Landscape Diversity	0.0	0.990	0.7	0.400	1.8	0.190	3.3	0.085	1.8	0.197
Margin Width	0.8	0.380	0.4	0.559	3.0	0.097	2.9	0.102	5.8	**0.025 (+)**
Vegetation Height	1.1	0.308	0.3	0.592	0.5	0.506	0.0	0.868	1.6	0.221
Floral Richness	1.1	0.299	2.1	0.164	1.4	0.256	0.3	0.563	1.5	0.242

A significant positive relationship was observed between CWM parasite and margin width ($P = 0.025$). No other relationships were observed.

Table 10. ***Analysis 1c:*** Relationships between general margin and landscape characteristics and the functional structure of the wild bee community in field margins. Summary of F-test on general linear models for FDis trait response variables. Df = 1 in all cases and n = 26. Significant *P* values ($P \leq 0.05$) are in bold; where (+) = a positive relationship and (-) = a negative relationship.

Predictor Variables	Response Variables: FDis Sociality		FDis Lecty		FDis Body Size		FDis Tongue Length		FDis Parasite		FDis Pollen Organ	
	F	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
Landscape Diversity	3.2	0.089	0.2	0.645	7.8	**0.011 (+)**	7.3	**0.013 (+)**	1.9	0.180	3.5	0.077
Margin Width	6.4	**0.020 (+)**	1.6	0.219	1.6	0.224	1.7	0.207	6.3	**0.020 (+)**	3.5	0.075
Vegetation Height	2.1	0.163	0.8	0.391	1.2	0.294	0.1	0.735	1.9	0.182	0.1	0.811
Floral Richness	4.7	**0.042 (+)**	4.0	0.059	1.0	0.318	0.4	0.540	1.8	0.198	6.2	**0.021 (+)**

A significant positive relationship was observed between FDis sociality and margin width ($P = 0.020$), as well as floral richness ($P = 0.042$). Both FDis body size and FDis tongue length were significantly positively related to landscape diversity ($P = 0.011$ and $P = 0.013$, respectlively). FDis parasite had a significant positive relationship with margin width ($P = 0.020$) and FDis pollen organ had a significant positive relationship with floral richness ($P = 0.021$). FDis lecty was not significantly related to any of the predictor variables.

4.1.6. Relationships between the functional structure of plant communities in field margins and wild bee community composition/functional structure

The Pearson correlation analysis to test for any linear correlations among potential predictor variables **(Table 11)** revealed a significant correlation between FDis number of stamens and FDis life form, as well as between FDis number of stigmata and FDis colour, FDis life form, FDis number of petals and FDis corolla size. Consequently, FDis number of stamens and FDis number of stigmata were omitted from the analysis. Variables included in the model comprised: proportion surrounding arable land, CWM nectar availability, CWM number of flowering months, FDis colour, FDis morphology, FDis life form, FDis number of petals, FDis corolla size and FDis height mean. All included variables were weakly correlated ($P > 0.05$).

Table 11. Pearson correlation coefficients among predictor variables for the functional structure of plant communities in field margins. Significant *P* values ($P \leq 0.05$) are in bold. **(**n.s.: $P > 0.05$; *: $0.01 < P \leq 0.05$; **: $0.001 < P \leq 0.01$; ***: $P \leq 0.001$.)

	% Arable Land	*CWM Nectar Availability*	*CWM Flowering Months*	*FDis Colour*	*FDis Morphology*	*FDis Life Form*	*FDis # Petals*	*FDis # Stamens*	*FDis # Stigmata*	*FDis Corolla Size*	*FDis Mean Height*
% Arable Land		n.s. -0.35	n.s. -0.13	n.s. 0.02	n.s. -0.07	n.s. -0.20	n.s. 0.15	n.s. -0.33	n.s. 0.37	n.s. 0.15	n.s. -0.25
CWM Nectar Availability	n.s. -0.35		n.s. -0.00	n.s. 0.34	n.s. -0.10	n.s. 0.30	n.s. 0.11	n.s. 0.35	n.s. -0.15	n.s. -0.23	n.s. 0.06
CWM Flowering Months	n.s. -0.13	n.s. -0.00		n.s. -0.04	n.s. 0.20	n.s. -0.31	n.s. 0.03	n.s. -0.18	n.s. 0.36	n.s. 0.36	n.s. -0.05
FDis Colour	n.s. 0.02	n.s. 0.34	n.s. -0.04		n.s. 0.27	n.s. 0.27	n.s. 0.30	n.s. -0.03	* **0.41**	n.s. 0.37	n.s. 0.18
FDis Morphology	n.s. -0.07	n.s. -0.10	n.s. 0.20	n.s. 0.27		n.s. 0.24	n.s. 0.10	n.s. 0.09	n.s. 0.18	n.s. 0.37	n.s. 0.06
FDis Life Form	n.s. -0.20	n.s. 0.30	n.s. -0.31	n.s. 0.27	n.s. 0.24		n.s. -0.06	** **0.52**	* **-0.48**	n.s. -0.35	n.s. 0.35
FDis # Petals	n.s. 0.15	n.s. 0.11	n.s. 0.03	n.s. 0.30	n.s. 0.10	n.s. -0.06		n.s. -0.12	* **0.46**	n.s. 0.30	n.s. -0.18
FDis # Stamens	n.s. -0.33	n.s. 0.35	n.s. -0.18	n.s. -0.03	n.s. 0.09	** **0.52**	n.s. -0.12		n.s. -0.36	n.s. -0.26	n.s. 0.00
FDis # Stigmata	n.s. 0.37	n.s. -0.15	n.s. 0.36	* **0.41**	n.s. 0.18	* **-0.48**	* **0.46**	n.s. -0.36		*** **0.87**	n.s. -0.25
FDis Corolla Size	n.s. 0.15	n.s. -0.23	n.s. 0.36	n.s. 0.37	n.s. 0.37	n.s. -0.35	n.s. 0.30	n.s. -0.26	*** **0.87**		n.s. -0.13
FDis Mean Height	n.s. -0.25	n.s. 0.06	n.s. -0.05	n.s. 0.18	n.s. 0.06	n.s. 0.35	n.s. -0.18	n.s. 0.00	n.s. -0.25	n.s. -0.13	

Linear correlations between the CWM and FDis of some plant trait predictor variables are listed in **Table 12**, for consideration in the interpretation of results. Nominal traits were not included because the CWM of these values was not relevant. Flowering months and nectar availability were not included because the FDis of these values was not interesting. Significant positive correlations were found between the CWM and FDis of corolla size and mean height, indicating that the increase in dispersion was due to the inclusion of bees with higher values for those traits. The CWM and FDis of number of petals were not significantly correlated.

Table 12. Pearson correlation coefficients among the CWM and FDis of plant trait predictor variables. Significant *P* values ($P \leq 0.05$) are in bold. **(**n.s.: $P > 0.05$; ***: $P \leq 0.001$.)

Plant Trait	CWM vs. FDis
# of Petals	n.s. -0.23
Corolla Size	*** **0.89**
Mean Height	*** **0.99**

The results from the generalized linear models for the relationships between the functional structure of plant communities in field margins and wild bee community composition response variables (Analysis 2a) are listed in **Table 13**.

Table 13. ***Analysis 2a:*** Relationships between the functional structure of the plant community and the composition of the wild bee community in field margins. Summary of F-test on generalized linear models for continuous response variables and chi-squared test for count response variables. Df = 1 in all cases and n=26. Significant *P* values ($P \leq 0.05$) are in bold; where (+) = a positive relationship and (-) = a negative relationship.

Predictor Variables	Continuous response Variables										Count response variables	
	Wild Bee Abundance		Morpho-species Diversity		Morpho-species Evenness		Median Body Size		Visual Abundance		Morpho-species Richness	Proportion Halictidae
	F	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*P*	*P*
CWM Flowering Months	0.3	0.606	1.6	0.221	0.5	0.490	0.0	0.913	0.3	0.567	0.694	0.654
CWM Nectar Availability	3.2	0.095	3.8	0.068	3.6	0.076	3.3	0.088	3.0	0.102	0.234	**0.001 (-)**
FDis Colour	1.7	0.211	3.0	0.101	9.4	**0.007 (+)**	0.0	0.890	0.0	0.967	0.596	0.874
FDis Mean Height	0.1	0.745	5.8	**0.028 (+)**	2.2	0.157	0.4	0.550	2.3	0.148	**0.022 (+)**	**0.000 (-)**
FDis Corolla Size	0.5	0.485	4.0	0.064	3.1	0.095	3.5	0.079	0.8	0.374	0.118	0.411
FDis Morphology	0.6	0.442	0.8	0.381	0.0	0.865	0.3	0.613	10.1	**0.006 (+)**	0.229	0.398
FDis Life Form	4.3	0.055	1.1	0.306	6.7	**0.020 (-)**	0.1	0.751	2.0	0.180	0.180	0.770
FDis # of Petals	0.3	0.613	4.5	0.051	6.3	**0.024 (+)**	1.6	0.223	0.2	0.644	0.322	0.223

A significant positive relationship was observed between both morphospecies diversity and richness and FDis mean height (P = 0.028 and P = 0.022, respectively). Morphospecies evenness was significantly positively related with FDis colour (P = 0.007) and FDis number of petals (P = 0.024), and negatively related with FDis life form (P = 0.020). Visual abundance had a significant positive relationship with FDis morphology (P = 0.006). Proportion Halictidae had a strong significant negative relationship with CWM nectar availability (P = 0.001) and FDis mean height (P = 0.000). No significant relationships were observed between trap abundance and median body size with predictor variables.

The results from the general linear models for the relationships between the functional structure of plant communities in field margins and wild bee community functional structure response variables are listed in **Table 14** for CWM trait response variables (Analysis 2b) and **Table 15** for FDis trait response variables (Analysis 2c).

Table 14. ***Analysis 2b:*** Relationships between the functional structure of the plant community and the functional structure of the wild bee community in field margins. Summary of F-test on general linear models for CWM trait response variables. Df = 1 in all cases and n = 26. Significant *P* values ($P \leq 0.05$) are in bold; where (+) = a positive relationship and (-) = a negative relationship.

Predictor Variables	Response Variables									
	CWM Sociality		CWM Lecty		CWM Body Size		CWM Tongue Length		CWM Parasite	
	F	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
CWM Flowering Months	1.3	0.270	0.7	0.423	0.4	0.515	0.0	0.988	7.0	**0.018 (-)**
CWM Nectar Availability	1.4	0.256	4.1	0.059	1.9	0.189	0.0	0.838	0.1	0.794
FDis Colour	0.7	0.427	1.4	0.257	1.6	0.223	5.2	**0.036 (+)**	4.7	**0.045 (+)**
FDis Mean Height	4.6	**0.048 (-)**	1.4	0.261	0.2	0.628	1.9	0.184	32.1	**0.000 (+)**
FDis Corolla Size	2.8	0.112	0.3	0.601	3.8	0.071	6.5	**0.022 (-)**	1.5	0.231
FDis Morphology	0.8	0.389	0.0	0.938	1.5	0.235	1.8	0.195	0.1	0.729
FDis Life Form	0.0	0.974	0.1	0.721	1.3	0.265	2.8	0.113	1.1	0.308
FDis # of Petals	0.2	0.627	0.9	0.358	2.0	0.176	2.2	0.155	1.0	0.344

CWM sociality was significantly negatively related with FDis mean height (P = 0.048). CWM tongue length was significantly positively related with FDis colour (P = 0.036) and significantly negatively related with FDis corolla size (P = 0.022). CWM parasite was significantly negatively related with CWM flowering months (P = 0.018) and significantly positively related to FDis colour (P = 0.045) and FDis mean height (P = 0.000). There were no significant relationships between CWM lecty and CWM body size with predictor variables.

Table 15. ***Analysis 2c:*** Relationships between the functional structure of the plant community and the functional structure of the wild bee community in field margins. Summary of F-test on general linear models for FDis trait response variables. Df = 1 in all cases and n = 26. Significant *P* values ($P \leq 0.05$) are in bold; where (+) = a positive relationship and (-) = a negative relationship.

Predictor Variables	Response Variables											
	FDis Sociality		FDis Lecty		FDis Body Size		FDis Tongue Length		FDis Parasite		FDis Pollen Organ	
	F	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
CWM Flowering Months	3.8	0.070	0.1	0.759	0.1	0.803	0.3	0.571	7.4	**0.015 (-)**	0.4	0.538
CWM Nectar Availability	3.7	0.074	5.1	**0.038 (+)**	0.3	0.607	0.0	0.959	0.0	0.963	2.7	0.121
FDis Colour	0.5	0.508	0.1	0.739	5.0	**0.040 (+)**	4.9	**0.042 (+)**	4.7	**0.046 (+)**	8.6	**0.010 (+)**
FDis Mean Height	5.7	**0.030 (+)**	0.6	0.442	1.4	0.249	3.6	0.074	34.8	**0.000 (+)**	6.0	**0.026 (+)**
FDis Corolla Size	5.2	**0.036 (-)**	2.8	0.112	1.1	0.314	1.4	0.261	1.9	0.184	4.5	**0.050 (-)**
FDis Morphology	1.4	0.256	0.8	0.396	1.9	0.182	1.9	0.188	0.0	0.908	2.5	0.132
FDis Life Form	1.1	0.304	0.3	0.591	3.9	0.064	2.4	0.138	1.4	0.251	1.8	0.196
FDis # of Petals	0.4	0.516	1.7	0.206	0.8	0.383	0.9	0.350	1.4	0.249	3.4	0.083

FDis sociality was significantly positively related to FDis mean height (*P* = 0.030) and significantly negatively related to FDis corolla size (*P* = 0.036). FDis lecty was significantly positively related with CWM nectar availability (*P* = 0.038). FDis body size and FDis tongue length were both significantly positively related to FDis colour (*P* = 0.040 and *P* = 0.042, respectively). FDis parasite was significantly negatively related to CWM flowering months (*P* = 0.015) and positively to FDis colour (*P* = 0.046) and FDis mean height (*P* = 0.000). FDis pollen organ had a significant positive relationship with FDis colour (*P* = 0.010) and FDis mean height (*P* = 0.026) and a significant negative relationship with FDis corolla size (*P* = 0.050).

4.2. Part B – Attractiveness of common flowering weeds to flower visiting insects

4.2.1. Insect visits

In total, 4770 insects were observed foraging on experimental flowers in 2015, and 4289 insects were observed in 2016. In 2015, this comprised 2913 bees, 1110 beetles, 435 hoverflies, 115 true bugs, 78 other insects, 63 butterflies and moths and 56 wasps. In 2016, 2172 beetles, 1194 bees, 788 true bugs, 96 other insects, 16 hoverflies, 14 wasps and 9 butterflies and moths were observed (**Figure 20**).

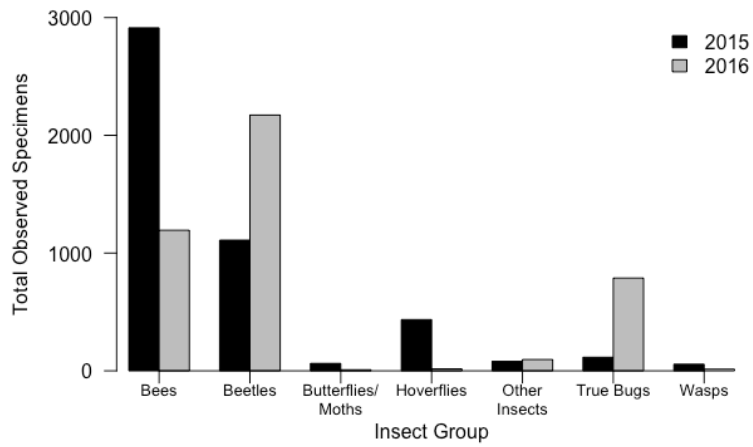

Figure 20. Total observed specimens of each insect group, per year.

Of the bees observed, in 2015, 25% were recorded as very small, 56% small, 8% medium, 10% from the genus Bombus and 0.2% from the genus Xylocopa. In 2016, 26% were recorded as very small, 57% small, 14% medium, 1% large, 1% from the genus Bombus and 0.1% from the genus Xylocopa.

In the category of 'other insects', in 2015, 68% were Diptera including all families except Syrphidae (mainly flies), 31% were Neuroptera from the genus Chrysopa and 1% were Heteroptera from the family Miridae. In 2016, 59% were Diptera including all families except Syrphidae, 9% were Neuroptera from the genus Chrysopa and 32% were other types of insects (e.g., caterpillars, spiders, etc.).

Using the specimens collected in the pan traps (see ***Section 4.2.2*** below), the beetle and true bug species which were frequently observed in the field were identified to family level, and in one case to species level. All hoverflies are from the family Syrphidae and were not identified further. Visits from butterflies, moths and wasps did not appear to be from any specific recurring species, and were thus not identified in the lab.

Of the beetles observed, in 2015, 52% were very small round and black, which were not necessarily all from the same family, but it is believed that most were from the family Dermestidae, likely *Orphilus beali* or *Orphilus niger* (see **Figure 21a**). Furthermore, 34% were very small and black with a tail from the family Mordellidae (for example, *Mordella aculeate*, **Figure 21b**); 9% were long and slender, green or brown, from the family Meloidae (for example, *Lytta vesicatoria*, **Figure 21c**); 2% were long and slender, copper or gold, likely from the families Meloidae or Cerambicidae (for example, *Arhopalus rusticus*, **Figure 21d**); 1% were long and slender, grey or black, likely from the families Cerambicidae or Cantharidae (for example, *Cantharis tristis*, **Figure 21e**); 0.2% were 'ladybirds' from the family Coccinellidae (for example, *Coccinella septempunctata*, **Figure 21f**); and 1% were other types of beetles. In 2016, 34% were very small round and black, mostly from the family Dermestidae; 22% were very small and black with a tail from the family Mordellidae; 6% were long and slender, green or brown, from the family Meloidae; 2% were long and slender, copper or gold, likely from the families Meloidae or Cerambicidae; 1% were long and slender, grey or black, likely from the families

Cerambicidae or Cantharidae; 3% were 'ladybirds' from the family Coccinellidae; and 32% were other types of beetles.

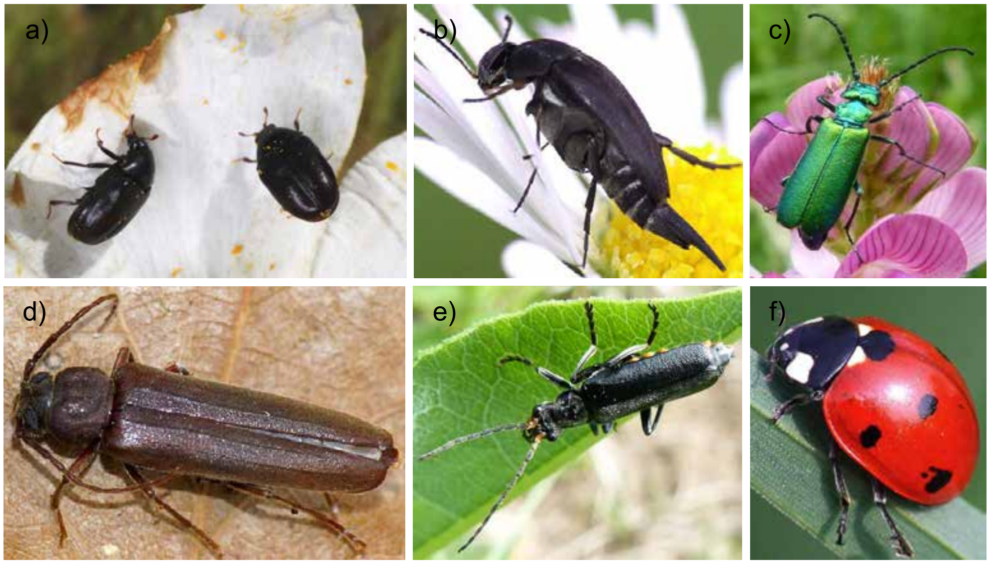

Figure 21. Observed beetles. a) *O. niger* (photo by: Bouyon), b) *M. aculeate* (photo by: Falatico), c) *L. vesicatoria* (photo by: Desjacquot), d) *A. rusticus* (photo by: Maleysson), e) *C. tristis* (photo by: Colombel) and f) *C. septempunctata* (photo by: Falatico)

Of the true bugs observed, in 2015, 65% were *Oxycarenus lavaterae* (family: Lygaeidae) (**Figure 22a**), 32% were larger true bugs from the families Lygaeidae or Pyrrhocoridae, likely *Lygaeus equestris* (**Figure 22b**) or *Scantius aegyptius* (**Figure 22c**), and 3% were other species. In 2016, 96% were *O. lavaterae* and 4% were larger true bugs from the families Lygaeidae or Pyrrhocoridae.

Figure 22. Observed true bugs. a) *O. lavaterae* ("El Desinsectador," 2017), b) *L. equestris* (photo by: Dubroca) and c) *S. aegyptius* (photo by: Maleysson)

4.2.2. Pan traps

In 2015, 704 bees were captured in all pan traps, combined from 10 different sampling days. The identification of these bee specimens revealed that nine genera were represented and that the great majority of the specimens (94.0%) belonged to the genus Halictus. Only four families were represented: Apidae (3.7%), Colletidae (0.1%), Halictidae (94.9%) and Megachilidae (1.3%) (**Table 16**).

Table 16. Bees captured in traps, genus and family representation.

	Genus	Family	%
1	Apis	Apidae	2.0
2	Ceratina	Apidae	0.3
3	Epeolus	Apidae	0.6
4	Eucera	Apidae	0.6
5	Halictus	Halictidae	94.0
6	Hylaeus	Colletidae	0.1
7	Lasioglossum	Halictidae	0.9
8	Nomada	Apidae	0.3
9	Stelis	Megachilidae	1.3

A total of 511 other, non-Apoid, insects were captured in the traps, many of which were not pollinators. This comprised 152 insects of the order Coleoptera, 142 Diptera, 121 Heteroptera, 76 non-bee Hymenoptera, 9 Lepidoptera and 82 other insects which did not fall into these categories. Amongst these specimens, species which were observed frequently visiting flowers during sampling were further identified to family (in one case species), see ***Section 4.2.1*** above.

4.2.3. Visitation rates throughout seasons

Below, visitation rates are plotted against all sampling dates in order to visualize flower visiting insect activity throughout the seasons. When examining the total visitation rates for all plots combined for both years side-by-side (**Figure 23**), it can be seen that 2016 had a much longer overall sampling season, and that in 2015 the sampling season ended later in the year. Even though 2015 had a delayed season, a peak visitation rate was observed at the end of June, whereas in 2016, the peak was not until the beginning of July. The peak visitation rate was similar in both years and only slightly higher in 2015. Temperature was quite consistent and very similar in both years, although the temperature was lower for flower species with an earlier flowering period in 2016. Furthermore, when analyzing the total number of open flowers throughout the seasons for each year side-by-side (**Figure 24**), a greater peak was observed in the number of flowers in 2015, whereas in 2016 open flowers were more evenly spread throughout the season.

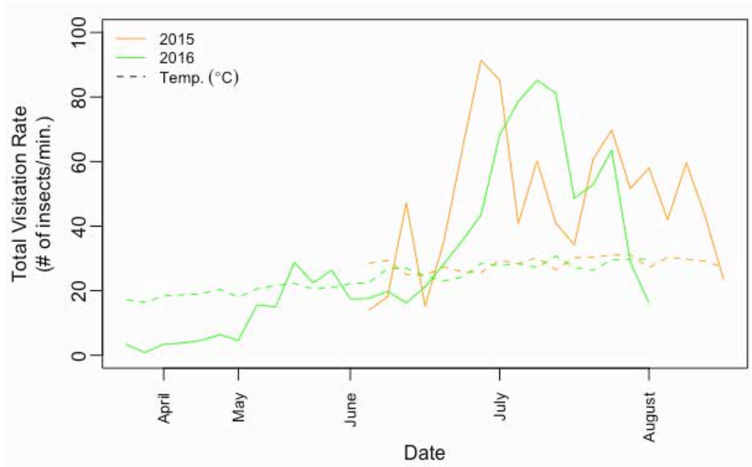

Figure 23. Total visitation rates for all plots combined, and temperature, throughout both sampling seasons.

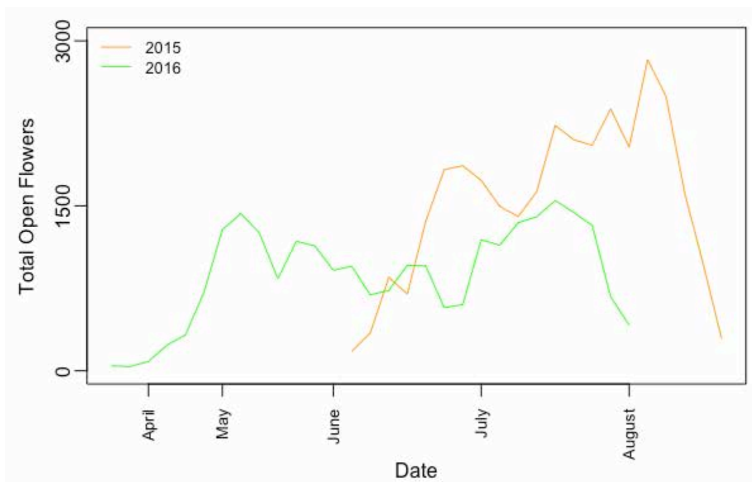

Figure 24. Total number of open flowers throughout both sampling seasons.

By comparing the mean relative visitation rates of all flower visiting insects to each flower species (and mixed plots), it can be seen that, in 2015 (**Figure 25**), *S. oleraceus* had the shortest flowering period (mean between three repetitions = 20 days), followed by *P. rhoeas* (mean = 28 days), *M. sylvestris* (mean = 35 days) and *D. carota* (mean = 101 days). The longest flowering period was tied between *C. arvensis* and mixed plots (mean = 118 days). In 2016 (**Figure 26**), *P. rhoeas* had the shortest flowering period (mean = 31 days), followed by *S. oleraceus* (mean = 49 days), *D. carota* (mean = 52 days), *M. sylvestris* (mean = 63 days) and mixed plots (mean = 67 days). *C. arvensis* had the longest flowering period (mean = 90 days). When comparing the mean relative visitation rates of all flower visiting insects throughout the seasons, for both years *D. carota* had the highest peak daily mean visitation rate (in 2016 this peak was extreme). Furthermore, in both years, *P. rhoeas* had the second highest peak daily mean visitation rate, followed by mixed plots, *M. sylvestris*, *C. arvensis* and *S. oleraceus*.

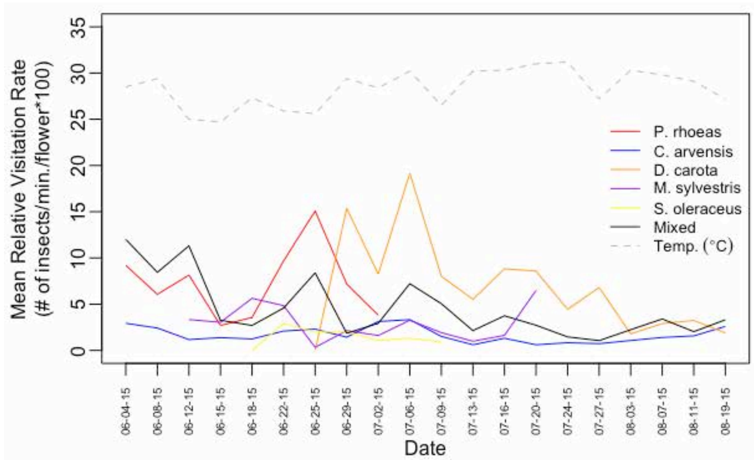

Figure 25. Mean relative visitation rates of all flower visiting insects for each flower species (including mixed plots), and temperature, throughout the 2015 sampling season.

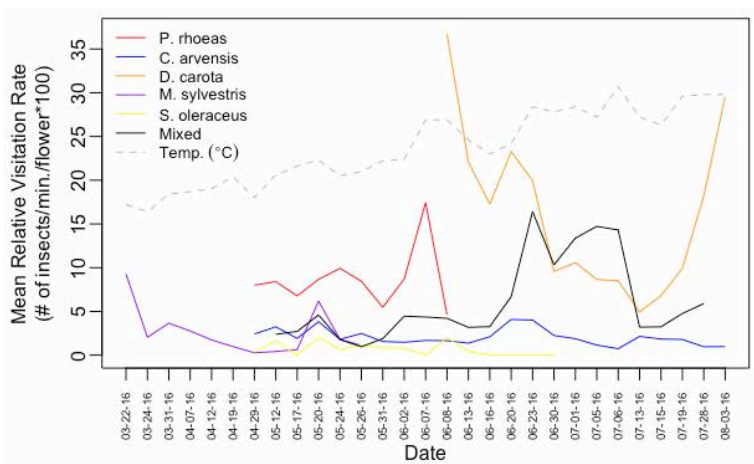

Figure 26. Mean relative visitation rates of all flower visiting insects for each flower species (including mixed plots), and temperature, throughout the 2016 sampling season.

When examining the total number of flowers throughout the 2015 and 2016 sampling seasons (**Figure 27** and **Figure 28**, respectively), it can be seen that *D. carota* had the greatest peak in open flowers in 2015 (near the end of the season), and *M. sylvestris* had the greatest peak in 2016 (at the beginning of the season). In 2015, the bloom of different flowers was consistently overlapped, and *C. arvensis* and mixed plots were in flower for the duration of sampling. In 2016, *M. sylvestris* was in bloom much earlier than the other plots.

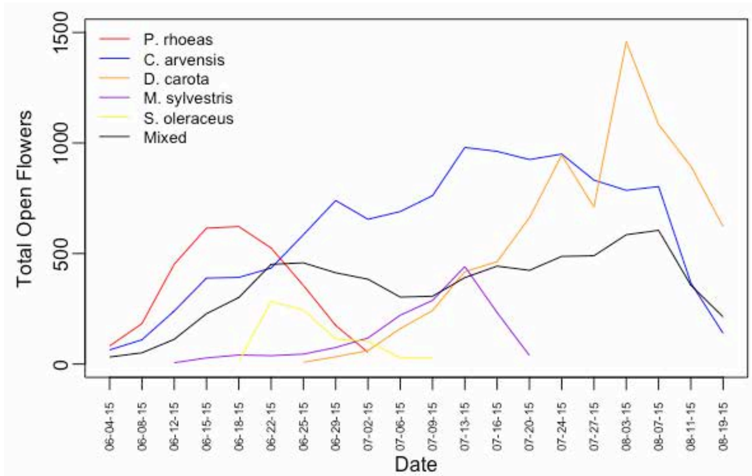

Figure 27. Total number of open flowers per flower species (including mixed plots) throughout the 2015 sampling season.

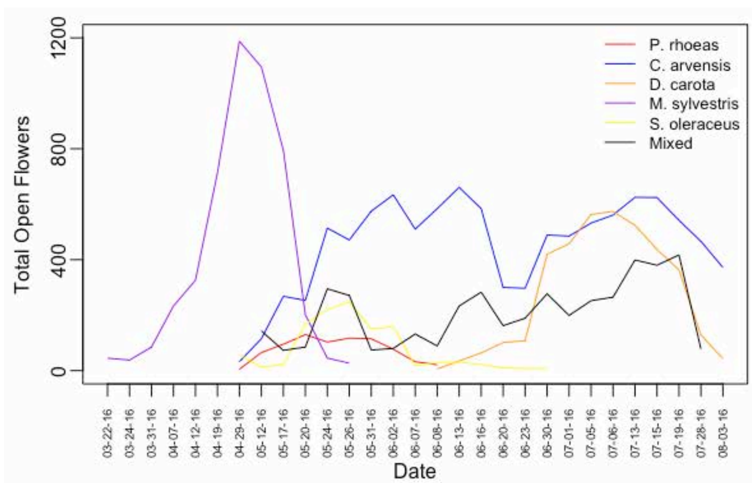

Figure 28. Total number of open flowers per flower species (including mixed plots) throughout the 2016 sampling season.

More detailed information about the differences and similarities between repetitions is provided in ***Supplementary Material – Appendix H***, where the relative visitation rates for each repetition of each flower species (including mixed plots) are displayed for the specific flowering periods of each year.

4.2.4. Total visits and mean relative visitation rates

The total visits and mean relative visitation rates of each insect group to each flower species (including mixed plots), with standard deviation between the three replicated trials, are listed in ***Supplementary Material – Appendix I***. Furthermore, information about the number of visits from different types of insects within the insect group 'other insects', to each flowers species, is also presented in this appendix.

4.2.5. Difference of means – years

The units of mean relative visitation rate, 'number of insect visits to flower sexual organs, per minute, per flower unit', are hereafter referred to as 'imf', and are always scaled by a factor of 100.

In order to visually compare insect visits to plots over both years, the mean relative visitation rates of all flowering visiting insects to each flower species are represented graphically for both 2015 and 2016 together in **Figure 29**. The order of the plots from most visited to least visited for 2015 was: *P. rhoeas* (mean = 7.27±0.39 imf*100), *D. carota* (mean = 6.90±2.62 imf*100), mixed plots (mean = 4.49±2.00 imf*100), *M. sylvestris* (mean = 2.91±0.69 imf*100), *C. arvensis* (mean = 1.68±0.78 imf*100) and *S. oleraceus* (mean = 1.61±1.13 imf*100). For 2016, the order was: *D. carota* (mean = 14.93±2.27 imf*100), *P. rhoeas* (mean = 8.84±4.38 imf*100), mixed plots (mean = 6.37±3.68 imf*100), *M. sylvestris* (mean = 2.64±1.90 imf*100), *C. arvensis* (mean = 2.04±0.29 imf*100) and *S. oleraceus* (mean = 0.74±0.31 imf*100). The only flower species with significant differences between years were *C. arvensis* and *D. carota.*

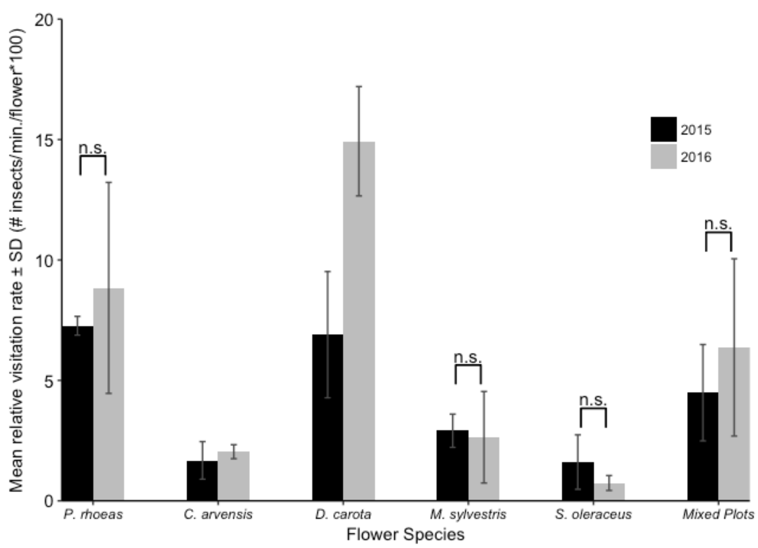

Figure 29. Mean relative visitation rates of all flower visiting insects to different flower species for 2015 and 2016. Error bars represent standard deviation between the three replicated plots. Non-significant differences of means between years ($P > 0.05$; Welch's t-test on square root transformed data), are indicated above flower species (n.s. = not significant).

Next, **Figure 30** to **Figure 35** show which insect groups were visiting each species. For *P. rhoeas*, the most frequent visitors during both years were bees (mean = 6.37±0.61 imf*100 in 2015 and mean = 6.80±3.61 imf*100 in 2016), followed by beetles (mean = 0.90±0.22 imf*100 in 2015 and mean = 1.80±0.68 imf*100 in 2016). All other mean visitation rates rounded to 0.00 imf*100 except for a low visitation rate by other insects in 2016 (mean = 0.24±0.25 imf*100). There were no significant differences between the yearly mean relative visitation rates of bees and beetles (**Figure 30**).

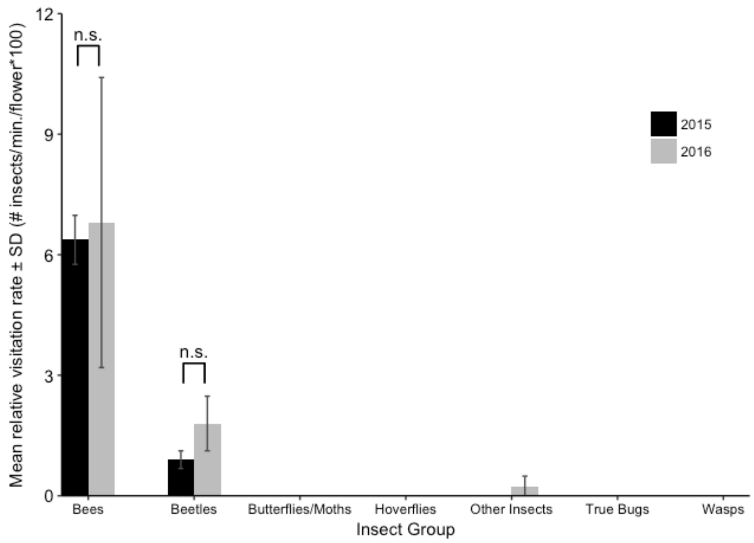

Figure 30. Mean relative visitation rates of different insect groups to *P. rhoeas* for 2015 and 2016. Error bars represent standard deviation between the three replicated plots. Non-significant differences of means between years ($P > 0.05$; Welch's t-test on square root transformed data) are indicated above insect groups (n.s. = not significant). Mean relative visitation rates equal to zero were not analyzed.

For *C. arvensis*, in 2015 the most frequent visitors were bees (mean = 0.95±0.39 imf*100), followed by beetles (mean = 0.54±0.35 imf*100); and in 2016 the most frequent visitors were beetles (mean = 1.30±0.17 imf*100), followed by bees (mean = 0.64±0.25 imf*100). Butterflies and moths had a comparably low visitation rate (mean = 0.11±0.04 imf*100) in 2015. All other insects had mean visitation rates ≤ 0.10 imf*100. There were no significant differences between the yearly mean relative visitation rates of bees and wasps (**Figure 31**).

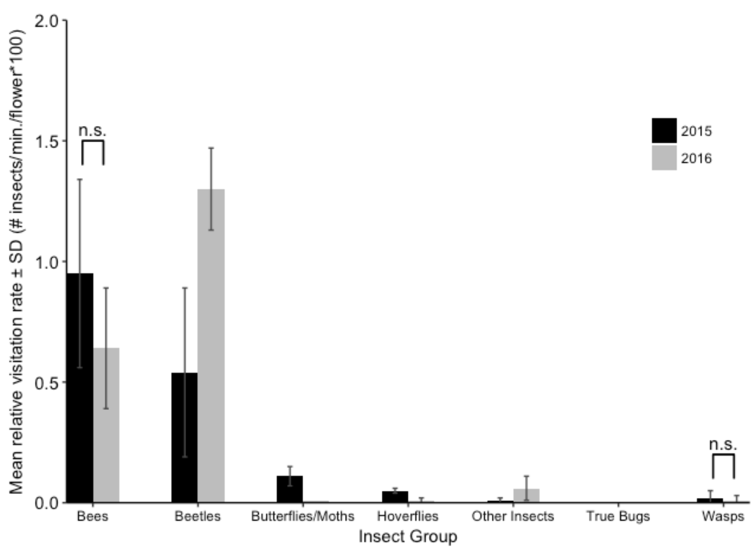

Figure 31. Mean relative visitation rates of different insect groups to *C. arvensis* for 2015 and 2016. Error bars represent standard deviation between the three replicated plots. Non-significant differences of means between years ($P > 0.05$; Welch's t-test on square root transformed data) are indicated above insect groups (n.s. = not significant). Mean relative visitation rates equal to zero were not analyzed.

For *D. carota*, in 2015 the most frequent visitors were bees (mean = 3.26±2.24 imf*100), followed by beetles (mean = 1.51±0.11 imf*100), then hoverflies (mean = 1.35±0.64 imf*100), wasps (mean = 0.38±0.29 imf*100), true bugs (mean = 0.26±0.19 imf*100) and other insects (mean = 0.14±0.04 imf*100). In 2016 the most frequent visitors were beetles (mean = 9.75±1.85 imf*100), followed by bees (mean = 3.25±0.62 imf*100), then true bugs (mean = 1.33±0.46 imf*100), other insects (mean = 0.39±0.11 imf*100), wasps (mean = 0.14±0.15 imf*100) and hoverflies (mean = 0.07±0.11 imf*100). There were no butterfly or moth visits on *D. carota*. There were no significant differences between the yearly mean relative visitation rates of bees, other insects and wasps (**Figure 32**).

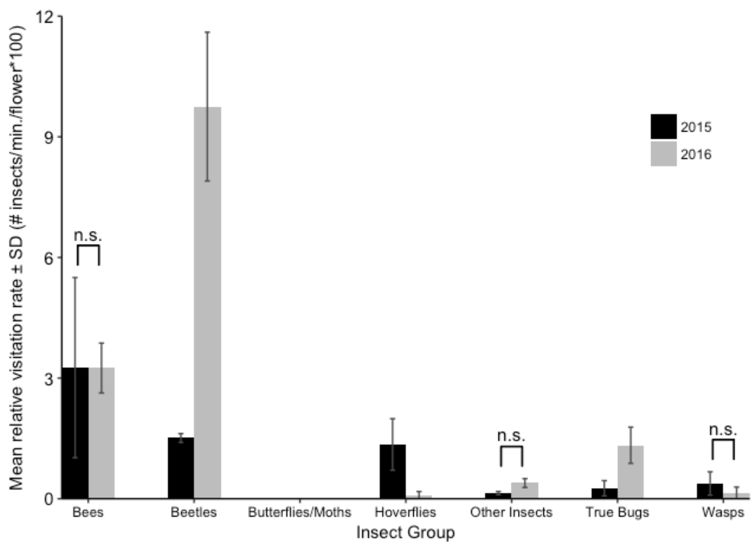

Figure 32. Mean relative visitation rates of different insect groups to *D. carota* for 2015 and 2016. Error bars represent standard deviation between the three replicated plots. Non-significant differences of means between years ($P > 0.05$; Welch's t-test on square root transformed data) are indicated above insect groups (n.s. = not significant). Mean relative visitation rates equal to zero were not analyzed.

For *M. sylvestris*, bees were the most frequent visitors for both years (mean = 2.04±0.63 imf*100 in 2015 and mean = 2.02±1.68 imf*100 in 2016). In 2015, true bugs (mean = 0.34±0.26 imf*100) were the second most frequent visitors, followed by beetles (mean = 0.20±0.18 imf*100), hoverflies (mean = 0.17±0.14 imf*100) and wasps (mean = 0.13±0.24 imf*100). In 2016, beetles were the second most frequent visitors (mean = 0.46±0.25 imf*100). All other insects had mean visitation rates ≤ 0.10 imf*100. There were no significant differences between the yearly mean relative visitation rates of bees and true bugs (**Figure 33**).

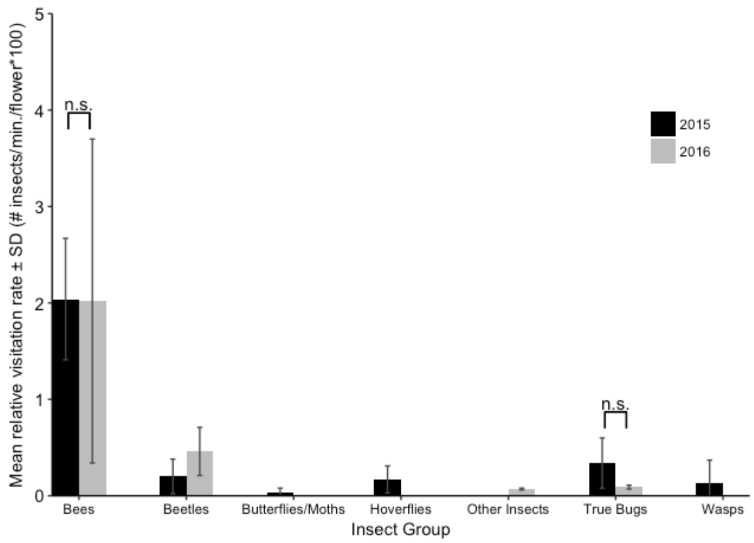

Figure 33. Mean relative visitation rates of different insect groups to *M. sylvestris* for 2015 and 2016. Error bars represent standard deviation between the three replicated plots. Non-significant differences of means between years ($P > 0.05$; Welch's t-test on square root transformed data) are indicated above insect groups (n.s. = not significant). Mean relative visitation rates equal to zero were not analyzed.

For *S. oleraceus*, bees were the most frequent visitors for both years (mean = 1.61±1.13 imf*100 in 2015 and mean = 0.49±0.36 imf*100 in 2016). In 2016 there were also visits from beetles (mean = 0.22±0.18 imf*100). All other insects had mean visitation rates ≤ 0.10 imf*100. There was a significant difference between the yearly mean relative visitation rates of bees (**Figure 34**).

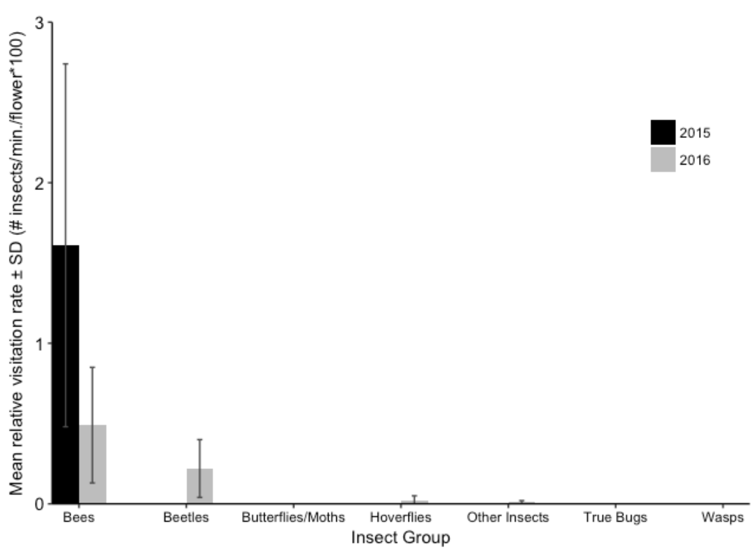

Figure 34. Mean relative visitation rates of different insect groups to *S. oleraceus* for 2015 and 2016. Error bars represent standard deviation between the three replicated plots. Non-significant differences of means between years ($P > 0.05$; Welch's t-test on square root transformed data) are indicated above insect groups (n.s. = not significant). Mean relative visitation rates equal to zero were not analyzed.

For mixed plots, the greatest visitation rates in 2015 were by bees (mean = 2.71±0.45 imf*100), then beetles (mean = 1.48±1.48 imf*100) and hoverflies (mean = 0.15±0.14

imf*100). In 2016 the greatest visitation rates were by beetles (mean = 3.15±1.38 imf*100), then true bugs (mean = 2.11±1.99 imf*100) and bees (mean = 1.00±0.36 imf*100). All other insects had mean visitation rates ≤ 0.10 imf*100. There was no significant difference between the yearly mean relative visitation rates of other insects (**Figure 35**).

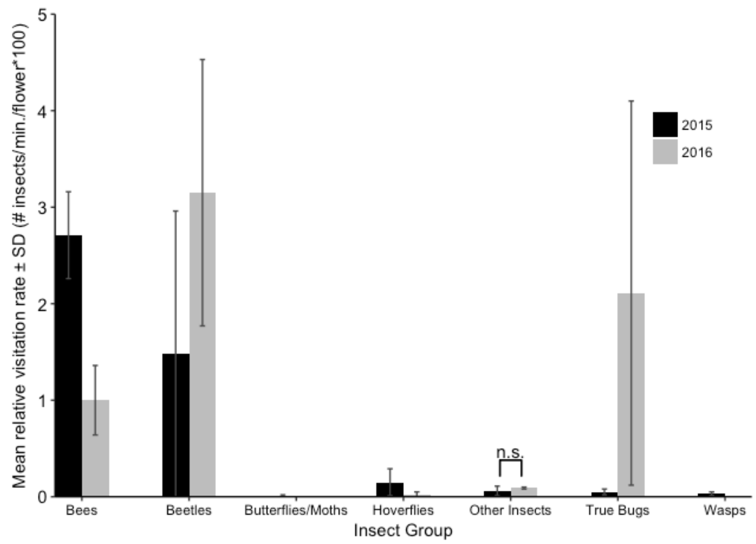

Figure 35. Mean relative visitation rates of different insect groups to mixed plots for 2015 and 2016. Error bars represent standard deviation between the three replicated plots. Non-significant differences of means between years ($P > 0.05$; Welch's t-test on square root transformed data) are indicated above insect groups (n.s. = not significant). Mean relative visitation rates equal to zero were not analyzed.

4.2.6. Difference of means – flower species

Another way to analyze the results was to organize mean relative visitation rate data so as to see the preferences of each insect group. For all flower visiting insects combined in 2015, *P. rhoeas* had the highest mean relative visitation rate (mean = 7.27±0.39 imf*100), then *D. carota* (6.90±2.62 imf*100), *M. sylvestris* (mean = 2.91±0.69 imf*100), *C. arvensis* (mean = 1.68±0.78 imf*100) and *S. oleraceus* (mean = 1.61±1.13 imf*100). There were no significant differences between *P. rhoeas* and *D. carota*, nor between *C. arvensis*, *M. sylvestris* and *S. oleraceus*. For all flower visiting insects combined in 2016, *D. carota* had the highest mean relative visitation rate (mean = 14.93±2.27 imf*100), then *P. rhoeas* (mean = 8.84±4.38 imf*100), *M. sylvestris* (mean = 2.64±1.90 imf*100), *C. arvensis* (mean = 2.04±0.29 imf*100) and *S. oleraceus* (mean = 0.74±0.31 imf*100). There was no significant difference between *C. arvensis* and *M. sylvestris* (**Figure 36**).

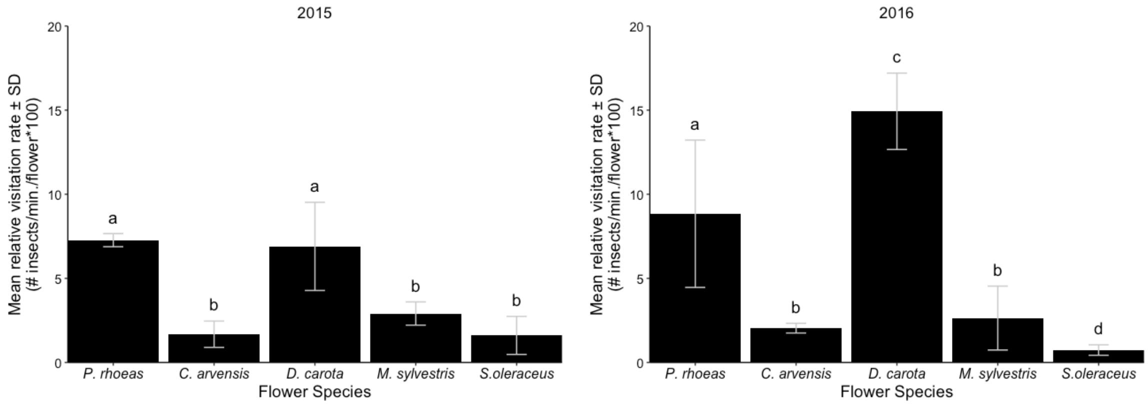

Figure 36. Mean relative visitation rates of **all flower visiting insects** to different flower species for 2015 (left) and 2016 (right). Error bars represent standard deviation between the three replicated plots. Lowercase letters indicate significant differences between visitation rates to flower species at $P < 0.05$ level (Welch's t-test on square root transformed data).

For bee visits in 2015, *P. rhoeas* had the highest mean relative visitation rate (mean = 6.37±0.61 imf*100), then *D. carota* (mean = 3.26±2.24 imf*100), *M. sylvestris* (mean = 2.04±0.63 imf*100), *S. oleraceus* (mean = 1.61±1.13 imf*100) and *C. arvensis* (mean = 0.95±0.39 imf*100). No significant difference was observed between *C. arvensis* and *S. oleraceus*, nor between *D. carota, M. sylvestris* and *S. oleraceus*. For bee visits in 2016, *P. rhoeas* had the highest mean relative visitation rate (mean = 6.80±3.61 imf*100), then *D. carota* (mean = 3.25±0.62 imf*100), *M. sylvestris* (mean = 2.02±1.68 imf*100), *C. arvensis* (mean = 0.64±0.25 imf*100) and *S. oleraceus* (mean = 0.49±0.36 imf*100). No significant difference was observed between *C. arvensis* and *M. sylvestris* nor between *M. sylvestris* and *S. oleraceus* (**Figure 37**).

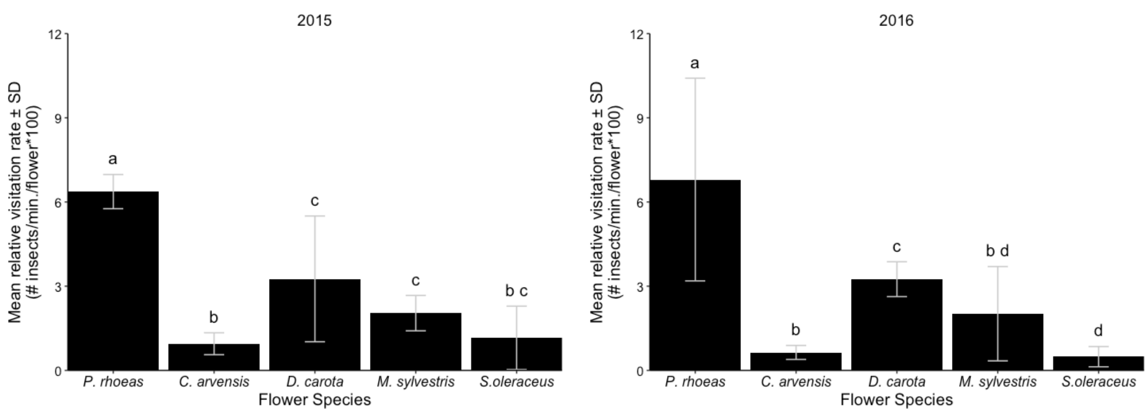

Figure 37. Mean relative visitation rates of **bees** to different flower species for 2015 (left) and 2016 (right). Error bars represent standard deviation between the three replicated plots. Lowercase letters indicate significant differences between visitation rates to flower species at $P < 0.05$ level (Welch's t-test on square root transformed data).

For beetle visits in 2015, *D. carota* had the highest mean relative visitation rate (mean = 1.51±0.11 imf*100), *P. rhoeas* (mean = 0.90±0.22 imf*100), *C. arvensis* (mean = 0.54±0.35 imf*100) and *M. sylvestris* (mean = 0.20±0.18 imf*100). *S. oleraceus* had no visits. There was no significant difference between *P. rhoeas* and *C. arvensis*. For beetle visits in 2016, *D. carota* had by far the highest mean relative visitation rate (mean = 9.75±1.85 imf*100), then *P. rhoeas* (mean = 1.80±0.68 imf*100), *C. arvensis* (mean = 1.30±0.17 imf*100), *M. sylvestris* (mean = 0.46±0.25 imf*100) and *S. oleraceus* (mean = 0.22±0.18 imf*100). There was no significant difference between *P. rhoeas* and *C. arvensis* (**Figure 38**).

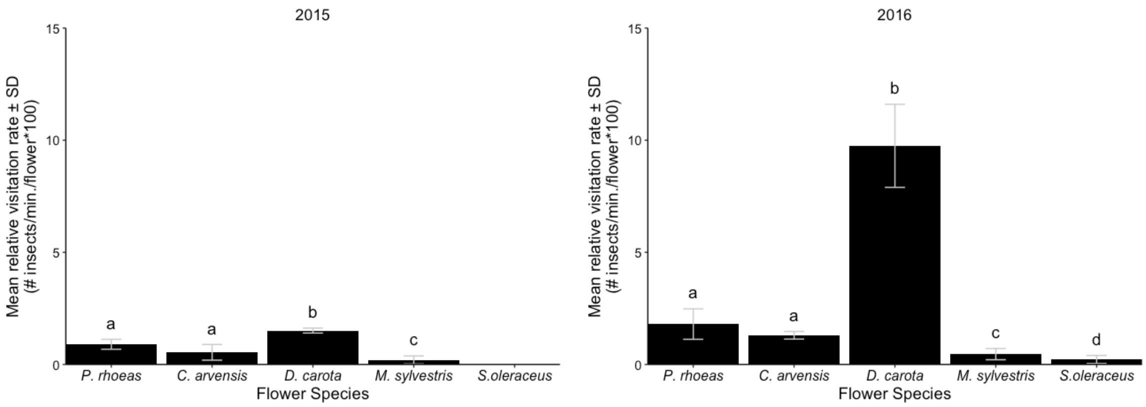

Figure 38. Mean relative visitation rates of **beetles** to different flower species for 2015 (left) and 2016 (right). Error bars represent standard deviation between the three replicated plots. Lowercase letters indicate significant differences between visitation rates to flower species at $P < 0.05$ level (Welch's t-test on square root transformed data).

For butterflies and moths in 2015, the most frequented flower was *C. arvensis* (mean = 0.11±0.04 imf*100). The second most visited flower was *M. sylvestris* (mean = 0.03±0.05 imf*100). There were no visits to *P. rhoeas*, *D. carota* or *S. arvensis*. The difference between the means of *C. arvensis* and *M. sylvestris* was significant. For butterflies and moths in 2016, the only flower visited was *C. arvensis* (mean = 0.01±0.01 imf*100 in 2016) (**Figure 39**).

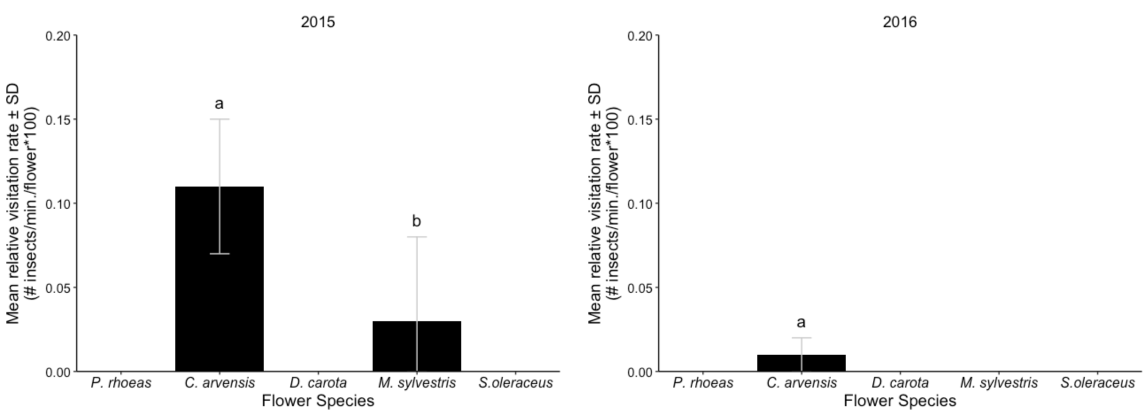

Figure 39. Mean relative visitation rates of **butterflies and moths** to different flower species for 2015 (left) and 2016 (right). Error bars represent standard deviation between the three replicated plots. Lowercase letters indicate significant differences between visitation rates to flower species at $P < 0.05$ level (Welch's t-test on square root transformed data).

For hoverflies in 2015, *D. carota* was the most frequented flower (mean = 1.35±0.64 imf*100), followed by *M. sylvestris* (mean = 0.17±0.14 imf*100) and *C. arvensis* (mean =

0.05±0.01 imf*100). There were no visits to *P. rhoeas* or *S. arvensis*. There was no significant difference between *C. arvensis* and *M. sylvestris*. For hoverflies in 2016, *D. carota* was the most frequented flower (mean = 0.07±0.11 imf*100), followed by *S. arvensis* (mean = 0.02±0.03 imf*100) and *C. arvensis* (mean = 0.01±0.01 imf*100). There were no visits to *P. rhoeas* or *M. sylvestris* and no significant difference between visitation rates to *C. arvensis*, *D. carota* and *S. arvensis* (**Figure 40**).

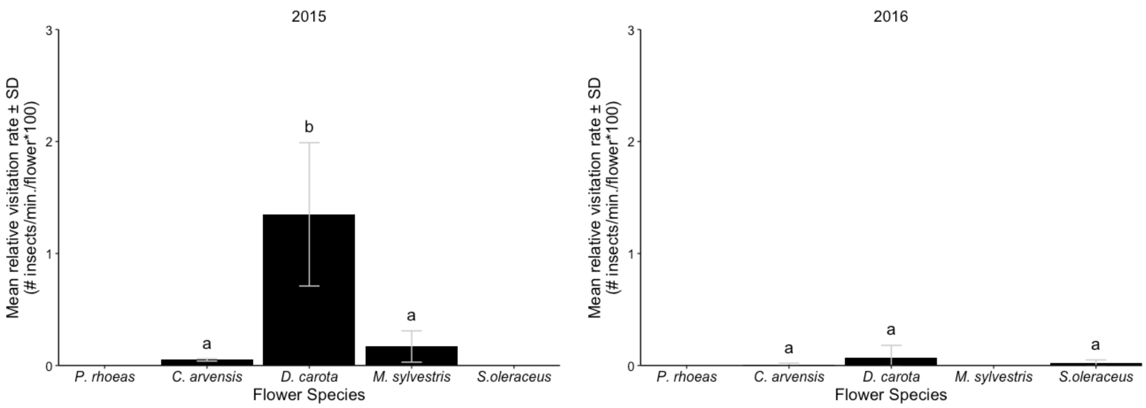

Figure 40. Mean relative visitation rates of **<u>hoverflies</u>** to different flower species for 2015 (left) and 2016 (right). Error bars represent standard deviation between the three replicated plots. Lowercase letters indicate significant differences between visitation rates to flower species at *P* < 0.05 level (Welch's t-test on square root transformed data).

For true bugs in 2015, the most frequently visited flower was *M. sylvestris* (mean = 0.34±0.26 imf*100), followed by *D. carota* (mean = 0.26±0.19 imf*100). No other flower species were visited and there was no significant difference between the two visited species. For true bugs in 2016, the most frequently visited flower was *D. carota* (mean = 1.33±0.46 imf*100), followed by *M. sylvestris* (mean = 0.09±0.02 imf*100). No other flower species were visited and there was a significant difference between *D. carota* and *M. sylvestris* (**Figure 41**).

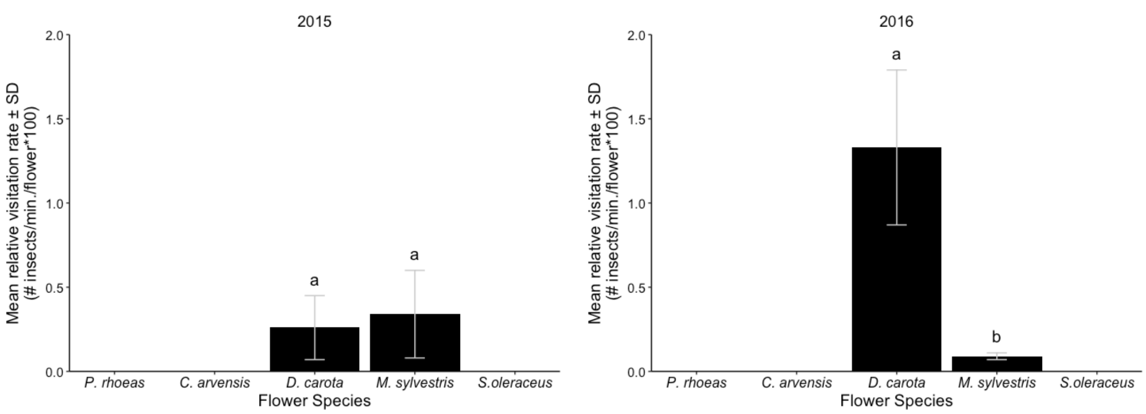

Figure 41. Mean relative visitation rates of **<u>true bugs</u>** to different flower species for 2015 (left) and 2016 (right). Error bars represent standard deviation between the three replicated plots. Lowercase letters indicate significant differences between visitation rates to flower species at *P* < 0.05 level (Welch's t-test on square root transformed data).

For wasps in 2015, the most visited flower was *D. carota* (mean = 0.38±0.29 imf*100), followed by *M. sylvestris* (mean = 0.13±0.24 imf*100), *C. arvensis* (mean = 0.02±0.03 imf*100) and no visits to *P. rhoeas* or *S. arvensis*. There were no significant differences between *C. arvensis* and *M. sylvestris* nor between *D. carota* and *M. sylvestris.* For wasps in 2016, the most visited flower species was *D. carota* (mean = 0.14±0.15 imf*100). The second most visited flower was *C. arvensis* (mean = 0.01±0.02 imf*100) and there were no visits to any other flower species. There was no significant difference between the two visited flower species (**Figure 42**).

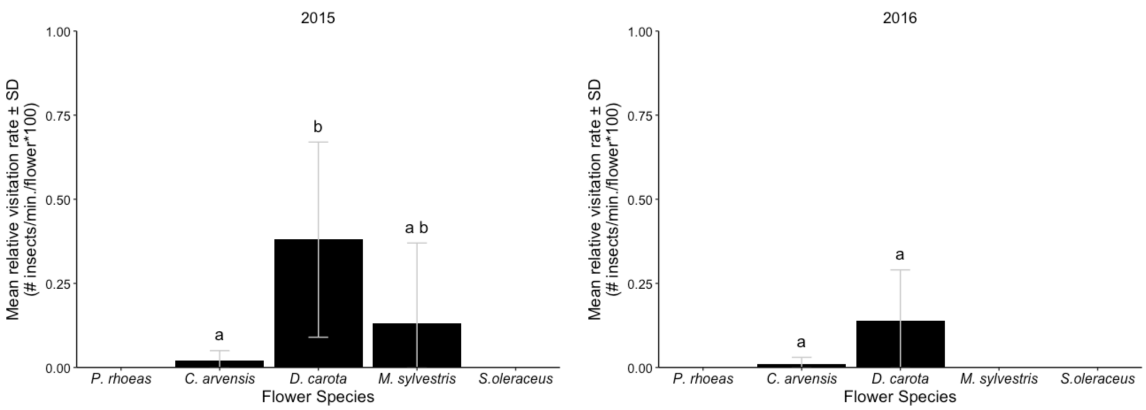

Figure 42. Mean relative visitation rates of **<u>wasps</u>** to different flower species for 2015 (left) and 2016 (right). Error bars represent standard deviation between the three replicated plots. Lowercase letters indicate significant differences between visitation rates to flower species at $P < 0.05$ level (Welch's t-test on square root transformed data).

For all other insects that do not fit into the previous categories, in 2015, *D. carota* was the flower species most visited (mean = 0.14±0.04 imf*100). The second most visited plot was *C. arvensis* (mean = 0.01±0.01 imf*100). The was a significant difference between the mean visitation rates of *C. arvensis* and *D. carota.* For all other insects in 2016, *D. carota* was the most visted flower species (mean = 0.39±0.11 imf*100 in 2016). The second most visited flower was *P. rhoeas* (mean = 0.24±0.25 imf*100), then *M. sylvestris* (mean = 0.07±0.01 imf*100), *C. arvensis* (mean = 0.06±0.05 imf*100) and *S. arvensis* (mean = 0.01±0.01 imf*100). There were no significant differences between *P. rhoeas* and any other species, nor between *C. arvensis* and *M. sylvestris* (**Figure 43**).

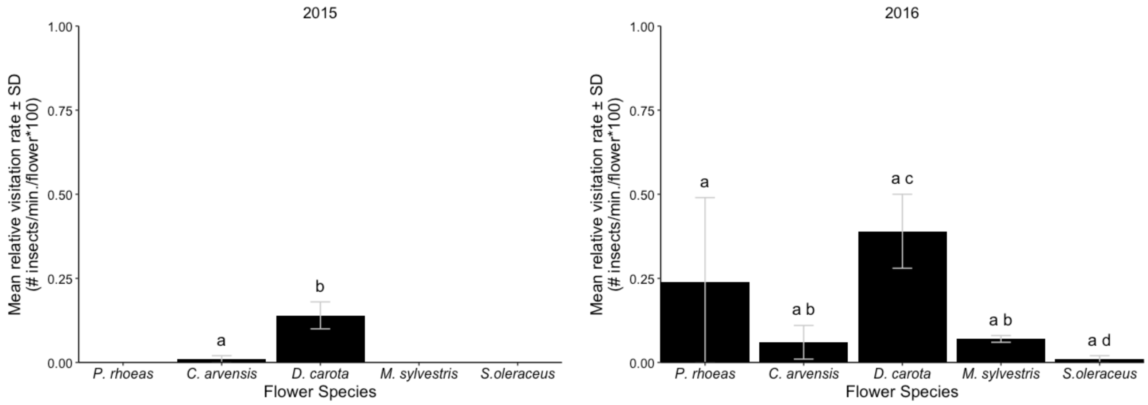

Figure 43. Mean relative visitation rates of **<u>other insects</u>** to different flower species for 2015 (left) and 2016 (right). Error bars represent standard deviation between the three replicated plots. Lowercase letters indicate significant differences between visitation rates to flower species at $P < 0.05$ level (Welch's t-test on square root transformed data).

4.2.7. Attractiveness efficiency

Combining all insects, it was observed that *D. carota* (2016) and *P. rhoeas* (2016) had medium attractiveness efficiencies (high mean visitation rates with short flowering periods) and *C. arvensis* (2015 and 2016), *M. sylvestris* (2016) and *D. carota* (2015) had medium attractiveness efficiencies (low mean visitation rates with long flowering periods). Everything else had a low attractiveness efficiency (**Figure 44**).

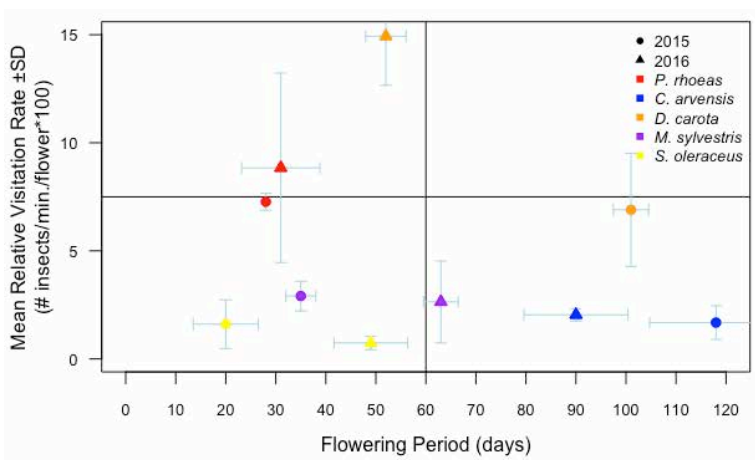

Figure 44. Attractiveness efficiency of **<u>all flower visiting insects</u>** for each flower species. Error bars represent standard deviation between the three replicated plots.

For bees, there were no flowers with a high attractiveness efficiency. *P. rhoeas* (2015 and 2016) had a medium attractiveness efficiency with a high mean visitation rate but relatively short flowering period; *C. arvensis* (2015 and 2016), *M. Sylvestris* (2016) and *D. carota* (2015) had a medium attractiveness efficiency with a relatively low mean visitation rate but long flowering period; and *S. oleraceus* (2015 and 2016), *M. sylvestris* (2015) and *D. carota* (2016) had low attractiveness efficiencies (**Figure 45**).

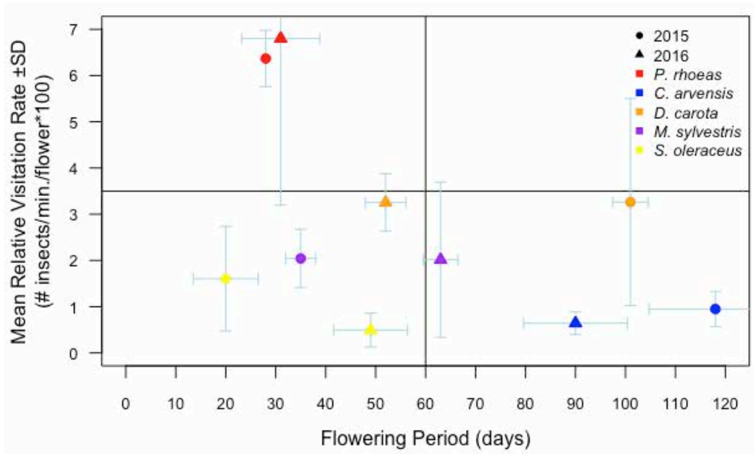

Figure 45. Attractiveness efficiency of **bees** for each flower species. Error bars represent standard deviation between the three replicated plots.

For beetles, no flowers had a high attractiveness efficiency. *D. carota* (2016) had a medium attractiveness efficiency with a high mean visitation rate and shorter flowering period. *C. arvensis* (2015 and 2016), *D. carota* (2015) and *M. sylvestris* (2016) had medium attractiveness efficiencies with low mean visitation rates and longer flowering periods. *P. rhoeas* (2015 and 2016), *S. oleraceus* (2015 and 2016) and *M. sylvestris* (2015) had low attractiveness efficiencies. *S. oleraceus* had no beetle visits in 2015 (**Figure 46**).

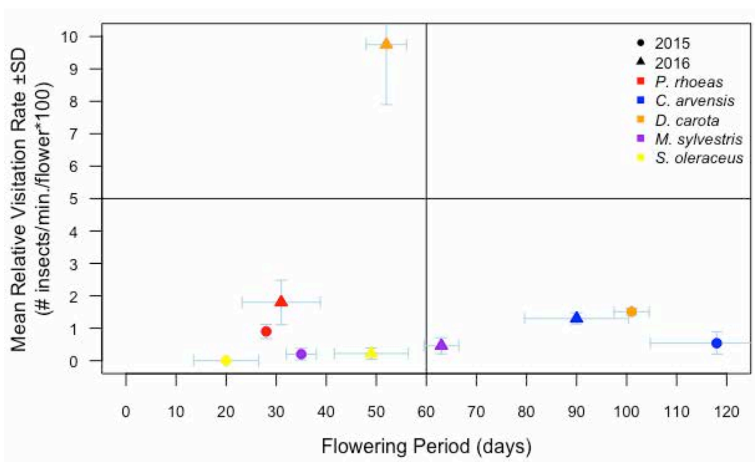

Figure 46. Attractiveness efficiency of **beetles** for each flower species. Error bars represent standard deviation between the three replicated plots.

The only flowers with visits from butterflies and moths were *C. arvensis* (2015), with a high attractiveness efficiency, *C. arvensis* (2016) with medium attractiveness efficiencies, having a low mean visitation rate but relatively long flowering period and *M. sylvestris* (2015) with low attractiveness efficiency (**Figure 47**).

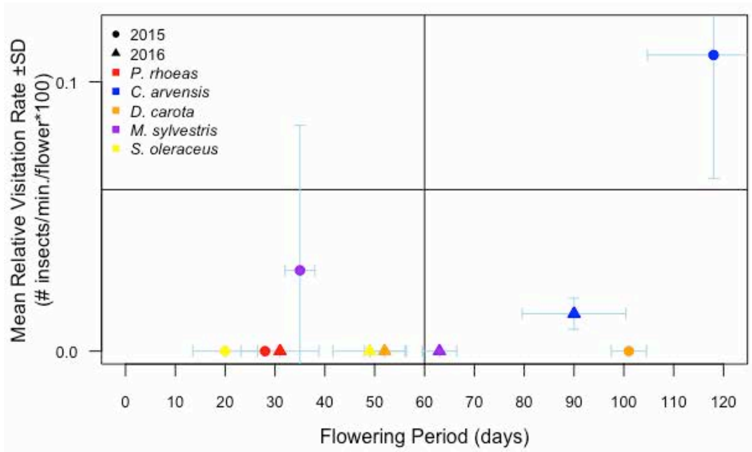

Figure 47. Attractiveness efficiency of **butterflies and moths** for each flower species. Error bars represent standard deviation between the three replicated plots.

For hoverflies, *D. carota* (2015) had a high attractiveness efficiency. *C. arvensis* (2015 and 2016) and *M. sylvestris* (2016) had medium attractiveness efficiencies with low mean visitation rates but a long flowering period. Everything else had a low attractiveness efficiency. *P. rhoeas* (2015 and 2016), *S. oleraceus* (2015) and *M. sylvestris* (2016) had no hoverfly visits (**Figure 48**).

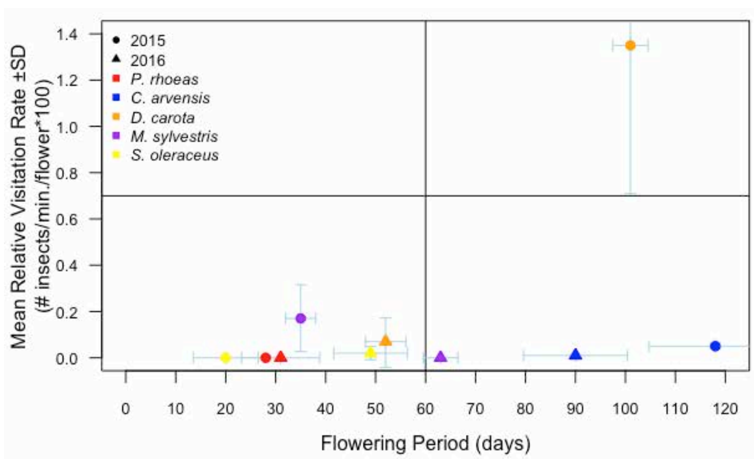

Figure 48. Attractiveness efficiency of **hoverflies** for each flower species. Error bars represent standard deviation between the three replicated plots.

For true bugs, again no flowers had high attractiveness efficiencies. *D. carota* (2016) had medium attractiveness efficiency with a high mean visitation rate and shorter flowering period. *D. carota* (2015) and *M. sylvestris* (2016) had medium attractiveness efficiencies with low mean visitation rates and longer flowering periods. *M. sylvestris* (2015) had low attractiveness efficiency. For both years, *P. rhoeas, C. arvensis* and *S. oleraceus* had mean visitation rates = 0.00 imf*100 (**Figure 49**).

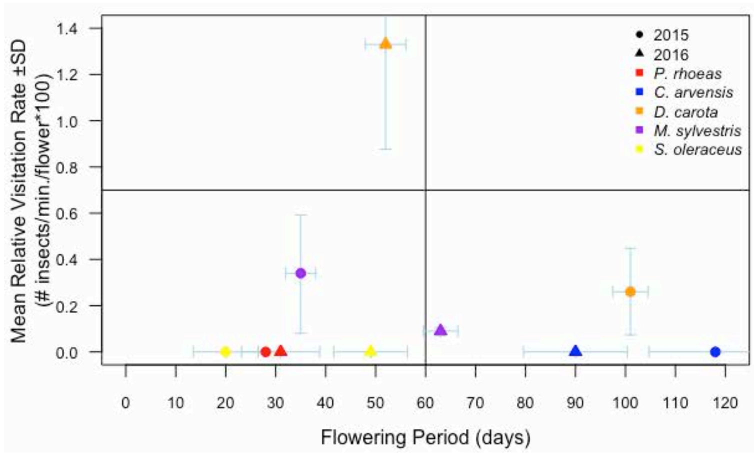

Figure 49. Attractiveness efficiency of **true bugs** for each flower species. Error bars represent standard deviation between the three replicated plots.

For wasps, *D. carota* (2015) had a high attractiveness efficiency and *C. arvensis* (2015 and 2016) had medium attractiveness efficiencies (low mean visitation rates, long flowering periods). Everything else had a low attractiveness efficiency, except for *P. rhoeas* (both years), *M. sylvestris* (2016) and *S. oleraceus* (both years) which had no wasp visits (**Figure 50**).

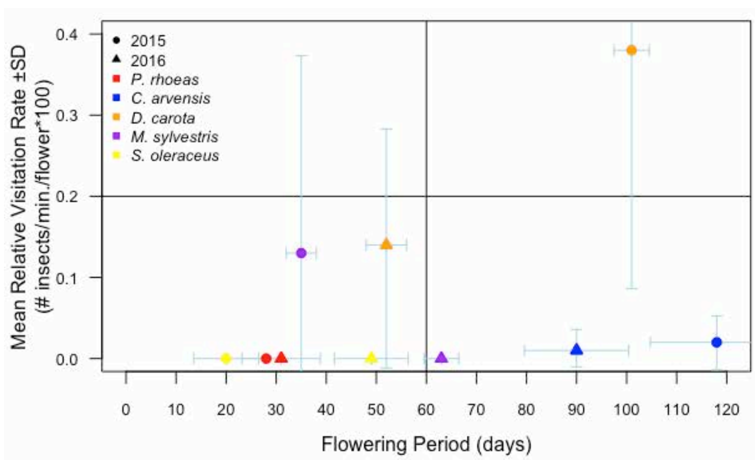

Figure 50. Attractiveness efficiency of **wasps** for each flower species. Error bars represent standard deviation between the three replicated plots.

For all other insects, *D. carota* (2016) and *P. rhoeas* (2016) had medium attractiveness efficiencies (high mean visitation rates with short flowering periods) and *C. arvensis* (2015 and 2016), *M. sylvestris* (2016) and *D. carota* (2015) had medium attractiveness efficiencies (low mean visitation rates with long flowering periods). *S. oleraceus* (2016) had a low attractiveness efficiency, and *S. oleraceus*, *P. rhoeas* and *M. sylvestris* had no visits from other insects in 2015 (**Figure 51**).

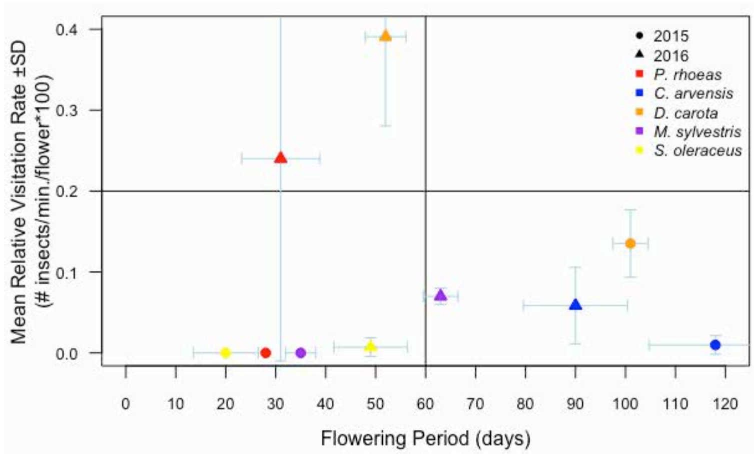

Figure 51. Attractiveness efficiency of **other insects** for each flower species. Error bars represent standard deviation between the three replicated plots.

4.2.8. Overall trends in insect visitation rates to flower species over years

The results from the general linear models for the relationships between flower species and the mean relative visitation rates of bees, beetles and all flower visiting insects, as well as the significance and interactions among years, are listed in **Table 17**.

Table 17. The relationships between flower species and mean relative visitation rates of bees, beetles and all flower visiting insects for both years and the significance and interactions among years. Summary of F-test on general linear models. Df = 1 in all cases and n = 30. Significant *P* values ($P \leq 0.05$) are in bold.

	Response Variables					
Predictor Variables	**Mean Relative Visitation Rate of Bees**		**Mean Relative Visitation Rate of Beetles**		**Mean Relative Visitation Rate of All Flower Visiting Insects**	
	F	***P***	***F***	***P***	***F***	***P***
Flower Species	14.7	**0.000**	74.1	**0.000**	30.4	**0.000**
Year	0.1	0.832	77.8	**0.000**	6.9	**0.016**
Flower Species | Year	0.2	0.934	43.3	**0.000**	5.1	**0.005**

For bees, a significant difference among flower species preference was observed, which was consistent in both years. For both beetles and all flower visiting insects combined, a significant difference among flower species preference was also seen, although there was a significant difference and interaction among years.

4.2.9. The relationship between floral characteristics and insect visitation rates

Potential predictor variables were chosen because data was available for all five flower species, and because the variables were related to either visibility to insect (flower size, plant height and flowering period) or capacity to provide a reward (nectar availability, number of stamens and number of stigmata). After performing an initial Pearson correlation test, two variables were further eliminated (number of stamens and number of stigmata) such that there were no highly significant correlations. The remaining variables to be used in the models included two that were measured in the field (these varied from year to year): mean flower size (flower width x flower height, cm^2) and mean flowering period (number of flowering days); and two fixed variables from the flowering plant trait database: mean plant height (cm) and nectar availability (none, concealed or exposed).

Thus, the final Pearson correlation analyses among these selected predictor variables to be used in the general linear models, measuring the contribution of various floral characteristics to foraging activity, are displayed in **Table 18** for 2015 and **Table 19** for 2016.

Table 18. Pearson correlation coefficients among predictor variables for 2015. Significant *P* values ($P \leq 0.05$) are in bold. (n.s.: $P > 0.05$; *: $0.01 < P \leq 0.05$.)

	Flower Size	*Mean Plant Height*	*Nectar Availability*	*Flowering Period*
Flower Size		n.s. 0.14	n.s. 0.13	n.s. 0.20
Mean Plant Height	n.s. 0.14		n.s. 0.46	n.s. -0.48
Nectar Availability	n.s. 0.13	n.s. 0.46		* **0.54**
Flowering Period	n.s. 0.20	n.s. -0.48	* **0.54**	

Table 19. Pearson correlation coefficients among predictor variables for 2016. Significant *P* values ($P \leq 0.05$) are in bold. (n.s.: $P > 0.05$; *: $0.01 < P \leq 0.05$.)

	Flower Size	*Mean Plant Height*	*Nectar Availability*	*Flowering Period*
Flower Size		n.s. -0.18	n.s. -0.51	* **-0.62**
Mean Plant Height	n.s. -0.18		n.s. 0.46	n.s. -0.47
Nectar Availability	n.s. -0.51	n.s. 0.46		n.s. 0.38
Flowering Period	* **-0.62**	n.s. -0.47	n.s. 0.38	

These analyses revealed only minor correlations between flowering period and nectar availability in 2015 and between flowering period and flower size in 2016. Nevertheless, all correlations had $P > 0.01$ and were deemed sufficiently minor to continue with general linear models. The results from the general linear models are presented in **Table 20** for 2015, and **Table 21** for 2016.

Table 20. The relationships between floral characteristics and mean relative visitation rates of bees, beetles and all flower visiting insects for 2015. Summary of F-test on general linear models. Df = 1 in all cases and n = 15. Significant *P* values ($P \leq 0.05$) are in bold; where (+) = a positive relationship and (-) = a negative relationship.

Predictor Variables	**Response Variables**					
	Mean Relative Visitation Rate of Bees		**Mean Relative Visitation Rate of Beetles**		**Mean Relative Visitation Rate of All Flower Visiting Insects**	
	F	***P***	***F***	***P***	***F***	***P***
Flower Size	23.7	**0.001 (+)**	89.6	**0.000 (+)**	47.5	**0.000 (+)**
Mean Plant Height	0.2	0.694	0.8	0.390	0.2	0.647
Nectar Availability	16.1	**0.002 (-)**	9.9	**0.010 (+)**	2.3	0.163
Flowering Period	0.3	0.613	0.0	0.871	0.2	0.659

In 2015, for both bees and beetles, there were significant relationships observed between mean relative visitation rates and both flower size (positive; $P = 0.001$ for bees and $P = 0.000$ for beetles) and nectar availability (negative for bees, $P = 0.002$; positive for beetles, $P = 0.010$). For all flower visiting insects combined, there was only a significant positive relationship between visitation rate and flower size ($P = 0.000$).

Table 21. The relationships between floral characteristics and mean relative visitation rates of bees, beetles and all flower visiting insects for 2016. Summary of F-test on general linear models. Df = 1 in all cases and n = 15. Significant *P* values ($P \leq 0.05$) are in bold; where (+) = a positive relationship and (-) = a negative relationship.

Predictor Variables	**Response Variables**					
	Mean Relative Visitation Rate of Bees		**Mean Relative Visitation Rate of Beetles**		**Mean Relative Visitation Rate of All Flower Visiting Insects**	
	F	***P***	***F***	***P***	***F***	***P***
Flower Size	22.6	**0.001 (+)**	15.4	**0.003 (+)**	29.5	**0.000 (+)**
Mean Plant Height	0.7	0.416	39.8	**0.000 (-)**	13.1	**0.005 (+)**
Nectar Availability	0.2	0.658	182.5	**0.000 (+)**	32.8	**0.000 (+)**
Flowering Period	0.1	0.742	0.0	0.970	0.1	0.788

For 2016, the general linear model shows a significant positive relationship between the mean relative visitation rate of bees and flower size ($P = 0.001$). For both beetles and all flower visiting insects combined, there were significant relationships observed between visitation rate and flower size (positive; $P = 0.003$ for beetles and $P = 0.000$ for all flower visiting insects), mean plant height (negative for beetles, $P = 0.000$; positive for all flower visiting insects, $P = 0.005$) and nectar availability (positive; $P = 0.000$ for both).

Chapter 5. Discussion

5.1. <u>Part A</u> – The role of field margins in supporting wild bees

5.1.1. General observations

Overall, dynamic insect foraging was witnessed and bee traps allowed us to collect ample specimens. A marked decrease in activity was witnessed near the end of the experimental season as floral resources decreased. In terms of wild bee diversity, 26 different genera were observed (from 3489 specimens). This level of diversity was similar or greater than other pan trap studies across the world, for example: Russell et al. (2005) identified 23 genera (from 2866 non-Apis specimens) at a National Wildlife Refuge center in Maryland, US; Le Féon et al. (2016) identified 20 genera (from 2384 non-Apis specimens) in semi-natural and cropped farm areas in Argentina; Droege et al. (2010) identified 20 genera (from 2199 non-Apis specimens) at a golf course in Oregon, US; and Nielsen et al. (2011) captured 26 genera (from 3261 non-Apis specimens) in semi-natural scrub lands and managed olive groves on the Greek island, Lesvos.

Although a relatively high number of genera were observed, by far the most abundant family of bees collected in the traps was Halictidae (71% of all bees captured). This appears to be a high percentage, but the fact that Halictidae bees are known to be collected in pan traps more abundantly than other families must be considered (Le Féon et al., 2016; Westphal et al., 2008; Roulston et al., 2007). In fact, this percentage was lower than multiple other pan strap studies in various contexts: Droege et al. (2010) captured 92% Halictidae bees (from 2199 non-Apis specimens) in their pan-trap study at the golf course in Oregon, US and 92% Halictidae bees (from 1995 non-Apis specimens) at a different golf course in Washington, US; Le Féon et al. (2016) observed 83% Halictidae bees (from 2384 non-Apis specimens) in the above mentioned semi-natural and cropped farm areas in Argentina; and Gollan et al. (2011) found 82% Halictidae bees (from 1176 non-Apis specimens) at roadsides in New South Wales, Australia. On the other hand, the proportion of Halictidae bees found in this study was slightly higher than the above mentioned study of Nielsen et al. (2011) who captured 69% Halictidae bees (from 3261 non-Apis specimens) in pan traps placed in semi-natural scrub lands and managed olive groves in Greece; and considerably higher than Tuell et al. (2009) who only observed 38% Halictidae bees (from 7932 non-Apis specimens) in a pan trap study at blueberry farms in Michigan, US.

It was interesting to analyze the proportion of Halictidae bees captured in the traps because this family includes some of the most common species and is mostly comprised of pollen generalists (polylectic bees) that gather floral resources from multiple plant species (Michener, 2007). Land-use intensification tends to increase the dominance of habitat and resource generalist pollinator species at the expense of specialists (Grass et al., 2016). In order to maintain robust biodiversity, rare bee species are very important; they are also the most vulnerable to extinction (Kleijn et al., 2015). A high proportion of Halictidae bees could indicate a homogenization of the local bee community and a pauperized bee assemblage (Le Féon et al., 2016). In general, the proportion of Halictidae bees identified in this study was normal to high for pan trap studies, however, what is more interesting is to see how this proportion changed in relation to landscape context, margin characteristics and the functional structure of the plant community (discussed in ***Sections 5.1.2*** and ***5.1.3***, below).

Only a very small proportion (3%) of all captured bees were cleptoparasitic. Cleptoparasitic bees spend less time foraging than non-parasitic bees and more time near nesting sites exploiting the resources and nests of other bees (Russell et al., 2005). Low cleptoparasitic bee presence could indicate poor quality nesting habitats, rather than poor floral resources, as these bees cannot be sustained if there are no adequate host nests (McKechnie et al., 2017). Subsequently, cleptoparasitic bee presence has been proposed as an indicator of the overall state of a bee community, where a high abundance and diversity of cleptoparastic bees could imply stability and high diversity within a bee assemblage (Le Féon et al., 2016). Thus, the overall low proportion of cleptoparasitic bees in the sampled margins could indicate poor nesting resources and instability within the bee communities. Although it is not well known how effective pan traps are in capturing cleptoparasitic species and it is possible that pan traps underrepresented this type of bee, Sheffield et al. (2013) deemed this trapping technique sufficient to study cleptoparasitic species abundance.

It was calculated that 17% of identified bees belonged to genera which were strictly solitary, 3% belonged to genera which were strictly social and 80% could be both. With so much variation in social behavior across genera (and variation in degrees of sociality), it is difficult to infer much in regards to sociality, and what effects this could have on an ecosystem, without species level identification.

A very small proportion (2%) of identified bees belonged to genera known to be oligolectic (pollen specialists) while the great majority (78%) were polylectic (pollen generalists) and 20% could not be generalized to either category. Pollen specialists are very vulnerable to extinction and very important in order to maintain overall biodiversity and to ensure adequate cross-pollination for diverse flower species (Kleijn et al., 2015). Maintaining plant diversity is crucial in maintaining oligolectic species. This is discussed further in ***Section 5.1.2.2***, below.

Most of the identified bee genera collect pollen using scopae situated both on the legs and the fringes of the underside of the gaster (71%). The minority of the identified genera used scopae situated only on the legs or only under the abdomen, scopae on the propodeum, flocci, corbiculae, an internal crop (to later regurgitate) or had no pollen carrying organ. There are many more subtle differences between scopae (e.g., size and spacing of the hairs, branched or unbranched hairs, etc.) which unfortunately could not be integrated with genus level identification.

The nesting preferences of wild bees are highly variable: many species dig nests underground, in a preferred location or soil type, other species make nests above ground in dead wood or plant stems, and some species rely on specific materials to build their nests (e.g., mud, resin, snail shells, etc.) (Hopwood, 2008). The great majority (92%) of the bees captured belonged to genera known to nest strictly below ground, while a very small proportion (3%) nest strictly above ground and 5% could be either. Several bee genera were known to utilize more than one type of nest substrate: 98% of bees utilized soil, 20% wood and 6% vegetation. In order to increase representation of above-ground nesting bee species, conservation efforts should focus on enhancing above-ground nesting habitats on farms.

In summary, there was an overall normal to high genus richness, however, there was also a normal to high proportion of Halictidae bees and a low proportion of cleptoparasitic, pollen specialist and above ground nesting bees which could indicate problematic nesting resources and flower diversity at study sites. These indications of a pauperized bee community could be attributed to agricultural intensification as 41% of the sampled margins had more than half the surrounding landscape comprised of agriculture. A total of 182 species of flowering plants were observed, which was similar to the richness of plant species found in field margins by Pallavicini-Fernández et al. (2013) who identified 198 different plant species in a mainly agricultural area.

Among all margins, there was a wide range of total observed bees (0-104) and total observed flower visiting insects (3-193) foraging on margin flora, with significant correlation between margins with high bee visits and margins with high overall insect visits. Based on observations in the field, the quantity of foraging insects depended largely on the abundance and density of open flowers in the margin.

5.1.2. Relationships between general margin/landscape characteristics and wild bee community composition/functional structure (Analyses 1a, 1b and 1c)

5.1.2.1. Influence of landscape on wild bee communities in field margins

This research provides insights into the taxonomic composition of bee assemblages in the cereal field margins of Catalonia, a region with variable topography and, in general, diverse land uses. The generalized linear model showed a strong negative correlation between the abundance of wild bees captured in pan traps and landscape diversity. This finding has two possible explanations: (i) that the greater the diversity of surrounding land uses, the greater the options for nesting and floral resources, resulting in wild bees being less reliant on agricultural field margins and (ii) that intensive agriculture somehow benefits bees in field margins. The latter could, for example, be the result of a particular flower species, one that is especially attractive to wild bees, being more prevalent in field margins surrounded by intensive agriculture. However, there were no observed trends between the flora present in the margins with high proportions of surrounding arable land and high abundances of captured bees. Nevertheless, field margins appear to be more crucial for sustaining wild bee abundance in more homogeneous landscapes. This is consistent with the findings of Carvell et al. (2011) and Winfree et al. (2007).

Morphospecies richness, diversity and evenness were not shown to be influenced by landscape diversity. However, Forrest et al. (2015) believe that agricultural intensification is likely to have an effect on species richness, as well as community functional trait compositions. Other studies have come to similar conclusions, observing that habitat and resource generalist pollinators are more dominant in intensified landscapes, at the expense of specialist species, resulting in the functional homogenization of pollinator communities (Grass et al., 2016). Although the morphospecies grouping methodology utilized in this study may have lacked the necessary sensitivity to detect such patterns, it was clearly observed that the proportion of Halictidae bees increased as landscape diversity decreased. As mentioned above, higher proportions of Halictidae bees could indicate a homogenization of the local bee community (Grass et al., 2016). While in this study there was no observed linear correlation between landscape diversity and floral richness, many other studies have found plant species richness in field boundaries to be positively influenced by landscape heterogeneity (Bassa et al., 2012). This relationship could explain why oligolectic bees, who forage on a narrow range or singular plant species, may be more abundant in heterogeneous landscapes.

Results did not show any relationships between landscape diversity and the median body size of specimens measured in the lab, nor with the CWM of body size (based on the mean body size of each genus). There was a significant positive relationship between landscape diversity and the FDis of body size. The general understanding is that the distance bees can fly in search of flowers increases with body size (Greenleaf et al., 2007), meaning fewer small bees may be expected in areas with limited nesting sites as these bees are less likely to travel far from home (Russell et al., 2005). Thus, it does make sense that a wider dispersion of body sizes was observed in areas with more land use diversity, although smaller bees were expected in these areas. The FDis of tongue length was also positively related to landscape diversity. Since tongue length is based on body size and family membership, this result can easily be interpreted.

The model did not suggest any effects of landscape diversity on the observed visual abundance of bees, nor the CWM of sociality, lecty, tongue length, number of cleptoparasitic genera, nor the FDis of sociality, lecty, cleptoparasitic genera and pollen organ type. Some of these results were surprising, for example, that there were not more polylectic bees in more homogeneous landscapes, or that there were not more cleptoparasitic bees in more heterogeneous landscapes. Because of the limitations with genus level identification in generalizing for some traits, it would be interesting to see if more subtle relationships would present themselves with species level bee identification.

5.1.2.2. *Influence of margin characteristics on wild bee communities*

Several similar studies have documented that the number of bee captures is likely to be higher when floral resources are scarce, attributed to a bias of the pan traps (Le Féon et al., 2016; Roulston et al., 2007). This study did not find wild bee abundance from pan traps to be strongly related to margin width, vegetation height (which was positively correlated to flower abundance) or floral richness. Results from the visual observations did, however, indicate a positive association between number of foraging bees and floral richness. Similarly, numerous other studies using strictly visual observations and netting reported positive influences of floral resources and vegetation height on pollinator abundance (Rosa García and Miñarro, 2014; Nicholls and Altieri, 2013). It is therefore possible that, in this study, any positive effect of floral resources on captured bee abundance was absent as a result of a sampling bias with the pan trap methodology.

Both morphospecies richness and diversity were significantly positively related with floral richness. Similar results were reported by Rosa García and Miñarro (2014) and Steffan-

Dewenter and Tscharntke (2001). As floral richness increases, so does variety in bloom periods and thus, the overall temporal availability of pollen and nectar resources in the margin. Furthermore, as discussed above, maintaining a greater floral richness can help support oligolectic species. Unsurprisingly, the proportion of Halictidae bees was shown to increase as floral richness decreased.

Floral richness was also positively related to the FDis of sociality level. Because 80% of all the identified bees belonged to genera which could be either solitary or some degree of social (i.e., Halictid bees), a higher FDis of sociality level would indicate more representation from either strictly solitary or strictly social species. The FDis of sociality is strongly linked to morphospecies diversity ($P \leq 0.001$), thus, this result is basically reiterating the relationship between floral diversity and morphospecies diversity.

Bee characteristics, such as pollen organs, have co-evolved alongside flowers. For example, specialist bees have scopae which complement the pollen size of their preferred flower (Wilson-Rich, 2014). A relationship between floral richness and the FDis of pollen organ type was observed, which is logical based on this knowledge. However, with genus level data specific differences in scopae could not be investigated, rather just the general type and placement of the pollen organ. Although this limited the depth of the investigation, it did provide some interesting information concerning the pollen collecting behaviour of a genus. Since the great majority of the identified genera in this study had scopae on both their legs and the fringes of the underside of their gaster, a higher FDis for pollen organ type would indicate more genera with alternate types of pollen organs – which is associated with higher floral richness. Depending on the contextual details, this relationship could be important, for example, a scopa on the underside of the abdomen increases the likelihood of direct contact with the flower stigma, improving the rate of pollination (O'Toole, 2014).

A positive linear correlation between floral richness and the proportion of shrubs and trees represented in the margins was also detected. Morandin and Kremen (2013) found greater floral abundance, floral diversity and nesting opportunities, and consequently, more diverse and abundant pollinator communities in well-established hedgerow borders compared to weedy unmanaged boundaries. Furthermore, Hannon and Sisk (2009) found that flowering shrubs supported bee species that were otherwise uncommon in their agricultural landscape and Morandin and Kremen (2013) reported that native perennial hedgerows significantly promoted uncommon native bee species.

The proportion of bees belonging to the Halictidae family was higher in narrower margins, potentially indicating a tendency for bee community homogenization. Wider margins can support a less homogeneous bee community because of an increased availability of nesting habitat (McKechnie et al., 2017), greater habitat diversity (Schippers and Joenje, 2002), better protection from agrochemicals (Schippers and Joenje, 2002) and overall, improved environmental quality (Bassa et al., 2012). This was supported by the results because the CWM and FDis of the number of cleptoparasitic genera increased significantly with margin width, which, as discussed above, could indicate better quality nesting resources and overall better stability within the bee community. The FDis of level of sociality was also observed to increase with increasing margin width which, as mentioned above, could be an indication of increasing morphospecies diversity.

While there was no observed correlation between margin width and floral richness, Schippers and Joenje (2002) reported plant species richness to increase with boundary width, and Pallavicini-Fernández et al. (2013) found increased plant functional diversity in wider margins. Additionally, Schippers and Joenje (2002) reported that an increase in field boundary area can result in an increase in plant species colonization and a decrease in plant extinction probability. Interestingly, a positive linear correlation was observed between margin width and the proportion of perennial plants present in the margin. Moreover, Pywell et al. (2005) reported that bumblebees tend to favour nectar-rich perennial and biennial species, and that, in general, annual plants do not provide a good supply of nectar and pollen.

Median body size, the CWM of body size and the FDis of body size were all unaffected by local margin characteristics. In general, small-bodied bees are thought to require less pollen and nectar resources and can be sustained in smaller fragments with impoverished resources (Cane et al., 2006). It is possible that in this study the effect of landscape on body size outweighed any effect of local margin factors.

No margin characteristics were shown to affect the CWM or FDis of lecty or tongue length. With a greater floral diversity, a greater proportion of specialist bees may be expected because of the higher likelihood that a preferred flower species would be present in the margin. Furthermore, bee tongue length has also evolved in relation to flowers. Bees are most efficient when foraging on flowers with a corolla depth that matches the length of their tongue (Goulson, 2010). For oligolectic bees, tongue length would conform to the size of the corolla of its chosen flower (Wilson-Rich, 2014). Thus, again, a greater FDis of tongue length might be expect when there is a greater diversity of flowers. The lack of relationships in the models between lecty and tongue length values and margin characteristics could be due to the very small proportion of bees belonging to genera known to be oligolectic. Additionally, the CWM and FDis of tongue length are potentially not very sensitive because they were based on the median body size of each genus.

One important margin characteristic which was not fully considered in this study is the availability of optimal nesting areas and substrate resources in field margins. Potts et al. (2005) found that bee community composition was strongly related to the diversity of nesting substrates and nest building materials, and that availability of bare ground and potential nest sites affected the structure of the entire bee community, the composition of guilds and the relative abundance of dominant species. Likewise, Carvell (2002) reported bumblebee abundance to be negatively correlated with dense vegetation and leaf litter, highlighting again the importance of exposed ground for certain bee species. Other physical margin characteristics likely to have a positive influence on their suitability as nesting habitat for diverse wild bee assemblages include: undisturbed areas, dead wood, dry branches, hollow stems, leaf litter, pre-existing burrows, sloping ground, earth banks and bare soil (Nicholls and Altieri, 2013; Potts et al., 2005).

One potential nesting component that was analyzed is vegetation height, which would be important for above-ground nesting species. However, it was not found to influence any of the response variables. This was potentially not an important factor in this study because the great majority of bees that were identified belonged to genera known to nest strictly below ground (92%).

5.1.3. Relationships between the functional structure of plant communities in field margins and wild bee community composition/functional structure (Analyses 2a, 2b and 2c)

Caution must be used when interpreting the results regarding the functional structure of the plant communities in the sampled margins because data was extrapolated from the plants observed in the five quadrats of each margin, furthermore, not all these plants were necessarily in bloom during sampling. Nevertheless, based on field observations, the plants identified in the quadrats did, in most cases, appear to appropriately represent an overall picture of the vegetation community of each margin.

Margins with an overall greater number of plants with longer flowering periods (higher CWM of flowering months) were negatively related to the CWM and FDis of the number of cleptoparasitic genera. Because cleptoparasitic genera are not interested in foraging on open flowers, these results were initially perplexing. However, the cleptoparasitic genera observed in this study all nest underground. Increased flowering periods in a margin could result in overall reduced access to bare soil (or visibility of bare soil) for nesting, and thus, potentially, the abundance of cleptoparasitic species. These results could also be the result of factors not considered in the models.

Margins with an overall greater number of plants with more available nectar (higher CWM of nectar availability) were observed to have a lower proportion of Halictid bees and a greater FDis of lecty. It is logical that a greater nectar availability would create a richer bee community with less homogenization (fewer of the dominant Halictid species). Because most observed bees were polylectic (78%), a greater FDis of lecty would signify more bees from genera that could be either oligolectic or polylectic and potentially more oligolectic species. If the flowers with more available nectar are the pollen hosts of specialist bee species, this could help to explain this result. More likely, it is because Halictid species are polylectic and there was a strong negative correlation between the FDis of lecty and the proportion of Halictidae species ($P \leq 0.001$).

The FDis of colour in field margins was significantly associated with many different factors. Firstly, it was positively related to morphospecies evenness, in other words, a greater similarity between the abundances of all morphospecies present in the margin. Community evenness is important for preserving the functional stability of an ecosystem, while a high number of one or a few species would make the community less resistant to environmental stress (Wittebolle et al., 2009). According to this result, a greater dispersion of colours could help to create a more stable bee community. Likewise, the FDis of colour was also positively related to the CWM and FDis of the number of cleptoparasitic genera, other indicators of a more stable community.

Additionally, the FDis of colour was significantly positively related to the CWM and FDis of tongue length, as well as the FDis of body size and pollen organs. As one may expect, the FDis of colour in the margins was positively correlated with floral diversity ($P \leq 0.05$). It is unsurprising based on what has been discussed that with greater floral diversity and a greater dispersion of colour, a greater dispersion of tongue lengths, body sizes and pollen organ types would be witnessed. The increasing CWM of tongue length as a result of an increased FDis of colour is more difficult to explain, especially since this positive relationship was not observed with the CWM of body size. This result could be due to factors not considered in the model and/or other hidden linkages.

The FDis of mean vegetation height in field margins was also significantly correlated with many different factors. It was positively associated with morphospecies richness and diversity and negatively associated with the proportion of bees from the Halictidae family. The FDis of mean vegetation height was also positively related with the CWM and FDis of the number of cleptoparasitic genera. All of these factors suggest improved stability within the bee community, in response to an increased dispersion of vegetation heights. Because bees and other pollinators prefer to fly and forage at consistent heights in order to optimize their time and energy expenditure (Dafni and Potts, 2004), varying vegetation heights in the margin may attract a greater diversity of pollinators, each type foraging at a different vertical level and profiting from niche differentiation. Moreover, the FDis of mean vegetation height was mildly correlated with floral richness ($P \leq 0.1$), helping to explain the increased overall stability. The FDis of mean vegetation height was also positively associated with the FDis of pollen organ type, most likely a result of the strong positive correlation between the FDis of pollen organ type with morphospecies diversity ($P \leq 0.001$).

Furthermore, the FDis of mean vegetation height had a negative effect on the CWM of sociality level and a positive effect on the FDis of sociality level. Because most bee genera could be either social or solitary (discussed above), a low CWM of sociality level indicates a greater number of strictly solitary species. The FDis and CWM of mean vegetation height were positively correlated (**Table 12**), therefore a higher FDis would also imply overall higher vegetation in these margins. In summary, the model portrayed that a higher FDis of vegetation height and higher overall vegetation would result in more strictly solitary genera. The majority of the genera identified in this study that nest above-ground in plant stems or twigs were solitary species. This could indicate that shorter vegetation had a negative impact on solitary, above-ground nesting species.

The FDis of corolla size was negatively related to the CWM of tongue length, the FDis of sociality level and the FDis of pollen organ type. The first result was extremely surprising because the FDis of corolla size was strongly positively correlated with the CWM of corolla size (**Table 12**), meaning that a greater CWM of tongue length was associated with a lower CWM of corolla size. This is counter-intuitive because, as mentioned above, bees are most efficient when feeding on flowers with a corolla depth matching the length of their tongue. It was also surprising that the FDis of corolla size was negatively associated with the FDis of sociality and pollen organ type, two factors strongly correlated with morphospecies diversity. It was initially assumed that a greater variety of corolla sizes would result in higher species diversity, however, the FDis of corolla sizes was not calculated to be significantly correlated with floral richness. In other words, a higher diversity of plant species usually just resulted in additional flowers close to the overall mean corolla size. The lack of relationship between the FDis of corolla size and floral richness could help to explain these strange results. Additionally, these results could be a result of the extrapolative nature of the study, as mentioned at the beginning of this section.

Although the FDis of flower morphology type did not influence the abundance of bees in traps or morphospecies diversity factors, it was positively related to the abundance of bees observed foraging during sampling periods. The visual observation data is, in some ways, more complete because it is not biased in any way by the pan trap methodology. Thus, it may represent more accurately the presence of larger bees, such as Colletes and Bombus. A higher visual bee abundance, but not a higher abundance in traps, was observed when there was a greater dispersion of flower morphology type. This could infer a greater attraction by larger bee species to more diverse morphological flower communities, a relationship not observed with traps, but it is impossible to verify this without at least genus level identification during visual observations.

Finally, the FDis of life forms and number of petals were both positively related to morphospecies evenness. The FDis of life forms, an alternate way of assessing plant diversity in relation to function within an ecosystem, was indeed strongly correlated with floral diversity ($P \leq 0.001$). Thus, according to the model, a greater FDis of life forms would clearly help to promote morphospecies evenness and overall ecosystem stability. The FDis of number of petals, on the other hand, was not correlated with floral diversity and is therefore difficult to explain. This significant relationship may again be due to factors not considered in the model or alternate linkages not obvious at this time.

5.2. Part B – Attractiveness of common flowering weeds to flower visiting insects

5.2.1. General observations

In general, in 2015, the greatest number of observed visits were by bees, then beetles, hoverflies, true bugs, other insects, butterflies and moths then wasps; in 2016, the most frequently observed flower visitors were beetles, then bees, true bugs, other insects, hoverflies, wasps then butterflies and moths.

In 2015, the most visited species was *P. rhoeas* followed by *D. carota*, and in 2016, the most visited species was *D. carota* followed by *P. rhoeas*. In both years, the third most visited plots were the weed mixtures, followed by *M. sylvestris*, *C. arvensis* and *S. oleraceus*. The only flower species that had a significant difference between the relative visitation rates of both years were *C. arvensis* and *D. carota*. For *C. arvensis*, this difference was still relatively minor ($P = 0.04$), whereas for *D. carota*, there was clearly a large discrepancy between years with many more visits in 2016. In 2015, there was no actual significant difference between the mean relative visitation rates to *P. rhoeas* and *D. carota*, nor between *C. arvensis*, *M. sylvestris* and *S. oleraceus*. In 2016, there were significant differences between everything except between *C. arvensis* and *M. sylvestris*. No flowers had a high attractiveness efficiency but *C. arvensis* and *D. carota* had medium efficiencies both years, and *P. rhoeas* and *M. sylvestris* in 2016 only.

When examining the overall visitation rates of 2015 and 2016 side-by-side, it can clearly be seen that in 2016 there was a much longer overall sampling season and that in 2015 flowers were in bloom until later in the year. This can mostly be attributed to *M. sylvestris* which began flowering at the end of March in 2016. Subsequent species did not begin flowering until the end of April, but this was still over a month ahead of 2015 plots. The earlier season in 2016 was most likely due to the fact that in 2015, flowers were sown in the greenhouse, transplanted and required time to become established in the field, potentially altering their natural flowering period. In 2016, the perennial and biennial plants (*C. arvensis*, *D. carota*, *M. sylvestris*) were already established from the prior year and annual plants (*P. rhoeas* and *S. oleraceus*) had seeds already in the soil ready to germinate from the prior year. Consequently, a greater peak was also observed in the number of flowers in 2015, whereas in 2016 open flowers were more evenly spread throughout the season. Furthermore, temperature was quite consistent and very similar in both years, although for flower species with an earlier flowering period in 2016, the temperature was lower due to normal seasonal weather changes.

P. rhoeas, *C. arvensis*, *D. carota* and mixed plots had longer flowering periods in 2015 than in 2016, while *M. sylvestris* and *S. oleraceus* had longer flowering periods in 2016. Thus, it is clear that the longer overall sampling season in 2016 was a result of more spread out flowering periods from all species, rather than longer individual flowering periods from each species.

Other than for *D. carota*, the peak mean relative visitation rate for each species was relatively similar in both years. In 2015, the main time of peak activity was between mid-June and mid-July; in 2016, it appears to have been from, approximately, early June to mid-July, with another peak at the end of July/beginning of August. For individual flower species, there were several peak relative visitation rates at the beginning and end of flowering periods, which were most likely due to a significantly low number of open flowers compared to a high number of visits. In general, there appeared to be a lot of variability in visitation rate throughout each season, sometimes even between the two sampling days carried out within the same week. This could be due to minor climatic variations or an inherent randomness in insect activity. For example, Bosch et al. (1997) stated that the same plant species sampled within a site and year can receive quite different visitor assemblages.

5.2.2. Traps

One reason traps were used was to assess the diversity of bee genera at the study site. The great majority of the bees captured in the traps were from the family Halictidae (95%) and only eight non-Apis genera were identified compared to 26 in Part A (keeping in mind that the sample size was almost five times larger in Part A). Although there is a known tendency for pan traps to over-represent bees from the Halictidae family, the proportion identified here was still very high. In Part A of this thesis, overall only 71% of bees captured in traps belonged to the family Halictidae. Furthermore, the proportion of bees from this family was lower than what was observed here for all six of the other pan trap studies mentioned in ***Section 5.1.1***, in some cases by a large margin (Le Féon et al., 2016; Gollan et al., 2011;

Nielsen et al., 2011; Droege et al., 2010; Tuell et al., 2009). Additionally, the great majority of bees observed visiting flowers during the trial were recorded as small or very small (81% in 2015 and 83% in 2016) and based on observations in the field, very small and small bees usually belonged to the Halictidae family. Therefore, it can be concluded with a degree of certainty that there was low overall diversity at the study site with an exceptionally high proportion of Halictidae bees, which could indicate a pauperized bee community. This was not surprising because of the high proportion of agricultural and urban/unproductive land uses in the study area (45% and 35%, respectively).

The other reason traps were set was to identify the most frequent flower visiting insects observed during sampling periods. These identified species are discussed below within their respective insect groups.

5.2.3. Preferences by insect group

5.2.3.1. Bees

Bees are usually considered the most important group of pollinators. They tend to visit many more flowers than other species because they are actively collecting pollen and nectar not only for themselves, but also for their young (Woodcock, 2012). This behaviour makes them very efficient pollinators and a very welcome presence in most environments.

Bees are known to generally prefer what appears to humans as yellow, blue, purple and white flowers (Roubik, 1992). Although bees do not normally perceive the colour red, some red flowers (like *P. rhoeas*) have ultra-violet pigments that are perceived by bees (Harborne, 2014). Therefore, colour-wise, bees could potentially be attracted to all of the flowers in this study.

For bees, in both years the top three most visited species were *P. rhoeas*, *D. carota* and *M. sylvestris*, in that order. The species with the lowest number of visits from bees were *C. arvensis* and *S. oleraceus*. Considering attractiveness efficiency, no flowers had a high attractiveness efficiency, *P. rhoeas* and *C. arvensis* had medium attractiveness efficiencies and *D. carota* and *M. sylvestris* had medium attractiveness efficiencies in 2015 and 2016 only, respectively. The mediocre visitation rate by bees to *M. sylvestris* was surprising as this was the species that bees were observed to visit most frequently in Part A of this thesis. Nevertheless, in Part A bees were also observed to visit *P. rhoeas* frequently; it was the species with the fourth highest number of visits by bees.

When considering bee visits to the flower species in this study, the high proportion of Halictid bees (95%) must be taken into consideration, as well as the low proportions of honeybees (2% of specimens from traps) and bumblebees (no specimens captured in traps, 10% of observed bees in 2015 and only 1% of observed bees in 2016). It should, however, be noted that visual observations were only performed from 8h to 12h30; honeybees, bumblebees or other insects that were active outside of these hours have not been recorded.

Bees from the family Halictidae are pollen generalists, they are known to pollinate a wide variety of flowers and are sometimes considered to be important pollinators (Moisan-De

Serres et al., 2014). Some species of Halictidae bees can be quite small, meaning that they may have to visit a flower several times in order to pollinate it appropriately. On the other hand, they can reach certain parts of the flower that are inaccessible to bigger pollinators, resulting in the fertilization of a greater number of ovules, producing bigger and better formed fruits (Moisan-De Serres et al., 2014). Bees from the genus Halictus are sometimes limited by their short tongues which prevent them from extracting resources from flowers with deep corollas (Moisan-De Serres et al., 2014). This is congruent with observations from this study, where bees preferred *P. rhoeas* which has an open, bowl shaped corolla and is known to be pollinated by short-tongued bees (Kühn et al., 2004). *D. carota*, which has exposed nectaries and open accessible inflorescences (Wäckers, 2004; Ahmad and Aslam, 2002), was also frequently visited by the bees in this study.

As mentioned, very low populations of honeybees and bumblebees were observed. Honeybees are well known as great pollinators, pollinating a large variety of flowers (Moisan-De Serres et al., 2014). Bumblebees are great pollinators because they remain active at low temperatures and are thus reliable in unpredictable climates (Goulson, 2010); this was observed in this study. They are also reliable pollinators in regions with fragmented natural areas, as is frequently the case in Europe, because they have large foraging ranges compared to small solitary species (Goulson, 2010).

5.2.3.2. Beetles

Not all beetles visit flowers, but there is a substantial percentage that eat pollen. While only a small amount of pollen sticks to the body of the beetle during foraging, they are important pollinators due to their sheer abundance (The Xerces Society, 2011). In some parts of the world there are major crops that rely on beetles for pollination (e.g., oil palm), although usually they feed on floral tissue and in some cases, can cause damage to flowers and developing fruit and be considered pests (Woodcock, 2012). The presence of beetles could be either positive or negative depending on the context.

The order in which beetles visited the flower species, from most frequently to least frequently, was: *D. carota*, *P. rhoeas*, *C. arvensis*, *M. sylestris* and *S. oleraceus* for both years (with no visits to *S. oleraceus* in 2015). Considering attractiveness efficiency, no flowers had a high attractiveness efficiency to beetles and *C. arvensis*, *D. carota* and *M. sylvestris* (2015 only) had medium efficiencies.

Beetles have been reported to generally visit dull flowers that are white, cream, green and occasionally orange or red (Harborne, 2014; Davies, 2013). They are said to have a poor colour sense, and some species are colour-blind and depend mainly on other cues when visiting flowers (Harborne, 2014). These colour preferences could partially explain their higher attraction to *D. carota*, *P. rhoeas* and *C. arvensis* (white and red flowers) and their lack of attraction to *M. sylvestris* and *S. oleraceus* (more vibrant, purple and yellow flowers).

Of the beetles observed, several were very small round and black (52% in 2015 and 34% in 2016), mainly from the family Dermestidae, genus Orphilus. The adults of these beetles feed on flowers (Zhantiev, 2001), but are not categorized in the literature as pests. There was also a significant number of small beetles from the family Mordellidae (34% in 2015 and 22% in 2016). These adults feed on the pollen of many different plants, especially from the families Apiaceae (like *D. carota*) and Asteraceae (like *S. oleraceus*) (Arnett et al., 2002). In this study, many mordellids were found on *D. carota*, but not on *S. oleraceus*. No claims were found in the literature suggesting that beetles from the Mordellidae family could be agricultural pests.

Long and slender beetles from the families Cerambicidae, Meloidae or Cantharidae, were also observed in relatively high numbers (12% combined in 2015 and 9% in 2016). All three of these families commonly visit flowers, although their short-tongues limit them to feed from flowers with freely exposed nectaries (Davies, 2013) which could explain their attraction to *D. carota* in this study. Although in some cases, the mouthparts of Meloidae beetles (e.g., genus Nemognatha) are adapted to form a tongue-like structure, allowing them to reach deeper within the flower structure (The Xerces Society, 2011). Carambicidae beetles feed on pollen as adults (Klots and Klots, 1977) and, according to The Xerces Society (2011), do contribute to pollination. Meloidae beetles feed on nectar and pollen from flowers (The Xerces Society, 2011). Cantharidae beetles mate on flowers and feed on both pollen and nectar (Moisan-De Serres et al., 2014; The Xerces Society, 2011), but, according to Moisan-De Serres et al. (2014), in Canada contribute little to the pollination of market garden species. The larvae of Cantharidae species are predators of a soft-bodied insects, feeding on caterpillars and locust eggs, and can potentially reduce the impact of certain pests on crops (Moisan-De Serres et al., 2014).

5.2.3.3. Butterflies and moths

In general, butterflies and moths are recognized as pollinators, but not necessary as efficient ones. Neither butterflies nor moths actively gather pollen, but while they are foraging for nectar, a small amount of pollen becomes stuck their bodies or tongues and is inevitably spread among flowers (The Xerces Society, 2011). For some specialized plants, moth or butterfly pollination is absolutely essential, particularly in tropical climates (Woodcock, 2012). However, Jennersten (1984) found that butterflies were of minor importance as pollinators for the majority of plant species. Courtney et al. (1982) also regarded butterflies as unimportant pollinators but suggested that they could play an important role as long distance pollinators. Wiklund et al. (1979), on the other hand, found adult butterflies to be parasitic, feeding on the nectar of flowers without pollinating them. Additionally, the larvae of butterflies and moths (caterpillars) feed on plant tissue and can be major agricultural pests (Woodcock, 2012). Therefore, the presence of butterflies and moths is most likely positive, but could be negative in certain situations.

In 2015, butterflies and moths only visited *C. arvensis* and *M. sylvestris*, with significantly more visits to *C. arvensis*. In 2016, butterflies and moths only visited *C. arvensis*. Relative to the other flowers, *C. arvensis* had a high attractiveness efficiency to butterflies and moth in 2015 and a medium efficiency in 2016. It must be remembered that the presence of butterflies or moths may be due to the occurrence of plants on which their larvae feed rather than the flowers upon which the adults forage (Oliveira et al., 2004).

Butterflies are said to be more attracted to brightly coloured flowers, while moths are more attracted to dull colours. However, both butterflies and moths are generally attracted to red and purple, and moths only are attracted to white (Harborne, 2014). Butterflies and moths were observed on both white and purple flowers (*C. arvensis* and *M. sylvestris*, respectively) which is in line with this general understanding, but it is perhaps surprising that butterflies were also observed on white flowers.

5.2.3.4. Hoverflies
Hoverflies are generalist pollinators which can sometimes be found abundantly in agricultural areas. Adult hoverflies feed on nectar, and some also on pollen (Woodcock, 2012). Although they do not forage pollen to feed their offspring, they are still considered to be important pollinators (Moisan-De Serres et al., 2014). The Xerces Society (2011) states that an abundance of small flowers increases the number of eggs an adult hoverfly can lay throughout its lifetime. The larvae of hoverflies can be viewed as beneficial insects. Their larvae are predators of small soft-bodied insects, mainly aphids, and as such, are considered to be important for biological control in certain crops (Moisan-De Serres et al., 2014). Thus, the presence of hoverflies is mostly always considered to be positive.

The greatest relative visitation rate by hoverflies was to *D. carota* in both years, although in 2016 there were very few visits at all. In 2015, there were also low visitation rates to *C. arvensis* and *M. sylvestris*. Relative to the other flowers, *D. carota* had a high attractiveness efficiency to hoverflies in 2015 only and *C. arvensis* had a medium efficiency in both years (although visitation rates were very low). In Part A of this thesis, the most visited species for hoverflies was *T. arvensis*, which is from the same family as *D. carota* and looks very similar.

It has been demonstrated that hoverflies use colour as their primary cue for flower discrimination (Shi et al., 2009), with a general preference for white or yellow coloured flowers (although specific flower preferences differ between different hoverfly species) (Sajjad and Saeed, 2010). Unsurprisingly, in this study, most hoverflies were observed on white flowers.

5.2.3.5. True bugs
True bugs are not usually considered to be significant pollen consumers or pollinators, except for a few species in the family Berytidae (Wheeler, 2001; Schaefer and Panizzi, 2000). Nevertheless, they are common flower visitors with potential ecological significance (Wheeler, 2001). Some species are known to be predators of other pest species (Froeschner, 2017) and can be used to control, for example, aphids, thrips and cottony cushion scale (Mackin, 2017). Because most true bugs feed on plants, some species can be serious pests to cultivated crops by damaging plant tissues and, potentially, weakening plants by removing sap or transmitting plant pathogens (Meyer, 2016). On the other hand, they could also prey on unwanted plants and are sometimes used for the biological control of weeds (Froeschner, 2017). The presence of true bugs is thus not necessarily positive or negative, and could depend on the species of true bug or the plant in question.

In both years, there were only visits from true bugs to *D. carota* and *M. sylvestris* (with more visits to *M. sylvestris* in 2015 and more visits to *D. carota* in 2016). Considering attractiveness efficiency, *D. carota* presented a medium attractiveness efficiency in both years and *M. sylvestris* presented a medium efficiency in 2016, but a low efficiency in 2015.

As for the colour preferences of true bugs, different and conflicting preferences have been reported depending on the species (see: Dimeglio et al., 2017; McNeill et al., 2016; Landis and Fox, 1972), and no common colours seem to be generally attractive to the order. Even within the genus Lygus, Blackmer et al. (2008) reported that previous studies demonstrated an attraction to various colours and that attraction appeared to be species specific, and sometimes depended on the habitat.

The majority of the true bugs belonged to the species *Oxycarenus lavaterae* (65% in 2015 and 96% in 2016). *O. lavaterae* is widespread throughout Europe (Borges et al., 2013). *O. lavaterae* feeds on plants and is trophically associated with the plant family Malvaceae, including *M. sylvestris* (Kalushkov et al., 2007), as was observed in this study. It is not considered to be a pest (Borges et al., 2013). In a citrus grove in Spain, *O. lavaterae* was found abundantly but no damages were detected (Ribes et al., 2004). Likewise, large infestations of *O. lavaterae* were observed on lime trees in France, but they were not deemed to be of economic importance or risk and no chemical control was recommended (Reynaud, 2000).

Several larger true bugs from the families Lygaeidae or Pyrrhocoridae were also observed, likely *Lygaeus equaestris* or *Scantius aegyptius* (32% in 2015 and 4% in 2016). *L. equestris* is a seed predator which feeds on a number of plant species. It could be a pest of commercial seed crops (Shuker et al., 2006). *S. aegyptius*, on the other hand, is not considered a plant pest and, according to Bryant (2009), does not appear to pose any serious threats to agriculture or the environment.

5.2.3.6. Wasps

Although not as efficient as bees, wasps do pollinate flowers and are considered as secondary pollinators (Moisan-De Serres et al., 2014). Wasps visit flowers mainly to harvest nectar and some common species also act as predators of insect pests, feeding on small insects such as caterpillars (Woodcock, 2012). Therefore, from a farmer's perspective, the presence of wasps is mostly positive.

For wasps, in 2015 they visited *D. carota*, *M. sylvestris* and C. *arvensis*, in that order of frequency. In 2016, they visited only *D. carota* and *C. arvensis*, with more visits to *D. carota*. Relative to other flowers, *D. carota* had a high attractiveness efficiency for wasps in 2015 and *C. arvensis* had a medium efficiency in both years.

Wasps are reported to generally prefer drab coloured flowers, like browns (Harborne, 2014), but are also said to be attracted to purples and blues (Davies, 2013). This is more or less congruent with what was observed in this study, where wasps visited mainly white flowers (*D. carota* and *C. arvensis*), but also purple flowers (*M. sylvestris*).

5.2.3.7. Other insects

For all other visiting insects, *D. carota* was the flower visited most frequently in both years. In 2015, *D. carota* had a significantly higher mean relative visitation rate than the only other flower with visits, *C. arvensis*. In 2016, all flowers received visits from other insects, where the order from most to least frequently visited was: *D. carota*, *P. rhoeas*, *M. sylvestris*, *C. arvensis* and *S. oleraceus*. For attractiveness efficiency, *C. arvensis* and *D. carota* had medium efficiencies for both years and *P. rhoeas* and *M. sylvestris* had medium efficiencies for 2016 only.

Most of the insects in this group were Diptera from families other than Syrphidae (68% in 2015 and 59% in 2016), mainly flies. Most flies visit flowers only to collect nectar (Woodcock, 2012) and are considered to be one of the four major groups of pollinating insects (The Xerces Society, 2011). Woodcock (2012) claims that flies from the families Anthomyiidae, Calliphoridae and Muscidae can be effective pollinators. Moisan-De Serres et al. (2014) reported that flies from the genus Lucilia are usually not very effective at pollinating crops due to their limited body hair, however, they tend to visit flowers species that are less attractive to the more conventional pollinators. Reckhaus (2017) points out that flies (specifically of the suborder Branchycera) have special features that help to increase their pollination capacity: they have small bodies which help them land on and penetrate flowers more easily; they are not as sensitive to temperature as bees and will pollinate plants where bees do not go; they are more active and require less energy than bees; and they often mate on specific plants, aiding with pollination. Reckhaus also reports that in certain regions, flies can pollinate at least as many plants as bees, and in Europe, that flies visit up to 80% of all plants.

A significant portion of the insects observed from this group were Neuroptera from the genus Chrysopa (31% in 2015 and 9% in 2016), and the great majority of the observed Chrysopa were visiting *D. carota* (96% in 2015 and 89% in 2016). Adult Chrysopa feed on honeydew, nectar and sometimes pollen (McEwen et al., 2007). Their larvae feed on aphids, making them important predators of this pest and useful for biological control (Capinera, 2008).

5.2.4. Flower species preferences

Through this work, the potential of these five flowering weeds to attract pollinators has been highlighted, but the invasiveness of the plants must always be taken into consideration. While it is not necessarily recommended that these species be sown, it is, for some species, encouraged that they be left unsprayed, unmowed and untilled in appropriate agricultural areas, such as field margins and roadsides. During this work, it was observed that these weeds are typically found on and around farms regardless of management intensity, and perhaps these results will simply change one’s perspective of the inevitable presence of these species.

5.2.4.1. P. rhoeas

The flowers of *P. rhoeas* have a large bowl shape (Forey, 1995) with petals larger than any of the other species studied here but the inside of the flower is very open and the anthers are easy to access. The plant is of medium height, although the second shortest among these presented species. *P. rhoeas* is strictly pollinated by insects (Kattge et al., 2011). In part A of this thesis, *P. rhoeas* was the flower species visited most frequently by all pollinators and the fifth most frequently by bees. As mentioned in ***Section 1.7.4,*** it is moderately competitive against wheat.

In 2015, there appeared to have been a general increase in relative visitation rate for all three repetitions near the end of the flowering period, and for repetition two there was an additional peak closer to the beginning of the season. In 2016, both repetitions two and three had peaks at the very end of the season and for repetition three there was an additional peak half-way through. Regardless of the earlier flowering period in 2016, resulting in higher temperatures during the flowering period of 2015, the peak relative visitation rate was similar in both years, and overall, the relative visitation rates were of the same magnitude. In 2015 a flush of open flowers came in mid-June and in 2016 the flush came at the end of May.

According to Kühn et al. (2004), the typical pollinators of *P. rhoeas* are: short tongued bees, beetles, hoverflies and flies. In this study, for both years, the main visitors to *P. rhoeas* were bees, followed at a distance by beetles, with no significant differences between the mean relative visitation rates from both years, from either insect group. Nearly no other insects visited, except for other insects in 2016. These results differ from those observed by Bosch et al. (1997) who, in a study of insect-flower relationships for the most common ruderal plants in an herbaceous community near the Spanish Mediterranean coast, observed that *P. rhoeas* was mostly visited by beetles (85%). A similar study in Mediterranean Israel found that *P. rhoeas* was pollinated primarily by scarabaeid beetles and secondarily by bees (Dafni et al., 1990). Nevertheless, a scientific review of *P. rhoeas* in the Journal of Ecology agrees with these results, stating that solitary bees are indeed particularly frequent visitors of *P. rhoeas* (Mcnaughton and Harper, 2012). Knuth and Mueller (1906) also observed bees to be the most numerous and important pollinators of *P. rhoeas*.

In general, relative to other flowers, *P. rhoeas* had high visitation rates but a shorter flowering period. *P. rhoeas* had a medium attractiveness efficiency for all flower visiting insects in 2016 (high mean relative visitation rate with a shorter flowering period) and a low attractiveness efficiency in 2015 (although very close to the boundary of medium efficiency). *P. rhoeas* had a medium attractiveness efficiency for bees in both years and for other insects in 2016. *P. rhoeas* had a low attractiveness efficiency for beetles in both years.

It is widely reported that *P. rhoeas* has no nectar (e.g., Bosch et al. (1997) and Mcnaughton and Harper (2012)), although, Hicks et al. (2016) recently reported that there is a very small amount (mean mass of nectar sugar = 0.57 ± 0.6 µg/flower/day). In any regard, it remains clear that insect visits to *P. rhoeas* are motivated only by pollen collection. The narrow spectra of visitors to *P. rhoeas* (only bees, beetles and other insects) is likely due to this fact. Bosch et al. (1997) found that nectar played a greater role than pollen in determining the distribution of anthophiles in Catalonia. They observed that more than 70% of flower visitors foraged only for nectar. This could be attributed to the fact that pollen collection is a much more complex skill than nectar collection, requiring foraging insects to remove pollen from flower anthers, aggregate pollen grains and pack pollen into the body in order to effectively transport it back to the nest. Nectar collection, on the other hand, only requires that foraging visitors learn how to best access the nectar of the flower and ingest it (Raine and Chittka, 2007).

For insects seeking primarily pollen, *P. rhoeas* is an attractive choice. For example, wild, native bees are mostly pollen collectors, foraging pollen to bring it back to the nest (Gashler, 2011). Bosch et al. (1997) reported that, of the 17 most abundant ruderal flower species in their grassland study, *P. rhoeas* had the third highest amount of pollen per flower unit (11.24 mg). Similarly, Hicks et al. (2016), in a study analyzing the nectar sugar and pollen rewards of 64 flowering plant species in the UK, found that *P. rhoeas* offered one of the highest pollen rewards per flower unit (13.3 μl), and the highest daily pollen rewards (5.96 μl) which were more than twice the value of the next-ranked species.

Although it has a short flowering period, here it is suggested that *P. rhoeas* be encouraged, to a certain extent, in agroecosystems because of its high attractiveness to bees and other insects, and only moderate competitiveness with wheat. Furthermore, it has potential as an alternate host to harmful crop pathogens (discussed in ***Section 1.7.4***).

5.2.4.2. C. arvensis

C. arvensis has large funnel-shaped flowers (Kühn et al., 2004). Although the plant is short, its ability to climb often allows it to position itself higher off the ground. These flowers have concealed nectar (Kühn et al., 2004) and are pollinated by insects, although self-fertilization is said to be possible (Kattge et al., 2011). In part A of this thesis, *C. arvensis* was the ninth most visited species by all pollinators, and the tenth most visited species by bees. However, *C. arvensis* is often considered to be a serious weed (see ***Section 1.7.1***).

Relative visitation rates to *C. arvensis* were consistently low in both years with no significant peaks. The flowering periods of both years were very long with an earlier season in 2016 resulting in lower early season temperatures, which did not appear to have affected visitation rates.

According to Kühn et al. (2004), the typical pollinators of *C. arvensis* are: bees, bumblebees, wasps, hoverflies and bee flies. In this study, the main insects visiting *C. arvensis* were bees and beetles, with more bees in 2015, more beetles in 2016 and few other visitors. Waddington (1976), from the University of Kansas, observed Halictid bees foraging at dense arrays of *C. arvensis* flowers (ranging from approximately 40-225 flowers/m^2) and found that bee numbers increased linearly with flower density. In this study, *C. arvensis* coverage was relatively dense (mean = 197 flowers/m^2 in 2015 and mean = 112 flowers/m^2 in 2016), nevertheless bee visits (which were mostly from the family Halictidae) were low compared to the other flower species. Because there was greater flower density in 2015, this may partially explain why there were more bees in that year.

In general, relative to other flowers, *C. arvensis* had low visitation rates but a very long flowering period. As a result of these long flowering periods, it had medium attractiveness efficiencies for all flower visiting insects combined, as well as for bees, beetles, hoverflies, wasps and other insects in both years and for butterflies and moths in 2016 – although all visitation rates were very low. For butterflies and moths, there was a high attractiveness efficiency in 2015.

In Canada, *C. arvensis* is considered intermediate in terms of pollinator visitation rate compared to other weed species, with "occasional" visits from insects (Mulligan and Kevan, 1973). A biological review of *C. arvensis* (albeit in, again, a North American context) stated that its main insect visitors were bees, butterflies and moths (Weaver and Riley, 1982). This is in line with the results presented here, except for the fact that a comparably high number of visits from beetles was also observed.

Regardless of its long flowering period, because it is difficult to control and exhibited mostly low attractiveness to flower visitors, *C. arvensis* should not be encouraged in agroecosystems.

5.2.4.3. D. carota

D. carota plants have large inflorescence disks with exposed nectar (Kühn et al., 2004). It is the highest plant among these studied species. It is pollinated by insects and self-fertilization is rare (Kattge et al., 2011). In part A of this thesis, it was the 12th most visited species by all pollinators, and the eighth most visited species by bees. *D. carota* is not usually considered to be a high priority weed for management (see ***Section 1.7.2***).

For this species, there were early season peaks in all repetitions in both years, and in 2016 there was another peak at the very end of the season for all repetitions. The early and late season peaks were likely a result of a high number of insect visits on a low number of open flowers – something especially possible for *D. carota* with its large inflorescences. Overall, relative visitation rates were slightly higher in 2016 and temperatures were similar.

The typical pollinators of *D. carota* are said to be: medium tongued bees, wasps, beetles, hoverflies and flies (Kühn et al., 2004). In this study, there were many visits from bees and beetles, with more bees in 2015 and more beetles in 2016 (to an extreme), as well as a relatively high number of visits from hoverflies (in 2015) and true bugs (in 2016). There were no visits from butterflies and moths.

In the same study mentioned above, conducted by Bosch et al. (1997) where insect visits to common Spanish ruderal plants were observed, it was reported that *D. carota* had a narrow visitor spectrum and was mostly visited by beetles from the family Mordellidae (68%). In this study, a high number of mordellids were also observed on *D. carota*, but less predominantly: in 2015 mordellids comprised 19% of all insect visits and 62% of all beetle visits and in 2016 mordellids comprised 29% of all insect visits and 53% of all beetle visits. Conversely to Bosch et al. (1997), *D. carota* was found to attract a great diversity of insect visitors, having visits from all insect groups in both years, except butterflies and moths. (*C. arvensis* is the only other species that had visits from all but one insect groups in both years.) This is in agreement with several studies which all observed a wide taxonomical range of insect visitors to *D. carota* (e.g.: Abrol, 2006; Lamborn and Ollerton, 2000; Pérez-Bañón et al., 2007).

While Bosch et al. (1997) found beetles to be the main insect visitor to *D. carota*, several other studies had similar and contrasting findings. In a study situated in England, Lamborn and Ollerton (2000) found beetles and hoverflies to be the main insect groups visiting *D. carota*. Ahmad and Aslam (2002), in Pakistan, found the majority of pollinating insect visitors to be Hymenoptera and Diptera. Ricciardelli d'Albore (1986) in Italy and Kumar et al. (1989) in India reported bees as the most frequent visitor. In general, bees, beetles and hoverflies appear to be the main visitors of *D. carota*, which is, more or less, in line with these findings where the main visitors were bees and beetles with high visits from hoverflies in 2015. Nevertheless, Ahmad and Aslam (2002) conclude that the generalized nature of insect visitors to *D. carota* make it highly unlikely that any one or two species are main pollinators. Rather, they suggest that pollination mainly occurs by functionally similar taxonomic groups who collectively provide an important pollination service to the species, while visits from individual species may vary.

Relative to the other flowers, *D. carota* had a long flowering period in 2015, a low to average flowering period in 2016 and generally high visitation rates (although this depended on the insect group). For all flower visiting insects combined, it had a medium attractiveness efficiency in both years, although in 2015 it had a long flowering period and a low visitation rate, and in 2016 it had a high visitation rate but a short flowering period. The same scenario was present for beetles, true bugs and other insects. For bees, there was a medium attractiveness efficiency in 2015 but a low attractiveness efficiency in 2016. For hoverflies and wasps, there was a high attractiveness efficiency in 2015 and a low attractiveness efficiency in 2016.

Amongst 17 of the most abundant ruderal flower species in a Spanish Mediterranean context (Bosch et al., 1997), *D. carota* was reported to have the highest amount of nectar per flower unit (21.84 µl; which was more than twice as much as the flower species with the second highest amount), as well as the highest amount of pollen per flower unit (28.39 mg). In contrast, Hicks et al. (2016), in the UK, found *D. carota* to be a much more mediocre producer of nectar and pollen producing a mean of 27.18 µg of nectar sugar per capitulum per day (42nd highest out of 64 species), a mean pollen volume of 0.02 µl per capitulum total (50th out of 64) and only 0.002 µl per capitulum per day (59th out of 64). These results by Hicks et al. (2016) assert that single flowers of *P. rhoeas* provide as much pollen per day as 1000 flowers of *D. carota* – a stark contrast to the results by Bosch et al. (1997) who reported more pollen in *D. carota* than in *P. rhoeas* (28.39 mg and 11.24 mg respectively).

In any case, unlike all the other species, the floral nectaries of *D. carota* are fully exposed (Wäckers, 2004) and the open accessible inflorescences facilitate pollen deposition from any suitably sized insect (Ahmad and Aslam, 2002). Westmoreland and Muntan (1996) suggest that flies and beetles are attracted to the plant's slightly pungent scent. These factors combined in addition to, at the very least, modest amounts of nectar and pollen, may explain why *D. carota* had high visitation rates compared to the other species (highest in 2016 and second highest in 2015), the highest daily peak mean visitation rates in both years and a wide variety of visitors. Similarly, Memmott (1999) also found *D. carota* to be exceptionally attractive, compared to 25 other flowering plant species in a British meadow, attracting 61% of all observed insect species (48 species) and responsible for 42% of all insect visits overall (1143 visits).

Based on its overall attractiveness to flower visiting insects, limited e, moderately long flowering period and potential as a good companion to crop plants (discussed in ***Section 1.7.2***), it is recommended that *D. carota* be encouraged in agroecosystems.

5.2.4.4. M. sylvestris

The flowers of *M. sylvestris* have a disk shape and large corollas (second largest amongst the studied species) (Kühn et al., 2004). Technically, *M. sylvestris* grows quite high, although in this study, flowers were positioned at various levels within each plant, with some along the ground. These flowers have concealed nectar (Kühn et al., 2004) and are fertilized strictly by insects (Kattge et al., 2011). In part A of this thesis, *M. sylvestris* received the third highest number of visits by all pollinators and the highest number of visits by bees. *M. sylvestris* has not been shown to be invasive in cereal crops (see ***Section 1.7.3***).

In contrast to the results from Part A, the relative visitation rates to *M. sylvestris* in this experiment were consistently low in both years. In 2015 there was a lot of variation in all repeated plots throughout the season, while in 2016 there were peaks in repetitions one and two at the very start of the season, and for repetition one again at the end of the season. Temperatures were lower in 2016 due to the earlier season. There were no visits from other insects in 2015, and no visits from butterflies and moths, hoverflies and wasps in 2016.

The typical pollinators of *M. sylvestris* are reported to be: bees, bumblebees, wasps, hoverflies and bee flies (the same as *C. arvensis*) (Kühn et al., 2004). In this study, the most frequent visitor was bees in both years. All other insect groups visited at least one of the years, although very infrequently. This is congruent with Willemstein (1987) who reported that *M. sylvestris* is mainly pollinated by long-tongued bees, but also by short-tongued Halictus species. Gorenflo et al. (2017), in Germany, also found bees to be the main visitor of *M. sylvestris* comprising 98% of all insect visits, but found honeybees (A. mellifera) to be by far the most frequent visitor (88% of total visits to *M. sylvestris*), followed by two different Bombus species (B. lapidarius and B. terrestris; 8% of total visits combined) and Halictidae bees (1% of total visits). Gorenflo et al. observed visitation frequencies to *M. sylvestris* of 15.03 imf*100 for honeybees, 1.34 imf*100 for bumblebees and 0.17 imf*100 for Halictidae bees. In this study, mean relative visitation rates of 2.04 imf*100 in 2015 and 2.02 imf*100 in 2016 were observed for all bees combined – although, this comprised mostly Halictidae bees and very few honeybees. These findings suggest that honeybees are avid visitors to *M. sylvestris* and thus, the low overall visitation rates to this species in this experiment (especially compared to the results from Part A) may be at least partially due to the sparsity of foraging honeybees at the study site.

In comparison to the other flowers, *M. sylvestris* had a short flowering period in 2015, a long flowering period in 2016 and low relative visitation rates. In all cases, this resulted in a medium attractiveness efficiency in 2016 due to the long flowering period but low visitation rate, and a low attractiveness efficiency in 2015 due to the short flowering period and low visitation rate.

An overall low attractiveness of *M. sylvestris* to flower visiting insects was also observed in other studies. A study conducted in the UK found that, in a mixture with six other floral species, *M. sylvestris* had a low visitation rate by bees (≤ 2% of total visits) and by hoverflies (≤ 3%) and contributed minimally to flower density or insect species diversity (Carreck and Williams, 1997, 2002). Another study of 26 flowering plant species in France found *M. Sylvestris* to be in the bottom three in terms of the diversity and density of visiting wasps (Dib et al., 2012). Values for the amounts of nectar and pollen produced by *M. sylvestris* could not be found, but Gorenflo et al. (2017) did confirm that it produces pollen and large amount of nectar.

Although it was only seen to be moderately attractive to most flower visiting insects, *M. sylvestris* is still considered to be a positive addition to agricultural field margins because it is perennial, it exhibited a moderately long flowering period, it was has not determined to be invasive in cereal crops and it has numerous other beneficial qualities (discussed in ***Section 1.7.3***).

5.2.4.5. S. oleraceus

S. oleraceus has small ray flowers with concealed nectar (Kühn et al., 2004). The plant grows to be relatively high (second highest among these studied species). Self-fertilization is the rule for this species (Kattge et al., 2011). In part A of this thesis, *S. oleraceus* was the seventh most visited species by all pollinators, and the 17th most visited species by bees. *S. oleraceus* is often considered to be an invasive species with the potential to compete with crops (see ***Section 1.7.5***).

For *S. oleraceus*, relative visitation rates were extremely low in both years with no significant peaks. Again, temperatures were lower in 2016 due to the earlier season. In 2015, there were breaks in sampling due to the lack of open flowers, and in 2016, repetition three did not flower until halfway through the season. The biggest downfall of *S. oleraceus* was the fact that the flowers were only open for a short period every day (often before sampling began). This short daily period in which pollination can take place was also noted by Lewin (1948) who documented that the flowers of *S. oleraceus* open earlier and remain open for shorter periods on sunny mornings following warm nights, than in cool or overcast conditions. Lewin states that capitula that are new to flower open one or two hours later than capitula that were open the preceding day. Furthermore, Percival (1955) reported that among 87 different flowering species, *S. oleraceus* was among the species with the shortest period of flower presentation (amongst the lowest eight species), and that the inflorescences of *S. oleraceus* may present all their day's quota of pollen within only ten minutes. The short daily flowering of *S. oleraceus* greatly reduces its efficiency in attracting flower visiting insects.

Like both *C. arvensis* and *M. sylvestris*, *S. oleraceus* is said to be typically visited by bees, bumblebees, wasps, hoverflies and bee flies (Kühn et al., 2004). However, in this study, the only visitor to *S. oleraceus* in 2015 was bees, and in 2016, only bees and beetles visited with more bees than beetles. Compared to other flowers, it had a short flowering period, low visitation rates and had a low attractiveness efficiency for all insect groups in both years.

Percival (1955) also found that compared to the aforementioned 87 flowering plant species studied, *S. oleraceus* had the lowest amount of pollen (0.01 mg total per flower unit and only 0.005 mg per day), suggesting that because the quantity is so low, pollen is not collected. This amount of pollen is considerably lower than what was reported above for *P. rhoeas* (11.24 mg per flower unit) and *D. carota* (28.39 mg per flower unit) (Bosch et al., 1997). However, in a much more recent study by Hicks et al. (2016), the amount of pollen in *S. oleraceus* was reported much more favourably. The mean volume of pollen per flower was reported as 1.33 µl total (17th highest out of 64 species and higher than *D. carota*) and 0.11 µl per day (26th highest out of 64 species and, again, higher than *D. carota*). Furthermore, the mean mass of nectar sugar per flower was reported as 568.84 µg per day which was the 13th highest out of 64 species.

S. oleraceus is not recommended in agroecosystems because it is difficult to control, and exhibited very limiting periods of daily bloom and a low attractiveness efficiency for all flower visiting insects.

5.2.4.6. Mixed plots

For mixed plots, in both years, flowering periods were long and there was a lot of variability in relative visitation rates throughout the seasons. In 2016, temperatures were lower at the beginning of the season and there were two extreme peaks near the end of the season in repetition three. Earlier in the season, relative visitation rates were higher in 2015, and later in the season, rates were higher in 2016.

There was a high frequency of visits from bees and beetles to mixed plots (more bees than beetles in 2015 and more beetles than bees in 2016), and in 2016 only, true bugs as well. All other insect groups had very low visitation rates and there were no visits by butterflies and moths or wasps in 2016.

When examining the floral composition of mixed plots in both years, there was considerable variance which may explain the high variability in visitation rates; this attributed to the reasoning for not including mixed plots in statistical analyses or direct comparison charts. In 2015, the mean proportions of flower species making up the mixed plots (the mean values of all daily proportions throughout the sampling period) were: *C. arvensis* (57%), *P. rhoeas* (51%), *S. oleraceus* (18%), *D. carota* (17%) and *M. sylvestris* (1%). In 2016, mean proportions were: *C. arvensis* (67%), *M. sylvestris* (55%), *D. carota* (17%), *S. oleraceus* (14%) and *P. rhoeas* (4%). In 2015 there were high proportions of *P. rhoeas* and low proportions of *M. sylvestris* and in 2016 it was the reverse. The proportions of the other species were more or less consistent over the years.

In general, floral mixtures have the advantage of a longer overall flowering period and more functional diversity than a species in monoculture. However, on most days there were more visits to *P. rhoeas* and *D. carota*, and sometimes even *M. sylvestris* and *C. arvensis*, than to the mixed plots. In the experiment of Barbir et al. (2014), from which this methodology was based, a similar phenomenon was witnessed where higher visits were recorded at monocultures compared to mixed plots. As hypothesized by Barbir, the lower visitation rate to mixed plots could be a result of the lower floral density of each individual species, where the probability for insects to see specific flowers from a distance is lower. For example, it is known that growing different crops in the same field, compared to monocultures, reduces the incidence of pests (Altieri and Nicholls, 2004).

5.2.5. Overall trends in insect visitation rates to flower species over years

Considering the first set of simple general linear models, for bees, there was a significant difference between the mean relative visitation rates to flower species, without any significant differences between years and floral preferences were consistent over both years. In other words, this data was quite robust.

For beetles, there was also a significant difference between the mean relative visitation rates to flower species, although there were significant differences between both years of data and results were not consistent over years. The extremely high visitation rate by beetles in 2016 was surely responsible for the significant difference between years and was likely also responsible for the significant difference between the interaction terms because the hierarchies of flower preference remained the same in both years.

For all flower visiting insects combined, again there was a significant difference between the mean relative visitation rates to flower species, and also a significant difference between the years and between the interaction terms from both years. The hierarchies of flower preference of both years were the same, although there were few significant differences between the mean relative visitation rates to each flower species in 2015. These results were likely also influenced by the high visitation rate from beetles in 2016, which comprised 51% of all insect visits that year. Because the F values were much smaller for the year and interaction terms of all flower visiting insects compared to beetles, it is clear that the variation between the years was higher for beetles and quite a bit lower for all flower visiting insects combined.

5.2.6. The relationship between floral characteristics and insect visitation rates

In both years, the mean relative visitation rates of bees, beetles and all flower visiting insects combined were significantly influenced by flower size, such that as flower size (flower width x flower height) increased so did the visitation rate. This tendency for pollinators is widely reported in the literature. In a review article on spatial flower parameters and insect spatial vision, Dafni et al. (1997) list seven different studies where higher pollinator visitation rates were observed with larger flowers or larger inflorescences. This tendency has also been observed within a plant species, for example, hoverflies were observed to respond positively to flower size among wild radish, *Raphanus raphanistrum* (Conner and Rush, 1996). However, in another study of wild radish, *Raphanus sativus*, Stanton et al. (1991) found no relationships between insect visitation rates and floral attributes. Furthermore, Mousseau et al. (2000) claim that no evidence exists that small, native bees (as seen in this study) prefer large flowers. Interestingly, Stanton et al. (1991) found a positive correlation between petal size and pollen production and Dafni et al. (1997) reported that larger flowers usually have more nectar than smaller ones. Thus, in some cases flower size could positively influence flower fertilization capacity due to a higher production of pollen combined with a higher number of visits by some pollinators (but not all) (Mousseau et al., 2000). The same authors also make a good point that "evidence that large flowers are visited more frequently or export more pollen than small flowers must be balanced by the possibility that large-flowered plants produce fewer flowers".

In 2015, mean plant height was not significantly associated with the mean relative visitation rates of bees, beetles or all flower visiting insects combined. In 2016, again bee visitation rates were not significantly related with mean plant height, but, beetle visitation rates were significantly negatively related with mean plant height and the visitation rates of all flower visiting insects combined were significantly positively related with mean plant height. For bees, these non-significant relationships were congruent with the results from Part A of this thesis, where mean vegetation height did not have a significant relationship with the abundance of trapped bees (see **Table 8**). From the literature, it appears that, indeed, solitary bees are not interested in flowers of a certain height, rather, they prefer to fly at a consistent height in order increase the energetic benefit-cost ratio during foraging (Dafni and Potts, 2004).

For beetles, the non-significant relationship between visitation rate and plant height in 2015 can perhaps be attributed to the fact that there were no visits at all to *S. oleraceus*, the third tallest flower. The results for beetles in 2016 are interesting because, although there was an extremely high visitation rate of beetles to *D. carota* in 2016 (the flower with the greatest mean height), there was still a negative relationship between visitation rate and mean height. This indicates that the overall trend for beetles to be attracted to flowers with a lower stature was great enough to overshadow the high number of visits to *D. carota*. When examining the data, extremely low beetle visitation rates to *M. sylvestris* and *S. oleraceus* are seen, two flower species with a high stature, just below that of *D. carota*. There was a comparably high visitation rate to *C. arvensis*, a flower with a stature significantly lower than the other species. These results indicating a negative relationship between beetle visitation rate and plant height were in contrast to those of Sjödin (2007) who observed fewer beetles in grasslands with shorter vegetation. Dafni and Potts (2004) observed beetle visitation rates to increase with plant height in *Ranunculus asiaticus*, but only up until the mean height of the plant within its community, and visitation rates decreased for plants taller than the mean height.

For all flower visiting insects combined, the non-significant relationship between visitation rate and plant height in 2015 can perhaps be attributed to the fact that there were no significant differences between the mean relative visitation rates to *C. arvensis*, *M. sylvestris* and *S. oleraceus*, while the mean height of *C. arvensis* was dramatically lower than the other two species. In 2016, it was observed that as a group, all flower visiting insects preferred flowers with a higher stature. Most reports concerning the plant height preferences of pollinators state that, like solitary bees, many pollinating insects like to fly at a constant height (Dafni and Potts, 2004). In this study, the three tallest flower species had mean heights that were relatively similar to one another (80 cm for *D. carota*, 75 cm for *S. oleraceus* and 70 cm for *M. sylvestris*) – which could have influenced pollinators to fly at that range, although insects were mostly just visiting *D. carota*. Not many other studies could be found that investigate how individual plant heights within a plant community may affect flower visitation rates (and Dafni and Potts (2004) could not find any either). Sjödin (2007) found that hoverfly species abundance (and richness) were positively correlated with vegetation height in a grassland plant community, but found no significant results for bees or butterflies. Other studies have examined the effect of plant height on visitation rates for a specific flower species; three of these types of studies found greater pollination success on taller plants (Lortie and Aarssen, 1999; O'Connell and Johnston, 1998; Andersson and Widén, 1993).

Nectar availability was significantly influenced by the mean relative visitation rates of bees and beetles in 2015 and by beetles and all flower visiting insects in 2016. Interestingly, for bees in 2015, visitation rates decreased as nectar availability increased, and for beetles in both years and all flower visiting insects in 2016, visitation rates increased as nectar availability increased. When exploring the data, the counter-intuitive results observed for bees, a negative relationship between visitation rates and nectar availability, can perhaps be attributed to the high number of visits to *P. rhoeas*, a nectar-free flower. Although, visits to *P. rhoeas* were equally high in 2016 and this general trend was not significant – perhaps this can be attributed to the large deviation witnessed among the three repetitions of *P. rhoeas* in 2016. The results for beetles and all other flower visiting insects (2016 only) were much more expected. Many studies discuss the importance of the nectar and/or pollen rewards offered by flowers in explaining the partitioning of flower visiting insects among flower species (Bosch et al., 1997). Bosch et al. (1997) looked for correlations among insect visitation rates, floral morphological traits, pollen and nectar rewards and blooming time, and found pollen and nectar rewards to affect visitor distribution most significantly. They further suggested that pollen and nectar rewards are what ultimately attract the flower visitors, and morphological traits, such as colour, odour and shape, may only act as cues to help visitors discriminate between flowers. The lack of a significant relationship between the visitation rate of all flower visiting insects and nectar availability in 2015 may be due to the fact that mean relative visitation rates to the flower species did not vary greatly (there were limited significant differences of means) and the fact that nectar availability was a fixed integer which did not vary between the repetitions of each species.

In no scenario was visitation rate influenced by the length of the flowering period. This could infer that with a long flowering period, desirability does not fade over time any more than species with a short flowering period (which would have been indicated by a negative relationship) or that flower visiting insects are not inherently attracted to flowers which are available for longer periods (which would have been indicated by a positive relationship).

5.3. General discussion

5.3.1. Implications for management

These results suggest the supreme importance of maintaining floral resources in agroecosystems, for example, in field margins. Wide margins with high flowering plant richness, comprising perennial and shrub species, were observed to best support a dense and diverse bee community. In Part A, the functional attributes of margin plant communities that, in one way or another, were observed to promote wild bee community stability were: high nectar availability, diversity in flower colour, diversity in vegetation height and diversity in flower morphology. In Part B, the influence of specific floral traits on visitation rates varied depending on the insect group, except for flower size which was consistently an attractive characteristic.

It is clear that a diversity of pollinators should be promoted in agricultural areas for ecosystem stability. Bees are usually considered the most important group of pollinators, where native bees are generally thought to be more effective pollinators than honeybees (Gashler, 2011). Beetles are also known to be important pollinators due to their sheer abundance (The Xerces Society, 2011), but their presence can be either positive or negative depending on the species and context. Butterflies and moths are recognized as inefficient pollinators (Jennersten, 1984) and some species can be considered agricultural pests in certain contexts. The presence of hoverflies is very positive as they are important pollinators and their larvae feed on agricultural pests. True bugs are not usually thought of as significant pollinators, but some species are considered to be beneficial insects and some are considered to be pests. Wasps are mostly positive in agricultural areas as they are secondary pollinators and can be predators of pests. Flies can be important pollinators in certain contexts and are not usually considered as agricultural pests. Finally, Chrysopa are important predators of aphids. These insects, observed on flowers in this study, include just a fraction of the insects known to be important (positively or negatively) in agroecosystems.

Biodiversity can best be maintained by protecting field margins from pesticides, fertilizers and disturbances. In conventional farming, Long and Krupke (2016) found that dust or spray drift from pesticides could accumulate in margins, settling on and contaminating flowers and later be expressed in their pollen – potentially poisoning insects (Nicholls and Altieri, 2013). Pesticides making their way to field boundaries can cause changes in plant communities by allowing resistant species to increase (Ryszkowski, 2001), resulting in lower plant species richness (Marshall, 2004). Schippers and Joenje (2002) showed that nutrients in field boundaries, misplaced during fertilizer application, caused eutrophication and also had a negative effect on plant species diversity. Ryszkowski (2001) states that fertilizer can have a particularly adverse effect on rare weeds. Disturbances can be inadvertent, as a result of adjacent cultivation, or intentional (e.g., from direct tilling, mowing or string trimming) (Ryszkowski, 2001). Enlarging margins is one solution (to at least two meters), as well as setting aside a spray-free zone in the adjacent field (Lagerlöf et al., 1992). Moonen and Marshall (2001) found that sown grass strips along the edge of margins protected margin flora and facilitated greater species richness by providing extra distance from farming operations. Additionally, best pesticide application practices include: using pesticide formulations with low toxicity to pollinators, spot spraying pests when possible to prevent drift and minimizing dust by using seed lubricants and directing exhaust toward the ground when planting treated seeds (Minnesota Department of Agriculture, 2017).

One common concern for farmers is that margins left to regenerate naturally may encourage pernicious weeds which can spread into the crop and be difficult to control (Marshall and

Moonen, 2002). Such concerns could result in the application of herbicides to margins, again resulting in the perpetuation of species-poor plant communities, in addition to ongoing management problems (Feber et al., 1996). Marshall (2004) claims that the perception that weed species in field margins will invade crops is misguided, and that the amount of important weed species that originate in margins is limited. Nevertheless, Marshall (2004) further noted that when winter annuals dominate the boundary flora, as is typical in Mediterranean conditions, margins may have a more significant influence on the presence of weed flora. In these circumstances, specialized margin management strategies should be applied, for example, by sowing non-invasive perennial species to help provide a barrier against the spread of weeds from the field edge into the crop (Marshall and Moonen, 2002). Spot mowing noxious weeds may be necessary, which would still supply refuge areas for pollinators (Minnesota Department of Agriculture, 2017).

Floral density and richness in field margins can be increased by supplementing naturally occurring vegetation with sown flowers. On the one hand, margins that are simply allowed to regenerate naturally are more cost-effective and lower maintenance for farmers. On the other hand, as discussed above, plant species richness tends to be lower in more intensively managed agricultural areas. The impoverished flora persisting in arable lands typically comprises species which can tolerate intensive farming practices, and these species often do not provide suitable forage resources for bees (Pywell et al., 2005). Many studies have found that sowing field boundaries with deliberately chosen wildflower mixtures further increases the abundance of pollinators within highly agricultural landscapes (Pywell et al., 2005; Feber et al., 1996). Hopwood (2008) found that sown native flowers in restored roadsides attracted a more diverse bee community than exotic flowers. Moreover, native plants attract more native pollinators and can be better hosts for larvae (Tscharntke et al., 2005). Also, as previously discussed, margins restored with perennial plants best maintain pollinator diversity, especially for less-common species. Thus, it is recommended that diverse native perennial floral mixtures be sown in field margins, where floral mixtures include flowers with an abundance of nectar and pollen, differing and overlapping flowering periods (flowering before and after the nearby crops) and a variety of colours and shapes to attract different pollinators (Tscharntke et al., 2005). Flowers should be planted in dense clumps, rather than highly intermingled, to better attract pollinators. Currently, many seed mixtures (containing at least some plant species considered to be weeds) marketed for bee or pollinator conservation and with aforementioned properties are available for purchase, some of which contain specific host plants for the larval stages of butterflies, moths and beetles (Tscharntke et al., 2005). According to Carreck and Williams (1997), the practical requirements for a sown floral mixture are that it should establish well, require minimum seedbed preparations, be able to compete with arable weed species, not require agrochemicals and be affordable. For this recommendation to be realistic, ongoing policies that encourage and support farmers to actively manage field margins are required.

5.3.2. Takeaways about pollinator conservation and the importance of native weeds and biodiversity

In general, a one-size-fits-all conservation approach is not an efficient way of spending the limited funds available for preserving biodiversity on farms. The ideal approach should be adapted to the landscape context and local flora, as well as the species groups being targeted (Batáry et al., 2011). Setting aside new field margins may not always be the most cost-effective conservation solution. Because this research showed margins to be less important for wild bees in heterogeneous landscapes, conservation efforts focused on maintaining the quality of existing natural patches in these landscapes may be best (Carvell et al., 2011).

In order to help preserve pollinators, small-scale and organic farming is recommended, or at least a more sustainable management of agrochemical use, tillage and mowing. In small farming systems, it may be practical for farmers to leave residues on soil or practice mulching, having a positive effect on wild bees (Nicholls and Altieri, 2013). Nicholls and Altieri (2013) note that squash bee density was found to be three times higher in no-tillage systems compared to tilled ones. Additionally, higher plant diversity has been seen in boundaries next to organic fields than next to conventional fields (Bassa et al., 2012). Finally, farms with a variety of landscape features (e.g., patches of bare soil, piles, shrubs, etc.) can provide a variety of nesting areas for wild bees (Nicholls and Altieri, 2013). Sustainable farming strategies are not only effective for conserving native plants and insect populations, but can promote agricultural productivity as well (Russell et al., 2005).

To reverse the negative impacts intensive agriculture has already had on bee populations, there is an ongoing need for the enforcement of policies and conservation programs. In developing these protocols, up-to-date and evidence-based knowledge must be utilized in order to most efficiently and cost-effectively support pollinators, while also advocating for the farmer. As more studies like this one emerge and a more general consensus is formed about the importance of biodiversity conservation in agroecosystems, continued effort is needed in translating science to policy to action by engaging with farmers and providing them with financial and logistical support (Carvell et al., 2011). It is clear that participation in sustainable agriculture requires changes in economic frameworks, including fair markets and prices, and governmental incentives (Altieri, 1995). For example, farmers can be compensated for losses in income which may arise as a result of adopting strategies for maintaining biodiversity (Tscharntke et al., 2005). Altieri (1995) believes that farmers will not shift to alternative systems unless there is financial gain and states that "factors like labor availability, access and conditions of credit, subsidies, perceived risk, price information, kinship obligations, family size, and access to other forms of livelihood are often critical to understanding the logic of a farming system." The hope is that this work will help lead the way for the development of realistic management strategies, sensitive to the reality of farmers, for efficient and environmentally sustainable farming – shifting agricultural paradigms to create more robust agroecosystems.

5.3.3. Suggestions for future research

In Part A, the capacity of agricultural field margins with naturally diverse flora to support pollinators was investigated, not margins sown with supplementary flowers. It would be interesting to repeat this experiment with margins of sown flowers. Although studies of this nature already exist (e.g., Haaland et al. (2011)), region specific studies with customized floral mixtures are needed in order to: (i) compare them with unmanaged, naturally diverse margins, (ii) optimize the floral mixtures and the capacity of each individual flower species to thrive for the given soil/climate/altitude conditions, and (iii) adapt subsequent management recommendations to the landscape context and existing flora, keeping in mind potential insect or plant species in need of conservation.

In this study, sampling was only carried out until the end of peak flower bloom and pollinator activity (July). However, in late season the low availability of naturally occurring floral resources surrounding agricultural fields is a significant limitation to the survival of pollinators. Determining which native floral species help support pollinators later in the season, and potentially sowing them into field margins, could help to improve the year-round conservation of pollinators. Likewise, a study examining the influences of margins with differing nesting features on pollinator communities would also be a great accompaniment to this work.

It was difficult to analyze certain relationships involving the functional structure of wild bee communities because of the high proportion of Halictidae species, as a result of the bias of pan traps. Thus, continued research is encouraged on appropriate trapping techniques, and researchers are urged to develop innovative new sampling strategies, eliminating this bias and improving the quality of bee research worldwide.

Furthermore, it is suggested that the margin study (Part A) be repeated with species-level bee identification in order to more effectively examine the functional structure of wild bee communities and how they are affected by differing landscapes, habitats and disturbances. For example, important information about rare bee species, cleptoparasites, sociality, lecty and nesting preferences would all be much more precise with species-level data, with more detailed discussion regarding possible implications. However, compiling the bee trait database for a high number of species would be extremely time consuming, especially lacking an existing database with detailed information about individual species. Consequently, there a need for a large database listing bee species and their morpho-physiological features and behaviours.

During the literature review for this study, it was observed that the information available about specific weed species (i.e., traits, attractiveness to pollinators and weediness) is limited and extremely out of date. In order to develop new floral mixes, to optimize the mixes that are currently available or to customize mixtures to specific regions (like for the research recommended in the first suggestion above), new research is needed on the attraction potential of individual flowering weed species, preferably native to the region in which they are being utilized. In research done by Carreck and Williams (1997) regarding different sown weeds in floral mixtures for pollinators, they realized that often certain species failed to become established due to an unsuitable seedbed, non-viable or dormant seeds, or even competition with other sown species. Likewise, in this study, *C. arvensis* could not be sown successfully. As such, it is recommended that more studies similar to the field trial study (Part B) be conducted, examining a wide range of flowering weed species and their attractiveness to pollinators. Research is also required on the viability of different weed species to be sown in specific regions, differing germination and seedbed requirements and species which do not grow well together.

To the above point, but more broadly, a large, widely accepted, open-access floral database including weed species and their traits is needed. In order to compile the database of functional flowering plant traits for this study (see ***Supplementary Material – Appendix B***), with only 155 entries, it was necessary to scour several different plant databases, encyclopedias, textbooks and scientific articles – a very tedious and time-consuming process with much room for human error. The topic has already received much attention (for example at the meetings of the European Weed Research Society) and some databases are already attempting to achieve this (i.e., Fitter and Peat, 1994, Kattge et al., 2011 and Kühn et al., 2004), but, efforts must be made to enlarge or amalgamate them and ensure they be accessible to all.

In the field trial study, it was difficult to assess the relationships between the specific floral traits of the studied species and visitation rates, most likely because of the small sample size (five species). Larger studies incorporating more flowering weed species, over a greater number of years, would allow for a more complete assessment of these relationships. Including a more precise insect identification could further detail these associations.

Finally, integrating biodiversity into a multi-objective and productive farm is a huge challenge, partly because of increased system complexity (Petit et al., 2011). More research is needed in order to develop reliable, context based protocols and management plans which ensure efficient farm operations (i.e., by avoiding system bottlenecks) and high yields, while supporting environmental health. Research is needed in the social spectrum in order to determine the best ways of imparting knowledge to farmers and encouraging their acceptance of biodiversity enhancement practices.

Chapter 6. Conclusions

6.1. Conclusions for the objectives of <u>Part A</u>

(i) Based on visual observations, the flower species found to be most attractive to insects in general were: *P. rhoeas*, *T. arvensis*, *M. sylvestris*, *Q. ilex* and *E. serrata*. The species most attractive to bees were: *M. sylvestris*, *L. vulgare*, *V. villosa*, *P. rhoeas* and *T. Arvenses*; with also a great number of visits to plants from the genus *Rubus*. The species most attractive to beetles and true bugs were: *P. rhoeas*, *Q. ilex*, *T. arvensis*, *M. sylvestris* and *E. nasturtiifolium*. Finally, the species most attractive to hoverflies were: *T. arvensis*, *D. erucoides, E. nasturtiifolium*, *P. rhoeas* and *A. clavatus*.

(ii) Greater wild bee abundance was observed in margins with lower landscape complexity. Thus, field margins were deemed more crucial in intensively farmed areas than in heterogeneous landscapes where foraging resources are more abundant.

(iii) Wide margins with high flowering plant richness, comprising perennial and shrub species, were shown to best support a dense and diverse bee community.

(iv) The functional attributes of margin plant communities that, in one way or another, were observed to promote wild bee community robustness included: high nectar availability, diversity in flower colour, diversity in flower morphology and diversity in vegetation height.

6.2. Conclusions for the objectives of <u>Part B</u>

(i) For *P. rhoeas*, in both years, the most frequent visitors were bees, then beetles. Relative to the other flowers, *P. rhoeas* had high visitation rates but a short flowering period. For *C. arvensis*, in 2015, the most visits were from bees, then beetles, then butterflies and moths. In 2016, the most visits were from beetles, then bees. Relative to the other flowers, *C. arvensis* had low visitation rates but a very long flowering period. For *D. carota*, in 2015, the most visits were from bees, then beetles, then hoverflies. In 2016, the most visits were from beetles, then bees, then true bugs. Relative to the other flowers, *D. carota* had a long flowering period in 2015, a low to average flowering period in 2016 and generally high visitation rates. For *M. sylvestris*, the most frequent visitors were bees, then true bugs and beetles (with more true bugs than beetles in 2015 and the opposite in 2016). In comparison to the other flowers, *M. sylvestris* had a short flowering period in 2015, a long flowering period in 2016 and low visitation rates. For *S. oleraceus*, in both years, bees were the most frequent visitors. Compared to other flowers, *S. oleraceus* had a short flowering period and low visitation rates.

(ii) For bees, in both years the top three most visited species, from highest to lowest, were: *P. rhoeas*, *D. carota* and *M. sylvestris*. For beetles, the top three most visited species in both years were: *D. carota*, *P. rhoeas* and *C. arvensis*. Butterflies and moths only visited *C. arvensis* and *M. sylvestris*, with significantly more visits to *C. arvenses*. The greatest relative visitation rate by hoverflies was to *D. carota* in both years. For true bugs, in both years there were only visits to *D. carota* and *M. sylvestris* (with more visits to *M. sylvestris* in 2015 and more visits to *D. carota* in 2016). For wasps, in both years they visited *D. carota* most frequently. For all other visiting insects, in 2015, only *D. carota* and *C. arvensis* received visits. In 2016, all flowers received visits from other insects, where the top three most visited species were: *D. carota*, *P. rhoeas* and *M. sylvestris*.

(iii) The influence of the specific floral characteristics of the five studied species on visitation rates varied depending on the insect group and the year, except for flower size which was consistently an attractive characteristic.

6.3. General conclusions

- These findings support the implementation of margins for wild bee conservation in highly agricultural landscapes. In more heterogeneous landscapes, conservation efforts should focus on maintaining the quality of existing natural or semi-natural habitats.
- In the context of this study, maintaining wide margins with high flowering plant richness, comprising perennial and shrub species, was shown to best support a dense and diverse bee community.
- If necessary, it is recommended that margins be sown with native perennial flowers, with differing and overlapping flowering periods, high in nectar and pollen, with a diverse assortment of colours, shapes and plant heights, and that they be managed so that a diversity of nesting features are offered.
- Similar yet more precise (species-level) studies are warranted which further examine the functional structure of wild bee communities and how they are affected by differing landscapes, habitats and disturbances.
- Based on their overall attractiveness to flower visiting insects, and other beneficial qualities, it is recommended that *P. rhoeas, D. carota* and *M. sylvestris* be encouraged, to a certain extent, in agroecosystems. It is important to remember that these species are ultimately weeds and can affect crop yields (*P. rhoeas*) or be virus carriers (*M. sylvestris*). The decision to maintain these species, or other weeds, in an agricultural landscape should take into account not only the potential beneficial effects but also the potential detrimental effects of the species.
- *C. arvensis* and *S. oleraceus* are not recommended because they are difficult to control, they exhibited mostly low attractiveness to flower visitors and, in the case of *S. oleraceus*, the period of daily bloom was extremely limiting.
- Due to the low foraging activity observed in mixed plots, it is recommended that flowering weeds sown for the conservation of pollinators be arranged in clumps, rather than highly intermingled, in order to improve visitation rates.
- Flower size had a consistently positive influence on visitation rates to the five studied flowering weed species. However, larger studies incorporating more plant species and with more precise insect identification would allow for a more complete assessment of the relationships between particular floral characteristics and insect visitation rates.

- Flowering weeds are important aspects of sustainable farms, helping to maintain biodiversity and ecosystem functioning, and should be promoted in order to dispel common misconceptions and encourage their acceptance. Continued effort is needed in translating science to policy, and engaging with farmers to incorporate new strategies by providing them with financial and logistical support.

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APPENDIX A

Margin Photos

Site	Photo
A1	
A2	
A3	

Site	Photo
CA	
CO	
G1	

Site	Photo
G2	
G3	
G4	

Site	Photo
G5	
G6	
G7	

Site	Photo
G8	
G9	
M	

Site	Photo
P1	
P2	
S1	

Site	Photo
S2	
S3	
S4	

Site	Photo
S5	
SA	
SB	

Site	Photo
SC	
SD	
SE	

APPENDIX B

Functional Flowering Plant Traits

Plant Species	Flowering Period	# of Flowering Months	Life Form	Nectar Availability	Flower Morphology	Flower Colour	Height (Typical Max, cm)	Height (Typical Mean, cm)	Petal Size (Mean Radius, cm)	# of Petals	# of Stamen	# of Stigma
Achillea millefolium	5-10	6	hemicryptophyte	concealed	ray and disk	white	70	45	0.23	5	5	2
Allium sp.	/	/	/	/	/	/	/	/	/	6	6	1 (3)
Allium sphaerocephalon	5-8	4	geophyte	partly exposed	disk	pink, purple	80	55	0.48	6	6	1
Alyssum alyssoides	3-6	4	therophyte	partly exposed	disk	yellow	20	13	0.35	4	6	2
Anacyclus clavatus	5-6	2	therophyte	/	/	white, yellow	40	25	0.09	5	5	2
Anagallis arvensis	2-10	9	therophyte	none	/	blue, red	30	18	0.55	5	5	1
Anthemis cotula	4-9	6	therophyte	concealed	ray and disk	white, yellow	50	30	1.05	5	5	2
Antirrhinum majus	4-10	7	chamaephyte	partly exposed	lip	pink, purple	120	80	3.75	3	4	1
Aphyllanthes monspeliensis	3-8	6	hemicryptophyte	/	/	blue, purple	30	20	1.75	6	6	3
Argyrolobium zanonii	2-5	4	chamaephyte	/	/	yellow	30	20	1.05	5	10	1
Ballota nigra	4-10	7	chamaephyte	/	lip	pink, purple, white	100	60	1.20	5	4	2
Biscutella auriculata	4-6	3	therophyte	partly exposed	disk	green, yellow	50	35	1.50	4	6	2
Blackstonia perfoliata	4-9	6	therophyte	concealed	disk	yellow	40	23	0.95	5	5	2
Bryonia cretica	4-8	5	hemicryptophyte	concealed	funnel	green	300	250	0.70	5	3	3
Calendula arvensis	2-10	9	therophyte	concealed	ray and disk	yellow	30	20	0.75	5	5	2
Campanula rapunculoides	6-8	3	hemicryptophyte	partly exposed	bell	purple	80	55	3.00	5	5	3
Capsella bursa-pastoris	1-12	12	therophyte (hemicryptophyte)	partly exposed	disk	white	40	21	0.23	4	6	2
Cardamine hirsuta	2-5	4	therophyte	partly exposed	disk	white	40	25	0.33	4	4	2
Carduus pycnocephalus	5-6	2	therophyte (hemicryptophyte)	concealed	disk	pink, purple	80	55	1.20	5	5	2
Carduus tenuiflorus	5-6	2	therophyte (hemicryptophyte)	concealed	disk	purple	100	65	1.20	5	5	2

Plant Species	Flowering Period	# of Flowering Months	Life Form	Nectar Availability	Flower Morphology	Flower Colour	Height (Typical Max, cm)	Height (Typical Mean, cm)	Petal Size (Mean Radius, cm)	# of Petals	# of Stamen	# of Stigma
Celtis autralis	3-4	2	macro-phanerophyte	/	/	/	2500	1500	/	0	5	6
Centaurea aspera	3-11	9	chamaephyte	concealed	disk	purple	50	30	1.25	5	5	2
Centaurea collina	6-8	3	hemicryptophyte	concealed	disk	purple, yellow	80	55	/	5	5	2
Centaurea jacea	6-10	5	hemicryptophyte	concealed	disk	pink, purple	120	70	/	5	5	2
Centaurea sp.	/	/	/	concealed	disk	/	/	/	/	5	5	2
Chenopodium album	7-12	6	therophyte	none	/	green	200	110	0.30	3	2	2
Chondrilla juncea	7-9	3	hemicryptophyte	concealed	ray	yellow	100	65	/	5	5	2
Chrysanthemum segetum	5-8	4	therophyte	concealed	ray and disk	yellow	50	30	1.40	5	5	2
Cirsium arvense	7-9	3	geophyte	concealed	disk	purple	100	65	1.55	5	5	2
Cirsium vulgare	6-9	4	hemicryptophyte	concealed	disk	purple	150	95	3.00	5	5	2
Clematis vitalba	6-8	3	phanerophyte	none	/	green, white	2000	1150	1.00	5	numerous	numerous
Convolvulus arvensis	4-10	7	geophyte (hemicryptophyte)	concealed	funnel	pink, white	10	7	1.75	5	5	2
Convulvulus lineatus	5-7	3	hemicryptophyte	concealed	funnel	pink, white	10	7	1.85	5	5	2
Coris monspeliensis	4-7	4	chamaephyte	/	/	blue, pink, purple	30	20	1.05	5	5	1
Cornus sanguinea	4-6	3	macro-phanerophyte (nano-phanerophyte)	exposed	disk	white	550	325	0.55	4	4	1
Coronilla minima	5-8	4	chamaephyte	/	flag	yellow	30	20	0.65	5	10	1
Coronilla scorpioides	2-6	5	therophyte	none	flag	yellow	40	25	0.55	5	10	1
Crataegus monogyna	3-6	4	macro-phanerophyte	partly exposed	disk	red, white	600	350	0.58	5	15	1
Crepis biennis	5-7	3	hemicryptophyte	concealed	ray	yellow	120	70	1.50	5	5	2
Crepis bursifolia	5-6	2	hemicryptophyte	concealed	ray	yellow	35	20	/	5	5	2
Crepis capillaris	5-9	5	hemicryptophyte (therophyte)	concealed	ray	yellow	80	50	1.00	5	5	2
Crepis pulchra	5-7	3	therophyte	concealed	ray	yellow	70	50	/	5	5	2
Crepis sp.	/	/	/	concealed	ray	yellow	/	/	/	5	5	2

Plant Species	Flowering Period	# of Flowering Months	Life Form	Nectar Availability	Flower Morphology	Flower Colour	Height (Typical Max, cm)	Height (Typical Mean, cm)	Petal Size (Mean Radius, cm)	# of Petals	# of Stamen	# of Stigma
Crupina vulgaris	5-7	3	therophyte	partly exposed	ray	pink, purple	40	25	/	5	5	2
Daucus carota	4-11	8	hemicryptophyte	exposed	disk	white	150	80	/	5	5	1
Diplotaxis erucoides	1-12	12	therophyte	partly exposed	disk	white	50	30	1.00	4	6	2
Dorycnium pentaphyllum	4-8	5	chamaephyte (nano-phanerophyte)	/	flag	white	80	45	0.30	5	10	1
Echium plantagineum	5-7	3	hemicryptophyte (therophyte)	partly exposed	lip	blue, pink, purple	70	45	2.40	5	5	1
Elaeagnus angustifolia	5-7	3	macro-phanerophyte	concealed	funnel	yellow	1000	600	0.90	0	4-8	1
Equisetum arvense	2-5	4	geophyte	/	/	/	60	40	/	/	/	/
Erodium ciconium	4-7	4	therophyte	partly exposed	disk	blue, purple	60	35	0.80	5	10	5
Erodium cicutarium	2-10	9	therophyte	partly exposed	disk	pink	60	33	0.50	5	5	5
Erucastrum nasturtiifolium	3-11	9	therophyte (chamaephyte)	exposed	disk	yellow	80	50	0.80	4	6	2
Eryngium campestre	5-10	6	geophyte	concealed	/	gray, green, white	60	45	1.25	5	5	1
Euphorbia peplus	1-12	12	therophyte	exposed	disk	green, yellow	40	22	0.25	0	1	3
Euphorbia prostrata	8-10	3	therophyte	exposed	disk	/	30	20	/	0	1	3
Euphorbia segetalis	1-12	12	therophyte (chamaephyte)	exposed	disk	yellow	40	25	0.28	0	1	3
Euphorbia serrata	2-7	6	chamaephyte	exposed	disk	green, yellow	50	35	0.55	0	1	3
Fumaria officinalis	2-10	9	therophyte	partly exposed	flag	pink, purple	50	30	0.75	4	2	1
Galium aparine	6-10	5	therophyte	exposed	disk	white	100	60	0.08	4	4	2
Galium lucidum	5-7	3	hemicryptophyte	exposed	disk	white	80	50	0.20	4	4	2
Galium parisiense	5-7	3	therophyte	exposed	disk	green, red	30	18	0.04	4	4	2
Galium spurium	6-10	5	therophyte	exposed	disk	green, yellow	100	60	0.05	4	4	2
Galium verum	6-9	4	hemicryptophyte	exposed	disk	yellow	120	75	0.14	4	4	2

Plant Species	Flowering Period	# of Flowering Months	Life Form	Nectar Availability	Flower Morphology	Flower Colour	Height (Typical Max, cm)	Height (Typical Mean, cm)	Petal Size (Mean Radius, cm)	# of Petals	# of Stamen	# of Stigma
Genista scorpius	2-5	4	nano-phanerophyte	none	flag	yellow	200	125	0.85	5	10	1
Geranium dissectum	4-7	4	therophyte	partly exposed	disk	pink, purple	40	25	0.50	5	10	5
Geranium robertianum	3-9	7	therophyte (hemicryptophyte)	partly exposed	disk	pink, purple	50	28	1.10	5	10	5
Geranium sanguineum	5-9	5	hemicryptophyte	partly exposed	disk	purple, red	40	25	1.55	5	10	5
Hallea ciliata	/	/	/	/	/	/	/	/	/	4	4	2
Hedera helix	9-11	3	phanerophyte	exposed	disk	green, yellow	15	10	0.40	5	5	1
Helianthemum oelandicum	3-7	5	chamaephyte	none	/	yellow	25	15	0.45	5	numerous	1 (3-5)
Heliotropium europaeum	6-10	5	therophyte	none	disk	blue, white, yellow	40	25	0.35	5	5	2
Hypericum perforatum	5-6	2	hemicryptophyte	none	/	yellow	60	40	1.00	5	numerous	3
Jasminum fruticans	4-8	5	nano-phanerophyte	/	/	yellow	300	200	0.68	5	2	1-2
Knautia dipsacifolia	6-9	4	hemicryptophyte	concealed	/	pink, purple	120	75	0.16	4	4	1
Kochia scoparia	8-10	3	therophyte	none	/	green	150	90	/	5	5	3
Lactuca serriola	6-8	3	therophyte (hemicryptophyte)	concealed	ray	yellow	250	155	/	5	5	2
Lamium amplexicaule	3-5	3	therophyte	partly exposed	lip	pink, purple	40	23	1.70	5	4	2
Lathyrus aphaca	3-7	5	therophyte	partly exposed	flag	yellow	50	30	1.15	5	10	1
Lathyrus setifolius	3-6	4	therophyte	partly exposed	flag	orange, red	60	35	0.95	5	10	1
Lathyrus sp.	/	/	/	partly exposed	flag	/	/	/	/	5	10	1
Lepidium draba	3-6	4	hemicryptophyte	partly exposed	disk	white	60	40	0.33	4	6	2
Ligustrum vulgare	4-7	4	nano-phanerophyte (macro-phanerophyte)	concealed	funnel	white	300	200	0.30	4	2	1
Linum perenne	5-8	4	chamaephyte	partly exposed	disk	blue	30	20	1.40	5	5	5

Plant Species	Flowering Period	# of Flowering Months	Life Form	Nectar Availability	Flower Morphology	Flower Colour	Height (Typical Max, cm)	Height (Typical Mean, cm)	Petal Size (Mean Radius, cm)	# of Petals	# of Stamen	# of Stigma
Lithospermum arvense	3-9	7	therophyte	concealed	disk	blue, purple, white	50	28	0.75	5	5	1
Lythrum salicaria	5-9	5	hemicryptophyte	concealed	funnel	purple, red	100	75	1.00	6	12	1
Malva sylvestris	3-10	8	hemicryptophyte	concealed	disk	pink, purple	120	70	2.10	5	numerous	numerous
Medicago lupulina	4-10	7	hemicryptophyte (therophyte)	partly exposed	flag	yellow	60	35	0.25	5	10	1
Medicago polymorpha	2-8	7	therophyte	partly exposed	flag	yellow	50	30	0.38	5	10	1
Medicago sativa	4-10	7	hemicryptophyte	/	/	yellow	80	45	0.90	5	10	1
Mentha sp.	/	/	/	concealed	funnel	/	/	/	/	5	4	2
Onobrychis saxatilis	4-7	4	chamaephyte	partly exposed	flag	pink, yellow	40	25	1.15	5	10	1
Ononis spinosa	4-10	7	chamaephyte	none	flag	pink, purple	60	35	1.30	5	10	1
Ononis viscosa	5-7	3	therophyte	none	flag	yellow	50	33	1.20	5	10	1
Orobanche cernua	5-7	3	geophyte	/	lip	blue, purple	40	25	1.60	5	4	2-4
Pallenis spinosa	5-7	3	hemicryptophyte	/	/	yellow	50	30	1.25	5	5	2
Papaver rhoeas	3-8	6	therophyte	none	bowl	red	60	40	3.15	6	>50	10
Parietaria officinalis	3-9	7	chamaephyte	none	/	green	50	35	/	4	4	numerous (1)
Phlomis herba-venti	5-8	4	hemicryptophyte	partly exposed	lip	purple	60	40	2.00	5	4	2
Pinus halepensis	4-5	2	macro-phanerophyte	/	/	/	2000	1500	/			
Plantago albicans	4-7	4	chamaephyte	none	/	white	40	25	0.35	4	4	1
Plantago lanceolata	4-10	7	hemicryptophyte	none	/	brown, cream	60	35	0.25	4	4	1
Plantago major	4-11	8	hemicryptophyte (therophyte)	none	/	cream	60	35	0.20	4	4	1
Polygonum aviculare	4-8	5	therophyte	none	bell	green, pink, white	80	43	0.30	5	8	3
Polygonum convolvulus	5-7	3	therophyte	none	bell	green, white	100	60	0.30	5	8	3
Potentilla inclinata	5-6	2	hemicryptophyte	partly exposed	disk	yellow	50	33	0.60	5	20	numerous

Plant Species	Flowering Period	# of Flowering Months	Life Form	Nectar Availability	Flower Morphology	Flower Colour	Height (Typical Max, cm)	Height (Typical Mean, cm)	Petal Size (Mean Radius, cm)	# of Petals	# of Stamen	# of Stigma
Potentilla reptans	1-10	10	hemicryptophyte	partly exposed	disk	yellow	80	45	1.13	5	20	numerous
Prunus domestica	4-5	2	macro-phanerophyte	partly exposed	disk	white	1000	600	0.95	5	20	1
Prunus dulcis	1-3	3	macro-phanerophyte	partly exposed	disk	pink, white	1200	800	0.20	5	20	1
Prunus spinosa	2-5	4	nano-phanerophyte (macro-phanerophyte)	partly exposed	disk	white	200	110	0.65	5	20	1
Quercus coccifera	4-5	2	nano-phanerophyte (macro-phanerophyte)	none	/	brown, yellow	300	175	/	5	10	1
Quercus faginea	4-5	2	macro-phanerophyte	none	/	green, yellow	2000	1250	/	5	10	1
Quercus ilex	4-5	2	macro-phanerophyte	none	/	green	2500	1500	small	5	6 (10)	3 (1)
Quercus robur	4-5	2	macro-phanerophyte	none	/	green, yellow	4500	3000	small	5	6 (10)	3 (1)
Reseda lutea	1-9	9	hemicryptophyte	partly exposed	disk	yellow	60	40	0.30	6	16	3
Rhamnus cathartica	5-6	2	macro-phanerophyte	exposed	disk	green, yellow	400	350	0.20	4	4	2
Rosa canina	5-7	3	phanerophyte	none	/	pink, white	300	200	2.00	5	numerous	numerous
Rosmarinus officinalis	1-12	12	nano-phanerophyte	/	/	blue	200	125	0.11	5	2	2
Rubia peregrina	5-8	4	phanerophyte	/	/	green, yellow	200	115	0.25	5	5	2
Rubus sp.	/	/	/	partly exposed	disk	pink	/	/	/	5	numerous	numerous (1)
Salsola kali	5-10	6	therophyte	none	/	green	80	50	0.20	5	5	2
Salsola vermiculata	6-10	5	nano-phanerophyte	none	/	green, pink, yellow	100	65	0.45	5	5	2
Sambucus nigra	2-6	5	macro-phanerophyte	none	/	white	1000	600	0.25	5	5	4
Sanguisorba minor	5-9	5	hemicryptophyte	partly exposed	disk	green, red	60	40	0.10	0	numerous	2
Santolina chamaecyparissus	6-9	4	chamaephyte	/	/	yellow	50	35	0.35	5	5	2
Scandix pecten-veneris	2-7	6	therophyte	/	/	white	40	25	0.05	5	5	1

Plant Species	Flowering Period	# of Flowering Months	Life Form	Nectar Availability	Flower Morphology	Flower Colour	Height (Typical Max, cm)	Height (Typical Mean, cm)	Petal Size (Mean Radius, cm)	# of Petals	# of Stamen	# of Stigma
Sedum sediforme	6-8	3	chamaephyte	partly exposed	disk	white, yellow	60	40	0.55	6.5	6 (13)	1
Seseli tortuosum	8-10	3	hemicryptophyte	exposed	disk	white, yellow	50	35	/	5	5	1
Solanum dulcamara	6-9	4	nano-phanerophyte	none	/	purple	250	140	0.63	5	5	1
Solanum nigrum	5-11	7	therophyte	none	/	white	60	35	0.60	5	5	1
Sonchus oleraceus	2-12	11	therophyte (hemicryptophyte)	concealed	ray	yellow	140	75	/	5	5	2
Sonchus tenerrimus	1-12	12	chamaephyte (therophyte)	concealed	ray	yellow	80	45	/	5	5	2
Stellaria media	1-12	12	therophyte	partly exposed	disk	white	60	33	0.40	5	10	3
Teucrium chamaedrys	5-9	5	chamaephyte	partly exposed	lip	purple	30	20	1.25	5	4	2
Thesium humifusum	5-8	4	hemicryptophyte	partly exposed	disk	green	50	35	0.15	5	5	1
Thlaspi arvense	3-6	4	therophyte	partly exposed	disk	white	30	20	0.35	4	6	2
Thymus vulgaris	2-6	5	chamaephyte	concealed	lip	pink, purple, white	30	20	0.50	5	4	2
Tordylium maximum	5-7	3	therophyte	exposed	disk	white	100	65	0.25	5	5	1
Torilis arvensis	5-8	4	therophyte	exposed	disk	red, white	100	60	0.10	5	5	1
Trifolium glomeratum	3-6	4	therophyte	partly exposed	flag	pink, purple	35	23	0.45	5	10	1
Trifolium pratense	4-11	8	hemicryptophyte	partly exposed	flag	pink, purple, red	70	40	1.35	5	10	1
Trifolium repens	4-11	8	hemicryptophyte	partly exposed	flag	pink, white	40	25	1.05	5	10	1
Urtica urens	3-10	8	therophyte	none	/	green	50	30	/	4	4	numerous
Verbena officinalis	5-10	6	hemicryptophyte	partly exposed	funnel	pink, purple	80	55	0.45	5	4	1
Veronica arvensis	3-10	8	therophyte	partly exposed	lip	blue	25	14	0.13	4	2	1
Veronica hederifolia	3-10	8	therophyte	concealed	lip	blue, purple	60	35	0.33	4	2	1
Veronica persica	1-12	12	therophyte	concealed	lip	blue	40	25	0.50	4	2	1
Veronica polita	2-10	9	therophyte	concealed	lip	blue	30	18	0.45	4	2	1

Plant Species	Flowering Period	# of Flowering Months	Life Form	Nectar Availability	Flower Morphology	Flower Colour	Height (Typical Max, cm)	Height (Typical Mean, cm)	Petal Size (Mean Radius, cm)	# of Petals	# of Stamen	# of Stigma
Veronica tenuifolia	5-7	4	chamaephyte	concealed	lip	blue	40	25	0.50	4	2	1
Vicia pannonica	4-7	4	therophyte	partly exposed	flag	purple, yellow	60	40	1.70	5	10	1
Vicia peregrina	4-6	3	therophyte	partly exposed	flag	purple	100	60	1.30	5	10	1
Vicia sativa	4-7	4	therophyte	partly exposed	flag	purple	80	45	2.00	5	10	1
Vicia sp.	/	/	/	partly exposed	flag	/	/	/	/	5	10	1
Vicia villosa	3-8	6	therophyte (hemicryptophyte)	partly exposed	flag	blue, purple	100	65	1.50	5	10	1
Viola tricolor	4-8	5	hemicryptophyte (therophyte)	partly exposed	lip	blue, purple, white, yellow	40	22	0.18	5	5	1

APPENDIX C

Functional Bee Genera Traits

Genus	Family	Subfamily	Tribe	Common Name	Nest Substrate	Parasite ?	Nest Location	Nesting Behaviour	Sociality	Lecty	Pollen Organ	Median ITD (mm)	Maximum Foraging Range (homing distance, km)	Typical Foraging Distance (homing distance, km)	Median Tongue Length (mm)
Andrena	Andrenidae	Andreninae	NA	Mining	soil	no	below	excavate	solitary	polylectic & oligolectic	scopa & floccus - hind leg (trochanter)	2.40	0.83	0.39	2.46
Anthidium	Megachilidae	Megachilinae	Anthidiini	Mason	soil, wood, conifer resin, plant hairs	no	above & below	rent	solitary	polylectic (mostly)	scopa - under abdomen	3.25	2.29	1.04	5.80
Anthophora	Apidae	Apinae	Anthophorini	Digger	soil	no	below	excavate	solitary	polylectic (mostly)	scopa - hind leg (tibia)	1.15	0.07	0.04	2.44
Bombus	Apidae	Apinae	Bombini	Bumblebee	soil, grass	no (mostly)	above & below	rent	social (mostly)	polylectic	corbicula - hind leg (tibia)	3.75	3.71	1.65	7.58
Ceratina	Apidae	Xylocopinae	Ceratinini	Small carpenter	stem	no	above	excavate	solitary (mostly)	polylectic	scopa - hind leg	1.30	0.10	0.05	2.74
Colletes	Colletidae	Colletinae	NA	Cellophane/ Plasterer	soil	no	below	excavate	solitary	polylectic & oligolectic	scopa - hind leg (femur) & propodeum	2.20	0.62	0.29	1.83
Dasypoda	Melittidae	Dasypodainae	Dasypodaini	/	soil	no	below	excavate	solitary	oligolectic	scopa - hind leg	2.90	1.56	0.72	/
Dufourea	Halictidae	Rophitinae	NA	Sweat	soil	no	below	excavate	solitary	oligolectic	scopa - hind leg (tibia)	2.03	0.47	0.23	2.72
Epeolus	Apidae	Nomadinae	Epeolini	/	soil	yes	below	cleptoparasite	solitary	polylectic (nectar only)	none	2.53	0.99	0.46	5.19
Eucera	Apidae	Apinae	Eucerini	Long-horned	soil	no	below	excavate	solitary	polylectic & oligolectic	scopa - hind leg (tibia)	2.40	0.83	0.39	4.94
Halictus	Halictidae	Halictinae	Halictini	Sweat	soil	no	below	excavate	social & solitary	polylectic	scopa - hind leg (femur, tibia, trochanter) & fringes under abdomen	1.40	0.13	0.07	1.91
Heriades	Megachilidae	Megachilinae	Osmiini	Mason	soil, twigs	no	above & below	rent	solitary	polylectic & oligolectic	scopa - under abdomen	1.50	0.17	0.08	2.76
Hoplitis	Megachilidae	Megachilinae	Osmiini	Mason	soil, stem, wood	no	above (mostly)	rent	solitary	polylectic & oligolectic	scopa - under abdomen	1.60	0.21	0.10	2.94
Hylaeus	Colletidae	Hylaeinae	NA	Yellow masked	stem	no	above	rent	solitary	polylectic	none	1.50	0.17	0.08	1.27
Lasioglossum	Halictidae	Halictinae	Halictini	Sweat	soil, wood	no	below (mostly)	excavate	social & solitary	polylectic (mostly)	scopa - hind leg (femur, tibia, trochanter) & fringes under abdomen	2.10	0.53	0.25	2.81
Megachile	Megachilidae	Megachilinae	Megachilini	Leaf-cutter	soil, stem, wood	no	above & below	rent	solitary	polylectic & oligolectic	scopa - under abdomen	2.98	1.71	0.78	5.33

Genus	Family	Subfamily	Tribe	Common Name	Nest Substrate	Parasite ?	Nest Location	Nesting Behaviour	Sociality	Lecty	Pollen Organ	Median ITD (mm)	Maximum Foraging Range (homing distance, km)	Typical Foraging Distance (homing distance, km)	Median Tongue Length (mm)
Melecta	Apidae	Apinae	Melectini	/	soil	yes	below	cleptoparasite	solitary	polylectic (nectar only)	none	2.13	0.55	0.26	4.40
Melitta	Melittidae	NA	NA	/	soil	no	below	excavate	solitary	oligolectic	scopa - hind leg (tibia)	2.20	0.62	0.29	/
Nomada	Apidae	Nomadinae	Nomadini	Cuckoo	soil	yes	below	cleptoparasite	solitary	polylectic (nectar only)	none	1.40	0.13	0.07	2.94
Osmia	Megachilidae	Megachilinae	Osmiini	Mason	soil, stem, wood	no	above & below	excavate & rent	solitary (mostly)	polylectic & oligolectic	scopa - under abdomen	2.70	1.23	0.57	4.85
Panurgus	Andrenidae	Panurginae	Panurgini	/	soil	no	below	excavate	social & solitary	polylectic & oligolectic	scopa - hind leg	1.75	0.29	0.14	1.81
Sphecodes	Halictidae	Halictinae	Halictini	Cuckoo	soil	yes	below	cleptoparasite	solitary	polylectic (nectar only)	none	1.13	0.07	0.03	1.55
Stelis	Megachilidae	Megachilinae	Anthidiini	Cuckoo	/	yes	above	cleptoparasite	solitary	polylectic (nectar only)	none	1.40	0.13	0.07	2.58
Xylocopa	Apidae	Xylocopinae	Xylocopini	Large carpenter	soil, wood	no	above & below	excavate	social & solitary	polylectic	scopa - hind leg	5.75	15.63	6.60	11.42

APPENDIX D

All Observed Plant Species

	Plant Species	Family	Herbaceous/ Shrub/Tree	Annual/Biennial/ Perennial	# of Margins Found In	% of Margins Found In	Sites
1	*Achillea millefolium*	Asteraceae/ Compositae	herbaceous	perennial	1	4	SB
2	*Agropyron repens*	Gramineae/Poaceae	herbaceous	perennial	5	19	A3, G2, G4, G8, M
3	*Allium sp.*	Amaryllidaceae/ Liliaceae	herbaceous	perennial	1	4	SB
4	*Allium sphaerocephalon*	Amaryllidaceae/ Liliaceae	herbaceous	perennial	1	4	SD
5	*Alopecurus myosuroides*	Gramineae/Poaceae	herbaceous	annual	1	4	SA
6	*Alyssum alyssoides*	Brassicaceae/ Cruciferae	herbaceous	annual/biennial	4	15	A3, CO, G2, G6
7	*Anacyclus clavatus*	Asteraceae/ Compositae	herbaceous	annual	7	26	A1, A3, G1, G2, G3, G7, G9
8	*Anagallis arvensis*	Primulaceae	herbaceous	annual	1	4	P2
9	*Anthemis cotula*	Asteraceae/ Compositae	herbaceous	annual	1	4	CO
10	*Antirrhinum majus*	Veronicaceae/ Plantaginaceae	herbaceous	biennial/perennial	1	4	S3
11	*Apera spica-venti*	Gramineae/Poaceae	herbaceous	annual/biennial	3	11	A3, G2, G6
12	*Aphyllanthes monspeliensis*	Asparagaceae	herbaceous	perennial	1	4	S4
13	*Argyrolobium zanonii*	Fabaceae/ Papilionaceae	shrub	perennial	1	4	S4
14	*Arrhenatherum album*	Gramineae/Poaceae	herbaceous	perennial	1	4	M
15	*Arrhenatherum elatius*	Gramineae/Poaceae	herbaceous	perennial	3	11	S2, S3, SD
16	*Avena sterilis*	Gramineae/Poaceae	herbaceous	annual	16	59	A2, A3, CA, G2, G3, G4, G5, G6, G7, G9, S1, S2, S3, SB, SC, SE
17	*Avenula bromoides*	Gramineae/Poaceae	herbaceous	perennial	1	4	S4
18	*Ballota nigra*	Lamiaceae/Labiatae	herbaceous	perennial	1	4	S3
19	*Biscutella auriculata*	Brassicaceae/ Cruciferae	herbaceous	annual	1	4	G8
20	*Blackstonia perfoliata*	Gentianaceae	herbaceous	annual	1	4	P2
21	*Brachypodium phoenicoides*	Gramineae/Poaceae	herbaceous	perennial	11	41	CO, G5, M, P1, P2, S1, S3, SA, SB, SC, SD
22	*Brachypodium retusum*	Gramineae/Poaceae	herbaceous	perennial	4	15	A1, A3, G5, G6

	Plant Species	Family	Herbaceous/ Shrub/Tree	Annual/Biennial/ Perennial	# of Margins Found In	% of Margins Found In	Sites
23	*Bromus diandrus*	Gramineae/Poaceae	herbaceous	annual	22	81	A1, A2, A3, CO, G1, G2, G3, G4, G5, G6, G8, M, P1, P2, S1, S3, S5, SA, SB, SC, SD, SE
24	*Bromus madritensis*	Gramineae/Poaceae	herbaceous	annual	2	7	S2, S3
25	*Bromus mollis*	Gramineae/Poaceae	herbaceous	annual/biennial	2	7	A3, G1
26	*Bromus rubens*	Gramineae/Poaceae	herbaceous	annual	5	19	A1, A2, A3, G6, G7
27	*Bryonia dioica*	Cucurbitaceae	herbaceous	perennial	8	30	CO, G1, M, S2, S3, S5, SB, SE
28	*Calendula arvensis*	Asteraceae/ Compositae	herbaceous	annual	1	4	CA
29	*Campanula rapunculoides*	Campanulaceae	herbaceous	perennial	2	7	SB, SD
30	*Capsella bursa-pastoris*	Brassicaceae/ Cruciferae	herbaceous	annual/biennial	2	7	A1, G8
31	*Cardamine hirsuta*	Brassicaceae/ Cruciferae	herbaceous	annual	1	4	G8
32	*Carduus pycnocephalus*	Asteraceae/ Compositae	herbaceous	annual/biennial	3	11	S2, S3, S5
33	*Carduus tenuiflorus*	Asteraceae/ Compositae	herbaceous	annual/biennial	7	26	CO, G1, G4, G6, G7, G8, M
34	*Celtis australis*	Cannabaceae/ Ulmaceae	tree	perennial	2	7	G6, S5
35	*Centaurea aspera*	Asteraceae/ Compositae	herbaceous	perennial	1	4	G6
36	*Centaurea collina*	Asteraceae/ Compositae	herbaceous	perennial	1	4	S2
37	*Centaurea jacea*	Asteraceae/ Compositae	herbaceous	perennial	2	7	A3, P2
38	*Centaurea sp.*	Asteraceae/ Compositae	herbaceous	annual/perennial	1	4	G4
39	*Chenopodium album*	Chenopodiaceae	herbaceous	annual	5	19	G9, G1, M, S1, SB
40	*Chondrilla juncea*	Asteraceae/ Compositae	herbaceous	biennial/perennial	1	4	G4
41	*Chrysanthemum segetum*	Asteraceae/ Compositae	herbaceous	annual/biennial/ perennial	1	4	P2
42	*Cirsium arvense*	Asteraceae/ Compositae	herbaceous	perennial	4	15	CA, G2, G5, G8
43	*Cirsium vulgare*	Asteraceae/ Compositae	herbaceous	biennial	1	4	SC
44	*Clematis vitalba*	Ranunculaceae	shrub	perennial	4	15	S3, S5, SC, SE
45	*Convolvulus arvensis*	Convolvulaceae	herbaceous	perennial	12	44	A3, CA, CO, G1, G2, G4, G8, G9, M, P2, S1, SD
46	*Convulvulus lineatus*	Convolvulaceae	herbaceous	perennial	2	7	A3, G6

	Plant Species	Family	Herbaceous/ Shrub/Tree	Annual/Biennial/ Perennial	# of Margins Found In	% of Margins Found In	Sites
47	*Coris monspeliensis*	Primulaceae	shrub	biennial/perennial	1	4	S4
48	*Cornus sanguinea*	Cornaceae	shrub	perennial	1	4	S3
49	*Coronilla minima*	Fabaceae/ Papilionaceae	shrub	perennial	1	4	S4
50	*Coronilla scorpioides*	Fabaceae/ Papilionaceae	herbaceous	annual	1	4	SD
51	*Crataegus monogyna*	Rosaceae	shrub/tree	perennial	1	4	P2
52	*Crepis biennis*	Asteraceae/ Compositae	herbaceous	biennial	1	4	G1
53	*Crepis bursifolia*	Asteraceae/ Compositae	herbaceous	perennial	1	4	SD
54	*Crepis capillaris*	Asteraceae/ Compositae	herbaceous	annual/biennial	1	4	CO
55	*Crepis pulchra*	Asteraceae/ Compositae	herbaceous	annual	3	11	CO, G6, SA, SB
56	*Crepis sp.*	Asteraceae/ Compositae	herbaceous	annual/perennial	4	15	G4, G5, G7, P2
57	*Crupina vulgaris*	Asteraceae/ Compositae	herbaceous	annual	1	4	G6
58	*Cynodon dactylon*	Gramineae/Poaceae	herbaceous	perennial	1	4	CA
59	*Dactylis glomerata*	Gramineae/Poaceae	herbaceous	perennial	5	19	A3, G2, G6, G7, P2
60	*Daucus carota*	Apiaceae/ Umbelliferae	herbaceous	annual/biennial/ perennial	3	11	CO, G8, P2
61	*Diplotaxis erucoides*	Brassicaceae/ Cruciferae	herbaceous	annual	6	22	CO, G1, G2, G3, S3, SC
62	*Dorycnium pentaphyllum*	Fabaceae/ Papilionaceae	herbaceous/shrub	perennial	3	11	A3, G5, S4
63	*Echinaria capitata*	Gramineae/Poaceae	herbaceous	annual	1	4	A3
64	*Echium plantagineum*	Boraginaceae	herbaceous	annual/biennial	1	4	CO
65	*Eleagnus angustifolia*	Elaeagnaceae	shrub/tree	perennial	1	4	G2
66	*Equisetum arvense*	Equisetaceae	herbaceous	perennial	1	4	SA
67	*Erodium ciconium*	Geraniaceae	herbaceous	annual/biennial	4	15	G2, G3, G6, G7
68	*Erodium cicutarium*	Geraniaceae	herbaceous	annual/biennial	1	4	SB
69	*Erucastrum nasturtiifolium*	Brassicaceae/ Cruciferae	herbaceous	annual/biennial/ perennial	2	7	G6, G8
70	*Eryngium campestre*	Apiaceae/ Umbelliferae	herbaceous	perennial	4	15	A3, G5, G1, G6
71	*Euphorbia peplus*	Euphorbiaceae	herbaceous	annual	3	11	CO

	Plant Species	Family	Herbaceous/ Shrub/Tree	Annual/Biennial/ Perennial	# of Margins Found In	% of Margins Found In	Sites
72	*Euphorbia prostrata*	Euphorbiaceae	herbaceous	annual	1	4	G9
73	*Euphorbia segetalis*	Euphorbiaceae	herbaceous	annual/biennial/ perennial	1	4	S5
74	*Euphorbia serrata*	Euphorbiaceae	herbaceous	perennial	1	4	A3, G3, G6
75	*Festuca ovina*	Gramineae/Poaceae	herbaceous	perennial	1	4	S4
76	*Festuca rubra*	Gramineae/Poaceae	herbaceous	perennial	1	4	SD
77	*Fumaria officinalis*	Papaveraceae	herbaceous	annual	13	48	A1, A3, G1, G4, G5, G8, M, P1, P2, S1, S3, SC, SE
78	*Galium aparine*	Rubiaceae	herbaceous	annual	14	52	A1, A2, CO, G8, M, P1, S1, S2, S3, S5, SA, SB, SC, SE
79	*Galium lucidum*	Rubiaceae	herbaceous	perennial	2	7	P2, S2
80	*Galium parisiense*	Rubiaceae	herbaceous	annual	3	11	CO, S3, SC
81	*Galium spurium*	Rubiaceae	herbaceous	annual	1	4	A1
82	*Galium verum*	Rubiaceae	herbaceous	perennial	1	4	CO
83	*Genista scorpius*	Fabaceae/ Papilionaceae	shrub	perennial	2	7	G5, S4
84	*Geranium dissectum*	Geraniaceae	herbaceous	annual	4	15	P2, SA, SD, SE
85	*Geranium robertianum*	Geraniaceae	herbaceous	annual/biennial	2	7	G5, SE
86	*Geranium sanguineum*	Geraniaceae	herbaceous	perennial	1	4	CO
87	*Hallea ciliata*	Rubiaceae	tree	perennial	1	4	G5
88	*Hedera helix*	Araliaceae	shrub	perennial	3	11	CO, M, SE
89	*Helianthemum oelandicum*	Cistaceae	shrub	perennial	1	4	P2
90	*Heliotropium europaeum*	Boraginaceae	herbaceous	annual	1	4	G9
91	*Hordeum murinum*	Gramineae/Poaceae	herbaceous	annual	6	22	A1, A3, CA, CO, G7, S2
92	*Hypericum perforatum*	Hypericaceae	herbaceous	perennial	3	11	G5, G8, P2
93	*Jasminum fruticans*	Oleaceae	shrub	perennial	2	7	G3, G6
94	*Knautia dipsacifolia*	Caprifoliaceae	herbaceous	perennial	2	7	P2, S2
95	*Kochia scoparia*	Chenopodiaceae	herbaceous	annual	5	19	A2, A3, G4, G8, G9
96	*Lactuca serriola*	Asteraceae/ Compositae	herbaceous	annual/biennial	11	41	A2, G1, G3, G4, G6, G7, G8, M, S5, SA, SD
97	*Lamium amplexicaule*	Lamiaceae/Labiatae	herbaceous	annual	6	22	CA, G4, S5, SB, SC, SE

	Plant Species	Family	Herbaceous/ Shrub/Tree	Annual/Biennial/ Perennial	# of Margins Found In	% of Margins Found In	Sites
98	*Lathyrus aphaca*	Fabaceae/ Papilionaceae	herbaceous	annual	1	4	SA
99	*Lathyrus setifolius*	Fabaceae/ Papilionaceae	herbaceous	annual	2	7	G4, SD
100	*Lathyrus sp.*	Fabaceae/ Papilionaceae	herbaceous	/	1	4	G7
101	*Lepidium draba*	Brassicaceae/ Cruciferae	herbaceous	perennial	3	11	G2, G4, S5
102	*Ligustrum vulgare*	Oleaceae	shrub	perennial	2	7	M, S3
103	*Linum perenne*	Linaceae	herbaceous	perennial	1	4	G6
104	*Lithospermum arvense*	Boraginaceae	herbaceous	annual	3	11	G4, G8, S1
105	*Lolium rigidum*	Gramineae/Poaceae	herbaceous	annual	12	44	A2, CA, CO, G2, G4, G6, G7, G9, S1, S2, SC, SE
106	*Lythrum salicaria*	Lythraceae	herbaceous	perennial	1	4	P2
107	*Malva sylvestris*	Malvaceae	herbaceous	biennial/perennial	3	11	CO, M, S2
108	*Medicago lupulina*	Fabaceae/ Papilionaceae	herbaceous	annual/biennial/ perennial	2	7	G1, P2
109	*Medicago polymorpha*	Fabaceae/ Papilionaceae	herbaceous	annual	2	7	A3, G6
110	*Medicago sativa*	Fabaceae/ Papilionaceae	herbaceous	perennial	1	4	SC
111	*Melica ciliata*	Gramineae/Poaceae	herbaceous	perennial	2	7	G5, S3
112	*Mentha sp.*	Lamiaceae/Labiatae	herbaceous	perennial	1	4	CO
113	*Onobrychis saxatilis*	Fabaceae/ Papilionaceae	herbaceous	perennial	2	7	CO, P2
114	*Ononis spinosa*	Fabaceae/ Papilionaceae	shrub	perennial	1	4	CO
115	*Ononis viscosa*	Fabaceae/ Papilionaceae	herbaceous	annual	1	4	SB
116	*Orobanche cernua*	Orobanchaceae	herbaceous	annual/perennial	1	4	S4
117	*Pallenis spinosa*	Asteraceae/ Compositae	herbaceous	annual	1	4	A3
118	*Papaver rhoeas*	Papaveraceae	herbaceous	annual	16	59	A1, A2, A3, CA, G1, G2, G4, G5, G6, G7, G8, P1, S1, SA, SB, SE
119	*Parietaria officinalis*	Urticaceae	herbaceous	perennial	1	4	S5
120	*Phleum phleoides*	Gramineae/Poaceae	herbaceous	perennial	1	4	SD
121	*Phlomis herba-venti*	Lamiaceae/Labiatae	herbaceous	annual	1	4	SB
122	*Pinus halepensis*	Pinaceae	tree	perennial	1	4	S4

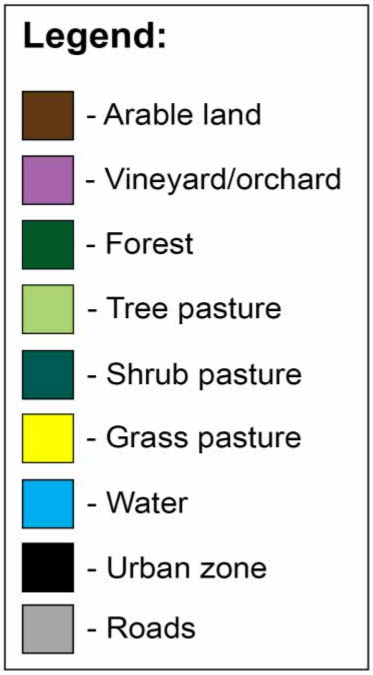
	Plant Species	Family	Herbaceous/ Shrub/Tree	Annual/Biennial/ Perennial	# of Margins Found In	% of Margins Found In	Sites
123	*Plantago albicans*	Plantaginaceae	herbaceous	perennial	1	4	G7
124	*Plantago lanceolata*	Plantaginaceae	herbaceous	perennial	7	26	A3, CA, CO, P2, S2, S4, SD
125	*Plantago major*	Plantaginaceae	herbaceous	perennial	1	4	CO
126	*Poa trivialis*	Gramineae/Poaceae	herbaceous	perennial	1	4	P2
127	*Polygonum aviculare*	Polygonaceae	herbaceous	annual	2	7	CA, G7
128	*Polygonum convolvulus*	Polygonaceae	herbaceous	annual	2	7	CA, S1
129	*Potentilla inclinata*	Rosaceae	herbaceous	perennial	1	4	S4
130	*Potentilla reptans*	Rosaceae	herbaceous	perennial	2	7	CO, P2
131	*Prunus domestica*	Rosaceae	tree	perennial	1	4	M
132	*Prunus dulcis*	Rosaceae	tree	perennial	3	11	G5, G6, SC
133	*Prunus spinosa*	Rosaceae	shrub	perennial	5	19	P2, S2, S3, SB, SD
134	*Quercus coccifera*	Fabaceae/ Papilionaceae	tree	perennial	3	11	G5, G6, S4
135	*Quercus faginea*	Fabaceae/ Papilionaceae	tree	perennial	2	7	G5, P2
136	*Quercus ilex*	Fabaceae/ Papilionaceae	tree	perennial	4	15	G4, S4, S5, SC
137	*Quercus robur*	Fabaceae/ Papilionaceae	tree	perennial	2	7	CO, S3
138	*Reseda lutea*	Resedaceae	herbaceous	annual/biennial/ perennial	1	4	G2
139	*Rhamnus cathartica*	Rhamnaceae	shrub/tree	perennial	1	4	G6
140	*Rosa canina*	Rosaceae	shrub	perennial	1	4	G5
141	*Rosmarinus officinalis*	Lamiaceae/Labiatae	shrub	perennial	1	4	S4
142	*Rubia peregrina*	Rubiaceae	herbaceous	perennial	5	19	A3, G1, G5, S3, S4
143	*Rubus sp.*	Rosaceae	herbaceous/shrub	perennial	6	22	G5, M, P2, SA, SB, S3, S5
144	*Salsola kali*	Amaranthaceae	herbaceous	annual	1	4	G9
145	*Salsola vermiculata*	Amaranthaceae	shrub	perennial	4	15	A1, A3, G7
146	*Sambucus nigra*	Caprifoliaceae	shrub/tree	perennial	1	4	M
147	*Sanguisorba minor*	Rosaceae	herbaceous	perennial	3	11	G8, P2, SD
148	*Santolina chamaecyparissus*	Asteraceae/ Compositae	shrub	perennial	1	4	G7
149	*Scandix pecten-veneris*	Apiaceae/ Umbelliferae	herbaceous	annual	1	4	SC

	Plant Species	Family	Herbaceous/ Shrub/Tree	Annual/Biennial/ Perennial	# of Margins Found In	% of Margins Found In	Sites
150	*Sedum sediforme*	Crassulaceae	herbaceous	perennial	5	19	G1, G6, G7, G8, SD
151	*Seseli tortuosum*	Apiaceae/ Umbelliferae	herbaceous	biennial	1	4	A3
152	*Setaria sp.*	Gramineae/Poaceae	herbaceous	/	1	4	A3
153	*Solanum dulcamara*	Solanaceae	herbaceous	perennial	1	4	S3
154	*Solanum nigrum*	Solanaceae	herbaceous	annual	1	4	G9
155	*Sonchus oleraceus*	Asteraceae/ Compositae	herbaceous	annual/biennial	9	33	CO, G1, G2, G3, G5, G6, S3, S5, SC
156	*Sonchus tenerrimus*	Asteraceae/ Compositae	herbaceous	annual/biennial/ perennial	2	7	G6, SC
157	*Sorghum halepense*	Gramineae/Poaceae	herbaceous	perennial	1	4	CA
158	*Stellaria media*	Caryophyllaceae	herbaceous	annual	1	4	SC
159	*Stipa parviflora*	Gramineae/Poaceae	herbaceous	perennial	2	7	A3, G5
160	*Teucrium chamaedrys*	Lamiaceae/Labiatae	shrub	perennial	2	7	G5, SB
161	*Thesium humifusum*	Santalaceae	herbaceous	perennial	1	4	S4
162	*Thlaspi arvense*	Brassicaceae/ Cruciferae	herbaceous	annual	2	7	G5, S4
163	*Thymus vulgaris*	Lamiaceae/Labiatae	shrub	perennial	2	7	S4, SD
164	*Tordylium maximum*	Apiaceae/ Umbelliferae	herbaceous	annual/biennial	2	7	CO, S2
165	*Torilis arvensis*	Apiaceae/ Umbelliferae	herbaceous	annual	9	33	G1, M, P2, S3, S5, SA, SB, SC, SE
166	*Trifolium glomeratum*	Fabaceae/ Papilionaceae	herbaceous	annual	1	4	S2
167	*Trifolium pratense*	Fabaceae/ Papilionaceae	herbaceous	perennial	1	4	P2
168	*Trifolium repens*	Fabaceae/ Papilionaceae	herbaceous	perennial	2	7	CO, G7
169	*Urtica urens*	Urticaceae	herbaceous	annual	1	4	SA
170	*Verbana officinalis*	Verbenaceae	herbaceous	annual/perennial	1	4	P2
171	*Veronica arvensis*	Scrophulariaceae	herbaceous	annual	2	7	G1, G8
172	*Veronica hederifolia*	Scrophulariaceae	herbaceous	annual	7	26	M, S1, S2, SA, SB, SC, SE
173	*Veronica persica*	Scrophulariaceae	herbaceous	annual	7	26	CA, M, P1, S1, S5, SB, SE
174	*Veronica polita*	Scrophulariaceae	herbaceous	annual	7	26	G1, P1, P2, S1, S2, SC, SD
175	*Veronica tennifolia*	Scrophulariaceae	shrub	perennial	1	4	S4

	Plant Species	Family	Herbaceous/ Shrub/Tree	Annual/Biennial/ Perennial	# of Margins Found In	% of Margins Found In	Sites
176	*Vicia pannonica*	Fabaceae/ Papilionaceae	herbaceous	annual	1	4	M
177	*Vicia peregrina*	Fabaceae/ Papilionaceae	herbaceous	annual	1	4	SD
178	*Vicia sativa*	Fabaceae/ Papilionaceae	herbaceous	annual	1	4	S5
179	*Vicia sp.*	Fabaceae/ Papilionaceae	herbaceous	annual/perennial	3	11	G2, G8, S2
180	*Vicia villosa*	Fabaceae/ Papilionaceae	herbaceous	annual	2	7	SB, SD
181	*Viola tricolor*	Violaceae	herbaceous	annual/biennial/ perennial	1	4	P1

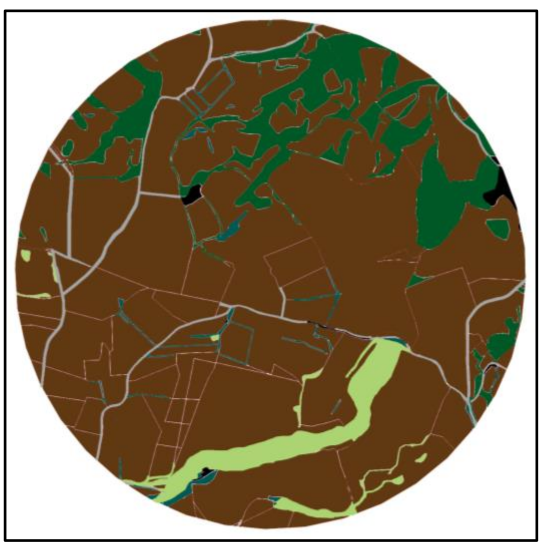
APPENDIX E

Landscape Structure Surrounding Margins



Site: A2
Proportion arable land: 74%
Diversity index: 0.95

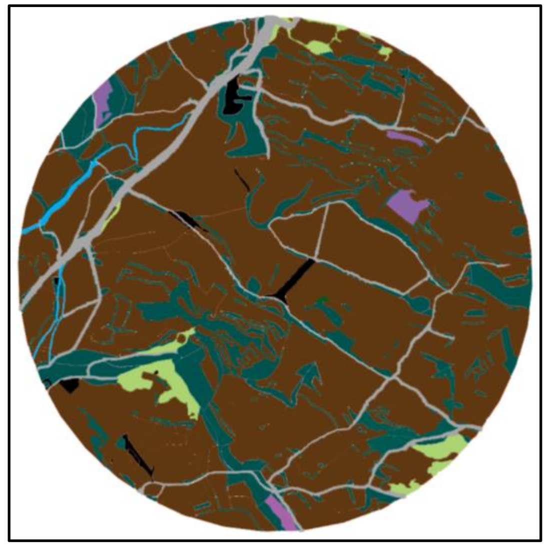
Site: A1
Proportion arable land: 78%
Diversity index: 0.78



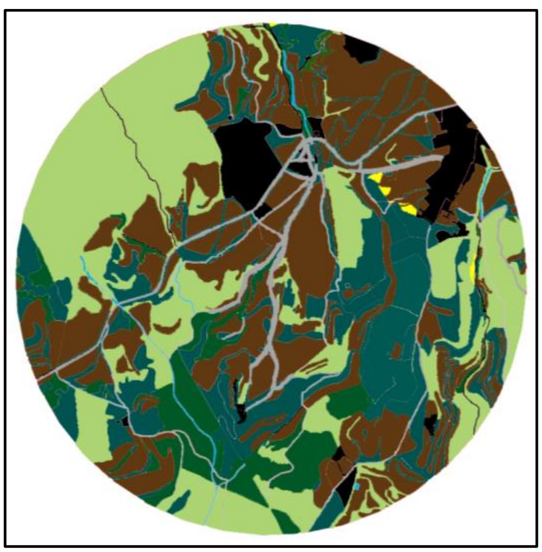
Site: A3
Proportion arable land: 87%
Diversity index: 0.52

Site: CA
Proportion arable land: 54%
Diversity index: 1.28

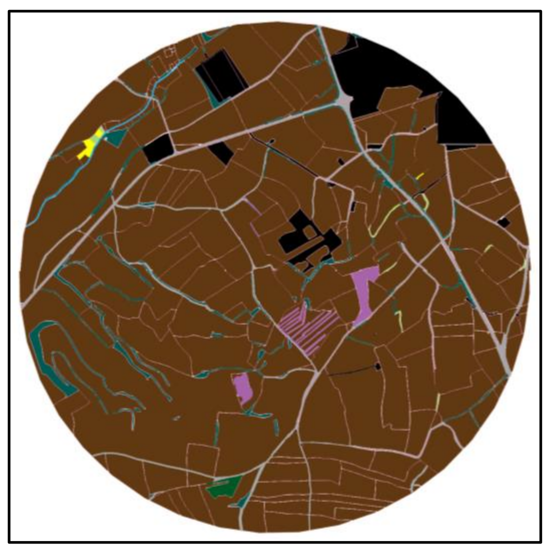
Site: G1
Proportion arable land: 70%
Diversity index: 0.89



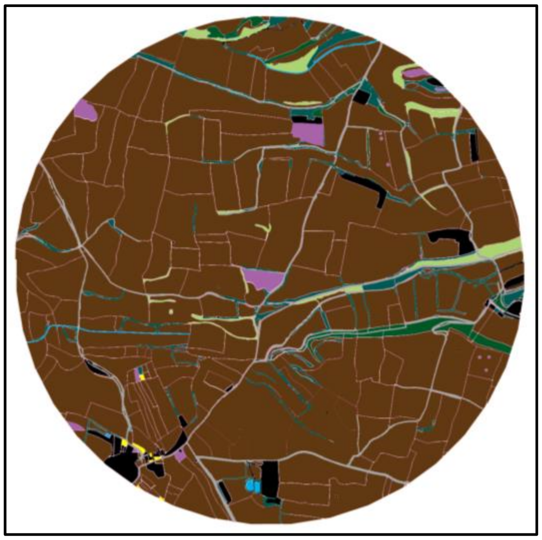
Site: CO
Proportion arable land: 31%
Diversity index: 1.52



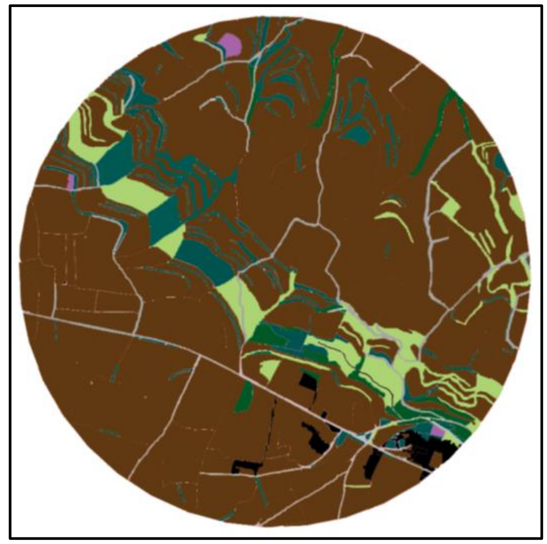
Site: G2
Proportion arable land: 81%
Diversity index: 0.67



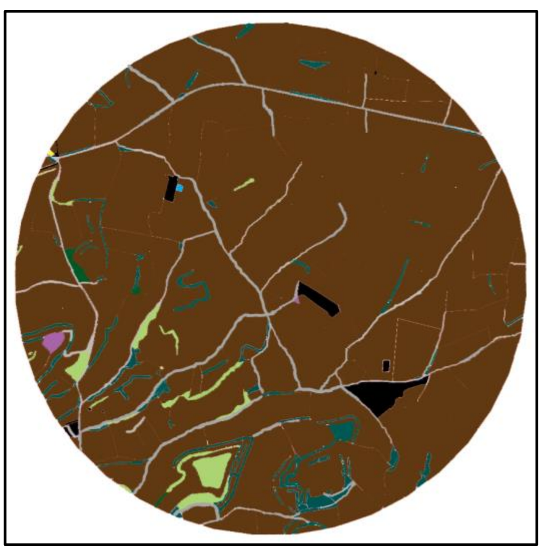
Site: G3
Proportion arable land: 80%
Diversity index: 0.77



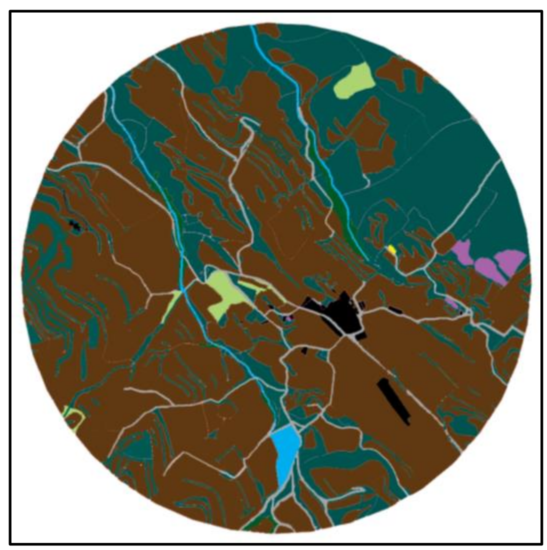
Site: G5
Proportion arable land: 75%
Diversity index: 0.89



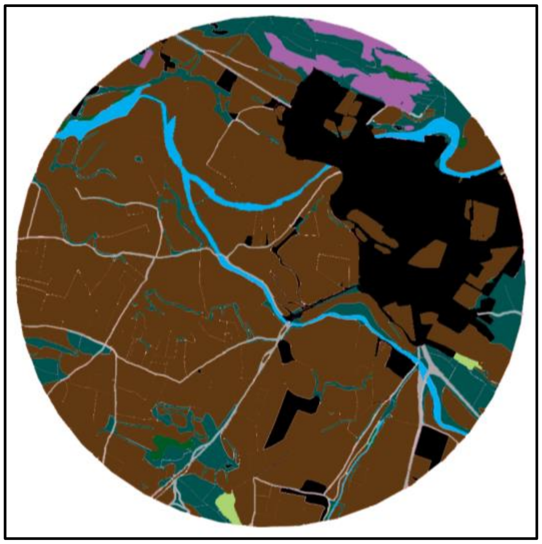
Site: G4
Proportion arable land: 85%
Diversity index: 0.58



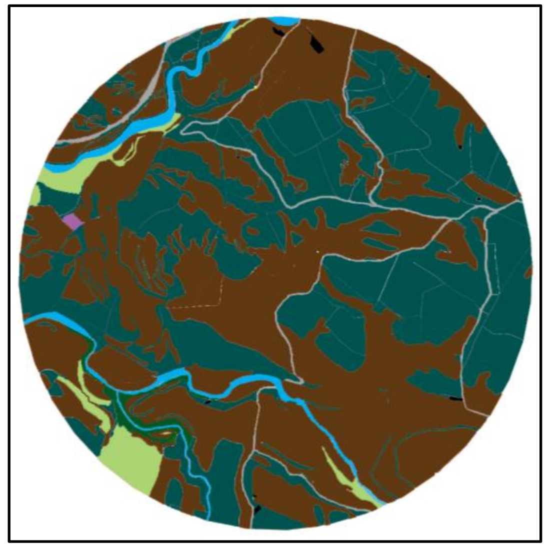
Site: G6
Proportion arable land: 57%
Diversity index: 1.01



Site: G7
Proportion arable land: 60%
Diversity index: 1.05

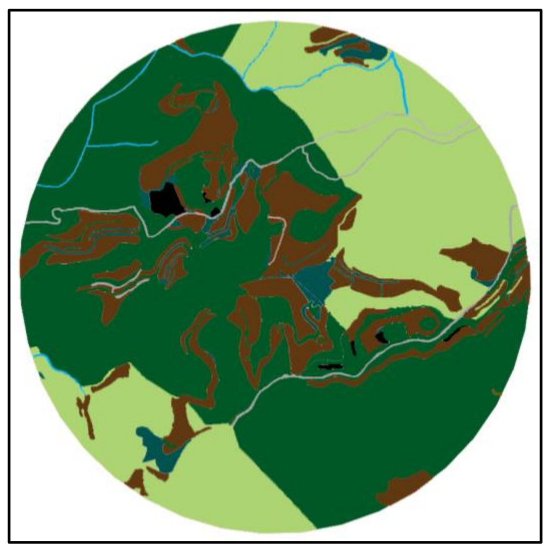


Site: G9
Proportion arable land: 49%
Diversity index: 1.03

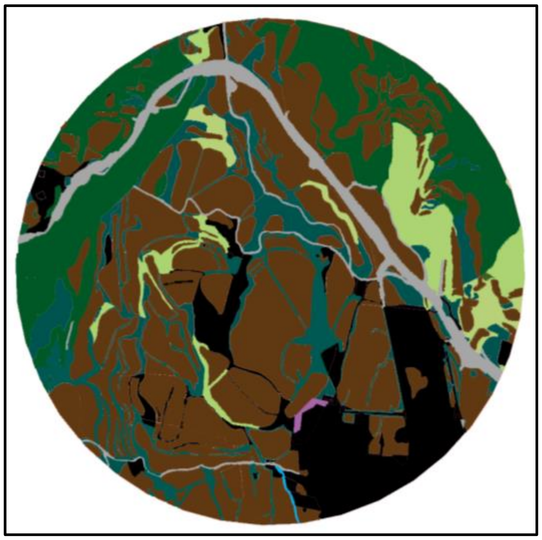


Site: G8
Proportion arable land: 41%
Diversity index: 1.06

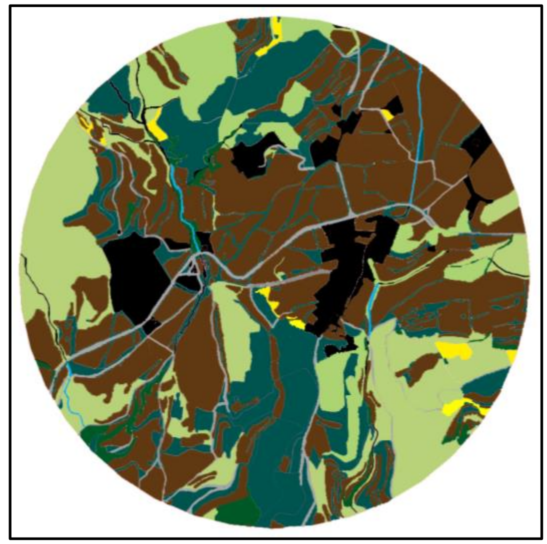
Site: M
Proportion arable land: 18%
Diversity index: 1.26



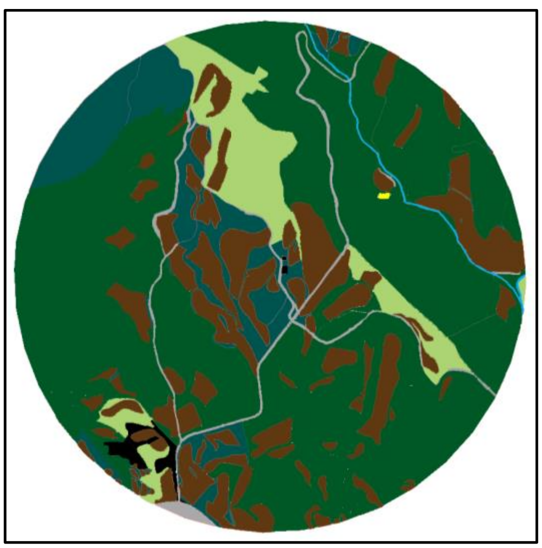
Site: P1
Proportion arable land: 44%
Diversity index: 1.44



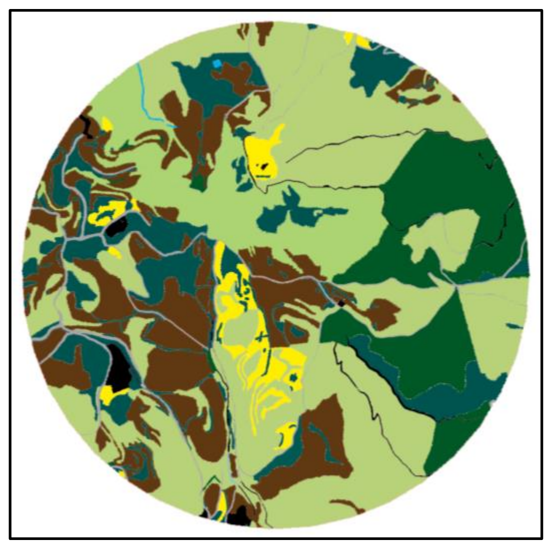
Site: S1
Proportion arable land: 39%
Diversity index: 1.44



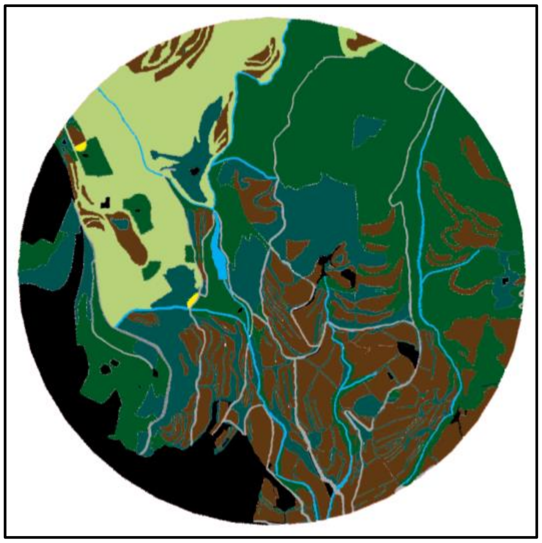
Site: P2
Proportion arable land: 20%
Diversity index: 1.21



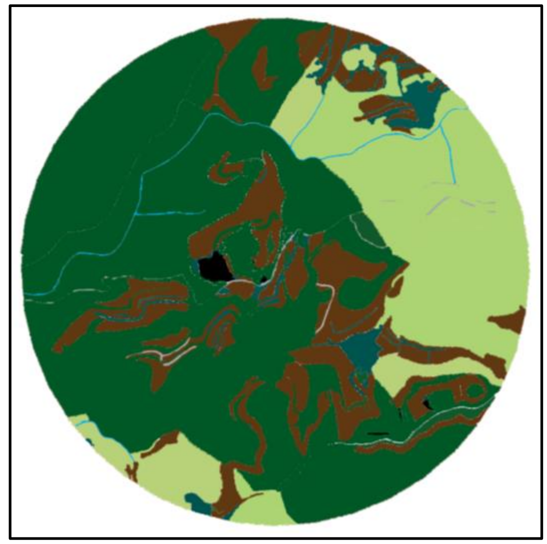
Site: S2
Proportion arable land: 19%
Diversity index: 1.52



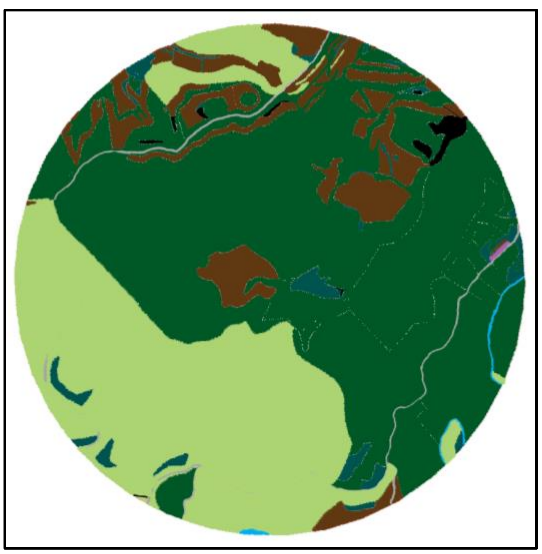
Site: S3
Proportion arable land: 23%
Diversity index: 1.57



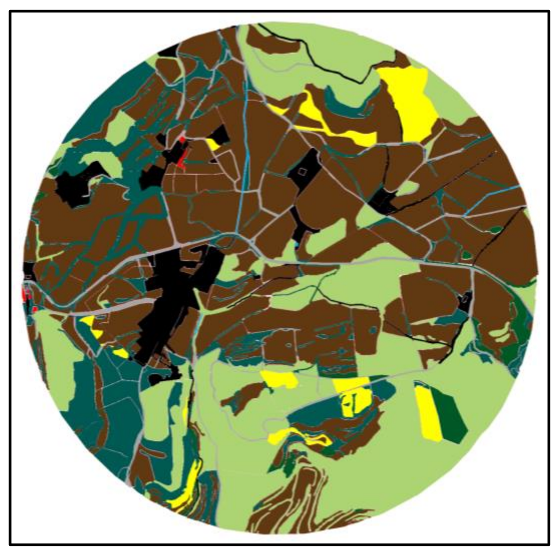
Site: S5
Proportion arable land: 19%
Diversity index: 1.25



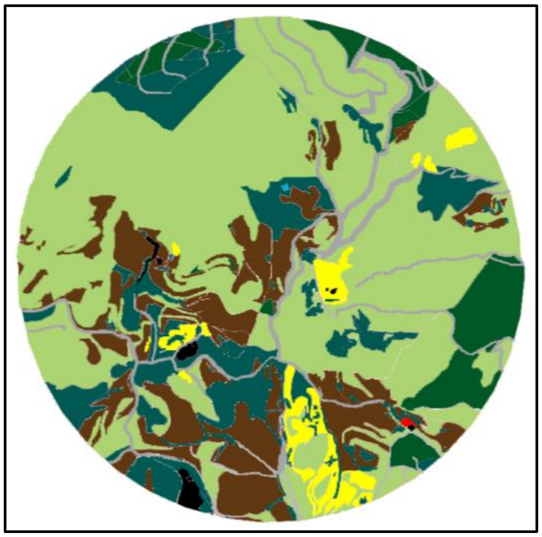
Site: S4
Proportion arable land: 11%
Diversity index: 1.17



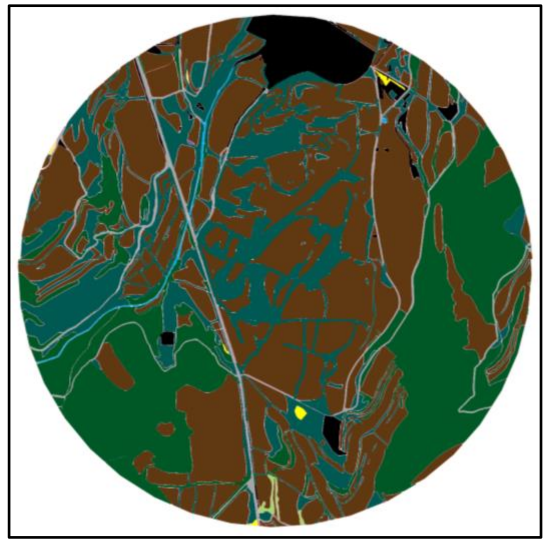
Site: SA
Proportion arable land: 43%
Diversity index: 1.44



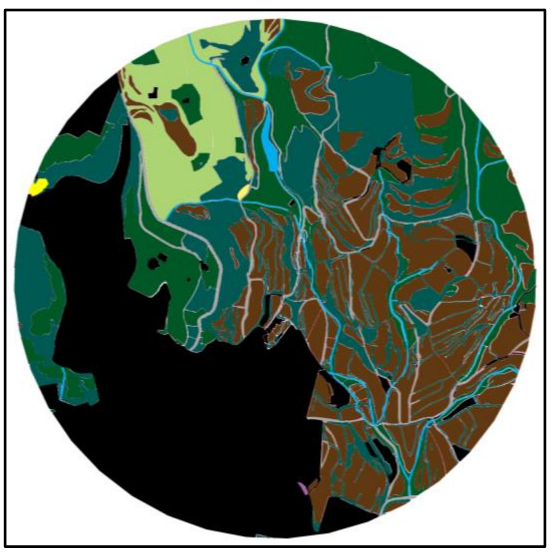
Site: SB
Proportion arable land: 19%
Diversity index: 1.33



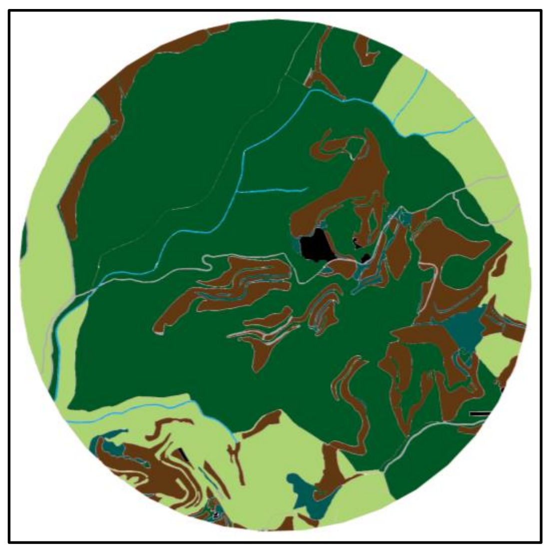
Site: SD
Proportion arable land: 46%
Diversity index: 1.26



Site: SC
Proportion arable land: 29%
Diversity index: 1.49



Site: SE
Proportion arable land: 19%
Diversity index: 1.21



APPENDIX F

All Wild Bee Captures in Pan Traps

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1	15-May-14	A1	1	Halictus	Halictidae	Halictus1	Female	0.9
2	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.0
3	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.1
4	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.3
5	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.3
6	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.3
7	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.3
8	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
9	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
10	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
11	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
12	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
13	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
14	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
15	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
16	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
17	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
18	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
19	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
20	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
21	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
22	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
23	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
24	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
25	15-May-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.4
26	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
27	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
28	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
29	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
30	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
31	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
32	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
33	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
34	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
35	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
36	15-May-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
37	15-May-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
38	15-May-14	A1	1	Osmia	Megachilidae	Osmia5	Male	2.8
39	15-May-14	A1	1	Panurgus	Andrenidae	Panurgus5	Female	2.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
40	15-May-14	A1	1	Panurgus	Andrenidae	Panurgus5	Female	2.7
41	15-May-14	A1	2	Halictus	Halictidae	Halictus1	Female	0.9
42	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.0
43	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.0
44	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.0
45	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.0
46	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.0
47	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.3
48	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
49	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
50	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
51	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
52	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
53	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
54	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
55	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
56	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
57	15-May-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
58	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
59	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
60	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
61	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
62	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
63	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
64	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
65	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
66	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.5
67	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.6
68	15-May-14	A1	2	Halictus	Halictidae	Halictus3	Female	1.6
69	15-May-14	A1	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
70	15-May-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
71	15-May-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
72	15-May-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
73	15-May-14	A1	2	Panurgus	Andrenidae	Panurgus3	Female	1.9
74	15-May-14	A1	3	Epeolus	Apidae	Epeolus4	Male	2.4
75	15-May-14	A1	3	Halictus	Halictidae	Halictus1	Female	0.8
76	15-May-14	A1	3	Halictus	Halictidae	Halictus1	Female	0.9
77	15-May-14	A1	3	Halictus	Halictidae	Halictus1	Female	0.9
78	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.0
79	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.1
80	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.2
81	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.2

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
82	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.2
83	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.2
84	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.3
85	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.3
86	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.3
87	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.3
88	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
89	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
90	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
91	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
92	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
93	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
94	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
95	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
96	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
97	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
98	15-May-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.4
99	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
100	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
101	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
102	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
103	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
104	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
105	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
106	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
107	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
108	15-May-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.6
109	15-May-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
110	15-May-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
111	15-May-14	A1	4	Halictus	Halictidae	Halictus1	Female	0.9
112	15-May-14	A1	4	Halictus	Halictidae	Halictus1	Female	0.9
113	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.0
114	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.0
115	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.0
116	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.1
117	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.1
118	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.4
119	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.4
120	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.4
121	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.4
122	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.4
123	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
124	15-May-14	A1	4	Halictus	Halictidae	Halictus2	Female	1.4
125	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.5
126	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.5
127	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.5
128	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.5
129	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.5
130	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.5
131	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.5
132	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.5
133	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.6
134	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.6
135	15-May-14	A1	4	Halictus	Halictidae	Halictus3	Female	1.6
136	15-May-14	A1	4	Heriades	Megachilidae	Heriades2	Female	1.4
137	15-May-14	A1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
138	15-May-14	A1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
139	15-May-14	A1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
140	15-May-14	A1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
141	15-May-14	A1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
142	15-May-14	A1	4	Panurgus	Andrenidae	Panurgus3	Female	1.9
143	15-May-14	A1	5	Ceratina	Apidae	Ceratina2	Female	1.2
144	15-May-14	A1	5	Halictus	Halictidae	Halictus1	Female	0.9
145	15-May-14	A1	5	Halictus	Halictidae	Halictus1	Female	0.9
146	15-May-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.0
147	15-May-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.0
148	15-May-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.1
149	15-May-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.2
150	15-May-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.4
151	15-May-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.4
152	15-May-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.4
153	15-May-14	A1	5	Halictus	Halictidae	Halictus3	Female	1.5
154	15-May-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
155	15-May-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
156	15-May-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
157	15-May-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
158	15-May-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
159	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.8
160	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.8
161	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.8
162	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.8
163	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.8
164	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.8
165	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
166	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
167	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
168	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
169	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
170	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
171	15-May-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
172	15-May-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.0
173	15-May-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.0
174	15-May-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.3
175	15-May-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.3
176	15-May-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.4
177	15-May-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.4
178	15-May-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.4
179	15-May-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.5
180	15-May-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.6
181	15-May-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.7
182	15-May-14	A2	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
183	15-May-14	A2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
184	15-May-14	A2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
185	15-May-14	A2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
186	15-May-14	A2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
187	15-May-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.8
188	15-May-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
189	15-May-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
190	15-May-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
191	15-May-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.0
192	15-May-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.4
193	15-May-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.7
194	15-May-14	A2	2	Halictus	Halictidae	Halictus4	Female	2.1
195	15-May-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.7
196	15-May-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.8
197	15-May-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.8
198	15-May-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.9
199	15-May-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.9
200	15-May-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.9
201	15-May-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.9
202	15-May-14	A2	3	Halictus	Halictidae	Halictus2	Female	1.4
203	15-May-14	A2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
204	15-May-14	A2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
205	15-May-14	A2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
206	15-May-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.8
207	15-May-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.8

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
208	15-May-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.9
209	15-May-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.9
210	15-May-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.0
211	15-May-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.0
212	15-May-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.2
213	15-May-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.4
214	15-May-14	A2	4	Halictus	Halictidae	Halictus3	Female	1.5
215	15-May-14	A2	4	Halictus	Halictidae	Halictus3	Female	1.5
216	15-May-14	A2	4	Halictus	Halictidae	Halictus3	Female	1.6
217	15-May-14	A2	4	Halictus	Halictidae	Halictus3	Female	1.7
218	15-May-14	A2	4	Halictus	Halictidae	Halictus3	Female	1.8
219	15-May-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
220	15-May-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
221	15-May-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
222	15-May-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
223	15-May-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
224	15-May-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
225	15-May-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
226	15-May-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.0
227	15-May-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.0
228	15-May-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.0
229	15-May-14	A2	5	Halictus	Halictidae	Halictus3	Female	1.6
230	15-May-14	A2	5	Halictus	Halictidae	Halictus4	Female	2.4
231	15-May-14	A2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
232	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.8
233	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.8
234	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.8
235	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
236	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
237	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
238	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
239	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
240	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
241	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
242	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
243	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
244	15-May-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
245	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0
246	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0
247	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0
248	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0
249	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
250	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Male	1.1
251	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.3
252	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
253	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
254	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
255	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
256	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
257	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
258	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
259	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
260	15-May-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
261	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
262	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
263	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
264	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
265	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
266	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
267	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
268	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
269	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
270	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
271	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
272	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
273	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
274	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
275	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
276	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.6
277	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.6
278	15-May-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.6
279	15-May-14	A3	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
280	15-May-14	A3	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
281	15-May-14	A3	1	Panurgus	Andrenidae	Panurgus3	Female	1.9
282	15-May-14	A3	2	Dasypoda	Melittidae	Dasypoda5	Female	2.5
283	15-May-14	A3	2	Dasypoda	Melittidae	Dasypoda5	Female	2.9
284	15-May-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.0
285	15-May-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.3
286	15-May-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.4
287	15-May-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.4
288	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
289	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
290	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
291	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
292	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
293	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
294	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
295	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
296	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
297	15-May-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
298	15-May-14	A3	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
299	15-May-14	A3	3	Andrena	Andrenidae	Andrena4	Female	2.0
300	15-May-14	A3	3	Halictus	Halictidae	Halictus1	Female	0.9
301	15-May-14	A3	3	Halictus	Halictidae	Halictus1	Female	0.9
302	15-May-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.0
303	15-May-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
304	15-May-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
305	15-May-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
306	15-May-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
307	15-May-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
308	15-May-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
309	15-May-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
310	15-May-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
311	15-May-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
312	15-May-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
313	15-May-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
314	15-May-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
315	15-May-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
316	15-May-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
317	15-May-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.6
318	15-May-14	A3	4	Dasypoda	Melittidae	Dasypoda6	Female	3.1
319	15-May-14	A3	4	Dasypoda	Melittidae	Dasypoda6	Female	3.2
320	15-May-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.1
321	15-May-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.2
322	15-May-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4
323	15-May-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4
324	15-May-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4
325	15-May-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4
326	15-May-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4
327	15-May-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4
328	15-May-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
329	15-May-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
330	15-May-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
331	15-May-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
332	15-May-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
333	15-May-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
334	15-May-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
335	15-May-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.6
336	15-May-14	A3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
337	15-May-14	A3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
338	15-May-14	A3	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
339	15-May-14	A3	4	Panurgus	Andrenidae	Panurgus5	Female	2.8
340	15-May-14	A3	5	Andrena	Andrenidae	Andrena5	Male	2.5
341	15-May-14	A3	5	Dasypoda	Melittidae	Dasypoda5	Female	2.8
342	15-May-14	A3	5	Dasypoda	Melittidae	Dasypoda5	Female	2.9
343	15-May-14	A3	5	Dasypoda	Melittidae	Dasypoda5	Female	2.9
344	15-May-14	A3	5	Dasypoda	Melittidae	Dasypoda5	Female	2.9
345	15-May-14	A3	5	Dasypoda	Melittidae	Dasypoda6	Female	3.3
346	15-May-14	A3	5	Dasypoda	Melittidae	Dasypoda6	Female	3.4
347	15-May-14	A3	5	Halictus	Halictidae	Halictus1	Female	0.9
348	15-May-14	A3	5	Halictus	Halictidae	Halictus2	Female	1.0
349	15-May-14	A3	5	Halictus	Halictidae	Halictus2	Female	1.2
350	15-May-14	A3	5	Halictus	Halictidae	Halictus2	Female	1.4
351	15-May-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
352	15-May-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
353	15-May-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.6
354	15-May-14	A3	5	Halictus	Halictidae	Halictus3	Male	1.7
355	15-May-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.8
356	15-May-14	A3	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
357	15-May-14	A3	5	Panurgus	Andrenidae	Panurgus6	Female	3.1
358	15-May-14	G2	1	Andrena	Andrenidae	Andrena3	Female	1.9
359	15-May-14	G2	1	Halictus	Halictidae	Halictus1	Female	0.9
360	15-May-14	G2	1	Halictus	Halictidae	Halictus3	Female	1.5
361	15-May-14	G2	1	Lasioglossum	Halictidae	Lasioglossum1	Female	0.9
362	15-May-14	G2	1	Lasioglossum	Halictidae	Lasioglossum2	Female	1.0
363	15-May-14	G2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
364	15-May-14	G2	1	Panurgus	Andrenidae	Panurgus5	Female	2.7
365	15-May-14	G2	1	Panurgus	Andrenidae	Panurgus7	Female	4.2
366	15-May-14	G2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
367	15-May-14	G2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
368	15-May-14	G2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
369	15-May-14	G2	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
370	15-May-14	G2	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
371	15-May-14	G2	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
372	15-May-14	G2	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
373	15-May-14	G2	3	Dasypoda	Melittidae	Dasypoda6	Female	3.0
374	15-May-14	G2	3	Halictus	Halictidae	Halictus1	Female	0.9
375	15-May-14	G2	3	Halictus	Halictidae	Halictus1	Female	0.9

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
376	15-May-14	G2	3	Halictus	Halictidae	Halictus2	Female	1.0
377	15-May-14	G2	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
378	15-May-14	G2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
379	15-May-14	G2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
380	15-May-14	G2	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
381	15-May-14	G2	3	Panurgus	Andrenidae	Panurgus5	Female	2.7
382	15-May-14	G2	4	Halictus	Halictidae	Halictus2	Female	1.1
383	15-May-14	G2	4	Halictus	Halictidae	Halictus4	Female	2.4
384	15-May-14	G2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
385	15-May-14	G2	5	Halictus	Halictidae	Halictus1	Female	0.9
386	15-May-14	G2	5	Halictus	Halictidae	Halictus3	Female	1.5
387	15-May-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
388	15-May-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
389	15-May-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
390	15-May-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
391	15-May-14	G2	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
392	15-May-14	G3	1	Anthopora	Apidae	Anthopora2	Male	1.2
393	15-May-14	G3	1	Halictus	Halictidae	Halictus2	Female	1.1
394	15-May-14	G3	1	Halictus	Halictidae	Halictus2	Female	1.2
395	15-May-14	G3	1	Halictus	Halictidae	Halictus3	Female	1.5
396	15-May-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
397	15-May-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
398	15-May-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
399	15-May-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
400	15-May-14	G3	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
401	15-May-14	G3	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
402	15-May-14	G3	1	Stelis	Megachilidae	Stelis7	Male	3.9
403	15-May-14	G3	2	Halictus	Halictidae	Halictus2	Female	1.3
404	15-May-14	G3	2	Halictus	Halictidae	Halictus2	Female	1.3
405	15-May-14	G3	2	Halictus	Halictidae	Halictus2	Female	1.4
406	15-May-14	G3	2	Heriades	Megachilidae	Heriades3	Male	1.6
407	15-May-14	G3	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
408	15-May-14	G3	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
409	15-May-14	G3	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
410	15-May-14	G3	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
411	15-May-14	G3	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
412	15-May-14	G3	2	Panurgus	Andrenidae	Panurgus2	Male	1.4
413	15-May-14	G3	2	Panurgus	Andrenidae	Panurgus3	Female	1.8
414	15-May-14	G3	3	Halictus	Halictidae	Halictus1	Female	0.8
415	15-May-14	G3	3	Halictus	Halictidae	Halictus2	Female	1.1
416	15-May-14	G3	3	Halictus	Halictidae	Halictus3	Female	1.6
417	15-May-14	G3	3	Halictus	Halictidae	Halictus3	Female	1.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
418	15-May-14	G3	3	Halictus	Halictidae	Halictus4	Female	2.3
419	15-May-14	G3	3	Heriades	Megachilidae	Heriades3	Female	1.5
420	15-May-14	G3	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
421	15-May-14	G3	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
422	15-May-14	G3	3	Nomada	Apidae	Nomada2	Female	1.3
423	15-May-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
424	15-May-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
425	15-May-14	G3	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
426	15-May-14	G3	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
427	15-May-14	G3	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
428	15-May-14	G3	4	Melecta	Apidae	Melecta4	Female	2.2
429	15-May-14	G3	4	Osmia	Megachilidae	Osmia4	Male	2.2
430	15-May-14	G3	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
431	15-May-14	G3	5	Andrena	Andrenidae	Andrena3	Female	1.9
432	15-May-14	G3	5	Ceratina	Apidae	Ceratina2	Female	1.3
433	15-May-14	G3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
434	15-May-14	G3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
435	15-May-14	G3	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
436	15-May-14	G3	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
437	15-May-14	G3	5	Panurgus	Andrenidae	Panurgus5	Female	2.8
438	15-May-14	G4	1	Andrena	Andrenidae	Andrena4	Female	2.2
439	15-May-14	G4	1	Halictus	Halictidae	Halictus2	Female	1.3
440	15-May-14	G4	1	Halictus	Halictidae	Halictus2	Female	1.4
441	15-May-14	G4	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
442	15-May-14	G4	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
443	15-May-14	G4	1	Panurgus	Andrenidae	Panurgus3	Female	1.9
444	15-May-14	G4	1	Panurgus	Andrenidae	Panurgus3	Female	1.9
445	15-May-14	G4	1	Panurgus	Andrenidae	Panurgus5	Female	2.7
446	15-May-14	G4	1	Panurgus	Andrenidae	Panurgus5	Female	2.8
447	15-May-14	G4	2	Halictus	Halictidae	Halictus3	Female	1.5
448	15-May-14	G4	2	Heriades	Megachilidae	Heriades3	Female	1.5
449	15-May-14	G4	2	Heriades	Megachilidae	Heriades3	Female	1.5
450	15-May-14	G4	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
451	15-May-14	G4	3	Ceratina	Apidae	Ceratina2	Female	1.4
452	15-May-14	G4	3	Halictus	Halictidae	Halictus1	Female	0.8
453	15-May-14	G4	3	Halictus	Halictidae	Halictus1	Female	0.8
454	15-May-14	G4	3	Halictus	Halictidae	Halictus1	Female	0.9
455	15-May-14	G4	3	Halictus	Halictidae	Halictus1	Female	0.9
456	15-May-14	G4	3	Halictus	Halictidae	Halictus1	Female	0.9
457	15-May-14	G4	3	Halictus	Halictidae	Halictus1	Female	0.9
458	15-May-14	G4	3	Halictus	Halictidae	Halictus1	Female	0.9
459	15-May-14	G4	3	Halictus	Halictidae	Halictus1	Female	0.9

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
460	15-May-14	G4	3	Halictus	Halictidae	Halictus2	Female	1.0
461	15-May-14	G4	3	Halictus	Halictidae	Halictus2	Female	1.2
462	15-May-14	G4	3	Halictus	Halictidae	Halictus2	Female	1.4
463	15-May-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
464	15-May-14	G4	3	Nomada	Apidae	Nomada3	Female	1.5
465	15-May-14	G4	3	Panurgus	Andrenidae	Panurgus7	Female	3.9
466	15-May-14	G4	4	Halictus	Halictidae	Halictus3	Female	1.7
467	15-May-14	G4	4	Halictus	Halictidae	Halictus3	Female	1.7
468	15-May-14	G4	4	Panurgus	Andrenidae	Panurgus5	Female	2.5
469	15-May-14	G4	4	Panurgus	Andrenidae	Panurgus5	Female	2.8
470	15-May-14	G4	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
471	15-May-14	G4	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
472	15-May-14	G4	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
473	15-May-14	G4	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.7
474	15-May-14	G4	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
475	15-May-14	G4	5	Panurgus	Andrenidae	Panurgus5	Female	2.6
476	15-May-14	G5	1	Ceratina	Apidae	Ceratina2	Female	1.2
477	15-May-14	G5	1	Halictus	Halictidae	Halictus1	Female	0.9
478	15-May-14	G5	1	Halictus	Halictidae	Halictus1	Female	0.9
479	15-May-14	G5	1	Halictus	Halictidae	Halictus2	Female	1.0
480	15-May-14	G5	1	Halictus	Halictidae	Halictus3	Female	1.8
481	15-May-14	G5	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
482	15-May-14	G5	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
483	15-May-14	G5	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
484	15-May-14	G5	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
485	15-May-14	G5	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
486	15-May-14	G5	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.7
487	15-May-14	G5	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.7
488	15-May-14	G5	1	Nomada	Apidae	Nomada2	Female	1.4
489	15-May-14	G5	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
490	15-May-14	G5	1	Panurgus	Andrenidae	Panurgus7	Female	3.8
491	15-May-14	G5	2	Anthidium	Megachilidae	Anthidium6	Female	3.2
492	15-May-14	G5	2	Halictus	Halictidae	Halictus1	Female	0.9
493	15-May-14	G5	2	Halictus	Halictidae	Halictus3	Female	1.7
494	15-May-14	G5	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
495	15-May-14	G5	2	Melitta	Melittidae	Melitta3	Male	1.5
496	15-May-14	G5	2	Panurgus	Andrenidae	Panurgus3	Female	1.7
497	15-May-14	G5	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
498	15-May-14	G5	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
499	15-May-14	G5	3	Panurgus	Andrenidae	Panurgus5	Female	2.7
500	15-May-14	G5	3	Panurgus	Andrenidae	Panurgus5	Female	2.7
501	15-May-14	G5	4	Ceratina	Apidae	Ceratina2	Female	1.3

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
502	15-May-14	G5	4	Halictus	Halictidae	Halictus1	Female	0.9
503	15-May-14	G5	4	Halictus	Halictidae	Halictus1	Female	0.9
504	15-May-14	G5	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
505	15-May-14	G5	5	Colletes	Colletidae	Colletes2	Male	1.0
506	15-May-14	G5	5	Halictus	Halictidae	Halictus2	Female	1.4
507	15-May-14	G5	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
508	15-May-14	G5	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
509	15-May-14	G5	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
510	15-May-14	G5	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
511	15-May-14	G5	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
512	15-May-14	G5	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
513	15-May-14	G5	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
514	15-May-14	G5	5	Panurgus	Andrenidae	Panurgus5	Female	2.5
515	16-May-14	G1	1	Dasypoda	Melittidae	Dasypoda7	Female	3.8
516	16-May-14	G1	1	Halictus	Halictidae	Halictus1	Female	0.6
517	16-May-14	G1	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
518	16-May-14	G1	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
519	16-May-14	G1	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
520	16-May-14	G1	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
521	16-May-14	G1	1	Panurgus	Andrenidae	Panurgus3	Male	1.8
522	16-May-14	G1	2	Andrena	Andrenidae	Andrena3	Female	1.8
523	16-May-14	G1	3	Nomada	Apidae	Nomada3	Male	1.9
524	16-May-14	G1	3	Panurgus	Andrenidae	Panurgus3	Male	1.8
525	16-May-14	G1	4	Andrena	Andrenidae	Andrena3	Female	1.6
526	16-May-14	G1	4	Andrena	Andrenidae	Andrena5	Female	2.9
527	16-May-14	G1	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
528	16-May-14	G1	5	Andrena	Andrenidae	Andrena4	Female	2.4
529	16-May-14	G1	5	Ceratina	Apidae	Ceratina2	Female	1.4
530	16-May-14	G1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
531	16-May-14	G1	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
532	16-May-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
533	16-May-14	G6	1	Andrena	Andrenidae	Andrena4	Female	2.2
534	16-May-14	G6	1	Andrena	Andrenidae	Andrena4	Female	2.3
535	16-May-14	G6	1	Halictus	Halictidae	Halictus1	Female	0.8
536	16-May-14	G6	1	Halictus	Halictidae	Halictus3	Female	1.8
537	16-May-14	G6	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
538	16-May-14	G6	1	Panurgus	Andrenidae	Panurgus7	Female	3.7
539	16-May-14	G6	2	Andrena	Andrenidae	Andrena3	Female	1.9
540	16-May-14	G6	2	Ceratina	Apidae	Ceratina2	Male	1.2
541	16-May-14	G6	2	Halictus	Halictidae	Halictus4	Female	2.2
542	16-May-14	G6	2	Halictus	Halictidae	Halictus4	Female	2.2
543	16-May-14	G6	2	Halictus	Halictidae	Halictus4	Female	2.3

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
544	16-May-14	G6	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
545	16-May-14	G6	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
546	16-May-14	G6	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
547	16-May-14	G6	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
548	16-May-14	G6	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
549	16-May-14	G6	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
550	16-May-14	G6	3	Halictus	Halictidae	Halictus2	Female	1.1
551	16-May-14	G6	3	Halictus	Halictidae	Halictus2	Female	1.1
552	16-May-14	G6	3	Melitta	Melittidae	Melitta4	Female	2.3
553	16-May-14	G6	3	Panurgus	Andrenidae	Panurgus3	Female	1.8
554	16-May-14	G6	3	Panurgus	Andrenidae	Panurgus6	Female	3.3
555	16-May-14	G6	4	Andrena	Andrenidae	Andrena4	Female	2.4
556	16-May-14	G6	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
557	16-May-14	G6	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.7
558	16-May-14	G6	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
559	16-May-14	G6	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
560	16-May-14	G6	5	Andrena	Andrenidae	Andrena5	Female	2.5
561	16-May-14	G6	5	Halictus	Halictidae	Halictus1	Female	0.9
562	16-May-14	G6	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
563	16-May-14	G6	5	Panurgus	Andrenidae	Panurgus3	Female	1.5
564	16-May-14	G6	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
565	16-May-14	G7	1	Halictus	Halictidae	Halictus1	Female	0.8
566	16-May-14	G7	1	Halictus	Halictidae	Halictus2	Female	1.3
567	16-May-14	G7	1	Halictus	Halictidae	Halictus3	Female	1.6
568	16-May-14	G7	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
569	16-May-14	G7	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
570	16-May-14	G7	2	Halictus	Halictidae	Halictus3	Female	1.5
571	16-May-14	G7	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
572	16-May-14	G7	2	Panurgus	Andrenidae	Panurgus7	Female	3.9
573	16-May-14	G7	2	Panurgus	Andrenidae	Panurgus7	Female	4.2
574	16-May-14	G7	3	Dasypoda	Melittidae	Dasypoda5	Female	2.5
575	16-May-14	G7	3	Dasypoda	Melittidae	Dasypoda5	Female	2.9
576	16-May-14	G7	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
577	16-May-14	G7	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
578	16-May-14	G7	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
579	16-May-14	G7	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
580	16-May-14	G7	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
581	16-May-14	G7	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
582	16-May-14	G7	4	Halictus	Halictidae	Halictus2	Female	1.4
583	16-May-14	G7	4	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
584	16-May-14	G7	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
585	16-May-14	G7	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
586	16-May-14	G7	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
587	16-May-14	G7	5	Andrena	Andrenidae	Andrena5	Female	2.6
588	16-May-14	G7	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
589	16-May-14	G8	1	Andrena	Andrenidae	Andrena3	Female	1.5
590	16-May-14	G8	1	Andrena	Andrenidae	Andrena3	Male	1.5
591	16-May-14	G8	1	Andrena	Andrenidae	Andrena4	Male	2.0
592	16-May-14	G8	1	Andrena	Andrenidae	Andrena5	Female	2.5
593	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.8
594	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.8
595	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.8
596	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
597	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
598	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
599	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
600	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
601	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
602	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
603	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
604	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
605	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
606	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
607	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
608	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
609	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
610	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
611	16-May-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
612	16-May-14	G8	1	Halictus	Halictidae	Halictus2	Female	1.4
613	16-May-14	G8	1	Halictus	Halictidae	Halictus2	Female	1.4
614	16-May-14	G8	1	Halictus	Halictidae	Halictus3	Female	1.5
615	16-May-14	G8	1	Halictus	Halictidae	Halictus3	Female	1.5
616	16-May-14	G8	1	Halictus	Halictidae	Halictus3	Female	1.5
617	16-May-14	G8	1	Halictus	Halictidae	Halictus3	Female	1.5
618	16-May-14	G8	1	Halictus	Halictidae	Halictus4	Female	2.3
619	16-May-14	G8	1	Halictus	Halictidae	Halictus5	Female	2.5
620	16-May-14	G8	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
621	16-May-14	G8	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
622	16-May-14	G8	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
623	16-May-14	G8	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
624	16-May-14	G8	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
625	16-May-14	G8	2	Andrena	Andrenidae	Andrena4	Male	2.0
626	16-May-14	G8	2	Andrena	Andrenidae	Andrena5	Female	2.6
627	16-May-14	G8	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
628	16-May-14	G8	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
629	16-May-14	G8	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
630	16-May-14	G8	3	Halictus	Halictidae	Halictus1	Female	0.8
631	16-May-14	G8	3	Halictus	Halictidae	Halictus2	Female	1.4
632	16-May-14	G8	3	Halictus	Halictidae	Halictus2	Female	1.4
633	16-May-14	G8	3	Halictus	Halictidae	Halictus2	Female	1.4
634	16-May-14	G8	3	Halictus	Halictidae	Halictus3	Female	1.5
635	16-May-14	G8	3	Halictus	Halictidae	Halictus4	Female	2.0
636	16-May-14	G8	3	Halictus	Halictidae	Halictus5	Female	2.5
637	16-May-14	G8	3	Halictus	Halictidae	Halictus5	Female	2.5
638	16-May-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
639	16-May-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
640	16-May-14	G8	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
641	16-May-14	G8	4	Andrena	Andrenidae	Andrena4	Female	2.3
642	16-May-14	G8	4	Andrena	Andrenidae	Andrena4	Female	2.4
643	16-May-14	G8	4	Bombus	Apidae	Bombus7	Female	3.8
644	16-May-14	G8	4	Halictus	Halictidae	Halictus1	Female	0.7
645	16-May-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.3
646	16-May-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.4
647	16-May-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.4
648	16-May-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.4
649	16-May-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.4
650	16-May-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.4
651	16-May-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.4
652	16-May-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.4
653	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
654	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
655	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
656	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
657	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
658	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
659	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
660	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
661	16-May-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
662	16-May-14	G8	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
663	16-May-14	G8	4	Panurgus	Andrenidae	Panurgus3	Female	1.6
664	16-May-14	G8	4	Panurgus	Andrenidae	Panurgus3	Female	1.6
665	16-May-14	G8	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
666	16-May-14	G8	5	Andrena	Andrenidae	Andrena4	Female	2.3
667	16-May-14	G8	5	Halictus	Halictidae	Halictus1	Female	0.4
668	16-May-14	G8	5	Halictus	Halictidae	Halictus1	Female	0.7
669	16-May-14	G8	5	Halictus	Halictidae	Halictus1	Female	0.8

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
670	16-May-14	G8	5	Halictus	Halictidae	Halictus1	Female	0.9
671	16-May-14	G8	5	Halictus	Halictidae	Halictus2	Female	1.1
672	16-May-14	G8	5	Halictus	Halictidae	Halictus2	Female	1.4
673	16-May-14	G8	5	Halictus	Halictidae	Halictus2	Female	1.4
674	16-May-14	G8	5	Halictus	Halictidae	Halictus2	Female	1.4
675	16-May-14	G8	5	Halictus	Halictidae	Halictus2	Female	1.4
676	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
677	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
678	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
679	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
680	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
681	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
682	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
683	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
684	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
685	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
686	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
687	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
688	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
689	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
690	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
691	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
692	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.5
693	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.6
694	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.6
695	16-May-14	G8	5	Halictus	Halictidae	Halictus3	Female	1.7
696	16-May-14	G8	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
697	16-May-14	G8	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
698	16-May-14	G8	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
699	16-May-14	G8	5	Nomada	Apidae	Nomada2	Male	1.4
700	16-May-14	G8	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
701	16-May-14	G8	5	Panurgus	Andrenidae	Panurgus3	Male	1.7
702	16-May-14	G8	5	Stelis	Megachilidae	Stelis2	Male	1.4
703	16-May-14	G9	1	Andrena	Andrenidae	Andrena5	Female	2.9
704	16-May-14	G9	1	Ceratina	Apidae	Ceratina2	Female	1.1
705	16-May-14	G9	1	Halictus	Halictidae	Halictus1	Female	0.7
706	16-May-14	G9	1	Halictus	Halictidae	Halictus1	Female	0.9
707	16-May-14	G9	1	Halictus	Halictidae	Halictus1	Female	0.9
708	16-May-14	G9	1	Halictus	Halictidae	Halictus1	Female	0.9
709	16-May-14	G9	1	Halictus	Halictidae	Halictus1	Female	0.9
710	16-May-14	G9	1	Halictus	Halictidae	Halictus1	Female	0.9
711	16-May-14	G9	1	Halictus	Halictidae	Halictus2	Female	1.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
712	16-May-14	G9	1	Halictus	Halictidae	Halictus2	Female	1.0
713	16-May-14	G9	1	Halictus	Halictidae	Halictus2	Female	1.1
714	16-May-14	G9	1	Halictus	Halictidae	Halictus2	Female	1.2
715	16-May-14	G9	1	Halictus	Halictidae	Halictus2	Female	1.2
716	16-May-14	G9	1	Halictus	Halictidae	Halictus3	Female	1.6
717	16-May-14	G9	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
718	16-May-14	G9	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
719	16-May-14	G9	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
720	16-May-14	G9	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
721	16-May-14	G9	2	Halictus	Halictidae	Halictus3	Female	1.5
722	16-May-14	G9	2	Halictus	Halictidae	Halictus3	Female	1.5
723	16-May-14	G9	2	Halictus	Halictidae	Halictus3	Female	1.6
724	16-May-14	G9	2	Halictus	Halictidae	Halictus3	Female	1.7
725	16-May-14	G9	2	Halictus	Halictidae	Halictus3	Female	1.8
726	16-May-14	G9	2	Halictus	Halictidae	Halictus3	Female	1.9
727	16-May-14	G9	2	Halictus	Halictidae	Halictus3	Female	1.9
728	16-May-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.0
729	16-May-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.0
730	16-May-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.0
731	16-May-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.2
732	16-May-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.3
733	16-May-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.3
734	16-May-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.4
735	16-May-14	G9	2	Halictus	Halictidae	Halictus5	Female	2.6
736	16-May-14	G9	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
737	16-May-14	G9	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
738	16-May-14	G9	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
739	16-May-14	G9	2	Panurgus	Andrenidae	Panurgus3	Female	1.7
740	16-May-14	G9	2	Panurgus	Andrenidae	Panurgus3	Female	1.9
741	16-May-14	G9	2	Sphecodes	Halictidae	Sphecodes2	Female	1.3
742	16-May-14	G9	3	Colletes	Colletidae	Colletes3	Male	1.5
743	16-May-14	G9	3	Halictus	Halictidae	Halictus1	Female	0.8
744	16-May-14	G9	3	Halictus	Halictidae	Halictus1	Female	0.8
745	16-May-14	G9	3	Halictus	Halictidae	Halictus1	Female	0.8
746	16-May-14	G9	3	Halictus	Halictidae	Halictus1	Female	0.8
747	16-May-14	G9	3	Halictus	Halictidae	Halictus1	Female	0.9
748	16-May-14	G9	3	Halictus	Halictidae	Halictus1	Female	0.9
749	16-May-14	G9	3	Halictus	Halictidae	Halictus1	Female	0.9
750	16-May-14	G9	3	Halictus	Halictidae	Halictus2	Female	1.0
751	16-May-14	G9	3	Halictus	Halictidae	Halictus2	Female	1.0
752	16-May-14	G9	3	Halictus	Halictidae	Halictus2	Female	1.0
753	16-May-14	G9	3	Halictus	Halictidae	Halictus2	Female	1.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
754	16-May-14	G9	3	Halictus	Halictidae	Halictus2	Female	1.1
755	16-May-14	G9	3	Halictus	Halictidae	Halictus2	Female	1.1
756	16-May-14	G9	3	Halictus	Halictidae	Halictus3	Female	1.5
757	16-May-14	G9	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
758	16-May-14	G9	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
759	16-May-14	G9	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
760	16-May-14	G9	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
761	16-May-14	G9	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
762	16-May-14	G9	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
763	16-May-14	G9	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
764	16-May-14	G9	3	Nomada	Apidae	Nomada2	Female	1.2
765	16-May-14	G9	4	Halictus	Halictidae	Halictus1	Female	0.9
766	16-May-14	G9	4	Halictus	Halictidae	Halictus2	Female	1.0
767	16-May-14	G9	4	Halictus	Halictidae	Halictus2	Female	1.2
768	16-May-14	G9	4	Halictus	Halictidae	Halictus2	Female	1.3
769	16-May-14	G9	4	Halictus	Halictidae	Halictus3	Female	1.8
770	16-May-14	G9	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
771	16-May-14	G9	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
772	16-May-14	G9	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
773	16-May-14	G9	4	Melecta	Apidae	Melecta4	Male	2.1
774	16-May-14	G9	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
775	16-May-14	G9	5	Ceratina	Apidae	Ceratina2	Female	1.3
776	16-May-14	G9	5	Halictus	Halictidae	Halictus1	Female	0.9
777	16-May-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.0
778	16-May-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.0
779	16-May-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.0
780	16-May-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.0
781	16-May-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.1
782	16-May-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.1
783	16-May-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.2
784	16-May-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.2
785	16-May-14	G9	5	Halictus	Halictidae	Halictus4	Female	2.2
786	16-May-14	G9	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
787	22-May-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.0
788	22-May-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.2
789	22-May-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.3
790	22-May-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.3
791	22-May-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.3
792	22-May-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.4
793	22-May-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
794	22-May-14	CA	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
795	22-May-14	CA	1	Stelis	Megachilidae	Stelis5	Female	2.9

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
796	22-May-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.0
797	22-May-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.0
798	22-May-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.0
799	22-May-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.3
800	22-May-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
801	22-May-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
802	22-May-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
803	22-May-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
804	22-May-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
805	22-May-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
806	22-May-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.6
807	22-May-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.7
808	22-May-14	CA	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
809	22-May-14	CA	3	Halictus	Halictidae	Halictus1	Female	0.8
810	22-May-14	CA	3	Halictus	Halictidae	Halictus1	Female	0.9
811	22-May-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
812	22-May-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
813	22-May-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
814	22-May-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.6
815	22-May-14	CA	4	Anthidium	Megachilidae	Anthidium6	Female	3.4
816	22-May-14	CA	4	Bombus	Apidae	Bombus7	Female	5.0
817	22-May-14	CA	4	Halictus	Halictidae	Halictus1	Female	0.9
818	22-May-14	CA	4	Halictus	Halictidae	Halictus2	Female	1.1
819	22-May-14	CA	4	Halictus	Halictidae	Halictus2	Female	1.4
820	22-May-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.5
821	22-May-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.5
822	22-May-14	CA	5	Ceratina	Apidae	Ceratina2	Female	1.4
823	22-May-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
824	22-May-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
825	22-May-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
826	22-May-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
827	22-May-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
828	22-May-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
829	22-May-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
830	22-May-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
831	22-May-14	CO	1	Halictus	Halictidae	Halictus3	Female	1.5
832	22-May-14	CO	1	Halictus	Halictidae	Halictus3	Female	1.5
833	22-May-14	CO	1	Halictus	Halictidae	Halictus3	Female	1.6
834	22-May-14	CO	1	Halictus	Halictidae	Halictus3	Female	1.7
835	22-May-14	CO	1	Lasioglossum	Halictidae	Lasioglossum1	Female	0.9
836	22-May-14	CO	2	Halictus	Halictidae	Halictus2	Female	1.3
837	22-May-14	CO	2	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
838	22-May-14	CO	3	Halictus	Halictidae	Halictus2	Female	1.4
839	22-May-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.5
840	22-May-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.5
841	22-May-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.8
842	22-May-14	CO	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
843	22-May-14	CO	5	Halictus	Halictidae	Halictus2	Female	1.2
844	22-May-14	CO	5	Halictus	Halictidae	Halictus3	Female	1.5
845	22-May-14	CO	5	Halictus	Halictidae	Halictus3	Female	1.5
846	22-May-14	CO	5	Halictus	Halictidae	Halictus4	Female	2.0
847	22-May-14	M	1	Andrena	Andrenidae	Andrena4	Female	2.4
848	22-May-14	M	1	Halictus	Halictidae	Halictus1	Female	0.9
849	22-May-14	M	1	Halictus	Halictidae	Halictus2	Female	1.4
850	22-May-14	M	1	Halictus	Halictidae	Halictus3	Female	1.5
851	22-May-14	M	1	Halictus	Halictidae	Halictus3	Female	1.6
852	22-May-14	M	1	Halictus	Halictidae	Halictus3	Female	1.7
853	22-May-14	M	1	Osmia	Megachilidae	Osmia5	Male	2.8
854	22-May-14	M	1	Sphecodes	Halictidae	Sphecodes2	Female	1.0
855	22-May-14	M	2	Halictus	Halictidae	Halictus4	Female	2.0
856	22-May-14	M	3	Andrena	Andrenidae	Andrena3	Female	1.9
857	22-May-14	M	3	Andrena	Andrenidae	Andrena4	Female	2.3
858	22-May-14	M	3	Eucera	Apidae	Eucera6	Male	3.1
859	22-May-14	M	3	Eucera	Apidae	Eucera6	Male	3.1
860	22-May-14	M	3	Halictus	Halictidae	Halictus2	Female	1.2
861	22-May-14	M	3	Halictus	Halictidae	Halictus2	Female	1.3
862	22-May-14	M	3	Halictus	Halictidae	Halictus3	Female	1.5
863	22-May-14	M	3	Halictus	Halictidae	Halictus3	Female	1.5
864	22-May-14	M	4	Andrena	Andrenidae	Andrena5	Female	2.7
865	22-May-14	M	4	Bombus	Apidae	Bombus7	Female	6.5
866	22-May-14	M	4	Halictus	Halictidae	Halictus1	Female	0.8
867	22-May-14	M	4	Halictus	Halictidae	Halictus1	Female	0.8
868	22-May-14	M	4	Halictus	Halictidae	Halictus1	Female	0.9
869	22-May-14	M	4	Halictus	Halictidae	Halictus1	Female	0.9
870	22-May-14	M	4	Halictus	Halictidae	Halictus2	Female	1.1
871	22-May-14	M	4	Halictus	Halictidae	Halictus2	Female	1.4
872	22-May-14	M	4	Halictus	Halictidae	Halictus4	Female	2.0
873	22-May-14	M	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
874	22-May-14	M	4	Nomada	Apidae	Nomada2	Female	1.4
875	22-May-14	M	5	Andrena	Andrenidae	Andrena5	Female	2.5
876	22-May-14	M	5	Andrena	Andrenidae	Andrena5	Female	2.5
877	22-May-14	M	5	Halictus	Halictidae	Halictus2	Female	1.4
878	22-May-14	M	5	Halictus	Halictidae	Halictus3	Female	1.6
879	22-May-14	M	5	Halictus	Halictidae	Halictus3	Female	1.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
880	22-May-14	M	5	Halictus	Halictidae	Halictus3	Female	1.9
881	22-May-14	M	5	Halictus	Halictidae	Halictus4	Female	2.2
882	22-May-14	M	5	Halictus	Halictidae	Halictus4	Female	2.3
883	22-May-14	M	5	Halictus	Halictidae	Halictus5	Female	2.5
884	22-May-14	M	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
885	23-May-14	P1	1	Andrena	Andrenidae	Andrena5	Female	2.6
886	23-May-14	P1	1	Andrena	Andrenidae	Andrena5	Female	2.8
887	23-May-14	P1	1	Bombus	Apidae	Bombus6	Female	3.3
888	23-May-14	P1	1	Bombus	Apidae	Bombus7	Female	3.7
889	23-May-14	P1	1	Bombus	Apidae	Bombus7	Female	3.9
890	23-May-14	P1	1	Bombus	Apidae	Bombus7	Female	4.3
891	23-May-14	P1	1	Bombus	Apidae	Bombus7	Female	4.6
892	23-May-14	P1	1	Halictus	Halictidae	Halictus2	Female	1.4
893	23-May-14	P1	1	Halictus	Halictidae	Halictus2	Female	1.4
894	23-May-14	P1	1	Halictus	Halictidae	Halictus3	Female	1.5
895	23-May-14	P1	1	Halictus	Halictidae	Halictus3	Female	1.6
896	23-May-14	P1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
897	23-May-14	P1	1	Panurgus	Andrenidae	Panurgus3	Male	1.6
898	23-May-14	P1	2	Halictus	Halictidae	Halictus1	Female	0.9
899	23-May-14	P1	3	Bombus	Apidae	Bombus6	Female	3.4
900	23-May-14	P1	3	Bombus	Apidae	Bombus7	Female	4.3
901	23-May-14	P1	3	Halictus	Halictidae	Halictus2	Female	1.4
902	23-May-14	P1	3	Halictus	Halictidae	Halictus2	Female	1.4
903	23-May-14	P1	3	Halictus	Halictidae	Halictus3	Female	1.5
904	23-May-14	P1	3	Halictus	Halictidae	Halictus3	Female	1.7
905	23-May-14	P1	4	Andrena	Andrenidae	Andrena4	Female	2.2
906	23-May-14	P1	4	Bombus	Apidae	Bombus7	Female	3.6
907	23-May-14	P1	4	Halictus	Halictidae	Halictus3	Female	1.5
908	23-May-14	P1	4	Halictus	Halictidae	Halictus4	Female	2.2
909	23-May-14	P1	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
910	23-May-14	P1	5	Andrena	Andrenidae	Andrena4	Female	2.3
911	23-May-14	P1	5	Bombus	Apidae	Bombus6	Female	3.4
912	23-May-14	P1	5	Bombus	Apidae	Bombus7	Female	4.2
913	23-May-14	P1	5	Bombus	Apidae	Bombus7	Female	4.3
914	23-May-14	P1	5	Halictus	Halictidae	Halictus2	Female	1.4
915	23-May-14	P1	5	Halictus	Halictidae	Halictus2	Female	1.4
916	23-May-14	P1	5	Halictus	Halictidae	Halictus3	Female	1.5
917	23-May-14	P1	5	Halictus	Halictidae	Halictus5	Female	2.7
918	23-May-14	P2	1	Andrena	Andrenidae	Andrena2	Female	1.4
919	23-May-14	P2	1	Andrena	Andrenidae	Andrena4	Female	2.3
920	23-May-14	P2	1	Bombus	Apidae	Bombus7	Female	3.5
921	23-May-14	P2	1	Bombus	Apidae	Bombus7	Female	4.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
922	23-May-14	P2	1	Halictus	Halictidae	Halictus2	Female	1.0
923	23-May-14	P2	1	Halictus	Halictidae	Halictus2	Female	1.3
924	23-May-14	P2	2	Andrena	Andrenidae	Andrena6	Female	3.0
925	23-May-14	P2	2	Bombus	Apidae	Bombus7	Male	3.8
926	23-May-14	P2	2	Hylaeus	Colletidae	Hylaeus3	Female	1.5
927	23-May-14	P2	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
928	23-May-14	P2	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
929	23-May-14	P2	3	Andrena	Andrenidae	Andrena5	Female	2.9
930	23-May-14	P2	3	Andrena	Andrenidae	Andrena5	Female	2.9
931	23-May-14	P2	3	Bombus	Apidae	Bombus7	Female	4.5
932	23-May-14	P2	4	Andrena	Andrenidae	Andrena5	Female	2.6
933	23-May-14	P2	4	Andrena	Andrenidae	Andrena5	Female	2.7
934	23-May-14	P2	4	Bombus	Apidae	Bombus7	Female	3.8
935	23-May-14	P2	4	Halictus	Halictidae	Halictus2	Female	1.4
936	23-May-14	P2	4	Xylocopa	Apidae	Xylocopa7	Female	6.3
937	23-May-14	P2	5	Andrena	Andrenidae	Andrena3	Male	1.9
938	23-May-14	P2	5	Andrena	Andrenidae	Andrena5	Female	2.8
939	23-May-14	P2	5	Andrena	Andrenidae	Andrena5	Female	2.8
940	23-May-14	P2	5	Bombus	Apidae	Bombus7	Female	4.0
941	23-May-14	P2	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
942	23-May-14	P2	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
943	23-May-14	P2	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
944	23-May-14	P2	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
945	10-Jun-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.0
946	10-Jun-14	A1	1	Halictus	Halictidae	Halictus2	Female	1.1
947	10-Jun-14	A1	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
948	10-Jun-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
949	10-Jun-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
950	10-Jun-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
951	10-Jun-14	A1	2	Andrena	Andrenidae	Andrena4	Male	2.2
952	10-Jun-14	A1	2	Andrena	Andrenidae	Andrena4	Male	2.4
953	10-Jun-14	A1	2	Andrena	Andrenidae	Andrena5	Male	2.5
954	10-Jun-14	A1	2	Andrena	Andrenidae	Andrena5	Male	2.5
955	10-Jun-14	A1	2	Andrena	Andrenidae	Andrena5	Male	2.6
956	10-Jun-14	A1	2	Andrena	Andrenidae	Andrena5	Male	2.9
957	10-Jun-14	A1	2	Andrena	Andrenidae	Andrena6	Female	3.2
958	10-Jun-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.2
959	10-Jun-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.2
960	10-Jun-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
961	10-Jun-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
962	10-Jun-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
963	10-Jun-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
964	10-Jun-14	A1	3	Halictus	Halictidae	Halictus1	Female	0.7
965	10-Jun-14	A1	3	Halictus	Halictidae	Halictus1	Female	0.8
966	10-Jun-14	A1	3	Halictus	Halictidae	Halictus1	Female	0.8
967	10-Jun-14	A1	3	Halictus	Halictidae	Halictus1	Female	0.8
968	10-Jun-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.0
969	10-Jun-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.0
970	10-Jun-14	A1	3	Halictus	Halictidae	Halictus2	Male	1.1
971	10-Jun-14	A1	3	Halictus	Halictidae	Halictus2	Female	1.2
972	10-Jun-14	A1	3	Halictus	Halictidae	Halictus2	Male	1.2
973	10-Jun-14	A1	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
974	10-Jun-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
975	10-Jun-14	A1	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
976	10-Jun-14	A1	5	Andrena	Andrenidae	Andrena4	Female	2.3
977	10-Jun-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.0
978	10-Jun-14	A1	5	Halictus	Halictidae	Halictus2	Female	1.0
979	10-Jun-14	A1	5	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
980	10-Jun-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
981	10-Jun-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
982	10-Jun-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
983	10-Jun-14	A1	5	Nomada	Apidae	Nomada2	Male	1.1
984	10-Jun-14	A2	1	Andrena	Andrenidae	Andrena3	Male	1.9
985	10-Jun-14	A2	1	Ceratina	Apidae	Ceratina2	Female	1.3
986	10-Jun-14	A2	1	Ceratina	Apidae	Ceratina2	Female	1.3
987	10-Jun-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.8
988	10-Jun-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
989	10-Jun-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
990	10-Jun-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
991	10-Jun-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.0
992	10-Jun-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.4
993	10-Jun-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.5
994	10-Jun-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.5
995	10-Jun-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.6
996	10-Jun-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.6
997	10-Jun-14	A2	1	Halictus	Halictidae	Halictus4	Female	2.0
998	10-Jun-14	A2	1	Panurgus	Andrenidae	Panurgus5	Female	2.5
999	10-Jun-14	A2	2	Bombus	Apidae	Bombus7	Female	3.8
1000	10-Jun-14	A2	2	Eucera	Apidae	Eucera5	Female	2.6
1001	10-Jun-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.6
1002	10-Jun-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.8
1003	10-Jun-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
1004	10-Jun-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
1005	10-Jun-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1006	10-Jun-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
1007	10-Jun-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
1008	10-Jun-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.0
1009	10-Jun-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.0
1010	10-Jun-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.1
1011	10-Jun-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.1
1012	10-Jun-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.4
1013	10-Jun-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
1014	10-Jun-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.8
1015	10-Jun-14	A2	2	Halictus	Halictidae	Halictus4	Female	2.1
1016	10-Jun-14	A2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1017	10-Jun-14	A2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1018	10-Jun-14	A2	2	Panurgus	Andrenidae	Panurgus3	Female	1.6
1019	10-Jun-14	A2	2	Panurgus	Andrenidae	Panurgus7	Female	3.7
1020	10-Jun-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.8
1021	10-Jun-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.8
1022	10-Jun-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.8
1023	10-Jun-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.9
1024	10-Jun-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.9
1025	10-Jun-14	A2	3	Halictus	Halictidae	Halictus3	Female	1.5
1026	10-Jun-14	A2	3	Halictus	Halictidae	Halictus3	Female	1.6
1027	10-Jun-14	A2	3	Halictus	Halictidae	Halictus3	Female	1.6
1028	10-Jun-14	A2	4	Andrena	Andrenidae	Andrena3	Male	1.9
1029	10-Jun-14	A2	4	Ceratina	Apidae	Ceratina2	Female	1.1
1030	10-Jun-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.8
1031	10-Jun-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.8
1032	10-Jun-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.9
1033	10-Jun-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.9
1034	10-Jun-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.9
1035	10-Jun-14	A2	4	Halictus	Halictidae	Halictus1	Male	0.9
1036	10-Jun-14	A2	4	Halictus	Halictidae	Halictus2	Male	1.0
1037	10-Jun-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.0
1038	10-Jun-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.1
1039	10-Jun-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.4
1040	10-Jun-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.4
1041	10-Jun-14	A2	4	Halictus	Halictidae	Halictus3	Female	1.5
1042	10-Jun-14	A2	4	Halictus	Halictidae	Halictus3	Female	1.6
1043	10-Jun-14	A2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1044	10-Jun-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.7
1045	10-Jun-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.8
1046	10-Jun-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
1047	10-Jun-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1048	10-Jun-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
1049	10-Jun-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
1050	10-Jun-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
1051	10-Jun-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
1052	10-Jun-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.0
1053	10-Jun-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.0
1054	10-Jun-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.4
1055	10-Jun-14	A2	5	Halictus	Halictidae	Halictus3	Female	1.6
1056	10-Jun-14	A2	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1057	10-Jun-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.8
1058	10-Jun-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
1059	10-Jun-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
1060	10-Jun-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
1061	10-Jun-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
1062	10-Jun-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.9
1063	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0
1064	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0
1065	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0
1066	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.0
1067	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Male	1.0
1068	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
1069	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
1070	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
1071	10-Jun-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
1072	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1073	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1074	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1075	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1076	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1077	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1078	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1079	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.6
1080	10-Jun-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.8
1081	10-Jun-14	A3	2	Ceratina	Apidae	Ceratina2	Female	1.3
1082	10-Jun-14	A3	2	Halictus	Halictidae	Halictus1	Female	0.9
1083	10-Jun-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.0
1084	10-Jun-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.1
1085	10-Jun-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.1
1086	10-Jun-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.2
1087	10-Jun-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.4
1088	10-Jun-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
1089	10-Jun-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1090	10-Jun-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.6
1091	10-Jun-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.7
1092	10-Jun-14	A3	2	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
1093	10-Jun-14	A3	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1094	10-Jun-14	A3	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1095	10-Jun-14	A3	3	Ceratina	Apidae	Ceratina2	Female	1.3
1096	10-Jun-14	A3	3	Halictus	Halictidae	Halictus1	Female	0.9
1097	10-Jun-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.0
1098	10-Jun-14	A3	3	Halictus	Halictidae	Halictus2	Male	1.0
1099	10-Jun-14	A3	3	Halictus	Halictidae	Halictus2	Male	1.1
1100	10-Jun-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1101	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
1102	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
1103	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
1104	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
1105	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.6
1106	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.6
1107	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.6
1108	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.6
1109	10-Jun-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.7
1110	10-Jun-14	A3	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1111	10-Jun-14	A3	3	Panurgus	Andrenidae	Panurgus2	Female	1.4
1112	10-Jun-14	A3	4	Ceratina	Apidae	Ceratina2	Female	1.4
1113	10-Jun-14	A3	4	Halictus	Halictidae	Halictus1	Female	0.8
1114	10-Jun-14	A3	4	Halictus	Halictidae	Halictus1	Female	0.8
1115	10-Jun-14	A3	4	Halictus	Halictidae	Halictus1	Female	0.9
1116	10-Jun-14	A3	4	Halictus	Halictidae	Halictus1	Female	0.9
1117	10-Jun-14	A3	4	Halictus	Halictidae	Halictus1	Female	0.9
1118	10-Jun-14	A3	4	Halictus	Halictidae	Halictus1	Female	0.9
1119	10-Jun-14	A3	4	Halictus	Halictidae	Halictus1	Female	0.9
1120	10-Jun-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.0
1121	10-Jun-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.0
1122	10-Jun-14	A3	4	Halictus	Halictidae	Halictus2	Male	1.0
1123	10-Jun-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.0
1124	10-Jun-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.0
1125	10-Jun-14	A3	4	Halictus	Halictidae	Halictus2	Male	1.1
1126	10-Jun-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4
1127	10-Jun-14	A3	4	Halictus	Halictidae	Halictus2	Male	1.4
1128	10-Jun-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
1129	10-Jun-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
1130	10-Jun-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.6
1131	10-Jun-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1132	10-Jun-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.6
1133	10-Jun-14	A3	4	Halictus	Halictidae	Halictus4	Female	2.0
1134	10-Jun-14	A3	4	Lasioglossum	Halictidae	Lasioglossum3	Male	1.8
1135	10-Jun-14	A3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1136	10-Jun-14	A3	4	Panurgus	Andrenidae	Panurgus5	Female	2.7
1137	10-Jun-14	A3	5	Ceratina	Apidae	Ceratina2	Female	1.2
1138	10-Jun-14	A3	5	Halictus	Halictidae	Halictus1	Female	0.8
1139	10-Jun-14	A3	5	Halictus	Halictidae	Halictus1	Female	0.9
1140	10-Jun-14	A3	5	Halictus	Halictidae	Halictus2	Male	1.4
1141	10-Jun-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
1142	10-Jun-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
1143	10-Jun-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
1144	10-Jun-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.6
1145	10-Jun-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.7
1146	10-Jun-14	A3	5	Hoplitis	Megachilidae	Hoplitis4	Female	2.4
1147	10-Jun-14	A3	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
1148	10-Jun-14	A3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1149	10-Jun-14	G2	1	Ceratina	Apidae	Ceratina2	Female	1.4
1150	10-Jun-14	G2	1	Ceratina	Apidae	Ceratina2	Female	1.4
1151	10-Jun-14	G2	1	Eucera	Apidae	Eucera4	Male	2.1
1152	10-Jun-14	G2	1	Halictus	Halictidae	Halictus1	Female	0.9
1153	10-Jun-14	G2	1	Halictus	Halictidae	Halictus1	Female	0.9
1154	10-Jun-14	G2	1	Halictus	Halictidae	Halictus2	Female	1.0
1155	10-Jun-14	G2	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1156	10-Jun-14	G2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1157	10-Jun-14	G2	2	Halictus	Halictidae	Halictus2	Female	1.0
1158	10-Jun-14	G2	2	Halictus	Halictidae	Halictus2	Female	1.1
1159	10-Jun-14	G2	2	Lasioglossum	Halictidae	Lasioglossum4	Male	2.3
1160	10-Jun-14	G2	3	Andrena	Andrenidae	Andrena5	Female	2.9
1161	10-Jun-14	G2	3	Halictus	Halictidae	Halictus1	Male	0.8
1162	10-Jun-14	G2	3	Halictus	Halictidae	Halictus1	Female	0.9
1163	10-Jun-14	G2	3	Halictus	Halictidae	Halictus1	Female	0.9
1164	10-Jun-14	G2	3	Halictus	Halictidae	Halictus1	Female	0.9
1165	10-Jun-14	G2	3	Halictus	Halictidae	Halictus2	Male	1.0
1166	10-Jun-14	G2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1167	10-Jun-14	G2	3	Panurgus	Andrenidae	Panurgus3	Female	1.5
1168	10-Jun-14	G2	3	Panurgus	Andrenidae	Panurgus5	Female	2.8
1169	10-Jun-14	G2	4	Ceratina	Apidae	Ceratina2	Female	1.2
1170	10-Jun-14	G2	4	Halictus	Halictidae	Halictus2	Female	1.0
1171	10-Jun-14	G2	4	Halictus	Halictidae	Halictus2	Female	1.4
1172	10-Jun-14	G2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1173	10-Jun-14	G2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1174	10-Jun-14	G2	4	Panurgus	Andrenidae	Panurgus5	Female	2.8
1175	10-Jun-14	G2	5	Andrena	Andrenidae	Andrena5	Male	2.6
1176	10-Jun-14	G2	5	Halictus	Halictidae	Halictus1	Female	0.6
1177	10-Jun-14	G2	5	Halictus	Halictidae	Halictus1	Female	0.9
1178	10-Jun-14	G2	5	Halictus	Halictidae	Halictus2	Female	1.1
1179	10-Jun-14	G2	5	Halictus	Halictidae	Halictus3	Female	1.6
1180	10-Jun-14	G2	5	Halictus	Halictidae	Halictus4	Female	2.0
1181	10-Jun-14	G2	5	Halictus	Halictidae	Halictus5	Female	2.5
1182	10-Jun-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1183	10-Jun-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1184	10-Jun-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1185	10-Jun-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1186	10-Jun-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1187	10-Jun-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1188	10-Jun-14	G2	5	Panurgus	Andrenidae	Panurgus7	Female	3.8
1189	10-Jun-14	G3	1	Bombus	Apidae	Bombus5	Female	2.9
1190	10-Jun-14	G3	1	Halictus	Halictidae	Halictus2	Male	1.0
1191	10-Jun-14	G3	1	Halictus	Halictidae	Halictus2	Male	1.1
1192	10-Jun-14	G3	1	Halictus	Halictidae	Halictus3	Female	1.5
1193	10-Jun-14	G3	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
1194	10-Jun-14	G3	1	Panurgus	Andrenidae	Panurgus7	Female	3.9
1195	10-Jun-14	G3	2	Bombus	Apidae	Bombus7	Female	4.0
1196	10-Jun-14	G3	2	Dasypoda	Melittidae	Dasypoda5	Female	2.9
1197	10-Jun-14	G3	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1198	10-Jun-14	G3	2	Panurgus	Andrenidae	Panurgus5	Female	2.9
1199	10-Jun-14	G3	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1200	10-Jun-14	G3	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1201	10-Jun-14	G3	4	Bombus	Apidae	Bombus5	Female	2.9
1202	10-Jun-14	G3	4	Halictus	Halictidae	Halictus1	Male	0.8
1203	10-Jun-14	G3	4	Halictus	Halictidae	Halictus1	Female	0.9
1204	10-Jun-14	G3	4	Halictus	Halictidae	Halictus1	Female	0.9
1205	10-Jun-14	G3	4	Halictus	Halictidae	Halictus2	Female	1.0
1206	10-Jun-14	G3	4	Halictus	Halictidae	Halictus2	Female	1.2
1207	10-Jun-14	G3	4	Halictus	Halictidae	Halictus2	Female	1.2
1208	10-Jun-14	G3	4	Halictus	Halictidae	Halictus2	Female	1.4
1209	10-Jun-14	G3	4	Halictus	Halictidae	Halictus3	Female	1.6
1210	10-Jun-14	G3	4	Lasioglossum	Halictidae	Lasioglossum2	Male	1.4
1211	10-Jun-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1212	10-Jun-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1213	10-Jun-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1214	10-Jun-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1215	10-Jun-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1216	10-Jun-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1217	10-Jun-14	G3	5	Halictus	Halictidae	Halictus3	Female	1.6
1218	10-Jun-14	G3	5	Halictus	Halictidae	Halictus3	Female	1.8
1219	10-Jun-14	G3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1220	10-Jun-14	G3	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1221	10-Jun-14	G3	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.7
1222	10-Jun-14	G4	1	Halictus	Halictidae	Halictus4	Female	2.2
1223	10-Jun-14	G4	1	Lasioglossum	Halictidae	Lasioglossum3	Male	1.8
1224	10-Jun-14	G4	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1225	10-Jun-14	G4	1	Panurgus	Andrenidae	Panurgus5	Female	2.8
1226	10-Jun-14	G4	1	Panurgus	Andrenidae	Panurgus7	Female	3.7
1227	10-Jun-14	G4	1	Stelis	Megachilidae	Stelis6	Female	3.3
1228	10-Jun-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1229	10-Jun-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1230	10-Jun-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1231	10-Jun-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1232	10-Jun-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1233	10-Jun-14	G4	3	Panurgus	Andrenidae	Panurgus3	Female	1.7
1234	10-Jun-14	G4	3	Panurgus	Andrenidae	Panurgus5	Female	2.7
1235	10-Jun-14	G4	3	Panurgus	Andrenidae	Panurgus5	Female	2.8
1236	10-Jun-14	G4	4	Andrena	Andrenidae	Andrena3	Female	1.6
1237	10-Jun-14	G4	4	Bombus	Apidae	Bombus7	Female	4.0
1238	10-Jun-14	G4	4	Halictus	Halictidae	Halictus1	Female	0.7
1239	10-Jun-14	G4	4	Halictus	Halictidae	Halictus1	Female	0.8
1240	10-Jun-14	G4	4	Halictus	Halictidae	Halictus1	Female	0.9
1241	10-Jun-14	G4	4	Halictus	Halictidae	Halictus1	Female	0.9
1242	10-Jun-14	G4	4	Halictus	Halictidae	Halictus1	Female	0.9
1243	10-Jun-14	G4	4	Halictus	Halictidae	Halictus2	Female	1.0
1244	10-Jun-14	G4	4	Halictus	Halictidae	Halictus4	Female	2.0
1245	10-Jun-14	G4	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1246	10-Jun-14	G4	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1247	10-Jun-14	G4	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1248	10-Jun-14	G4	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1249	10-Jun-14	G4	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1250	10-Jun-14	G4	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1251	10-Jun-14	G4	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1252	10-Jun-14	G4	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1253	10-Jun-14	G4	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1254	10-Jun-14	G4	5	Panurgus	Andrenidae	Panurgus5	Female	2.6
1255	10-Jun-14	G4	5	Panurgus	Andrenidae	Panurgus7	Female	3.5
1256	12-Jun-14	G1	1	Andrena	Andrenidae	Andrena4	Female	2.0
1257	12-Jun-14	G1	1	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1258	12-Jun-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1259	12-Jun-14	G1	1	Melitta	Melittidae	Melitta5	Female	2.5
1260	12-Jun-14	G1	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
1261	12-Jun-14	G1	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
1262	12-Jun-14	G1	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
1263	12-Jun-14	G1	2	Andrena	Andrenidae	Andrena5	Female	2.8
1264	12-Jun-14	G1	2	Halictus	Halictidae	Halictus3	Female	1.6
1265	12-Jun-14	G1	2	Halictus	Halictidae	Halictus3	Female	1.7
1266	12-Jun-14	G1	2	Halictus	Halictidae	Halictus5	Female	2.5
1267	12-Jun-14	G1	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1268	12-Jun-14	G1	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1269	12-Jun-14	G1	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1270	12-Jun-14	G1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1271	12-Jun-14	G1	2	Panurgus	Andrenidae	Panurgus3	Female	1.6
1272	12-Jun-14	G1	2	Panurgus	Andrenidae	Panurgus3	Female	1.8
1273	12-Jun-14	G1	2	Panurgus	Andrenidae	Panurgus5	Female	2.8
1274	12-Jun-14	G1	3	Halictus	Halictidae	Halictus1	Female	0.9
1275	12-Jun-14	G1	3	Halictus	Halictidae	Halictus1	Female	0.9
1276	12-Jun-14	G1	3	Halictus	Halictidae	Halictus5	Female	2.5
1277	12-Jun-14	G1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1278	12-Jun-14	G1	3	Panurgus	Andrenidae	Panurgus3	Female	1.5
1279	12-Jun-14	G1	3	Panurgus	Andrenidae	Panurgus3	Female	1.6
1280	12-Jun-14	G1	3	Panurgus	Andrenidae	Panurgus3	Female	1.8
1281	12-Jun-14	G1	4	Andrena	Andrenidae	Andrena4	Male	2.2
1282	12-Jun-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1283	12-Jun-14	G1	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
1284	12-Jun-14	G1	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
1285	12-Jun-14	G1	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
1286	12-Jun-14	G1	4	Panurgus	Andrenidae	Panurgus3	Male	1.7
1287	12-Jun-14	G1	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
1288	12-Jun-14	G1	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
1289	12-Jun-14	G1	4	Panurgus	Andrenidae	Panurgus3	Female	1.9
1290	12-Jun-14	G1	4	Panurgus	Andrenidae	Panurgus3	Female	1.9
1291	12-Jun-14	G1	5	Andrena	Andrenidae	Andrena6	Female	3.3
1292	12-Jun-14	G1	5	Bombus	Apidae	Bombus6	Female	3.0
1293	12-Jun-14	G1	5	Halictus	Halictidae	Halictus4	Female	2.0
1294	12-Jun-14	G1	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1295	12-Jun-14	G1	5	Melecta	Apidae	Melecta6	Female	3.3
1296	12-Jun-14	G1	5	Nomada	Apidae	Nomada2	Male	1.3
1297	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.6
1298	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.6
1299	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.7

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1300	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
1301	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
1302	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
1303	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
1304	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
1305	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
1306	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
1307	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
1308	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.9
1309	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.9
1310	12-Jun-14	G1	5	Panurgus	Andrenidae	Panurgus4	Female	2.0
1311	12-Jun-14	G5	1	Halictus	Halictidae	Halictus4	Female	2.2
1312	12-Jun-14	G5	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1313	12-Jun-14	G5	1	Panurgus	Andrenidae	Panurgus3	Male	1.7
1314	12-Jun-14	G5	2	Andrena	Andrenidae	Andrena3	Female	1.6
1315	12-Jun-14	G5	2	Andrena	Andrenidae	Andrena4	Female	2.0
1316	12-Jun-14	G5	2	Andrena	Andrenidae	Andrena4	Male	2.3
1317	12-Jun-14	G5	2	Halictus	Halictidae	Halictus1	Female	0.8
1318	12-Jun-14	G5	2	Halictus	Halictidae	Halictus1	Female	0.9
1319	12-Jun-14	G5	2	Halictus	Halictidae	Halictus1	Female	0.9
1320	12-Jun-14	G5	2	Halictus	Halictidae	Halictus2	Female	1.0
1321	12-Jun-14	G5	2	Halictus	Halictidae	Halictus2	Female	1.1
1322	12-Jun-14	G5	2	Halictus	Halictidae	Halictus2	Female	1.1
1323	12-Jun-14	G5	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1324	12-Jun-14	G5	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1325	12-Jun-14	G5	2	Nomada	Apidae	Nomada5	Female	2.5
1326	12-Jun-14	G5	2	Panurgus	Andrenidae	Panurgus3	Female	1.6
1327	12-Jun-14	G5	2	Panurgus	Andrenidae	Panurgus3	Female	1.6
1328	12-Jun-14	G5	2	Panurgus	Andrenidae	Panurgus3	Female	1.8
1329	12-Jun-14	G5	2	Stelis	Megachilidae	Stelis3	Female	1.5
1330	12-Jun-14	G5	3	Bombus	Apidae	Bombus6	Female	3.4
1331	12-Jun-14	G5	3	Bombus	Apidae	Bombus7	Female	3.8
1332	12-Jun-14	G5	3	Halictus	Halictidae	Halictus3	Female	1.5
1333	12-Jun-14	G5	3	Halictus	Halictidae	Halictus3	Female	1.6
1334	12-Jun-14	G5	3	Panurgus	Andrenidae	Panurgus3	Female	1.8
1335	12-Jun-14	G5	4	Andrena	Andrenidae	Andrena3	Male	1.9
1336	12-Jun-14	G5	4	Andrena	Andrenidae	Andrena4	Female	2.0
1337	12-Jun-14	G5	4	Andrena	Andrenidae	Andrena4	Female	2.0
1338	12-Jun-14	G5	4	Andrena	Andrenidae	Andrena4	Female	2.1
1339	12-Jun-14	G5	4	Bombus	Apidae	Bombus7	Female	4.2
1340	12-Jun-14	G5	4	Halictus	Halictidae	Halictus1	Female	0.8
1341	12-Jun-14	G5	4	Halictus	Halictidae	Halictus2	Female	1.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1342	12-Jun-14	G5	4	Halictus	Halictidae	Halictus3	Female	1.6
1343	12-Jun-14	G5	4	Halictus	Halictidae	Halictus3	Female	1.7
1344	12-Jun-14	G5	4	Halictus	Halictidae	Halictus3	Female	1.7
1345	12-Jun-14	G5	4	Halictus	Halictidae	Halictus3	Female	1.8
1346	12-Jun-14	G5	4	Halictus	Halictidae	Halictus4	Female	2.1
1347	12-Jun-14	G5	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1348	12-Jun-14	G5	4	Panurgus	Andrenidae	Panurgus3	Female	1.5
1349	12-Jun-14	G5	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
1350	12-Jun-14	G5	4	Stelis	Megachilidae	Stelis3	Female	1.5
1351	12-Jun-14	G5	5	Halictus	Halictidae	Halictus2	Female	1.0
1352	12-Jun-14	G5	5	Halictus	Halictidae	Halictus3	Female	1.7
1353	12-Jun-14	G5	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
1354	12-Jun-14	G5	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1355	12-Jun-14	G5	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
1356	12-Jun-14	G6	1	Andrena	Andrenidae	Andrena4	Male	2.1
1357	12-Jun-14	G6	1	Dasypoda	Melittidae	Dasypoda3	Female	1.9
1358	12-Jun-14	G6	1	Dasypoda	Melittidae	Dasypoda4	Female	2.0
1359	12-Jun-14	G6	1	Eucera	Apidae	Eucera6	Female	3.3
1360	12-Jun-14	G6	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1361	12-Jun-14	G6	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1362	12-Jun-14	G6	2	Eucera	Apidae	Eucera4	Male	2.3
1363	12-Jun-14	G6	2	Halictus	Halictidae	Halictus2	Female	1.3
1364	12-Jun-14	G6	2	Halictus	Halictidae	Halictus3	Female	1.5
1365	12-Jun-14	G6	2	Halictus	Halictidae	Halictus4	Female	2.3
1366	12-Jun-14	G6	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1367	12-Jun-14	G6	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1368	12-Jun-14	G6	2	Nomada	Apidae	Nomada2	Female	1.3
1369	12-Jun-14	G6	2	Panurgus	Andrenidae	Panurgus5	Female	2.7
1370	12-Jun-14	G6	3	Panurgus	Andrenidae	Panurgus4	Male	2.4
1371	12-Jun-14	G6	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1372	12-Jun-14	G7	1	Halictus	Halictidae	Halictus2	Female	1.0
1373	12-Jun-14	G7	1	Lasioglossum	Halictidae	Lasioglossum2	Female	1.0
1374	12-Jun-14	G7	1	Panurgus	Andrenidae	Panurgus6	Female	3.0
1375	12-Jun-14	G7	2	Dasypoda	Melittidae	Dasypoda5	Female	2.9
1376	12-Jun-14	G7	2	Halictus	Halictidae	Halictus1	Female	0.9
1377	12-Jun-14	G7	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1378	12-Jun-14	G8	1	Andrena	Andrenidae	Andrena5	Female	2.8
1379	12-Jun-14	G8	1	Andrena	Andrenidae	Andrena6	Female	3.0
1380	12-Jun-14	G8	1	Eucera	Apidae	Eucera3	Male	1.8
1381	12-Jun-14	G8	1	Eucera	Apidae	Eucera4	Male	2.3
1382	12-Jun-14	G8	1	Eucera	Apidae	Eucera4	Male	2.3
1383	12-Jun-14	G8	1	Eucera	Apidae	Eucera4	Male	2.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1384	12-Jun-14	G8	1	Eucera	Apidae	Eucera4	Male	2.4
1385	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1386	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1387	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1388	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1389	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1390	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1391	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1392	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1393	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
1394	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.6
1395	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.7
1396	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.7
1397	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.8
1398	12-Jun-14	G8	1	Eucera	Apidae	Eucera5	Male	2.8
1399	12-Jun-14	G8	1	Eucera	Apidae	Eucera6	Female	3.0
1400	12-Jun-14	G8	1	Eucera	Apidae	Eucera6	Female	3.0
1401	12-Jun-14	G8	1	Eucera	Apidae	Eucera6	Male	3.0
1402	12-Jun-14	G8	1	Eucera	Apidae	Eucera6	Male	3.0
1403	12-Jun-14	G8	1	Eucera	Apidae	Eucera6	Male	3.1
1404	12-Jun-14	G8	1	Eucera	Apidae	Eucera7	Male	3.5
1405	12-Jun-14	G8	1	Halictus	Halictidae	Halictus3	Female	1.6
1406	12-Jun-14	G8	1	Lasioglossum	Halictidae	Lasioglossum2	Female	1.0
1407	12-Jun-14	G8	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1408	12-Jun-14	G8	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1409	12-Jun-14	G8	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.8
1410	12-Jun-14	G8	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.8
1411	12-Jun-14	G8	1	Lasioglossum	Halictidae	Lasioglossum6	Female	3.3
1412	12-Jun-14	G8	1	Melitta	Melittidae	Melitta3	Female	1.5
1413	12-Jun-14	G8	1	Melitta	Melittidae	Melitta4	Female	2.3
1414	12-Jun-14	G8	2	Dufourea	Halictidae	Dufourea5	Female	2.6
1415	12-Jun-14	G8	2	Eucera	Apidae	Eucera6	Male	3.0
1416	12-Jun-14	G8	2	Halictus	Halictidae	Halictus3	Female	1.6
1417	12-Jun-14	G8	2	Halictus	Halictidae	Halictus3	Female	1.6
1418	12-Jun-14	G8	2	Halictus	Halictidae	Halictus3	Female	1.7
1419	12-Jun-14	G8	2	Halictus	Halictidae	Halictus3	Female	1.9
1420	12-Jun-14	G8	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1421	12-Jun-14	G8	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1422	12-Jun-14	G8	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1423	12-Jun-14	G8	2	Melitta	Melittidae	Melitta5	Female	2.9
1424	12-Jun-14	G8	3	Andrena	Andrenidae	Andrena4	Female	2.1
1425	12-Jun-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1426	12-Jun-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1427	12-Jun-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1428	12-Jun-14	G8	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1429	12-Jun-14	G8	4	Eucera	Apidae	Eucera4	Male	2.1
1430	12-Jun-14	G8	4	Halictus	Halictidae	Halictus2	Female	1.1
1431	12-Jun-14	G8	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1432	12-Jun-14	G8	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1433	12-Jun-14	G8	5	Halictus	Halictidae	Halictus2	Female	1.0
1434	12-Jun-14	G8	5	Halictus	Halictidae	Halictus2	Female	1.1
1435	12-Jun-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1436	12-Jun-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1437	12-Jun-14	G9	1	Eucera	Apidae	Eucera4	Male	2.4
1438	12-Jun-14	G9	1	Eucera	Apidae	Eucera5	Male	2.8
1439	12-Jun-14	G9	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1440	12-Jun-14	G9	1	Melitta	Melittidae	Melitta4	Female	2.2
1441	12-Jun-14	G9	2	Andrena	Andrenidae	Andrena5	Male	2.5
1442	12-Jun-14	G9	2	Eucera	Apidae	Eucera4	Male	2.4
1443	12-Jun-14	G9	2	Halictus	Halictidae	Halictus1	Female	0.9
1444	12-Jun-14	G9	2	Halictus	Halictidae	Halictus2	Female	1.2
1445	12-Jun-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.2
1446	12-Jun-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.2
1447	12-Jun-14	G9	2	Halictus	Halictidae	Halictus4	Female	2.3
1448	12-Jun-14	G9	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1449	12-Jun-14	G9	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
1450	12-Jun-14	G9	3	Andrena	Andrenidae	Andrena4	Male	2.4
1451	12-Jun-14	G9	3	Eucera	Apidae	Eucera4	Male	2.4
1452	12-Jun-14	G9	3	Halictus	Halictidae	Halictus3	Female	1.5
1453	12-Jun-14	G9	3	Halictus	Halictidae	Halictus3	Female	1.5
1454	12-Jun-14	G9	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1455	12-Jun-14	G9	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1456	12-Jun-14	G9	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1457	12-Jun-14	G9	5	Bombus	Apidae	Bombus7	Female	4.1
1458	12-Jun-14	G9	5	Panurgus	Andrenidae	Panurgus5	Female	2.7
1459	13-Jun-14	CA	1	Halictus	Halictidae	Halictus1	Female	0.8
1460	13-Jun-14	CA	1	Halictus	Halictidae	Halictus1	Female	0.8
1461	13-Jun-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.2
1462	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
1463	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
1464	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
1465	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
1466	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
1467	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1468	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
1469	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
1470	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
1471	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.6
1472	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.6
1473	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.6
1474	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.6
1475	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.6
1476	13-Jun-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.6
1477	13-Jun-14	CA	2	Andrena	Andrenidae	Andrena6	Female	3.1
1478	13-Jun-14	CA	2	Halictus	Halictidae	Halictus1	Female	0.8
1479	13-Jun-14	CA	2	Halictus	Halictidae	Halictus1	Female	0.8
1480	13-Jun-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
1481	13-Jun-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
1482	13-Jun-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
1483	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1484	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1485	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1486	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1487	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1488	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1489	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1490	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1491	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
1492	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.6
1493	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.6
1494	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.7
1495	13-Jun-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.8
1496	13-Jun-14	CA	2	Lasioglossum	Halictidae	Lasioglossum2	Female	1.3
1497	13-Jun-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.3
1498	13-Jun-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.3
1499	13-Jun-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.3
1500	13-Jun-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
1501	13-Jun-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
1502	13-Jun-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
1503	13-Jun-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
1504	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
1505	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
1506	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
1507	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
1508	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
1509	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1510	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
1511	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.6
1512	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.6
1513	13-Jun-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.8
1514	13-Jun-14	CA	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1515	13-Jun-14	CA	4	Halictus	Halictidae	Halictus1	Female	0.9
1516	13-Jun-14	CA	4	Halictus	Halictidae	Halictus2	Female	1.4
1517	13-Jun-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.6
1518	13-Jun-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
1519	13-Jun-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
1520	13-Jun-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
1521	13-Jun-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
1522	13-Jun-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
1523	13-Jun-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.6
1524	13-Jun-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.6
1525	13-Jun-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.6
1526	13-Jun-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.6
1527	13-Jun-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.6
1528	13-Jun-14	CO	1	Halictus	Halictidae	Halictus2	Female	1.0
1529	13-Jun-14	CO	1	Halictus	Halictidae	Halictus2	Female	1.2
1530	13-Jun-14	CO	1	Panurgus	Andrenidae	Panurgus3	Female	1.9
1531	13-Jun-14	CO	2	Halictus	Halictidae	Halictus1	Female	0.8
1532	13-Jun-14	CO	2	Panurgus	Andrenidae	Panurgus3	Female	1.8
1533	13-Jun-14	CO	2	Panurgus	Andrenidae	Panurgus3	Female	1.9
1534	13-Jun-14	CO	2	Panurgus	Andrenidae	Panurgus3	Female	1.9
1535	13-Jun-14	CO	3	Bombus	Apidae	Bombus7	Female	3.7
1536	13-Jun-14	CO	3	Halictus	Halictidae	Halictus2	Female	1.4
1537	13-Jun-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.5
1538	13-Jun-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.7
1539	13-Jun-14	CO	4	Andrena	Andrenidae	Andrena4	Female	2.0
1540	13-Jun-14	CO	4	Andrena	Andrenidae	Andrena4	Female	2.1
1541	13-Jun-14	CO	4	Bombus	Apidae	Bombus6	Female	3.4
1542	13-Jun-14	CO	4	Halictus	Halictidae	Halictus2	Female	1.2
1543	13-Jun-14	CO	4	Halictus	Halictidae	Halictus2	Female	1.4
1544	13-Jun-14	CO	5	Bombus	Apidae	Bombus7	Female	4.0
1545	13-Jun-14	CO	5	Halictus	Halictidae	Halictus2	Female	1.1
1546	13-Jun-14	CO	5	Halictus	Halictidae	Halictus4	Female	2.0
1547	13-Jun-14	M	1	Bombus	Apidae	Bombus6	Female	3.4
1548	13-Jun-14	M	1	Halictus	Halictidae	Halictus2	Male	1.0
1549	13-Jun-14	M	1	Halictus	Halictidae	Halictus2	Female	1.1
1550	13-Jun-14	M	1	Halictus	Halictidae	Halictus2	Female	1.1
1551	13-Jun-14	M	1	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1552	13-Jun-14	M	1	Halictus	Halictidae	Halictus3	Female	1.5
1553	13-Jun-14	M	1	Halictus	Halictidae	Halictus3	Female	1.5
1554	13-Jun-14	M	1	Nomada	Apidae	Nomada3	Male	1.7
1555	13-Jun-14	M	1	Panurgus	Andrenidae	Panurgus4	Male	2.4
1556	13-Jun-14	M	2	Colletes	Colletidae	Colletes5	Female	2.9
1557	13-Jun-14	M	2	Halictus	Halictidae	Halictus2	Female	1.1
1558	13-Jun-14	M	2	Halictus	Halictidae	Halictus2	Male	1.4
1559	13-Jun-14	M	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1560	13-Jun-14	M	3	Andrena	Andrenidae	Andrena4	Female	2.0
1561	13-Jun-14	M	3	Andrena	Andrenidae	Andrena4	Female	2.0
1562	13-Jun-14	M	3	Andrena	Andrenidae	Andrena4	Female	2.1
1563	13-Jun-14	M	3	Andrena	Andrenidae	Andrena4	Female	2.3
1564	13-Jun-14	M	3	Andrena	Andrenidae	Andrena5	Female	2.8
1565	13-Jun-14	M	3	Bombus	Apidae	Bombus6	Female	3.3
1566	13-Jun-14	M	3	Bombus	Apidae	Bombus7	Female	3.5
1567	13-Jun-14	M	3	Bombus	Apidae	Bombus7	Male	3.5
1568	13-Jun-14	M	3	Halictus	Halictidae	Halictus2	Female	1.1
1569	13-Jun-14	M	3	Halictus	Halictidae	Halictus2	Female	1.2
1570	13-Jun-14	M	3	Halictus	Halictidae	Halictus3	Female	1.5
1571	13-Jun-14	M	3	Halictus	Halictidae	Halictus3	Female	1.5
1572	13-Jun-14	M	3	Halictus	Halictidae	Halictus3	Female	1.6
1573	13-Jun-14	M	3	Halictus	Halictidae	Halictus3	Female	1.6
1574	13-Jun-14	M	3	Halictus	Halictidae	Halictus3	Female	1.7
1575	13-Jun-14	M	3	Halictus	Halictidae	Halictus3	Female	1.8
1576	13-Jun-14	M	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1577	13-Jun-14	M	3	Melitta	Melittidae	Melitta3	Male	1.6
1578	13-Jun-14	M	3	Melitta	Melittidae	Melitta3	Male	1.7
1579	13-Jun-14	M	4	Bombus	Apidae	Bombus7	Female	4.0
1580	13-Jun-14	M	4	Eucera	Apidae	Eucera5	Male	2.6
1581	13-Jun-14	M	4	Halictus	Halictidae	Halictus2	Female	1.0
1582	13-Jun-14	M	4	Halictus	Halictidae	Halictus2	Female	1.1
1583	13-Jun-14	M	4	Halictus	Halictidae	Halictus2	Female	1.1
1584	13-Jun-14	M	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1585	13-Jun-14	M	5	Andrena	Andrenidae	Andrena4	Female	2.3
1586	13-Jun-14	M	5	Andrena	Andrenidae	Andrena4	Male	2.3
1587	13-Jun-14	M	5	Andrena	Andrenidae	Andrena4	Female	2.4
1588	13-Jun-14	M	5	Andrena	Andrenidae	Andrena4	Male	2.4
1589	13-Jun-14	M	5	Bombus	Apidae	Bombus7	Female	3.5
1590	13-Jun-14	M	5	Bombus	Apidae	Bombus7	Female	4.0
1591	13-Jun-14	M	5	Halictus	Halictidae	Halictus2	Female	1.3
1592	13-Jun-14	M	5	Halictus	Halictidae	Halictus2	Female	1.3
1593	13-Jun-14	M	5	Halictus	Halictidae	Halictus2	Female	1.3

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1594	20-Jun-14	P1	1	Halictus	Halictidae	Halictus2	Female	1.1
1595	20-Jun-14	P1	1	Halictus	Halictidae	Halictus3	Female	1.5
1596	20-Jun-14	P1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1597	20-Jun-14	P1	1	Melitta	Melittidae	Melitta5	Female	2.8
1598	20-Jun-14	P1	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
1599	20-Jun-14	P1	2	Halictus	Halictidae	Halictus2	Female	1.0
1600	20-Jun-14	P1	2	Halictus	Halictidae	Halictus2	Female	1.1
1601	20-Jun-14	P1	3	Halictus	Halictidae	Halictus2	Female	1.0
1602	20-Jun-14	P1	4	Bombus	Apidae	Bombus7	Female	3.8
1603	20-Jun-14	P1	4	Bombus	Apidae	Bombus7	Female	3.9
1604	20-Jun-14	P1	4	Eucera	Apidae	Eucera5	Male	2.6
1605	20-Jun-14	P1	4	Halictus	Halictidae	Halictus2	Female	1.0
1606	20-Jun-14	P1	4	Halictus	Halictidae	Halictus3	Female	1.5
1607	20-Jun-14	P1	5	Andrena	Andrenidae	Andrena5	Female	2.5
1608	20-Jun-14	P1	5	Halictus	Halictidae	Halictus1	Female	0.8
1609	20-Jun-14	P1	5	Halictus	Halictidae	Halictus2	Female	1.2
1610	20-Jun-14	P1	5	Halictus	Halictidae	Halictus3	Female	1.5
1611	20-Jun-14	P1	5	Halictus	Halictidae	Halictus3	Female	1.5
1612	20-Jun-14	P2	1	Andrena	Andrenidae	Andrena5	Female	2.7
1613	20-Jun-14	P2	1	Halictus	Halictidae	Halictus1	Male	0.8
1614	20-Jun-14	P2	1	Halictus	Halictidae	Halictus2	Female	1.1
1615	20-Jun-14	P2	1	Halictus	Halictidae	Halictus2	Female	1.3
1616	20-Jun-14	P2	1	Xylocopa	Apidae	Xylocopa7	Female	3.9
1617	20-Jun-14	P2	2	Andrena	Andrenidae	Andrena4	Female	2.1
1618	20-Jun-14	P2	2	Andrena	Andrenidae	Andrena4	Female	2.4
1619	20-Jun-14	P2	2	Halictus	Halictidae	Halictus1	Female	0.9
1620	20-Jun-14	P2	2	Halictus	Halictidae	Halictus2	Female	1.0
1621	20-Jun-14	P2	2	Halictus	Halictidae	Halictus2	Female	1.2
1622	20-Jun-14	P2	2	Halictus	Halictidae	Halictus2	Female	1.4
1623	20-Jun-14	P2	3	Bombus	Apidae	Bombus6	Female	3.3
1624	20-Jun-14	P2	3	Halictus	Halictidae	Halictus3	Female	1.7
1625	20-Jun-14	P2	3	Halictus	Halictidae	Halictus3	Female	1.8
1626	20-Jun-14	P2	3	Melitta	Melittidae	Melitta5	Female	2.7
1627	20-Jun-14	P2	4	Andrena	Andrenidae	Andrena5	Female	2.9
1628	20-Jun-14	P2	4	Bombus	Apidae	Bombus7	Female	3.6
1629	20-Jun-14	P2	4	Bombus	Apidae	Bombus7	Female	4.1
1630	20-Jun-14	P2	4	Halictus	Halictidae	Halictus2	Female	1.0
1631	20-Jun-14	P2	4	Halictus	Halictidae	Halictus2	Female	1.1
1632	20-Jun-14	P2	4	Halictus	Halictidae	Halictus2	Female	1.1
1633	20-Jun-14	P2	4	Halictus	Halictidae	Halictus2	Female	1.3
1634	20-Jun-14	P2	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1635	20-Jun-14	P2	5	Bombus	Apidae	Bombus7	Female	4.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1636	20-Jun-14	P2	5	Bombus	Apidae	Bombus7	Female	5.2
1637	20-Jun-14	P2	5	Dasypoda	Melittidae	Dasypoda5	Female	2.9
1638	20-Jun-14	P2	5	Dufourea	Halictidae	Dufourea3	Female	1.5
1639	20-Jun-14	P2	5	Halictus	Halictidae	Halictus2	Female	1.3
1640	20-Jun-14	P2	5	Halictus	Halictidae	Halictus2	Female	1.3
1641	20-Jun-14	P2	5	Halictus	Halictidae	Halictus4	Female	2.0
1642	20-Jun-14	P2	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
1643	20-Jun-14	P2	5	Stelis	Megachilidae	Stelis2	Female	1.3
1644	20-Jun-14	P2	5	Stelis	Megachilidae	Stelis3	Female	1.5
1645	8-Jul-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.5
1646	8-Jul-14	A1	1	Halictus	Halictidae	Halictus3	Female	1.9
1647	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum2	Female	1.3
1648	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
1649	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
1650	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1651	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1652	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1653	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1654	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1655	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1656	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1657	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1658	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1659	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1660	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1661	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1662	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1663	8-Jul-14	A1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1664	8-Jul-14	A1	2	Halictus	Halictidae	Halictus2	Male	1.0
1665	8-Jul-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
1666	8-Jul-14	A1	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
1667	8-Jul-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1668	8-Jul-14	A1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1669	8-Jul-14	A1	2	Panurgus	Andrenidae	Panurgus4	Female	2.1
1670	8-Jul-14	A1	3	Eucera	Apidae	Eucera3	Male	1.8
1671	8-Jul-14	A1	3	Eucera	Apidae	Eucera4	Male	2.1
1672	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1673	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1674	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1675	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1676	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1677	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1678	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1679	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1680	8-Jul-14	A1	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1681	8-Jul-14	A1	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1682	8-Jul-14	A1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1683	8-Jul-14	A1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1684	8-Jul-14	A1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1685	8-Jul-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1686	8-Jul-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1687	8-Jul-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1688	8-Jul-14	A2	1	Ceratina	Apidae	Ceratina2	Female	1.3
1689	8-Jul-14	A2	1	Ceratina	Apidae	Ceratina2	Female	1.4
1690	8-Jul-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
1691	8-Jul-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
1692	8-Jul-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
1693	8-Jul-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.4
1694	8-Jul-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.4
1695	8-Jul-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.4
1696	8-Jul-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.4
1697	8-Jul-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.5
1698	8-Jul-14	A2	1	Halictus	Halictidae	Halictus3	Female	1.5
1699	8-Jul-14	A2	1	Halictus	Halictidae	Halictus4	Female	2.1
1700	8-Jul-14	A2	1	Lasioglossum	Halictidae	Lasioglossum3	Male	1.6
1701	8-Jul-14	A2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1702	8-Jul-14	A2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1703	8-Jul-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
1704	8-Jul-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.1
1705	8-Jul-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.4
1706	8-Jul-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.4
1707	8-Jul-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.4
1708	8-Jul-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.4
1709	8-Jul-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.4
1710	8-Jul-14	A2	2	Halictus	Halictidae	Halictus2	Female	1.4
1711	8-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
1712	8-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
1713	8-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
1714	8-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
1715	8-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
1716	8-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
1717	8-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.6
1718	8-Jul-14	A2	2	Halictus	Halictidae	Halictus4	Female	2.1
1719	8-Jul-14	A2	2	Lasioglossum	Halictidae	Lasioglossum3	Male	1.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1720	8-Jul-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.8
1721	8-Jul-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.9
1722	8-Jul-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.9
1723	8-Jul-14	A2	3	Halictus	Halictidae	Halictus2	Female	1.0
1724	8-Jul-14	A2	3	Halictus	Halictidae	Halictus2	Female	1.4
1725	8-Jul-14	A2	3	Halictus	Halictidae	Halictus2	Female	1.4
1726	8-Jul-14	A2	3	Halictus	Halictidae	Halictus3	Female	1.5
1727	8-Jul-14	A2	3	Halictus	Halictidae	Halictus3	Female	1.5
1728	8-Jul-14	A2	3	Halictus	Halictidae	Halictus3	Female	1.5
1729	8-Jul-14	A2	3	Halictus	Halictidae	Halictus3	Female	1.5
1730	8-Jul-14	A2	3	Halictus	Halictidae	Halictus3	Female	1.7
1731	8-Jul-14	A2	3	Halictus	Halictidae	Halictus4	Female	2.3
1732	8-Jul-14	A2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1733	8-Jul-14	A2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1734	8-Jul-14	A2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1735	8-Jul-14	A2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1736	8-Jul-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.4
1737	8-Jul-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.4
1738	8-Jul-14	A2	4	Halictus	Halictidae	Halictus3	Female	1.5
1739	8-Jul-14	A2	4	Lasioglossum	Halictidae	Lasioglossum3	Male	1.5
1740	8-Jul-14	A2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1741	8-Jul-14	A2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1742	8-Jul-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.7
1743	8-Jul-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.8
1744	8-Jul-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
1745	8-Jul-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
1746	8-Jul-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
1747	8-Jul-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.4
1748	8-Jul-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.4
1749	8-Jul-14	A2	5	Halictus	Halictidae	Halictus3	Female	1.5
1750	8-Jul-14	A2	5	Halictus	Halictidae	Halictus4	Female	2.4
1751	8-Jul-14	A2	5	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
1752	8-Jul-14	A2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1753	8-Jul-14	A2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1754	8-Jul-14	A2	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1755	8-Jul-14	A3	1	Eucera	Apidae	Eucera4	Female	2.3
1756	8-Jul-14	A3	1	Eucera	Apidae	Eucera4	Female	2.4
1757	8-Jul-14	A3	1	Halictus	Halictidae	Halictus1	Female	0.8
1758	8-Jul-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.3
1759	8-Jul-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
1760	8-Jul-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
1761	8-Jul-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1762	8-Jul-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
1763	8-Jul-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.4
1764	8-Jul-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1765	8-Jul-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
1766	8-Jul-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.6
1767	8-Jul-14	A3	1	Halictus	Halictidae	Halictus4	Female	2.1
1768	8-Jul-14	A3	1	Lasioglossum	Halictidae	Lasioglossum3	Male	1.6
1769	8-Jul-14	A3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1770	8-Jul-14	A3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1771	8-Jul-14	A3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1772	8-Jul-14	A3	2	Ceratina	Apidae	Ceratina2	Female	1.3
1773	8-Jul-14	A3	2	Halictus	Halictidae	Halictus1	Female	0.8
1774	8-Jul-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.4
1775	8-Jul-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.4
1776	8-Jul-14	A3	2	Halictus	Halictidae	Halictus2	Female	1.4
1777	8-Jul-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
1778	8-Jul-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
1779	8-Jul-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
1780	8-Jul-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.5
1781	8-Jul-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.7
1782	8-Jul-14	A3	2	Halictus	Halictidae	Halictus3	Female	1.8
1783	8-Jul-14	A3	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1784	8-Jul-14	A3	2	Nomada	Apidae	Nomada3	Female	1.6
1785	8-Jul-14	A3	3	Can't identify	NA	NA	Male	2.9
1786	8-Jul-14	A3	3	Ceratina	Apidae	Ceratina2	Female	1.3
1787	8-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1788	8-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1789	8-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1790	8-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1791	8-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1792	8-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1793	8-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1794	8-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
1795	8-Jul-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
1796	8-Jul-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.5
1797	8-Jul-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.6
1798	8-Jul-14	A3	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1799	8-Jul-14	A3	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1800	8-Jul-14	A3	4	Ceratina	Apidae	Ceratina2	Female	1.2
1801	8-Jul-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.0
1802	8-Jul-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4
1803	8-Jul-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1804	8-Jul-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.5
1805	8-Jul-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.7
1806	8-Jul-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.7
1807	8-Jul-14	A3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1808	8-Jul-14	A3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1809	8-Jul-14	A3	5	Halictus	Halictidae	Halictus2	Female	1.3
1810	8-Jul-14	A3	5	Halictus	Halictidae	Halictus2	Female	1.4
1811	8-Jul-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
1812	8-Jul-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
1813	8-Jul-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
1814	8-Jul-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.5
1815	8-Jul-14	A3	5	Halictus	Halictidae	Halictus3	Female	1.6
1816	8-Jul-14	A3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1817	8-Jul-14	A3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1818	8-Jul-14	A3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1819	8-Jul-14	G1	1	Halictus	Halictidae	Halictus3	Female	1.6
1820	8-Jul-14	G1	1	Halictus	Halictidae	Halictus5	Female	2.8
1821	8-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1822	8-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1823	8-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1824	8-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1825	8-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1826	8-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1827	8-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1828	8-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1829	8-Jul-14	G1	2	Andrena	Andrenidae	Andrena4	Female	2.4
1830	8-Jul-14	G1	2	Halictus	Halictidae	Halictus2	Female	1.4
1831	8-Jul-14	G1	2	Halictus	Halictidae	Halictus4	Female	2.4
1832	8-Jul-14	G1	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1833	8-Jul-14	G1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1834	8-Jul-14	G1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1835	8-Jul-14	G1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1836	8-Jul-14	G1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1837	8-Jul-14	G1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1838	8-Jul-14	G1	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1839	8-Jul-14	G1	3	Andrena	Andrenidae	Andrena4	Female	2.2
1840	8-Jul-14	G1	3	Eucera	Apidae	Eucera5	Male	2.6
1841	8-Jul-14	G1	3	Halictus	Halictidae	Halictus4	Female	2.2
1842	8-Jul-14	G1	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1843	8-Jul-14	G1	4	Andrena	Andrenidae	Andrena4	Male	2.1
1844	8-Jul-14	G1	4	Halictus	Halictidae	Halictus2	Female	1.3
1845	8-Jul-14	G1	4	Halictus	Halictidae	Halictus3	Female	1.7

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1846	8-Jul-14	G1	4	Halictus	Halictidae	Halictus4	Female	2.0
1847	8-Jul-14	G1	4	Halictus	Halictidae	Halictus4	Female	2.1
1848	8-Jul-14	G1	4	Halictus	Halictidae	Halictus4	Female	2.3
1849	8-Jul-14	G1	4	Halictus	Halictidae	Halictus5	Female	2.5
1850	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1851	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
1852	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1853	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1854	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1855	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1856	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1857	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1858	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1859	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1860	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1861	8-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1862	8-Jul-14	G1	4	Melitta	Melittidae	Melitta5	Female	2.8
1863	8-Jul-14	G1	5	Andrena	Andrenidae	Andrena4	Female	2.3
1864	8-Jul-14	G1	5	Andrena	Andrenidae	Andrena4	Female	2.3
1865	8-Jul-14	G1	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1866	8-Jul-14	G1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1867	8-Jul-14	G1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1868	8-Jul-14	G1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1869	8-Jul-14	G2	1	Ceratina	Apidae	Ceratina2	Female	1.2
1870	8-Jul-14	G2	1	Halictus	Halictidae	Halictus2	Female	1.0
1871	8-Jul-14	G2	1	Halictus	Halictidae	Halictus2	Female	1.0
1872	8-Jul-14	G2	1	Halictus	Halictidae	Halictus3	Female	1.5
1873	8-Jul-14	G2	1	Halictus	Halictidae	Halictus3	Female	1.5
1874	8-Jul-14	G2	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
1875	8-Jul-14	G2	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1876	8-Jul-14	G2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1877	8-Jul-14	G2	1	Lasioglossum	Halictidae	Lasioglossum4	Male	2.1
1878	8-Jul-14	G2	2	Halictus	Halictidae	Halictus1	Female	0.9
1879	8-Jul-14	G2	2	Halictus	Halictidae	Halictus1	Female	0.9
1880	8-Jul-14	G2	2	Halictus	Halictidae	Halictus1	Female	0.9
1881	8-Jul-14	G2	2	Halictus	Halictidae	Halictus3	Female	1.5
1882	8-Jul-14	G2	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
1883	8-Jul-14	G2	2	Lasioglossum	Halictidae	Lasioglossum4	Male	2.0
1884	8-Jul-14	G2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1885	8-Jul-14	G2	2	Lasioglossum	Halictidae	Lasioglossum4	Male	2.2
1886	8-Jul-14	G2	3	Halictus	Halictidae	Halictus2	Female	1.0
1887	8-Jul-14	G2	3	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1888	8-Jul-14	G2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1889	8-Jul-14	G2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1890	8-Jul-14	G2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1891	8-Jul-14	G2	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1892	8-Jul-14	G2	4	Halictus	Halictidae	Halictus1	Female	0.8
1893	8-Jul-14	G2	4	Halictus	Halictidae	Halictus2	Female	1.0
1894	8-Jul-14	G2	4	Halictus	Halictidae	Halictus3	Female	1.5
1895	8-Jul-14	G2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1896	8-Jul-14	G2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1897	8-Jul-14	G2	5	Andrena	Andrenidae	Andrena5	Female	2.5
1898	8-Jul-14	G2	5	Halictus	Halictidae	Halictus2	Female	1.0
1899	8-Jul-14	G2	5	Halictus	Halictidae	Halictus3	Female	1.6
1900	8-Jul-14	G2	5	Halictus	Halictidae	Halictus3	Female	1.7
1901	8-Jul-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1902	8-Jul-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1903	8-Jul-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1904	8-Jul-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1905	8-Jul-14	G2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1906	8-Jul-14	G2	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1907	8-Jul-14	G3	1	Andrena	Andrenidae	Andrena5	Male	2.6
1908	8-Jul-14	G3	1	Eucera	Apidae	Eucera3	Male	1.9
1909	8-Jul-14	G3	1	Eucera	Apidae	Eucera4	Male	2.1
1910	8-Jul-14	G3	1	Eucera	Apidae	Eucera4	Male	2.3
1911	8-Jul-14	G3	1	Halictus	Halictidae	Halictus4	Female	2.2
1912	8-Jul-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1913	8-Jul-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1914	8-Jul-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1915	8-Jul-14	G3	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1916	8-Jul-14	G3	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1917	8-Jul-14	G3	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.7
1918	8-Jul-14	G3	2	Eucera	Apidae	Eucera4	Male	2.0
1919	8-Jul-14	G3	2	Eucera	Apidae	Eucera4	Male	2.0
1920	8-Jul-14	G3	2	Eucera	Apidae	Eucera4	Male	2.0
1921	8-Jul-14	G3	2	Eucera	Apidae	Eucera4	Male	2.0
1922	8-Jul-14	G3	2	Eucera	Apidae	Eucera4	Female	2.2
1923	8-Jul-14	G3	2	Lasioglossum	Halictidae	Lasioglossum4	Male	2.0
1924	8-Jul-14	G3	2	Lasioglossum	Halictidae	Lasioglossum4	Male	2.1
1925	8-Jul-14	G3	2	Lasioglossum	Halictidae	Lasioglossum4	Male	2.1
1926	8-Jul-14	G3	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1927	8-Jul-14	G3	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1928	8-Jul-14	G3	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1929	8-Jul-14	G3	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1930	8-Jul-14	G3	3	Eucera	Apidae	Eucera3	Male	1.9
1931	8-Jul-14	G3	4	Halictus	Halictidae	Halictus4	Female	2.0
1932	8-Jul-14	G3	4	Panurgus	Andrenidae	Panurgus5	Female	2.9
1933	8-Jul-14	G3	5	Dasypoda	Melittidae	Dasypoda4	Male	2.4
1934	8-Jul-14	G3	5	Eucera	Apidae	Eucera3	Male	1.9
1935	8-Jul-14	G3	5	Eucera	Apidae	Eucera3	Male	1.9
1936	8-Jul-14	G3	5	Eucera	Apidae	Eucera4	Male	2.1
1937	8-Jul-14	G3	5	Eucera	Apidae	Eucera4	Male	2.2
1938	8-Jul-14	G3	5	Eucera	Apidae	Eucera4	Female	2.3
1939	8-Jul-14	G3	5	Eucera	Apidae	Eucera4	Female	2.3
1940	8-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum4	Male	2.0
1941	8-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1942	8-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1943	8-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1944	8-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1945	8-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
1946	8-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.8
1947	8-Jul-14	G3	5	Panurgus	Andrenidae	Panurgus5	Female	2.9
1948	8-Jul-14	G4	1	Andrena	Andrenidae	Andrena4	Female	2.4
1949	8-Jul-14	G4	1	Halictus	Halictidae	Halictus1	Female	0.9
1950	8-Jul-14	G4	1	Halictus	Halictidae	Halictus3	Female	1.6
1951	8-Jul-14	G4	1	Halictus	Halictidae	Halictus3	Female	1.7
1952	8-Jul-14	G4	1	Halictus	Halictidae	Halictus3	Female	1.9
1953	8-Jul-14	G4	1	Halictus	Halictidae	Halictus4	Female	2.1
1954	8-Jul-14	G4	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1955	8-Jul-14	G4	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1956	8-Jul-14	G4	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1957	8-Jul-14	G4	1	Nomada	Apidae	Nomada5	Female	2.5
1958	8-Jul-14	G4	2	Andrena	Andrenidae	Andrena4	Female	2.1
1959	8-Jul-14	G4	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
1960	8-Jul-14	G4	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1961	8-Jul-14	G4	3	Halictus	Halictidae	Halictus2	Male	1.0
1962	8-Jul-14	G4	3	Halictus	Halictidae	Halictus2	Female	1.4
1963	8-Jul-14	G4	3	Halictus	Halictidae	Halictus3	Female	1.6
1964	8-Jul-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1965	8-Jul-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1966	8-Jul-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1967	8-Jul-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
1968	8-Jul-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
1969	8-Jul-14	G4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
1970	8-Jul-14	G4	3	Panurgus	Andrenidae	Panurgus5	Female	2.9
1971	8-Jul-14	G4	4	Andrena	Andrenidae	Andrena5	Female	2.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
1972	8-Jul-14	G4	4	Halictus	Halictidae	Halictus4	Female	2.1
1973	8-Jul-14	G4	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1974	8-Jul-14	G4	5	Andrena	Andrenidae	Andrena3	Male	1.8
1975	8-Jul-14	G4	5	Andrena	Andrenidae	Andrena4	Female	2.3
1976	8-Jul-14	G4	5	Andrena	Andrenidae	Andrena4	Female	2.3
1977	8-Jul-14	G4	5	Andrena	Andrenidae	Andrena4	Female	2.4
1978	8-Jul-14	G4	5	Andrena	Andrenidae	Andrena4	Female	2.4
1979	8-Jul-14	G4	5	Andrena	Andrenidae	Andrena4	Female	2.4
1980	8-Jul-14	G4	5	Andrena	Andrenidae	Andrena6	Female	3.1
1981	8-Jul-14	G4	5	Halictus	Halictidae	Halictus2	Female	1.4
1982	8-Jul-14	G4	5	Halictus	Halictidae	Halictus4	Female	2.2
1983	8-Jul-14	G4	5	Halictus	Halictidae	Halictus4	Female	2.4
1984	8-Jul-14	G4	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
1985	8-Jul-14	G4	5	Lasioglossum	Halictidae	Lasioglossum3	Male	1.7
1986	8-Jul-14	G4	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
1987	8-Jul-14	G5	1	Andrena	Andrenidae	Andrena4	Female	2.2
1988	8-Jul-14	G5	1	Andrena	Andrenidae	Andrena4	Female	2.2
1989	8-Jul-14	G5	1	Andrena	Andrenidae	Andrena4	Female	2.4
1990	8-Jul-14	G5	1	Andrena	Andrenidae	Andrena5	Female	2.5
1991	8-Jul-14	G5	1	Andrena	Andrenidae	Andrena5	Female	2.5
1992	8-Jul-14	G5	1	Andrena	Andrenidae	Andrena5	Female	2.5
1993	8-Jul-14	G5	1	Halictus	Halictidae	Halictus1	Female	0.7
1994	8-Jul-14	G5	1	Halictus	Halictidae	Halictus1	Female	0.8
1995	8-Jul-14	G5	1	Halictus	Halictidae	Halictus3	Female	1.8
1996	8-Jul-14	G5	1	Halictus	Halictidae	Halictus4	Female	2.0
1997	8-Jul-14	G5	1	Halictus	Halictidae	Halictus4	Female	2.3
1998	8-Jul-14	G5	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
1999	8-Jul-14	G5	1	Nomada	Apidae	Nomada3	Female	1.7
2000	8-Jul-14	G5	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
2001	8-Jul-14	G5	2	Andrena	Andrenidae	Andrena3	Male	1.9
2002	8-Jul-14	G5	2	Nomada	Apidae	Nomada3	Female	1.6
2003	8-Jul-14	G5	3	Halictus	Halictidae	Halictus4	Female	2.3
2004	8-Jul-14	G5	4	Andrena	Andrenidae	Andrena4	Female	2.3
2005	8-Jul-14	G5	4	Andrena	Andrenidae	Andrena4	Female	2.4
2006	8-Jul-14	G5	4	Andrena	Andrenidae	Andrena5	Female	2.6
2007	8-Jul-14	G5	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2008	8-Jul-14	G6	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2009	8-Jul-14	G6	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2010	8-Jul-14	G6	4	Andrena	Andrenidae	Andrena4	Female	2.2
2011	8-Jul-14	G6	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2012	8-Jul-14	G6	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2013	8-Jul-14	G6	5	Bombus	Apidae	Bombus6	Female	3.1

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2014	8-Jul-14	G6	5	Eucera	Apidae	Eucera3	Male	1.9
2015	8-Jul-14	G7	1	Andrena	Andrenidae	Andrena5	Female	2.5
2016	8-Jul-14	G7	1	Andrena	Andrenidae	Andrena5	Female	2.5
2017	8-Jul-14	G7	1	Eucera	Apidae	Eucera5	Male	2.6
2018	8-Jul-14	G7	1	Eucera	Apidae	Eucera5	Female	2.8
2019	8-Jul-14	G7	1	Halictus	Halictidae	Halictus2	Female	1.0
2020	8-Jul-14	G7	1	Halictus	Halictidae	Halictus3	Female	1.5
2021	8-Jul-14	G7	1	Halictus	Halictidae	Halictus3	Female	1.6
2022	8-Jul-14	G7	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.7
2023	8-Jul-14	G7	2	Andrena	Andrenidae	Andrena4	Female	2.4
2024	8-Jul-14	G7	2	Andrena	Andrenidae	Andrena5	Female	2.6
2025	8-Jul-14	G7	2	Halictus	Halictidae	Halictus2	Female	1.0
2026	8-Jul-14	G7	2	Halictus	Halictidae	Halictus2	Female	1.4
2027	8-Jul-14	G7	2	Halictus	Halictidae	Halictus2	Female	1.4
2028	8-Jul-14	G7	2	Halictus	Halictidae	Halictus2	Female	1.4
2029	8-Jul-14	G7	2	Halictus	Halictidae	Halictus3	Female	1.5
2030	8-Jul-14	G7	2	Halictus	Halictidae	Halictus3	Female	1.5
2031	8-Jul-14	G7	2	Halictus	Halictidae	Halictus3	Female	1.6
2032	8-Jul-14	G7	2	Halictus	Halictidae	Halictus3	Female	1.6
2033	8-Jul-14	G7	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2034	8-Jul-14	G7	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2035	8-Jul-14	G7	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2036	8-Jul-14	G7	3	Eucera	Apidae	Eucera4	Male	2.4
2037	8-Jul-14	G7	3	Eucera	Apidae	Eucera4	Male	2.4
2038	8-Jul-14	G7	3	Halictus	Halictidae	Halictus3	Female	1.5
2039	8-Jul-14	G7	4	Andrena	Andrenidae	Andrena5	Female	2.5
2040	8-Jul-14	G7	4	Eucera	Apidae	Eucera4	Male	2.3
2041	8-Jul-14	G7	4	Eucera	Apidae	Eucera4	Male	2.4
2042	8-Jul-14	G7	4	Eucera	Apidae	Eucera4	Male	2.4
2043	8-Jul-14	G7	4	Eucera	Apidae	Eucera4	Male	2.4
2044	8-Jul-14	G7	4	Eucera	Apidae	Eucera4	Male	2.4
2045	8-Jul-14	G7	4	Eucera	Apidae	Eucera4	Male	2.4
2046	8-Jul-14	G7	4	Eucera	Apidae	Eucera4	Male	2.4
2047	8-Jul-14	G7	4	Eucera	Apidae	Eucera4	Male	2.4
2048	8-Jul-14	G7	4	Eucera	Apidae	Eucera5	Male	2.6
2049	8-Jul-14	G7	4	Eucera	Apidae	Eucera5	Male	2.7
2050	8-Jul-14	G7	4	Eucera	Apidae	Eucera5	Female	2.9
2051	8-Jul-14	G7	4	Halictus	Halictidae	Halictus4	Female	2.2
2052	8-Jul-14	G7	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2053	8-Jul-14	G7	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2054	8-Jul-14	G7	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2055	8-Jul-14	G7	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2056	8-Jul-14	G7	5	Andrena	Andrenidae	Andrena3	Male	1.9
2057	8-Jul-14	G7	5	Andrena	Andrenidae	Andrena4	Female	2.4
2058	8-Jul-14	G7	5	Andrena	Andrenidae	Andrena4	Female	2.4
2059	8-Jul-14	G7	5	Andrena	Andrenidae	Andrena4	Female	2.4
2060	8-Jul-14	G7	5	Eucera	Apidae	Eucera4	Male	2.2
2061	8-Jul-14	G7	5	Eucera	Apidae	Eucera4	Male	2.3
2062	8-Jul-14	G7	5	Eucera	Apidae	Eucera4	Male	2.3
2063	8-Jul-14	G7	5	Eucera	Apidae	Eucera6	Female	3.4
2064	8-Jul-14	G7	5	Halictus	Halictidae	Halictus3	Female	1.5
2065	8-Jul-14	G7	5	Halictus	Halictidae	Halictus3	Female	1.5
2066	8-Jul-14	G7	5	Halictus	Halictidae	Halictus3	Female	1.7
2067	8-Jul-14	G7	5	Halictus	Halictidae	Halictus4	Female	2.2
2068	8-Jul-14	G7	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2069	8-Jul-14	G7	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2070	8-Jul-14	G7	5	Melitta	Melittidae	Melitta4	Male	2.1
2071	8-Jul-14	G8	1	Andrena	Andrenidae	Andrena4	Male	2.4
2072	8-Jul-14	G8	1	Ceratina	Apidae	Ceratina2	Female	1.3
2073	8-Jul-14	G8	1	Eucera	Apidae	Eucera4	Male	2.3
2074	8-Jul-14	G8	1	Eucera	Apidae	Eucera4	Male	2.3
2075	8-Jul-14	G8	1	Eucera	Apidae	Eucera4	Male	2.3
2076	8-Jul-14	G8	1	Eucera	Apidae	Eucera4	Male	2.4
2077	8-Jul-14	G8	1	Eucera	Apidae	Eucera5	Male	2.5
2078	8-Jul-14	G8	1	Eucera	Apidae	Eucera5	Female	2.8
2079	8-Jul-14	G8	1	Halictus	Halictidae	Halictus1	Female	0.9
2080	8-Jul-14	G8	1	Halictus	Halictidae	Halictus2	Female	1.0
2081	8-Jul-14	G8	1	Halictus	Halictidae	Halictus2	Male	1.2
2082	8-Jul-14	G8	1	Halictus	Halictidae	Halictus2	Female	1.3
2083	8-Jul-14	G8	1	Halictus	Halictidae	Halictus3	Female	1.6
2084	8-Jul-14	G8	1	Halictus	Halictidae	Halictus3	Female	1.7
2085	8-Jul-14	G8	1	Halictus	Halictidae	Halictus4	Female	2.2
2086	8-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum1	Female	0.8
2087	8-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2088	8-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2089	8-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2090	8-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2091	8-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2092	8-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2093	8-Jul-14	G8	2	Bombus	Apidae	Bombus7	Female	3.6
2094	8-Jul-14	G8	2	Eucera	Apidae	Eucera4	Male	2.1
2095	8-Jul-14	G8	2	Eucera	Apidae	Eucera5	Female	2.8
2096	8-Jul-14	G8	2	Halictus	Halictidae	Halictus2	Female	1.4
2097	8-Jul-14	G8	2	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2098	8-Jul-14	G8	2	Halictus	Halictidae	Halictus3	Female	1.8
2099	8-Jul-14	G8	2	Halictus	Halictidae	Halictus4	Female	2.2
2100	8-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum2	Male	1.1
2101	8-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum2	Male	1.2
2102	8-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
2103	8-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2104	8-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2105	8-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2106	8-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2107	8-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2108	8-Jul-14	G8	3	Andrena	Andrenidae	Andrena4	Female	2.4
2109	8-Jul-14	G8	3	Eucera	Apidae	Eucera4	No	2.4
2110	8-Jul-14	G8	3	Eucera	Apidae	Eucera4	No	2.4
2111	8-Jul-14	G8	3	Eucera	Apidae	Eucera5	Female	2.9
2112	8-Jul-14	G8	3	Halictus	Halictidae	Halictus2	Female	1.1
2113	8-Jul-14	G8	3	Halictus	Halictidae	Halictus2	Female	1.4
2114	8-Jul-14	G8	3	Halictus	Halictidae	Halictus4	Female	2.1
2115	8-Jul-14	G8	3	Halictus	Halictidae	Halictus4	Female	2.4
2116	8-Jul-14	G8	3	Halictus	Halictidae	Halictus4	Female	2.4
2117	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum2	Female	1.2
2118	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2119	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2120	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2121	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2122	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2123	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2124	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2125	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2126	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2127	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Male	2.1
2128	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2129	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2130	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2131	8-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2132	8-Jul-14	G8	4	Andrena	Andrenidae	Andrena4	Female	2.3
2133	8-Jul-14	G8	4	Andrena	Andrenidae	Andrena4	Female	2.3
2134	8-Jul-14	G8	4	Eucera	Apidae	Eucera3	Male	1.9
2135	8-Jul-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
2136	8-Jul-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
2137	8-Jul-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
2138	8-Jul-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.5
2139	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2140	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2141	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2142	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2143	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2144	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2145	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2146	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2147	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2148	8-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum4	Male	2.2
2149	8-Jul-14	G8	5	Eucera	Apidae	Eucera4	Male	2.2
2150	8-Jul-14	G8	5	Eucera	Apidae	Eucera5	Male	2.6
2151	8-Jul-14	G8	5	Eucera	Apidae	Eucera5	Female	2.9
2152	8-Jul-14	G8	5	Halictus	Halictidae	Halictus4	Female	2.0
2153	8-Jul-14	G8	5	Halictus	Halictidae	Halictus4	Female	2.3
2154	8-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Male	2.0
2155	8-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2156	8-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Male	2.1
2157	8-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2158	8-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2159	8-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2160	8-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
2161	8-Jul-14	G9	1	Andrena	Andrenidae	Andrena4	Male	2.4
2162	8-Jul-14	G9	1	Eucera	Apidae	Eucera3	Male	1.9
2163	8-Jul-14	G9	1	Eucera	Apidae	Eucera3	Male	1.9
2164	8-Jul-14	G9	1	Eucera	Apidae	Eucera3	Male	1.9
2165	8-Jul-14	G9	1	Eucera	Apidae	Eucera3	Male	1.9
2166	8-Jul-14	G9	1	Eucera	Apidae	Eucera4	Male	2.0
2167	8-Jul-14	G9	1	Eucera	Apidae	Eucera4	Male	2.0
2168	8-Jul-14	G9	1	Eucera	Apidae	Eucera4	Male	2.0
2169	8-Jul-14	G9	1	Eucera	Apidae	Eucera4	Male	2.0
2170	8-Jul-14	G9	1	Eucera	Apidae	Eucera4	Male	2.0
2171	8-Jul-14	G9	1	Eucera	Apidae	Eucera4	Male	2.4
2172	8-Jul-14	G9	1	Eucera	Apidae	Eucera4	Male	2.4
2173	8-Jul-14	G9	1	Eucera	Apidae	Eucera4	Male	2.4
2174	8-Jul-14	G9	1	Eucera	Apidae	Eucera5	Male	2.5
2175	8-Jul-14	G9	1	Eucera	Apidae	Eucera5	Male	2.5
2176	8-Jul-14	G9	1	Eucera	Apidae	Eucera5	Male	2.5
2177	8-Jul-14	G9	1	Eucera	Apidae	Eucera5	Male	2.7
2178	8-Jul-14	G9	1	Halictus	Halictidae	Halictus3	Female	1.5
2179	8-Jul-14	G9	1	Halictus	Halictidae	Halictus3	Female	1.5
2180	8-Jul-14	G9	1	Halictus	Halictidae	Halictus4	Female	2.1
2181	8-Jul-14	G9	1	Halictus	Halictidae	Halictus4	Female	2.2

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2182	8-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2183	8-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2184	8-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2185	8-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2186	8-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2187	8-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2188	8-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2189	8-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2190	8-Jul-14	G9	2	Ceratina	Apidae	Ceratina2	Female	1.3
2191	8-Jul-14	G9	2	Eucera	Apidae	Eucera5	Male	2.6
2192	8-Jul-14	G9	2	Halictus	Halictidae	Halictus2	Female	1.4
2193	8-Jul-14	G9	2	Halictus	Halictidae	Halictus2	Female	1.4
2194	8-Jul-14	G9	2	Halictus	Halictidae	Halictus2	Female	1.4
2195	8-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2196	8-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
2197	8-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
2198	8-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2199	8-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2200	8-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2201	8-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2202	8-Jul-14	G9	3	Bombus	Apidae	Bombus6	Female	3.2
2203	8-Jul-14	G9	3	Halictus	Halictidae	Halictus2	Female	1.4
2204	8-Jul-14	G9	3	Lasioglossum	Halictidae	Lasioglossum2	Female	1.3
2205	8-Jul-14	G9	3	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
2206	8-Jul-14	G9	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2207	8-Jul-14	G9	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2208	8-Jul-14	G9	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2209	8-Jul-14	G9	3	Melitta	Melittidae	Melitta4	Female	2.1
2210	8-Jul-14	G9	3	Melitta	Melittidae	Melitta4	Female	2.3
2211	8-Jul-14	G9	4	Eucera	Apidae	Eucera4	Male	2.3
2212	8-Jul-14	G9	4	Eucera	Apidae	Eucera6	Female	3.1
2213	8-Jul-14	G9	4	Halictus	Halictidae	Halictus1	Female	0.8
2214	8-Jul-14	G9	4	Halictus	Halictidae	Halictus4	Female	2.1
2215	8-Jul-14	G9	4	Halictus	Halictidae	Halictus4	Female	2.4
2216	8-Jul-14	G9	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2217	8-Jul-14	G9	4	Lasioglossum	Halictidae	Lasioglossum3	Male	1.8
2218	8-Jul-14	G9	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2219	8-Jul-14	G9	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2220	8-Jul-14	G9	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2221	8-Jul-14	G9	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2222	8-Jul-14	G9	5	Ceratina	Apidae	Ceratina2	Female	1.4
2223	8-Jul-14	G9	5	Eucera	Apidae	Eucera3	Male	1.9

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2224	8-Jul-14	G9	5	Eucera	Apidae	Eucera4	Male	2.4
2225	8-Jul-14	G9	5	Eucera	Apidae	Eucera6	Female	3.1
2226	8-Jul-14	G9	5	Halictus	Halictidae	Halictus1	Female	0.9
2227	8-Jul-14	G9	5	Halictus	Halictidae	Halictus2	Female	1.4
2228	8-Jul-14	G9	5	Halictus	Halictidae	Halictus3	Female	1.5
2229	8-Jul-14	G9	5	Halictus	Halictidae	Halictus4	Female	2.1
2230	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2231	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
2232	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2233	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2234	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2235	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2236	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2237	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2238	8-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
2239	8-Jul-14	G9	5	Melitta	Melittidae	Melitta3	Male	1.9
2240	9-Jul-14	CA	1	Andrena	Andrenidae	Andrena4	Female	2.4
2241	9-Jul-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.3
2242	9-Jul-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.3
2243	9-Jul-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.4
2244	9-Jul-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.4
2245	9-Jul-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.4
2246	9-Jul-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
2247	9-Jul-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
2248	9-Jul-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
2249	9-Jul-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
2250	9-Jul-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
2251	9-Jul-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.5
2252	9-Jul-14	CA	1	Halictus	Halictidae	Halictus3	Female	1.6
2253	9-Jul-14	CA	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2254	9-Jul-14	CA	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2255	9-Jul-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
2256	9-Jul-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
2257	9-Jul-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
2258	9-Jul-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.4
2259	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2260	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2261	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2262	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2263	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2264	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2265	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2266	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2267	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2268	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2269	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2270	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.7
2271	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.7
2272	9-Jul-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.7
2273	9-Jul-14	CA	3	Andrena	Andrenidae	Andrena3	Female	1.5
2274	9-Jul-14	CA	3	Halictus	Halictidae	Halictus1	Female	0.8
2275	9-Jul-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
2276	9-Jul-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
2277	9-Jul-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
2278	9-Jul-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.4
2279	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2280	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2281	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2282	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2283	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2284	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2285	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2286	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2287	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2288	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.5
2289	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.6
2290	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.6
2291	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.6
2292	9-Jul-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.7
2293	9-Jul-14	CA	3	Halictus	Halictidae	Halictus4	Female	2.2
2294	9-Jul-14	CA	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2295	9-Jul-14	CA	4	Halictus	Halictidae	Halictus2	Female	1.4
2296	9-Jul-14	CA	4	Halictus	Halictidae	Halictus2	Female	1.4
2297	9-Jul-14	CA	4	Halictus	Halictidae	Halictus2	Female	1.4
2298	9-Jul-14	CA	4	Halictus	Halictidae	Halictus2	Female	1.4
2299	9-Jul-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.5
2300	9-Jul-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.5
2301	9-Jul-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.5
2302	9-Jul-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.5
2303	9-Jul-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.6
2304	9-Jul-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.6
2305	9-Jul-14	CA	4	Halictus	Halictidae	Halictus3	Female	1.7
2306	9-Jul-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
2307	9-Jul-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2308	9-Jul-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
2309	9-Jul-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
2310	9-Jul-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
2311	9-Jul-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
2312	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2313	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2314	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2315	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2316	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2317	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2318	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2319	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2320	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2321	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2322	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2323	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2324	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2325	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2326	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2327	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2328	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2329	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2330	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.6
2331	9-Jul-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.6
2332	9-Jul-14	CO	1	Halictus	Halictidae	Halictus3	Female	1.5
2333	9-Jul-14	CO	1	Halictus	Halictidae	Halictus3	Female	1.6
2334	9-Jul-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.5
2335	9-Jul-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.9
2336	9-Jul-14	CO	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2337	9-Jul-14	CO	4	Halictus	Halictidae	Halictus2	Female	1.3
2338	9-Jul-14	CO	5	Halictus	Halictidae	Halictus2	Female	1.2
2339	9-Jul-14	CO	5	Halictus	Halictidae	Halictus2	Female	1.3
2340	9-Jul-14	CO	5	Halictus	Halictidae	Halictus2	Female	1.3
2341	9-Jul-14	CO	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2342	9-Jul-14	CO	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2343	9-Jul-14	M	1	Halictus	Halictidae	Halictus2	Female	1.4
2344	9-Jul-14	M	1	Halictus	Halictidae	Halictus2	Female	1.4
2345	9-Jul-14	M	1	Halictus	Halictidae	Halictus2	Female	1.4
2346	9-Jul-14	M	2	Andrena	Andrenidae	Andrena5	Female	2.5
2347	9-Jul-14	M	2	Bombus	Apidae	Bombus7	Female	3.5
2348	9-Jul-14	M	2	Halictus	Halictidae	Halictus2	Female	1.4
2349	9-Jul-14	M	2	Halictus	Halictidae	Halictus3	Female	1.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2350	9-Jul-14	M	3	Andrena	Andrenidae	Andrena6	Female	3.0
2351	9-Jul-14	M	3	Halictus	Halictidae	Halictus2	Female	1.4
2352	9-Jul-14	M	3	Halictus	Halictidae	Halictus2	Female	1.4
2353	9-Jul-14	M	3	Halictus	Halictidae	Halictus2	Female	1.4
2354	9-Jul-14	M	4	Halictus	Halictidae	Halictus2	Female	1.4
2355	9-Jul-14	M	4	Halictus	Halictidae	Halictus2	Female	1.4
2356	9-Jul-14	M	4	Halictus	Halictidae	Halictus2	Female	1.4
2357	9-Jul-14	M	4	Halictus	Halictidae	Halictus2	Female	1.4
2358	9-Jul-14	M	4	Halictus	Halictidae	Halictus3	Female	1.5
2359	9-Jul-14	M	4	Halictus	Halictidae	Halictus3	Female	1.6
2360	9-Jul-14	M	4	Halictus	Halictidae	Halictus3	Female	1.6
2361	9-Jul-14	M	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2362	9-Jul-14	M	5	Andrena	Andrenidae	Andrena5	Female	2.8
2363	9-Jul-14	M	5	Halictus	Halictidae	Halictus2	Female	1.3
2364	9-Jul-14	M	5	Halictus	Halictidae	Halictus2	Female	1.4
2365	11-Jul-14	P1	1	Halictus	Halictidae	Halictus3	Female	1.6
2366	11-Jul-14	P1	1	Halictus	Halictidae	Halictus3	Female	1.8
2367	11-Jul-14	P1	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2368	11-Jul-14	P1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2369	11-Jul-14	P1	1	Xylocopa	Apidae	Xylocopa6	Female	3.0
2370	11-Jul-14	P1	2	Halictus	Halictidae	Halictus2	Female	1.1
2371	11-Jul-14	P1	2	Halictus	Halictidae	Halictus4	Female	2.2
2372	11-Jul-14	P1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2373	11-Jul-14	P1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2374	11-Jul-14	P1	2	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
2375	11-Jul-14	P1	2	Melitta	Melittidae	Melitta4	Female	2.3
2376	11-Jul-14	P1	3	Andrena	Andrenidae	Andrena6	Female	3.0
2377	11-Jul-14	P1	3	Halictus	Halictidae	Halictus3	Female	1.6
2378	11-Jul-14	P1	3	Halictus	Halictidae	Halictus3	Female	1.8
2379	11-Jul-14	P1	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2380	11-Jul-14	P1	3	Panurgus	Andrenidae	Panurgus3	Female	1.8
2381	11-Jul-14	P1	5	Halictus	Halictidae	Halictus2	Female	1.1
2382	11-Jul-14	P1	5	Halictus	Halictidae	Halictus3	Female	1.8
2383	11-Jul-14	P2	1	Halictus	Halictidae	Halictus1	Female	0.9
2384	11-Jul-14	P2	1	Halictus	Halictidae	Halictus2	Female	1.2
2385	11-Jul-14	P2	1	Heriades	Megachilidae	Heriades3	Female	1.5
2386	11-Jul-14	P2	1	Melecta	Apidae	Melecta2	Male	1.4
2387	11-Jul-14	P2	3	Andrena	Andrenidae	Andrena4	Female	2.2
2388	11-Jul-14	P2	3	Halictus	Halictidae	Halictus1	Female	0.8
2389	11-Jul-14	P2	3	Halictus	Halictidae	Halictus1	Female	0.9
2390	11-Jul-14	P2	3	Stelis	Megachilidae	Stelis2	Male	1.1
2391	11-Jul-14	P2	4	Andrena	Andrenidae	Andrena4	Female	2.2

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2392	11-Jul-14	P2	4	Bombus	Apidae	Bombus6	Male	3.4
2393	11-Jul-14	P2	4	Halictus	Halictidae	Halictus2	Female	1.1
2394	11-Jul-14	P2	4	Halictus	Halictidae	Halictus4	Female	2.1
2395	11-Jul-14	P2	4	Halictus	Halictidae	Halictus4	Female	2.2
2396	11-Jul-14	P2	4	Halictus	Halictidae	Halictus4	Female	2.2
2397	11-Jul-14	P2	4	Xylocopa	Apidae	Xylocopa7	Female	4.4
2398	30-Jul-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
2399	30-Jul-14	A1	2	Halictus	Halictidae	Halictus2	Female	1.4
2400	30-Jul-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
2401	30-Jul-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
2402	30-Jul-14	A1	3	Halictus	Halictidae	Halictus3	Female	1.5
2403	30-Jul-14	A1	5	Ceratina	Apidae	Ceratina2	Female	1.3
2404	30-Jul-14	A1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2405	30-Jul-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
2406	30-Jul-14	A2	1	Halictus	Halictidae	Halictus1	Female	0.9
2407	30-Jul-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.0
2408	30-Jul-14	A2	1	Halictus	Halictidae	Halictus2	Female	1.0
2409	30-Jul-14	A2	1	Halictus	Halictidae	Halictus4	Female	2.3
2410	30-Jul-14	A2	2	Halictus	Halictidae	Halictus1	Female	0.9
2411	30-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
2412	30-Jul-14	A2	2	Halictus	Halictidae	Halictus3	Female	1.5
2413	30-Jul-14	A2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2414	30-Jul-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.8
2415	30-Jul-14	A2	3	Halictus	Halictidae	Halictus1	Female	0.8
2416	30-Jul-14	A2	3	Halictus	Halictidae	Halictus2	Female	1.4
2417	30-Jul-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.9
2418	30-Jul-14	A2	4	Halictus	Halictidae	Halictus1	Female	0.9
2419	30-Jul-14	A2	4	Halictus	Halictidae	Halictus2	Female	1.4
2420	30-Jul-14	A2	4	Lasioglossum	Halictidae	Lasioglossum2	Female	1.0
2421	30-Jul-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.7
2422	30-Jul-14	A2	5	Halictus	Halictidae	Halictus1	Female	0.9
2423	30-Jul-14	A2	5	Halictus	Halictidae	Halictus2	Female	1.0
2424	30-Jul-14	A3	1	Halictus	Halictidae	Halictus2	Female	1.3
2425	30-Jul-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
2426	30-Jul-14	A3	1	Halictus	Halictidae	Halictus3	Female	1.5
2427	30-Jul-14	A3	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2428	30-Jul-14	A3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2429	30-Jul-14	A3	2	Ceratina	Apidae	Ceratina2	Female	1.2
2430	30-Jul-14	A3	3	Halictus	Halictidae	Halictus1	Female	0.8
2431	30-Jul-14	A3	3	Halictus	Halictidae	Halictus2	Female	1.4
2432	30-Jul-14	A3	3	Halictus	Halictidae	Halictus3	Female	1.7
2433	30-Jul-14	A3	4	Eucera	Apidae	Eucera4	Female	2.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2434	30-Jul-14	A3	4	Halictus	Halictidae	Halictus2	Female	1.3
2435	30-Jul-14	A3	4	Halictus	Halictidae	Halictus3	Female	1.6
2436	30-Jul-14	A3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2437	30-Jul-14	G2	3	Ceratina	Apidae	Ceratina3	Female	1.5
2438	30-Jul-14	G2	3	Halictus	Halictidae	Halictus1	Female	0.9
2439	30-Jul-14	G3	1	Eucera	Apidae	Eucera4	Male	2.2
2440	30-Jul-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2441	30-Jul-14	G3	1	Lasioglossum	Halictidae	Lasioglossum4	Male	2.3
2442	30-Jul-14	G3	2	Halictus	Halictidae	Halictus2	Female	1.2
2443	30-Jul-14	G3	2	Halictus	Halictidae	Halictus4	Female	2.1
2444	30-Jul-14	G3	2	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
2445	30-Jul-14	G3	3	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
2446	30-Jul-14	G3	4	Halictus	Halictidae	Halictus2	Male	1.2
2447	30-Jul-14	G3	4	Halictus	Halictidae	Halictus2	Male	1.3
2448	30-Jul-14	G3	4	Halictus	Halictidae	Halictus3	Female	1.6
2449	30-Jul-14	G3	4	Halictus	Halictidae	Halictus4	Female	2.2
2450	30-Jul-14	G3	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2451	30-Jul-14	G3	5	Halictus	Halictidae	Halictus2	Female	1.0
2452	30-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2453	30-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2454	30-Jul-14	G3	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2455	30-Jul-14	G4	1	Eucera	Apidae	Eucera4	Male	2.0
2456	30-Jul-14	G4	1	Halictus	Halictidae	Halictus2	Female	1.4
2457	30-Jul-14	G4	1	Halictus	Halictidae	Halictus2	Female	1.4
2458	30-Jul-14	G4	1	Halictus	Halictidae	Halictus3	Female	1.5
2459	30-Jul-14	G4	1	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
2460	30-Jul-14	G4	2	Halictus	Halictidae	Halictus2	Female	1.3
2461	30-Jul-14	G4	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2462	30-Jul-14	G4	3	Halictus	Halictidae	Halictus2	Female	1.2
2463	30-Jul-14	G4	3	Halictus	Halictidae	Halictus3	Female	1.5
2464	30-Jul-14	G4	3	Halictus	Halictidae	Halictus4	Female	2.0
2465	30-Jul-14	G4	4	Eucera	Apidae	Eucera3	Male	1.9
2466	30-Jul-14	G4	4	Halictus	Halictidae	Halictus2	Female	1.0
2467	30-Jul-14	G4	4	Halictus	Halictidae	Halictus2	Female	1.4
2468	30-Jul-14	G4	4	Halictus	Halictidae	Halictus2	Female	1.4
2469	30-Jul-14	G4	5	Halictus	Halictidae	Halictus1	Female	0.7
2470	30-Jul-14	G4	5	Nomada	Apidae	Nomada3	Female	1.5
2471	31-Jul-14	G1	1	Ceratina	Apidae	Ceratina2	Female	1.2
2472	31-Jul-14	G1	1	Colletes	Colletidae	Colletes6	Male	3.1
2473	31-Jul-14	G1	1	Halictus	Halictidae	Halictus1	Female	0.8
2474	31-Jul-14	G1	1	Halictus	Halictidae	Halictus2	Female	1.1
2475	31-Jul-14	G1	1	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2476	31-Jul-14	G1	1	Halictus	Halictidae	Halictus2	Female	1.4
2477	31-Jul-14	G1	1	Halictus	Halictidae	Halictus2	Female	1.4
2478	31-Jul-14	G1	1	Halictus	Halictidae	Halictus2	Female	1.4
2479	31-Jul-14	G1	1	Halictus	Halictidae	Halictus2	Female	1.4
2480	31-Jul-14	G1	1	Halictus	Halictidae	Halictus3	Female	1.5
2481	31-Jul-14	G1	1	Halictus	Halictidae	Halictus3	Female	1.5
2482	31-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2483	31-Jul-14	G1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2484	31-Jul-14	G1	2	Andrena	Andrenidae	Andrena4	Female	2.4
2485	31-Jul-14	G1	2	Ceratina	Apidae	Ceratina2	Female	1.3
2486	31-Jul-14	G1	2	Ceratina	Apidae	Ceratina2	Female	1.3
2487	31-Jul-14	G1	2	Halictus	Halictidae	Halictus1	Female	0.8
2488	31-Jul-14	G1	2	Halictus	Halictidae	Halictus2	Female	1.0
2489	31-Jul-14	G1	2	Halictus	Halictidae	Halictus3	Female	1.5
2490	31-Jul-14	G1	3	Halictus	Halictidae	Halictus2	Female	1.0
2491	31-Jul-14	G1	3	Halictus	Halictidae	Halictus2	Female	1.0
2492	31-Jul-14	G1	3	Halictus	Halictidae	Halictus2	Female	1.4
2493	31-Jul-14	G1	3	Halictus	Halictidae	Halictus3	Female	1.5
2494	31-Jul-14	G1	3	Halictus	Halictidae	Halictus5	Female	2.6
2495	31-Jul-14	G1	4	Ceratina	Apidae	Ceratina2	Female	1.3
2496	31-Jul-14	G1	4	Halictus	Halictidae	Halictus1	Female	0.9
2497	31-Jul-14	G1	4	Halictus	Halictidae	Halictus3	Female	1.6
2498	31-Jul-14	G1	4	Halictus	Halictidae	Halictus3	Female	1.6
2499	31-Jul-14	G1	4	Halictus	Halictidae	Halictus4	Female	2.2
2500	31-Jul-14	G1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2501	31-Jul-14	G1	5	Halictus	Halictidae	Halictus1	Male	0.8
2502	31-Jul-14	G1	5	Halictus	Halictidae	Halictus3	Female	1.5
2503	31-Jul-14	G1	5	Halictus	Halictidae	Halictus3	Female	1.5
2504	31-Jul-14	G1	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2505	31-Jul-14	G1	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2506	31-Jul-14	G1	5	Panurgus	Andrenidae	Panurgus3	Female	1.6
2507	31-Jul-14	G5	1	Ceratina	Apidae	Ceratina2	Female	1.1
2508	31-Jul-14	G5	1	Ceratina	Apidae	Ceratina2	Female	1.3
2509	31-Jul-14	G5	1	Ceratina	Apidae	Ceratina2	Female	1.4
2510	31-Jul-14	G5	1	Halictus	Halictidae	Halictus1	Female	0.8
2511	31-Jul-14	G5	1	Halictus	Halictidae	Halictus1	Female	0.9
2512	31-Jul-14	G5	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2513	31-Jul-14	G5	1	Nomada	Apidae	Nomada3	Female	1.8
2514	31-Jul-14	G5	2	Halictus	Halictidae	Halictus1	Female	0.7
2515	31-Jul-14	G5	2	Halictus	Halictidae	Halictus2	Female	1.0
2516	31-Jul-14	G5	2	Halictus	Halictidae	Halictus2	Female	1.3
2517	31-Jul-14	G5	2	Nomada	Apidae	Nomada3	Female	1.8

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2518	31-Jul-14	G5	3	Ceratina	Apidae	Ceratina2	Female	1.1
2519	31-Jul-14	G5	3	Ceratina	Apidae	Ceratina2	Female	1.2
2520	31-Jul-14	G5	3	Ceratina	Apidae	Ceratina2	Female	1.3
2521	31-Jul-14	G5	3	Ceratina	Apidae	Ceratina2	Female	1.3
2522	31-Jul-14	G5	3	Ceratina	Apidae	Ceratina3	Female	1.5
2523	31-Jul-14	G5	3	Halictus	Halictidae	Halictus2	Female	1.0
2524	31-Jul-14	G5	3	Halictus	Halictidae	Halictus3	Female	1.5
2525	31-Jul-14	G5	3	Halictus	Halictidae	Halictus3	Female	1.7
2526	31-Jul-14	G5	4	Ceratina	Apidae	Ceratina2	Female	1.4
2527	31-Jul-14	G5	4	Halictus	Halictidae	Halictus1	Female	0.6
2528	31-Jul-14	G5	4	Halictus	Halictidae	Halictus1	Female	0.7
2529	31-Jul-14	G5	4	Halictus	Halictidae	Halictus1	Female	0.7
2530	31-Jul-14	G5	4	Halictus	Halictidae	Halictus1	Female	0.8
2531	31-Jul-14	G5	4	Halictus	Halictidae	Halictus2	Female	1.4
2532	31-Jul-14	G5	4	Halictus	Halictidae	Halictus3	Female	1.5
2533	31-Jul-14	G5	4	Halictus	Halictidae	Halictus3	Female	1.7
2534	31-Jul-14	G5	4	Halictus	Halictidae	Halictus4	Female	2.0
2535	31-Jul-14	G5	4	Halictus	Halictidae	Halictus4	Female	2.3
2536	31-Jul-14	G5	4	Lasioglossum	Halictidae	Lasioglossum3	Male	1.7
2537	31-Jul-14	G5	5	Eucera	Apidae	Eucera3	Male	1.5
2538	31-Jul-14	G6	2	Dasypoda	Melittidae	Dasypoda5	Female	2.8
2539	31-Jul-14	G6	3	Halictus	Halictidae	Halictus2	Female	1.1
2540	31-Jul-14	G6	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2541	31-Jul-14	G6	4	Halictus	Halictidae	Halictus3	Female	1.5
2542	31-Jul-14	G7	1	Eucera	Apidae	Eucera6	Female	3.0
2543	31-Jul-14	G7	1	Halictus	Halictidae	Halictus4	Female	2.3
2544	31-Jul-14	G7	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2545	31-Jul-14	G7	2	Halictus	Halictidae	Halictus2	Female	1.4
2546	31-Jul-14	G7	3	Eucera	Apidae	Eucera4	Male	2.4
2547	31-Jul-14	G7	3	Eucera	Apidae	Eucera5	Female	2.9
2548	31-Jul-14	G7	3	Halictus	Halictidae	Halictus4	Female	2.3
2549	31-Jul-14	G7	4	Halictus	Halictidae	Halictus2	Female	1.2
2550	31-Jul-14	G7	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2551	31-Jul-14	G7	5	Eucera	Apidae	Eucera4	Female	2.3
2552	31-Jul-14	G7	5	Halictus	Halictidae	Halictus2	Female	1.1
2553	31-Jul-14	G7	5	Halictus	Halictidae	Halictus5	Female	2.5
2554	31-Jul-14	G7	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2555	31-Jul-14	G7	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2556	31-Jul-14	G7	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2557	31-Jul-14	G7	5	Megachile	Megachilidae	Megachile5	Male	2.7
2558	31-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2559	31-Jul-14	G8	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2560	31-Jul-14	G8	1	Stelis	Megachilidae	Stelis3	Female	1.8
2561	31-Jul-14	G8	2	Halictus	Halictidae	Halictus2	Female	1.4
2562	31-Jul-14	G8	2	Halictus	Halictidae	Halictus2	Female	1.4
2563	31-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
2564	31-Jul-14	G8	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2565	31-Jul-14	G8	3	Eucera	Apidae	Eucera5	Female	2.9
2566	31-Jul-14	G8	3	Halictus	Halictidae	Halictus2	Female	1.3
2567	31-Jul-14	G8	3	Halictus	Halictidae	Halictus2	Female	1.3
2568	31-Jul-14	G8	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
2569	31-Jul-14	G8	4	Halictus	Halictidae	Halictus3	Female	1.6
2570	31-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
2571	31-Jul-14	G8	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2572	31-Jul-14	G8	4	Stelis	Megachilidae	Stelis2	Female	1.4
2573	31-Jul-14	G8	5	Epeolus	Apidae	Epeolus5	Female	2.7
2574	31-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
2575	31-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
2576	31-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2577	31-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2578	31-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2579	31-Jul-14	G8	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2580	31-Jul-14	G9	1	Eucera	Apidae	Eucera3	Male	1.9
2581	31-Jul-14	G9	1	Eucera	Apidae	Eucera3	Male	1.9
2582	31-Jul-14	G9	1	Eucera	Apidae	Eucera3	Male	1.9
2583	31-Jul-14	G9	1	Eucera	Apidae	Eucera3	Male	1.9
2584	31-Jul-14	G9	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2585	31-Jul-14	G9	2	Ceratina	Apidae	Ceratina2	Female	1.3
2586	31-Jul-14	G9	2	Eucera	Apidae	Eucera4	Male	2.0
2587	31-Jul-14	G9	2	Halictus	Halictidae	Halictus2	Female	1.4
2588	31-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2589	31-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2590	31-Jul-14	G9	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2591	31-Jul-14	G9	3	Ceratina	Apidae	Ceratina2	Female	1.3
2592	31-Jul-14	G9	3	Halictus	Halictidae	Halictus2	Female	1.4
2593	31-Jul-14	G9	3	Halictus	Halictidae	Halictus3	Female	1.5
2594	31-Jul-14	G9	3	Halictus	Halictidae	Halictus3	Female	1.7
2595	31-Jul-14	G9	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2596	31-Jul-14	G9	4	Ceratina	Apidae	Ceratina2	Female	1.2
2597	31-Jul-14	G9	4	Eucera	Apidae	Eucera3	Male	1.9
2598	31-Jul-14	G9	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2599	31-Jul-14	G9	5	Ceratina	Apidae	Ceratina2	Female	1.4
2600	31-Jul-14	G9	5	Eucera	Apidae	Eucera4	Male	2.0
2601	31-Jul-14	G9	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2602	1-Aug-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.0
2603	1-Aug-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.4
2604	1-Aug-14	CA	1	Halictus	Halictidae	Halictus2	Female	1.4
2605	1-Aug-14	CA	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2606	1-Aug-14	CA	2	Halictus	Halictidae	Halictus2	Female	1.3
2607	1-Aug-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2608	1-Aug-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2609	1-Aug-14	CA	2	Halictus	Halictidae	Halictus3	Female	1.5
2610	1-Aug-14	CA	3	Halictus	Halictidae	Halictus1	Female	0.9
2611	1-Aug-14	CA	3	Halictus	Halictidae	Halictus2	Male	1.0
2612	1-Aug-14	CA	3	Halictus	Halictidae	Halictus2	Female	1.2
2613	1-Aug-14	CA	3	Halictus	Halictidae	Halictus3	Female	1.6
2614	1-Aug-14	CA	3	Halictus	Halictidae	Halictus3	Male	1.7
2615	1-Aug-14	CA	3	Halictus	Halictidae	Halictus4	Female	2.2
2616	1-Aug-14	CA	5	Halictus	Halictidae	Halictus2	Female	1.4
2617	1-Aug-14	CA	5	Halictus	Halictidae	Halictus3	Female	1.5
2618	1-Aug-14	CA	5	Halictus	Halictidae	Halictus4	Female	2.3
2619	1-Aug-14	CO	1	Halictus	Halictidae	Halictus2	Female	1.4
2620	1-Aug-14	CO	1	Halictus	Halictidae	Halictus3	Female	1.8
2621	1-Aug-14	CO	2	Halictus	Halictidae	Halictus2	Female	1.2
2622	1-Aug-14	CO	2	Halictus	Halictidae	Halictus2	Female	1.3
2623	1-Aug-14	CO	2	Halictus	Halictidae	Halictus2	Female	1.4
2624	1-Aug-14	CO	2	Halictus	Halictidae	Halictus3	Female	1.5
2625	1-Aug-14	CO	2	Halictus	Halictidae	Halictus3	Female	1.5
2626	1-Aug-14	CO	2	Halictus	Halictidae	Halictus3	Female	1.9
2627	1-Aug-14	CO	2	Halictus	Halictidae	Halictus4	Female	2.1
2628	1-Aug-14	CO	2	Halictus	Halictidae	Halictus4	Female	2.4
2629	1-Aug-14	CO	2	Panurgus	Andrenidae	Panurgus3	Female	1.9
2630	1-Aug-14	CO	3	Halictus	Halictidae	Halictus1	Female	0.7
2631	1-Aug-14	CO	3	Halictus	Halictidae	Halictus2	Female	1.3
2632	1-Aug-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.5
2633	1-Aug-14	CO	3	Halictus	Halictidae	Halictus3	Female	1.9
2634	1-Aug-14	CO	3	Halictus	Halictidae	Halictus4	Female	2.2
2635	1-Aug-14	CO	3	Panurgus	Andrenidae	Panurgus3	Female	1.6
2636	1-Aug-14	CO	5	Bombus	Apidae	Bombus7	Female	3.6
2637	1-Aug-14	CO	5	Halictus	Halictidae	Halictus1	Female	0.7
2638	1-Aug-14	CO	5	Halictus	Halictidae	Halictus2	Female	1.4
2639	1-Aug-14	CO	5	Halictus	Halictidae	Halictus2	Female	1.4
2640	1-Aug-14	CO	5	Halictus	Halictidae	Halictus3	Female	1.5
2641	1-Aug-14	CO	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2642	1-Aug-14	CO	5	Xylocopa	Apidae	Xylocopa7	Female	7.7
2643	1-Aug-14	M	2	Halictus	Halictidae	Halictus4	Female	2.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2644	1-Aug-14	M	2	Panurgus	Andrenidae	Panurgus6	Male	3.1
2645	1-Aug-14	M	3	Halictus	Halictidae	Halictus3	Female	1.5
2646	1-Aug-14	M	3	Halictus	Halictidae	Halictus4	Female	2.2
2647	1-Aug-14	M	3	Halictus	Halictidae	Halictus4	Female	2.3
2648	1-Aug-14	M	4	Halictus	Halictidae	Halictus2	Female	1.4
2649	1-Aug-14	M	4	Halictus	Halictidae	Halictus2	Female	1.4
2650	1-Aug-14	M	4	Halictus	Halictidae	Halictus5	Female	2.6
2651	1-Aug-14	M	4	Stelis	Megachilidae	Stelis2	Female	1.2
2652	1-Aug-14	M	5	Bombus	Apidae	Bombus6	Female	3.3
2653	1-Aug-14	M	5	Bombus	Apidae	Bombus7	Female	3.9
2654	1-Aug-14	M	5	Halictus	Halictidae	Halictus5	Female	2.5
2655	1-Aug-14	M	5	Stelis	Megachilidae	Stelis2	Female	1.3
2656	8-Aug-14	P1	1	Panurgus	Andrenidae	Panurgus3	Female	1.6
2657	8-Aug-14	P1	2	Halictus	Halictidae	Halictus2	Female	1.2
2658	8-Aug-14	P1	2	Halictus	Halictidae	Halictus3	Female	1.5
2659	8-Aug-14	P1	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2660	8-Aug-14	P1	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2661	8-Aug-14	P1	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2662	8-Aug-14	P1	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2663	8-Aug-14	P1	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2664	8-Aug-14	P2	1	Halictus	Halictidae	Halictus1	Female	0.8
2665	8-Aug-14	P2	1	Halictus	Halictidae	Halictus2	Female	1.1
2666	8-Aug-14	P2	1	Halictus	Halictidae	Halictus2	Female	1.2
2667	8-Aug-14	P2	1	Halictus	Halictidae	Halictus3	Female	1.6
2668	8-Aug-14	P2	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
2669	8-Aug-14	P2	2	Panurgus	Andrenidae	Panurgus3	Female	1.7
2670	8-Aug-14	P2	3	Halictus	Halictidae	Halictus1	Female	0.7
2671	8-Aug-14	P2	3	Halictus	Halictidae	Halictus1	Female	0.7
2672	8-Aug-14	P2	3	Halictus	Halictidae	Halictus1	Female	0.9
2673	8-Aug-14	P2	3	Halictus	Halictidae	Halictus1	Female	0.9
2674	8-Aug-14	P2	3	Halictus	Halictidae	Halictus2	Female	1.0
2675	8-Aug-14	P2	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
2676	8-Aug-14	P2	3	Stelis	Megachilidae	Stelis2	Male	1.3
2677	8-Aug-14	P2	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
2678	8-Aug-14	P2	5	Halictus	Halictidae	Halictus1	Female	0.7
2679	8-Aug-14	P2	5	Halictus	Halictidae	Halictus1	Female	0.7
2680	8-Aug-14	P2	5	Halictus	Halictidae	Halictus1	Female	0.8
2681	8-Aug-14	P2	5	Halictus	Halictidae	Halictus1	Female	0.8
2682	8-Aug-14	P2	5	Halictus	Halictidae	Halictus1	Female	0.9
2683	8-Aug-14	P2	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2684	14-May-15	S1	1	Halictus	Halictidae	Halictus1	Female	0.8
2685	14-May-15	S1	1	Halictus	Halictidae	Halictus1	Female	0.8

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2686	14-May-15	S1	1	Halictus	Halictidae	Halictus1	Female	0.8
2687	14-May-15	S1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
2688	14-May-15	S1	2	Halictus	Halictidae	Halictus2	Female	1.2
2689	14-May-15	S1	3	Halictus	Halictidae	Halictus3	Female	1.6
2690	14-May-15	S1	5	Halictus	Halictidae	Halictus1	Female	0.9
2691	14-May-15	S1	5	Halictus	Halictidae	Halictus1	Female	0.9
2692	14-May-15	S2	1	Andrena	Andrenidae	Andrena5	Female	2.5
2693	14-May-15	S2	1	Halictus	Halictidae	Halictus1	Female	0.7
2694	14-May-15	S2	1	Halictus	Halictidae	Halictus1	Female	0.7
2695	14-May-15	S2	1	Halictus	Halictidae	Halictus3	Female	1.7
2696	14-May-15	S2	1	Melitta	Melittidae	Melitta7	Female	3.7
2697	14-May-15	S2	2	Halictus	Halictidae	Halictus2	Female	1.0
2698	14-May-15	S2	2	Halictus	Halictidae	Halictus3	Female	1.6
2699	14-May-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.6
2700	14-May-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.6
2701	14-May-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.7
2702	14-May-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.7
2703	14-May-15	S2	4	Halictus	Halictidae	Halictus2	Female	1.4
2704	14-May-15	S2	4	Lasioglossum	Halictidae	Lasioglossum5	Female	2.6
2705	14-May-15	S3	1	Andrena	Andrenidae	Andrena4	Female	2.1
2706	14-May-15	S3	1	Ceratina	Apidae	Ceratina3	Male	1.7
2707	14-May-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.5
2708	14-May-15	S3	1	Stelis	Megachilidae	Stelis7	Female	3.6
2709	14-May-15	S3	4	Andrena	Andrenidae	Andrena3	Female	1.9
2710	14-May-15	S3	5	Andrena	Andrenidae	Andrena3	Male	1.7
2711	14-May-15	S4	1	Andrena	Andrenidae	Andrena3	Male	1.9
2712	14-May-15	S4	1	Dasypoda	Melittidae	Dasypoda7	Female	3.9
2713	14-May-15	S4	1	Halictus	Halictidae	Halictus3	Female	1.7
2714	14-May-15	S4	1	Osmia	Megachilidae	Osmia4	Female	2.0
2715	14-May-15	S4	2	Bombus	Apidae	Bombus6	Female	3.2
2716	14-May-15	S4	3	Andrena	Andrenidae	Andrena5	Female	2.5
2717	14-May-15	S4	4	Andrena	Andrenidae	Andrena6	Female	3.1
2718	14-May-15	S4	4	Stelis	Megachilidae	Stelis2	Female	1.4
2719	14-May-15	S4	5	Andrena	Andrenidae	Andrena5	Female	2.6
2720	14-May-15	S4	5	Panurgus	Andrenidae	Panurgus3	Male	1.8
2721	14-May-15	S5	1	Dasypoda	Melittidae	Dasypoda7	Female	4.3
2722	14-May-15	S5	1	Epeolus	Apidae	Epeolus4	Male	2.1
2723	14-May-15	S5	1	Osmia	Megachilidae	Osmia4	Male	2.4
2724	14-May-15	S5	2	Ceratina	Apidae	Ceratina2	Female	1.3
2725	14-May-15	S5	2	Ceratina	Apidae	Ceratina3	Female	1.5
2726	14-May-15	S5	2	Ceratina	Apidae	Ceratina3	Female	1.5
2727	14-May-15	S5	2	Stelis	Megachilidae	Stelis7	Female	3.8

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2728	14-May-15	S5	3	Dasypoda	Melittidae	Dasypoda7	Female	3.5
2729	14-May-15	S5	3	Panurgus	Andrenidae	Panurgus3	Male	1.8
2730	14-May-15	S5	4	Bombus	Apidae	Bombus7	Female	3.7
2731	14-May-15	S5	4	Eucera	Apidae	Eucera7	Male	3.8
2732	14-May-15	S5	4	Halictus	Halictidae	Halictus3	Female	1.5
2733	14-May-15	S5	4	Halictus	Halictidae	Halictus4	Female	2.4
2734	14-May-15	S5	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
2735	14-May-15	S5	4	Stelis	Megachilidae	Stelis6	Female	3.2
2736	14-May-15	S5	5	Eucera	Apidae	Eucera6	Male	3.0
2737	14-May-15	S5	5	Eucera	Apidae	Eucera6	Male	3.4
2738	14-May-15	S5	5	Halictus	Halictidae	Halictus1	Female	0.9
2739	14-May-15	S5	5	Stelis	Megachilidae	Stelis2	Female	1.4
2740	11-Jun-15	S1	1	Halictus	Halictidae	Halictus1	Female	0.9
2741	11-Jun-15	S1	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2742	11-Jun-15	S1	2	Halictus	Halictidae	Halictus2	Female	1.0
2743	11-Jun-15	S1	2	Panurgus	Andrenidae	Panurgus3	Male	1.7
2744	11-Jun-15	S1	3	Halictus	Halictidae	Halictus2	Female	1.3
2745	11-Jun-15	S1	3	Panurgus	Andrenidae	Panurgus3	Male	1.7
2746	11-Jun-15	S1	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
2747	11-Jun-15	S1	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
2748	11-Jun-15	S1	4	Stelis	Megachilidae	Stelis7	Female	3.5
2749	11-Jun-15	S1	5	Andrena	Andrenidae	Andrena5	Female	2.7
2750	11-Jun-15	S1	5	Andrena	Andrenidae	Andrena5	Female	2.7
2751	11-Jun-15	S1	5	Halictus	Halictidae	Halictus2	Female	1.2
2752	11-Jun-15	S1	5	Halictus	Halictidae	Halictus2	Female	1.2
2753	11-Jun-15	S1	5	Panurgus	Andrenidae	Panurgus3	Male	1.7
2754	11-Jun-15	S1	5	Panurgus	Andrenidae	Panurgus3	Male	1.7
2755	11-Jun-15	S2	1	Bombus	Apidae	Bombus7	Female	4.5
2756	11-Jun-15	S2	1	Halictus	Halictidae	Halictus3	Female	1.5
2757	11-Jun-15	S2	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.2
2758	11-Jun-15	S2	2	Epeolus	Apidae	Epeolus5	Male	2.7
2759	11-Jun-15	S2	2	Halictus	Halictidae	Halictus3	Female	1.5
2760	11-Jun-15	S2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
2761	11-Jun-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.5
2762	11-Jun-15	S2	3	Heriades	Megachilidae	Heriades3	Female	1.6
2763	11-Jun-15	S2	3	Heriades	Megachilidae	Heriades3	Female	1.6
2764	11-Jun-15	S2	3	Panurgus	Andrenidae	Panurgus2	Male	1.4
2765	11-Jun-15	S2	4	Osmia	Megachilidae	Osmia6	Female	3.2
2766	11-Jun-15	S2	4	Xylocopa	Apidae	Xylocopa7	Female	3.9
2767	11-Jun-15	S2	5	Bombus	Apidae	Bombus7	Female	4.4
2768	11-Jun-15	S2	5	Halictus	Halictidae	Halictus2	Female	1.0
2769	11-Jun-15	S2	5	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2770	11-Jun-15	S3	1	Halictus	Halictidae	Halictus1	Female	0.9
2771	11-Jun-15	S3	1	Halictus	Halictidae	Halictus1	Female	0.9
2772	11-Jun-15	S3	1	Halictus	Halictidae	Halictus1	Female	0.9
2773	11-Jun-15	S3	1	Halictus	Halictidae	Halictus1	Female	0.9
2774	11-Jun-15	S3	1	Halictus	Halictidae	Halictus1	Female	0.9
2775	11-Jun-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.5
2776	11-Jun-15	S3	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.8
2777	11-Jun-15	S3	2	Andrena	Andrenidae	Andrena3	Female	1.5
2778	11-Jun-15	S3	2	Ceratina	Apidae	Ceratina3	Female	1.5
2779	11-Jun-15	S3	2	Eucera	Apidae	Eucera4	Female	2.0
2780	11-Jun-15	S3	2	Halictus	Halictidae	Halictus2	Female	1.0
2781	11-Jun-15	S3	2	Halictus	Halictidae	Halictus2	Female	1.1
2782	11-Jun-15	S3	2	Halictus	Halictidae	Halictus3	Female	1.8
2783	11-Jun-15	S3	2	Halictus	Halictidae	Halictus4	Female	2.2
2784	11-Jun-15	S3	3	Andrena	Andrenidae	Andrena4	Female	2.0
2785	11-Jun-15	S3	3	Andrena	Andrenidae	Andrena5	Female	2.8
2786	11-Jun-15	S3	3	Andrena	Andrenidae	Andrena5	Female	2.8
2787	11-Jun-15	S3	3	Bombus	Apidae	Bombus7	Female	3.8
2788	11-Jun-15	S3	3	Halictus	Halictidae	Halictus2	Female	1.0
2789	11-Jun-15	S3	3	Halictus	Halictidae	Halictus2	Female	1.1
2790	11-Jun-15	S3	3	Halictus	Halictidae	Halictus2	Female	1.2
2791	11-Jun-15	S3	3	Halictus	Halictidae	Halictus3	Female	1.5
2792	11-Jun-15	S3	3	Halictus	Halictidae	Halictus3	Female	1.5
2793	11-Jun-15	S3	3	Halictus	Halictidae	Halictus4	Female	2.2
2794	11-Jun-15	S3	3	Halictus	Halictidae	Halictus5	Female	2.5
2795	11-Jun-15	S3	3	Halictus	Halictidae	Halictus5	Female	2.7
2796	11-Jun-15	S3	3	Melecta	Apidae	Melecta4	Male	2.1
2797	11-Jun-15	S3	3	Panurgus	Andrenidae	Panurgus3	Female	1.9
2798	11-Jun-15	S3	3	Stelis	Megachilidae	Stelis2	Female	1.3
2799	11-Jun-15	S3	3	Stelis	Megachilidae	Stelis2	Female	1.4
2800	11-Jun-15	S3	4	Halictus	Halictidae	Halictus1	Female	0.9
2801	11-Jun-15	S3	4	Halictus	Halictidae	Halictus2	Female	1.1
2802	11-Jun-15	S3	4	Halictus	Halictidae	Halictus2	Female	1.1
2803	11-Jun-15	S3	4	Halictus	Halictidae	Halictus2	Female	1.2
2804	11-Jun-15	S3	4	Halictus	Halictidae	Halictus3	Female	1.5
2805	11-Jun-15	S3	4	Halictus	Halictidae	Halictus3	Female	1.5
2806	11-Jun-15	S3	4	Halictus	Halictidae	Halictus3	Female	1.7
2807	11-Jun-15	S3	4	Heriades	Megachilidae	Heriades4	Female	2.1
2808	11-Jun-15	S3	4	Stelis	Megachilidae	Stelis2	Female	1.4
2809	11-Jun-15	S3	5	Halictus	Halictidae	Halictus2	Female	1.0
2810	11-Jun-15	S3	5	Halictus	Halictidae	Halictus2	Female	1.1
2811	11-Jun-15	S3	5	Halictus	Halictidae	Halictus2	Female	1.2

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2812	11-Jun-15	S3	5	Halictus	Halictidae	Halictus3	Female	1.5
2813	11-Jun-15	S3	5	Halictus	Halictidae	Halictus3	Female	1.8
2814	11-Jun-15	S3	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2815	11-Jun-15	S3	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2816	11-Jun-15	S3	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
2817	11-Jun-15	S4	1	Andrena	Andrenidae	Andrena5	Female	2.8
2818	11-Jun-15	S4	1	Andrena	Andrenidae	Andrena5	Female	2.8
2819	11-Jun-15	S4	1	Bombus	Apidae	Bombus7	Female	4.8
2820	11-Jun-15	S4	1	Halictus	Halictidae	Halictus2	Female	1.3
2821	11-Jun-15	S4	1	Halictus	Halictidae	Halictus3	Female	1.6
2822	11-Jun-15	S4	1	Halictus	Halictidae	Halictus3	Female	1.6
2823	11-Jun-15	S4	1	Halictus	Halictidae	Halictus3	Female	1.6
2824	11-Jun-15	S4	1	Lasioglossum	Halictidae	Lasioglossum2	Female	1.3
2825	11-Jun-15	S4	1	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2826	11-Jun-15	S4	1	Melecta	Apidae	Melecta5	Male	2.5
2827	11-Jun-15	S4	2	Andrena	Andrenidae	Andrena5	Female	2.5
2828	11-Jun-15	S4	2	Halictus	Halictidae	Halictus1	Female	0.8
2829	11-Jun-15	S4	2	Halictus	Halictidae	Halictus2	Female	1.4
2830	11-Jun-15	S4	2	Halictus	Halictidae	Halictus2	Female	1.4
2831	11-Jun-15	S4	2	Halictus	Halictidae	Halictus3	Female	1.5
2832	11-Jun-15	S4	2	Panurgus	Andrenidae	Panurgus3	Male	1.7
2833	11-Jun-15	S4	2	Panurgus	Andrenidae	Panurgus3	Male	1.7
2834	11-Jun-15	S4	3	Andrena	Andrenidae	Andrena5	Female	2.6
2835	11-Jun-15	S4	3	Andrena	Andrenidae	Andrena5	Female	2.6
2836	11-Jun-15	S4	3	Andrena	Andrenidae	Andrena5	Female	2.8
2837	11-Jun-15	S4	3	Halictus	Halictidae	Halictus2	Female	1.2
2838	11-Jun-15	S4	3	Halictus	Halictidae	Halictus2	Female	1.3
2839	11-Jun-15	S4	3	Halictus	Halictidae	Halictus3	Female	1.6
2840	11-Jun-15	S4	3	Halictus	Halictidae	Halictus3	Female	1.7
2841	11-Jun-15	S4	3	Halictus	Halictidae	Halictus4	Female	2.1
2842	11-Jun-15	S4	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
2843	11-Jun-15	S4	4	Bombus	Apidae	Bombus7	Female	3.9
2844	11-Jun-15	S4	4	Bombus	Apidae	Bombus7	Female	4.3
2845	11-Jun-15	S4	4	Bombus	Apidae	Bombus7	Female	4.3
2846	11-Jun-15	S4	4	Halictus	Halictidae	Halictus2	Female	1.4
2847	11-Jun-15	S4	4	Halictus	Halictidae	Halictus3	Female	1.6
2848	11-Jun-15	S4	5	Bombus	Apidae	Bombus7	Female	3.8
2849	11-Jun-15	S4	5	Eucera	Apidae	Eucera5	Female	2.8
2850	11-Jun-15	S4	5	Eucera	Apidae	Eucera5	Female	2.8
2851	11-Jun-15	S4	5	Halictus	Halictidae	Halictus2	Female	1.4
2852	11-Jun-15	S4	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
2853	11-Jun-15	S5	1	Andrena	Andrenidae	Andrena5	Female	2.8

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2854	11-Jun-15	S5	1	Bombus	Apidae	Bombus6	Female	3.4
2855	11-Jun-15	S5	1	Bombus	Apidae	Bombus7	Female	4.0
2856	11-Jun-15	S5	1	Halictus	Halictidae	Halictus2	Female	1.1
2857	11-Jun-15	S5	2	Andrena	Andrenidae	Andrena5	Female	2.8
2858	11-Jun-15	S5	2	Halictus	Halictidae	Halictus2	Female	1.1
2859	11-Jun-15	S5	2	Halictus	Halictidae	Halictus2	Female	1.2
2860	11-Jun-15	S5	2	Halictus	Halictidae	Halictus2	Female	1.2
2861	11-Jun-15	S5	2	Halictus	Halictidae	Halictus4	Female	2.2
2862	11-Jun-15	S5	2	Lasioglossum	Halictidae	Lasioglossum2	Female	1.2
2863	11-Jun-15	S5	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2864	11-Jun-15	S5	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.9
2865	11-Jun-15	S5	2	Stelis	Megachilidae	Stelis3	Female	1.5
2866	11-Jun-15	S5	4	Ceratina	Apidae	Ceratina3	Female	1.8
2867	11-Jun-15	S5	4	Halictus	Halictidae	Halictus1	Female	0.9
2868	11-Jun-15	S5	4	Halictus	Halictidae	Halictus2	Female	1.1
2869	11-Jun-15	S5	4	Halictus	Halictidae	Halictus2	Female	1.3
2870	11-Jun-15	S5	4	Halictus	Halictidae	Halictus3	Female	1.5
2871	11-Jun-15	S5	4	Lasioglossum	Halictidae	Lasioglossum2	Female	1.2
2872	11-Jun-15	S5	4	Stelis	Megachilidae	Stelis2	Female	1.4
2873	11-Jun-15	S5	4	Stelis	Megachilidae	Stelis2	Female	1.4
2874	11-Jun-15	S5	4	Stelis	Megachilidae	Stelis3	Female	1.5
2875	11-Jun-15	S5	4	Stelis	Megachilidae	Stelis3	Female	1.5
2876	11-Jun-15	S5	4	Stelis	Megachilidae	Stelis3	Female	1.5
2877	11-Jun-15	S5	5	Andrena	Andrenidae	Andrena5	Female	2.5
2878	11-Jun-15	S5	5	Bombus	Apidae	Bombus7	Female	3.8
2879	11-Jun-15	S5	5	Ceratina	Apidae	Ceratina3	Female	1.8
2880	11-Jun-15	S5	5	Halictus	Halictidae	Halictus2	Female	1.2
2881	11-Jun-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.5
2882	11-Jun-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.5
2883	11-Jun-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.5
2884	11-Jun-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.9
2885	3-Jul-15	S1	1	Halictus	Halictidae	Halictus1	Female	0.9
2886	3-Jul-15	S1	1	Halictus	Halictidae	Halictus3	Female	1.5
2887	3-Jul-15	S1	1	Halictus	Halictidae	Halictus3	Female	1.5
2888	3-Jul-15	S1	1	Halictus	Halictidae	Halictus3	Female	1.5
2889	3-Jul-15	S1	2	Bombus	Apidae	Bombus7	Female	4.3
2890	3-Jul-15	S1	2	Halictus	Halictidae	Halictus1	Female	0.8
2891	3-Jul-15	S1	2	Halictus	Halictidae	Halictus1	Female	0.8
2892	3-Jul-15	S1	2	Halictus	Halictidae	Halictus1	Female	0.8
2893	3-Jul-15	S1	2	Halictus	Halictidae	Halictus1	Female	0.8
2894	3-Jul-15	S1	3	Halictus	Halictidae	Halictus3	Female	1.5
2895	3-Jul-15	S1	3	Stelis	Megachilidae	Stelis2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2896	3-Jul-15	S1	4	Halictus	Halictidae	Halictus3	Female	1.5
2897	3-Jul-15	S1	5	Stelis	Megachilidae	Stelis2	Female	1.3
2898	3-Jul-15	S2	1	Andrena	Andrenidae	Andrena3	Female	1.9
2899	3-Jul-15	S2	1	Halictus	Halictidae	Halictus2	Female	1.1
2900	3-Jul-15	S2	1	Halictus	Halictidae	Halictus3	Female	1.6
2901	3-Jul-15	S2	1	Halictus	Halictidae	Halictus3	Female	1.6
2902	3-Jul-15	S2	1	Halictus	Halictidae	Halictus3	Female	1.6
2903	3-Jul-15	S2	2	Bombus	Apidae	Bombus7	Female	5.4
2904	3-Jul-15	S2	2	Halictus	Halictidae	Halictus2	Female	1.4
2905	3-Jul-15	S2	2	Halictus	Halictidae	Halictus2	Female	1.4
2906	3-Jul-15	S2	3	Halictus	Halictidae	Halictus2	Female	1.1
2907	3-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.5
2908	3-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.5
2909	3-Jul-15	S2	4	Eucera	Apidae	Eucera6	Male	3.0
2910	3-Jul-15	S2	4	Halictus	Halictidae	Halictus2	Female	1.3
2911	3-Jul-15	S2	4	Halictus	Halictidae	Halictus2	Female	1.4
2912	3-Jul-15	S2	4	Halictus	Halictidae	Halictus3	Female	1.6
2913	3-Jul-15	S2	4	Halictus	Halictidae	Halictus3	Female	1.6
2914	3-Jul-15	S2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2915	3-Jul-15	S2	5	Halictus	Halictidae	Halictus2	Female	1.4
2916	3-Jul-15	S2	5	Halictus	Halictidae	Halictus3	Female	1.5
2917	3-Jul-15	S2	5	Halictus	Halictidae	Halictus3	Female	1.5
2918	3-Jul-15	S3	1	Andrena	Andrenidae	Andrena5	Female	2.5
2919	3-Jul-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.5
2920	3-Jul-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.8
2921	3-Jul-15	S3	2	Andrena	Andrenidae	Andrena4	Female	2.1
2922	3-Jul-15	S3	2	Andrena	Andrenidae	Andrena5	Female	2.5
2923	3-Jul-15	S3	2	Bombus	Apidae	Bombus7	Female	3.9
2924	3-Jul-15	S3	2	Halictus	Halictidae	Halictus2	Female	1.1
2925	3-Jul-15	S3	2	Halictus	Halictidae	Halictus3	Female	1.6
2926	3-Jul-15	S3	2	Halictus	Halictidae	Halictus3	Female	1.6
2927	3-Jul-15	S3	3	Andrena	Andrenidae	Andrena3	Female	1.8
2928	3-Jul-15	S3	3	Andrena	Andrenidae	Andrena3	Female	1.8
2929	3-Jul-15	S3	3	Andrena	Andrenidae	Andrena5	Female	2.5
2930	3-Jul-15	S3	3	Halictus	Halictidae	Halictus2	Female	1.4
2931	3-Jul-15	S3	3	Halictus	Halictidae	Halictus2	Female	1.4
2932	3-Jul-15	S3	3	Halictus	Halictidae	Halictus4	Female	2.0
2933	3-Jul-15	S3	4	Halictus	Halictidae	Halictus2	Female	1.4
2934	3-Jul-15	S3	4	Nomada	Apidae	Nomada2	Female	1.3
2935	3-Jul-15	S3	4	Panurgus	Andrenidae	Panurgus3	Male	1.7
2936	3-Jul-15	S3	5	Andrena	Andrenidae	Andrena5	Female	2.7
2937	3-Jul-15	S4	1	Bombus	Apidae	Bombus7	Female	3.8

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2938	3-Jul-15	S4	1	Lasioglossum	Halictidae	Lasioglossum2	Male	1.4
2939	3-Jul-15	S4	1	Stelis	Megachilidae	Stelis3	Female	1.5
2940	3-Jul-15	S4	1	Xylocopa	Apidae	Xylocopa7	Female	6.2
2941	3-Jul-15	S4	2	Andrena	Andrenidae	Andrena5	Female	2.6
2942	3-Jul-15	S4	2	Andrena	Andrenidae	Andrena5	Female	2.6
2943	3-Jul-15	S4	2	Andrena	Andrenidae	Andrena5	Female	2.6
2944	3-Jul-15	S4	2	Bombus	Apidae	Bombus6	Female	3.0
2945	3-Jul-15	S4	2	Halictus	Halictidae	Halictus3	Female	1.5
2946	3-Jul-15	S4	2	Halictus	Halictidae	Halictus3	Female	1.5
2947	3-Jul-15	S4	2	Stelis	Megachilidae	Stelis2	Female	1.4
2948	3-Jul-15	S4	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
2949	3-Jul-15	S4	3	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
2950	3-Jul-15	S4	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
2951	3-Jul-15	S4	4	Bombus	Apidae	Bombus7	Female	4.4
2952	3-Jul-15	S4	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
2953	3-Jul-15	S4	5	Bombus	Apidae	Bombus7	Female	3.9
2954	3-Jul-15	S4	5	Stelis	Megachilidae	Stelis2	Male	1.2
2955	3-Jul-15	S4	5	Stelis	Megachilidae	Stelis6	Female	3.0
2956	3-Jul-15	S5	1	Andrena	Andrenidae	Andrena4	Female	2.0
2957	3-Jul-15	S5	1	Halictus	Halictidae	Halictus3	Female	1.5
2958	3-Jul-15	S5	1	Halictus	Halictidae	Halictus3	Female	1.5
2959	3-Jul-15	S5	1	Halictus	Halictidae	Halictus3	Female	1.5
2960	3-Jul-15	S5	1	Halictus	Halictidae	Halictus4	Female	2.0
2961	3-Jul-15	S5	1	Halictus	Halictidae	Halictus4	Female	2.2
2962	3-Jul-15	S5	1	Lasioglossum	Halictidae	Lasioglossum3	Male	1.6
2963	3-Jul-15	S5	2	Bombus	Apidae	Bombus7	Female	3.5
2964	3-Jul-15	S5	2	Halictus	Halictidae	Halictus2	Female	1.3
2965	3-Jul-15	S5	2	Halictus	Halictidae	Halictus3	Female	1.5
2966	3-Jul-15	S5	2	Nomada	Apidae	Nomada3	Female	1.6
2967	3-Jul-15	S5	3	Bombus	Apidae	Bombus5	Female	2.9
2968	3-Jul-15	S5	3	Halictus	Halictidae	Halictus2	Female	1.0
2969	3-Jul-15	S5	3	Halictus	Halictidae	Halictus3	Female	1.5
2970	3-Jul-15	S5	3	Halictus	Halictidae	Halictus4	Female	2.2
2971	3-Jul-15	S5	3	Nomada	Apidae	Nomada3	Female	1.5
2972	3-Jul-15	S5	4	Bombus	Apidae	Bombus6	Female	3.3
2973	3-Jul-15	S5	4	Ceratina	Apidae	Ceratina3	Female	1.5
2974	3-Jul-15	S5	4	Halictus	Halictidae	Halictus1	Female	0.8
2975	3-Jul-15	S5	4	Halictus	Halictidae	Halictus2	Female	1.4
2976	3-Jul-15	S5	4	Halictus	Halictidae	Halictus4	Female	2.0
2977	3-Jul-15	S5	5	Andrena	Andrenidae	Andrena3	Female	1.9
2978	3-Jul-15	S5	5	Ceratina	Apidae	Ceratina2	Female	1.4
2979	3-Jul-15	S5	5	Halictus	Halictidae	Halictus2	Female	1.2

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
2980	3-Jul-15	S5	5	Halictus	Halictidae	Halictus2	Female	1.2
2981	3-Jul-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.8
2982	3-Jul-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.8
2983	3-Jul-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.8
2984	3-Jul-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.8
2985	3-Jul-15	S5	5	Halictus	Halictidae	Halictus3	Female	1.8
2986	3-Jul-15	S5	5	Stelis	Megachilidae	Stelis3	Female	1.6
2987	27-Jul-15	S1	2	Halictus	Halictidae	Halictus1	Female	0.8
2988	27-Jul-15	S1	4	Halictus	Halictidae	Halictus2	Female	1.2
2989	27-Jul-15	S1	5	Halictus	Halictidae	Halictus2	Female	1.0
2990	27-Jul-15	S2	1	Halictus	Halictidae	Halictus1	Female	0.9
2991	27-Jul-15	S2	1	Halictus	Halictidae	Halictus2	Female	1.2
2992	27-Jul-15	S2	1	Halictus	Halictidae	Halictus3	Female	1.5
2993	27-Jul-15	S2	1	Halictus	Halictidae	Halictus3	Female	1.5
2994	27-Jul-15	S2	2	Ceratina	Apidae	Ceratina3	Female	1.6
2995	27-Jul-15	S2	2	Halictus	Halictidae	Halictus1	Female	0.9
2996	27-Jul-15	S2	2	Halictus	Halictidae	Halictus2	Female	1.3
2997	27-Jul-15	S2	2	Halictus	Halictidae	Halictus2	Female	1.3
2998	27-Jul-15	S2	2	Halictus	Halictidae	Halictus2	Female	1.3
2999	27-Jul-15	S2	2	Halictus	Halictidae	Halictus3	Female	1.5
3000	27-Jul-15	S2	2	Halictus	Halictidae	Halictus3	Female	1.5
3001	27-Jul-15	S2	2	Halictus	Halictidae	Halictus3	Female	1.5
3002	27-Jul-15	S2	2	Lasioglossum	Halictidae	Lasioglossum4	Female	2.4
3003	27-Jul-15	S2	3	Ceratina	Apidae	Ceratina3	Female	1.9
3004	27-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.6
3005	27-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.6
3006	27-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.6
3007	27-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.7
3008	27-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.7
3009	27-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.7
3010	27-Jul-15	S2	3	Halictus	Halictidae	Halictus3	Female	1.7
3011	27-Jul-15	S2	3	Halictus	Halictidae	Halictus4	Female	2.1
3012	27-Jul-15	S2	3	Lasioglossum	Halictidae	Lasioglossum3	Male	1.5
3013	27-Jul-15	S2	3	Lasioglossum	Halictidae	Lasioglossum5	Female	2.5
3014	27-Jul-15	S2	4	Bombus	Apidae	Bombus7	Female	4.0
3015	27-Jul-15	S2	4	Halictus	Halictidae	Halictus2	Female	1.0
3016	27-Jul-15	S2	4	Halictus	Halictidae	Halictus2	Female	1.0
3017	27-Jul-15	S2	4	Halictus	Halictidae	Halictus2	Female	1.0
3018	27-Jul-15	S2	4	Halictus	Halictidae	Halictus2	Female	1.4
3019	27-Jul-15	S2	4	Halictus	Halictidae	Halictus4	Female	2.1
3020	27-Jul-15	S2	4	Lasioglossum	Halictidae	Lasioglossum4	Female	2.3
3021	27-Jul-15	S2	5	Bombus	Apidae	Bombus6	Female	3.1

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3022	27-Jul-15	S2	5	Halictus	Halictidae	Halictus2	Female	1.2
3023	27-Jul-15	S2	5	Halictus	Halictidae	Halictus2	Female	1.2
3024	27-Jul-15	S2	5	Halictus	Halictidae	Halictus2	Female	1.2
3025	27-Jul-15	S2	5	Halictus	Halictidae	Halictus2	Female	1.2
3026	27-Jul-15	S2	5	Halictus	Halictidae	Halictus3	Female	1.6
3027	27-Jul-15	S3	1	Ceratina	Apidae	Ceratina3	Female	1.6
3028	27-Jul-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.6
3029	27-Jul-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.6
3030	27-Jul-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.6
3031	27-Jul-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.6
3032	27-Jul-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.6
3033	27-Jul-15	S3	1	Halictus	Halictidae	Halictus3	Female	1.9
3034	27-Jul-15	S3	2	Halictus	Halictidae	Halictus3	Female	1.5
3035	27-Jul-15	S3	2	Stelis	Megachilidae	Stelis2	Female	1.4
3036	27-Jul-15	S3	3	Halictus	Halictidae	Halictus3	Female	1.7
3037	27-Jul-15	S3	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3038	27-Jul-15	S3	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3039	27-Jul-15	S3	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3040	27-Jul-15	S3	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3041	27-Jul-15	S3	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3042	27-Jul-15	S3	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3043	27-Jul-15	S3	4	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3044	27-Jul-15	S3	5	Stelis	Megachilidae	Stelis2	Female	1.4
3045	27-Jul-15	S4	2	Bombus	Apidae	Bombus6	Female	3.4
3046	27-Jul-15	S4	2	Halictus	Halictidae	Halictus1	Female	0.9
3047	27-Jul-15	S4	3	Bombus	Apidae	Bombus6	Female	3.4
3048	27-Jul-15	S4	3	Ceratina	Apidae	Ceratina3	Female	1.5
3049	27-Jul-15	S4	3	Halictus	Halictidae	Halictus2	Female	1.0
3050	27-Jul-15	S4	3	Halictus	Halictidae	Halictus2	Female	1.0
3051	27-Jul-15	S4	3	Halictus	Halictidae	Halictus2	Female	1.2
3052	27-Jul-15	S4	3	Stelis	Megachilidae	Stelis2	Female	1.2
3053	27-Jul-15	S4	4	Bombus	Apidae	Bombus7	Female	3.8
3054	27-Jul-15	S4	4	Bombus	Apidae	Bombus7	Female	4.0
3055	27-Jul-15	S4	4	Ceratina	Apidae	Ceratina3	Female	1.6
3056	27-Jul-15	S4	5	Halictus	Halictidae	Halictus2	Female	1.0
3057	27-Jul-15	S4	5	Halictus	Halictidae	Halictus4	Female	2.3
3058	27-Jul-15	S4	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.8
3059	27-Jul-15	S4	5	Stelis	Megachilidae	Stelis2	Female	1.2
3060	27-Jul-15	S5	1	Ceratina	Apidae	Ceratina3	Female	1.5
3061	27-Jul-15	S5	1	Lasioglossum	Halictidae	Lasioglossum4	Female	2.0
3062	27-Jul-15	S5	1	Stelis	Megachilidae	Stelis2	Female	1.1
3063	27-Jul-15	S5	1	Stelis	Megachilidae	Stelis2	Female	1.1

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3064	27-Jul-15	S5	2	Ceratina	Apidae	Ceratina3	Female	1.7
3065	27-Jul-15	S5	2	Halictus	Halictidae	Halictus4	Female	2.2
3066	27-Jul-15	S5	3	Halictus	Halictidae	Halictus2	Female	1.2
3067	27-Jul-15	S5	3	Halictus	Halictidae	Halictus2	Female	1.2
3068	27-Jul-15	S5	4	Ceratina	Apidae	Ceratina3	Female	1.7
3069	27-Jul-15	S5	5	Bombus	Apidae	Bombus5	Female	2.9
3070	27-Jul-15	S5	5	Ceratina	Apidae	Ceratina2	Female	1.4
3071	27-Jul-15	S5	5	Ceratina	Apidae	Ceratina3	Female	1.7
3072	26-Apr-16	SA	1	Halictus	Halictidae	Halictus3	Female	1.8
3073	26-Apr-16	SA	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
3074	26-Apr-16	SA	2	Andrena	Andrenidae	Andrena5	Female	2.8
3075	26-Apr-16	SA	2	Melitta	Melittidae	Melitta4	Female	2.0
3076	26-Apr-16	SA	3	Andrena	Andrenidae	Andrena3	Female	1.9
3077	26-Apr-16	SA	3	Halictus	Halictidae	Halictus2	Female	1.3
3078	26-Apr-16	SA	3	Halictus	Halictidae	Halictus2	Female	1.3
3079	26-Apr-16	SA	3	Halictus	Halictidae	Halictus2	Female	1.4
3080	26-Apr-16	SA	3	Halictus	Halictidae	Halictus3	Female	1.8
3081	26-Apr-16	SA	3	Halictus	Halictidae	Halictus3	Female	1.8
3082	26-Apr-16	SA	4	Halictus	Halictidae	Halictus2	Female	1.0
3083	26-Apr-16	SA	4	Halictus	Halictidae	Halictus2	Female	1.0
3084	26-Apr-16	SA	4	Halictus	Halictidae	Halictus2	Female	1.2
3085	26-Apr-16	SA	4	Halictus	Halictidae	Halictus2	Female	1.2
3086	26-Apr-16	SA	4	Halictus	Halictidae	Halictus2	Female	1.3
3087	26-Apr-16	SA	4	Halictus	Halictidae	Halictus2	Female	1.3
3088	26-Apr-16	SA	4	Halictus	Halictidae	Halictus3	Female	1.6
3089	26-Apr-16	SA	5	Halictus	Halictidae	Halictus2	Female	1.3
3090	26-Apr-16	SA	5	Halictus	Halictidae	Halictus2	Female	1.3
3091	26-Apr-16	SA	5	Halictus	Halictidae	Halictus3	Female	1.5
3092	26-Apr-16	SA	5	Halictus	Halictidae	Halictus3	Female	1.6
3093	26-Apr-16	SA	5	Halictus	Halictidae	Halictus3	Female	1.9
3094	26-Apr-16	SA	5	Halictus	Halictidae	Halictus3	Female	1.9
3095	26-Apr-16	SB	1	Andrena	Andrenidae	Andrena4	Male	2.1
3096	26-Apr-16	SB	1	Bombus	Apidae	Bombus7	Female	3.6
3097	26-Apr-16	SB	1	Bombus	Apidae	Bombus7	Female	4.3
3098	26-Apr-16	SB	1	Bombus	Apidae	Bombus7	Female	4.8
3099	26-Apr-16	SB	1	Halictus	Halictidae	Halictus2	Female	1.2
3100	26-Apr-16	SB	1	Halictus	Halictidae	Halictus2	Female	1.2
3101	26-Apr-16	SB	1	Halictus	Halictidae	Halictus2	Female	1.3
3102	26-Apr-16	SB	1	Halictus	Halictidae	Halictus2	Female	1.3
3103	26-Apr-16	SB	1	Halictus	Halictidae	Halictus2	Female	1.3
3104	26-Apr-16	SB	1	Halictus	Halictidae	Halictus2	Female	1.4
3105	26-Apr-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.5

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3106	26-Apr-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.5
3107	26-Apr-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.7
3108	26-Apr-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.7
3109	26-Apr-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.7
3110	26-Apr-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.7
3111	26-Apr-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.8
3112	26-Apr-16	SB	1	Halictus	Halictidae	Halictus4	Female	2.0
3113	26-Apr-16	SB	1	Halictus	Halictidae	Halictus6	Female	3.0
3114	26-Apr-16	SB	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
3115	26-Apr-16	SB	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
3116	26-Apr-16	SB	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
3117	26-Apr-16	SB	1	Osmia	Megachilidae	Osmia5	Male	2.5
3118	26-Apr-16	SB	2	Halictus	Halictidae	Halictus3	Female	1.6
3119	26-Apr-16	SB	3	Andrena	Andrenidae	Andrena4	Male	2.0
3120	26-Apr-16	SB	3	Andrena	Andrenidae	Andrena4	Male	2.0
3121	26-Apr-16	SB	3	Andrena	Andrenidae	Andrena4	Male	2.2
3122	26-Apr-16	SB	3	Eucera	Apidae	Eucera6	Male	3.0
3123	26-Apr-16	SB	3	Halictus	Halictidae	Halictus2	Female	1.2
3124	26-Apr-16	SB	3	Halictus	Halictidae	Halictus4	Female	2.0
3125	26-Apr-16	SB	4	Andrena	Andrenidae	Andrena6	Female	3.0
3126	26-Apr-16	SB	5	Andrena	Andrenidae	Andrena5	Female	2.8
3127	26-Apr-16	SB	5	Bombus	Apidae	Bombus6	Female	3.3
3128	26-Apr-16	SB	5	Bombus	Apidae	Bombus7	Female	5.0
3129	26-Apr-16	SB	5	Halictus	Halictidae	Halictus2	Female	1.2
3130	26-Apr-16	SB	5	Halictus	Halictidae	Halictus3	Female	1.8
3131	26-Apr-16	SB	5	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3132	26-Apr-16	SC	1	Andrena	Andrenidae	Andrena4	Female	2.4
3133	26-Apr-16	SC	1	Andrena	Andrenidae	Andrena5	Female	2.6
3134	26-Apr-16	SC	1	Andrena	Andrenidae	Andrena6	Female	3.1
3135	26-Apr-16	SC	1	Halictus	Halictidae	Halictus2	Female	1.3
3136	26-Apr-16	SC	1	Halictus	Halictidae	Halictus2	Female	1.3
3137	26-Apr-16	SC	1	Halictus	Halictidae	Halictus3	Female	1.6
3138	26-Apr-16	SC	1	Lasioglossum	Halictidae	Lasioglossum4	Male	2.0
3139	26-Apr-16	SC	1	Melitta	Melittidae	Melitta3	Female	1.7
3140	26-Apr-16	SC	1	Nomada	Apidae	Nomada1	Male	0.9
3141	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena3	Male	1.7
3142	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena4	Male	2.1
3143	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena4	Male	2.1
3144	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena4	Female	2.1
3145	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena4	Female	2.4
3146	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena5	Female	2.6
3147	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena5	Female	2.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3148	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena5	Female	2.8
3149	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena5	Female	2.9
3150	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena5	Female	2.9
3151	26-Apr-16	SC	2	Andrena	Andrenidae	Andrena6	Female	3.0
3152	26-Apr-16	SC	2	Eucera	Apidae	Eucera5	Female	2.6
3153	26-Apr-16	SC	2	Halictus	Halictidae	Halictus2	Female	1.2
3154	26-Apr-16	SC	2	Halictus	Halictidae	Halictus2	Female	1.3
3155	26-Apr-16	SC	2	Halictus	Halictidae	Halictus2	Female	1.3
3156	26-Apr-16	SC	2	Halictus	Halictidae	Halictus2	Female	1.4
3157	26-Apr-16	SC	2	Halictus	Halictidae	Halictus3	Female	1.9
3158	26-Apr-16	SC	2	Melitta	Melittidae	Melitta2	Female	1.3
3159	26-Apr-16	SC	2	Osmia	Megachilidae	Osmia4	Male	2.2
3160	26-Apr-16	SC	3	Andrena	Andrenidae	Andrena3	Male	1.7
3161	26-Apr-16	SC	3	Andrena	Andrenidae	Andrena4	Male	2.0
3162	26-Apr-16	SC	3	Eucera	Apidae	Eucera5	Male	2.8
3163	26-Apr-16	SC	3	Eucera	Apidae	Eucera5	Male	2.9
3164	26-Apr-16	SC	3	Eucera	Apidae	Eucera6	Male	3.0
3165	26-Apr-16	SC	3	Eucera	Apidae	Eucera6	Male	3.4
3166	26-Apr-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.2
3167	26-Apr-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.2
3168	26-Apr-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.2
3169	26-Apr-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.2
3170	26-Apr-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.2
3171	26-Apr-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.3
3172	26-Apr-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.3
3173	26-Apr-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.4
3174	26-Apr-16	SC	3	Halictus	Halictidae	Halictus3	Female	1.8
3175	26-Apr-16	SC	3	Halictus	Halictidae	Halictus4	Female	2.2
3176	26-Apr-16	SC	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
3177	26-Apr-16	SC	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.7
3178	26-Apr-16	SC	3	Osmia	Megachilidae	Osmia5	Male	2.6
3179	26-Apr-16	SC	3	Osmia	Megachilidae	Osmia6	Female	3.0
3180	26-Apr-16	SC	3	Panurgus	Andrenidae	Panurgus5	Female	2.5
3181	26-Apr-16	SC	4	Andrena	Andrenidae	Andrena4	Female	2.1
3182	26-Apr-16	SC	4	Andrena	Andrenidae	Andrena4	Female	2.3
3183	26-Apr-16	SC	4	Andrena	Andrenidae	Andrena4	Female	2.4
3184	26-Apr-16	SC	4	Andrena	Andrenidae	Andrena5	Female	2.5
3185	26-Apr-16	SC	4	Andrena	Andrenidae	Andrena5	Female	2.5
3186	26-Apr-16	SC	4	Halictus	Halictidae	Halictus2	Female	1.0
3187	26-Apr-16	SC	4	Halictus	Halictidae	Halictus2	Female	1.4
3188	26-Apr-16	SC	4	Halictus	Halictidae	Halictus2	Female	1.4
3189	26-Apr-16	SC	4	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3190	26-Apr-16	SC	4	Halictus	Halictidae	Halictus3	Female	1.5
3191	26-Apr-16	SC	4	Halictus	Halictidae	Halictus3	Female	1.7
3192	26-Apr-16	SC	5	Andrena	Andrenidae	Andrena5	Female	2.5
3193	26-Apr-16	SC	5	Andrena	Andrenidae	Andrena5	Female	2.6
3194	26-Apr-16	SC	5	Halictus	Halictidae	Halictus2	Female	1.2
3195	26-Apr-16	SC	5	Halictus	Halictidae	Halictus2	Female	1.3
3196	26-Apr-16	SC	5	Halictus	Halictidae	Halictus2	Female	1.4
3197	26-Apr-16	SC	5	Halictus	Halictidae	Halictus3	Female	1.5
3198	26-Apr-16	SD	1	Halictus	Halictidae	Halictus2	Female	1.0
3199	26-Apr-16	SD	1	Halictus	Halictidae	Halictus2	Female	1.1
3200	26-Apr-16	SD	1	Halictus	Halictidae	Halictus2	Female	1.1
3201	26-Apr-16	SD	1	Halictus	Halictidae	Halictus2	Female	1.1
3202	26-Apr-16	SD	1	Halictus	Halictidae	Halictus2	Female	1.3
3203	26-Apr-16	SD	2	Halictus	Halictidae	Halictus2	Female	1.1
3204	26-Apr-16	SD	2	Panurgus	Andrenidae	Panurgus7	Female	3.7
3205	26-Apr-16	SD	3	Halictus	Halictidae	Halictus2	Female	1.1
3206	26-Apr-16	SD	3	Panurgus	Andrenidae	Panurgus7	Female	3.6
3207	26-Apr-16	SD	3	Panurgus	Andrenidae	Panurgus7	Female	3.6
3208	26-Apr-16	SD	4	Halictus	Halictidae	Halictus2	Female	1.2
3209	26-Apr-16	SD	5	Halictus	Halictidae	Halictus2	Female	1.2
3210	26-Apr-16	SD	5	Halictus	Halictidae	Halictus2	Female	1.2
3211	26-Apr-16	SD	5	Halictus	Halictidae	Halictus2	Female	1.2
3212	26-Apr-16	SE	1	Andrena	Andrenidae	Andrena5	Female	2.8
3213	26-Apr-16	SE	1	Andrena	Andrenidae	Andrena6	Female	3.2
3214	26-Apr-16	SE	1	Halictus	Halictidae	Halictus3	Female	1.8
3215	26-Apr-16	SE	1	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3216	26-Apr-16	SE	2	Andrena	Andrenidae	Andrena4	Female	2.3
3217	26-Apr-16	SE	2	Halictus	Halictidae	Halictus4	Female	2.1
3218	26-Apr-16	SE	2	Halictus	Halictidae	Halictus4	Female	2.2
3219	26-Apr-16	SE	2	Melitta	Melittidae	Melitta4	Female	2.2
3220	26-Apr-16	SE	3	Andrena	Andrenidae	Andrena6	Female	3.0
3221	26-Apr-16	SE	3	Osmia	Megachilidae	Osmia5	Male	2.9
3222	26-Apr-16	SE	4	Halictus	Halictidae	Halictus2	Female	1.0
3223	26-Apr-16	SE	4	Halictus	Halictidae	Halictus2	Female	1.4
3224	26-Apr-16	SE	4	Panurgus	Andrenidae	Panurgus7	Female	3.5
3225	19-May-16	SA	1	Panurgus	Andrenidae	Panurgus6	Female	3.3
3226	19-May-16	SA	2	Andrena	Andrenidae	Andrena3	Female	1.5
3227	19-May-16	SA	2	Halictus	Halictidae	Halictus2	Female	1.2
3228	19-May-16	SA	2	Halictus	Halictidae	Halictus3	Female	1.5
3229	19-May-16	SA	3	Andrena	Andrenidae	Andrena5	Female	2.5
3230	19-May-16	SA	3	Halictus	Halictidae	Halictus2	Female	1.1
3231	19-May-16	SA	3	Osmia	Megachilidae	Osmia6	Female	3.0

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3232	19-May-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.7
3233	19-May-16	SB	2	Bombus	Apidae	Bombus6	Female	3.4
3234	19-May-16	SB	4	Bombus	Apidae	Bombus7	Female	4.5
3235	19-May-16	SC	2	Halictus	Halictidae	Halictus2	Female	1.4
3236	19-May-16	SC	2	Halictus	Halictidae	Halictus2	Female	1.4
3237	19-May-16	SC	3	Andrena	Andrenidae	Andrena4	Female	2.3
3238	19-May-16	SC	3	Osmia	Megachilidae	Osmia4	Male	2.3
3239	19-May-16	SC	4	Osmia	Megachilidae	Osmia4	Male	2.3
3240	19-May-16	SC	5	Andrena	Andrenidae	Andrena5	Female	2.7
3241	9-Jun-16	SA	1	Eucera	Apidae	Eucera7	Male	3.7
3242	9-Jun-16	SA	1	Halictus	Halictidae	Halictus3	Female	1.5
3243	9-Jun-16	SA	1	Halictus	Halictidae	Halictus3	Female	1.5
3244	9-Jun-16	SA	1	Melitta	Melittidae	Melitta3	Female	1.8
3245	9-Jun-16	SA	1	Nomada	Apidae	Nomada3	Female	1.6
3246	9-Jun-16	SA	2	Halictus	Halictidae	Halictus3	Female	1.5
3247	9-Jun-16	SA	2	Panurgus	Andrenidae	Panurgus3	Male	1.5
3248	9-Jun-16	SA	3	Halictus	Halictidae	Halictus2	Female	1.0
3249	9-Jun-16	SA	4	Bombus	Apidae	Bombus7	Female	4.2
3250	9-Jun-16	SA	5	Bombus	Apidae	Bombus7	Female	3.9
3251	9-Jun-16	SA	5	Halictus	Halictidae	Halictus3	Female	1.5
3252	9-Jun-16	SA	5	Halictus	Halictidae	Halictus3	Female	1.6
3253	9-Jun-16	SB	1	Andrena	Andrenidae	Andrena4	Female	2.0
3254	9-Jun-16	SB	1	Bombus	Apidae	Bombus5	Female	2.7
3255	9-Jun-16	SB	1	Bombus	Apidae	Bombus6	Female	3.2
3256	9-Jun-16	SB	1	Bombus	Apidae	Bombus6	Female	3.2
3257	9-Jun-16	SB	1	Bombus	Apidae	Bombus7	Female	4.5
3258	9-Jun-16	SB	1	Dasypoda	Melittidae	Dasypoda7	Female	3.5
3259	9-Jun-16	SB	3	Bombus	Apidae	Bombus7	Female	4.7
3260	9-Jun-16	SB	3	Bombus	Apidae	Bombus7	Female	5.0
3261	9-Jun-16	SB	3	Panurgus	Andrenidae	Panurgus3	Male	1.7
3262	9-Jun-16	SB	4	Andrena	Andrenidae	Andrena4	Male	2.0
3263	9-Jun-16	SB	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
3264	9-Jun-16	SB	5	Halictus	Halictidae	Halictus2	Female	1.3
3265	9-Jun-16	SB	5	Xylocopa	Apidae	Xylocopa7	Female	5.8
3266	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3267	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3268	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3269	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.6
3270	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
3271	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
3272	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
3273	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.7

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3274	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
3275	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
3276	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
3277	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
3278	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
3279	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Male	1.8
3280	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.8
3281	9-Jun-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.9
3282	9-Jun-16	SC	2	Halictus	Halictidae	Halictus2	Female	1.4
3283	9-Jun-16	SC	2	Heriades	Megachilidae	Heriades3	Female	1.5
3284	9-Jun-16	SC	2	Osmia	Megachilidae	Osmia5	Female	2.8
3285	9-Jun-16	SC	2	Panurgus	Andrenidae	Panurgus3	Female	1.5
3286	9-Jun-16	SC	2	Panurgus	Andrenidae	Panurgus3	Female	1.6
3287	9-Jun-16	SC	2	Panurgus	Andrenidae	Panurgus3	Female	1.7
3288	9-Jun-16	SC	2	Panurgus	Andrenidae	Panurgus3	Female	1.8
3289	9-Jun-16	SC	2	Panurgus	Andrenidae	Panurgus3	Female	1.9
3290	9-Jun-16	SC	3	Halictus	Halictidae	Halictus1	Female	0.8
3291	9-Jun-16	SC	3	Halictus	Halictidae	Halictus1	Female	0.9
3292	9-Jun-16	SC	3	Panurgus	Andrenidae	Panurgus3	Female	1.5
3293	9-Jun-16	SC	3	Panurgus	Andrenidae	Panurgus3	Female	1.5
3294	9-Jun-16	SC	3	Panurgus	Andrenidae	Panurgus3	Female	1.8
3295	9-Jun-16	SC	3	Stelis	Megachilidae	Stelis2	Female	1.3
3296	9-Jun-16	SC	3	Stelis	Megachilidae	Stelis2	Female	1.3
3297	9-Jun-16	SC	4	Nomada	Apidae	Nomada3	Male	1.6
3298	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.5
3299	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.5
3300	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.6
3301	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.6
3302	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.6
3303	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.6
3304	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
3305	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
3306	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
3307	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
3308	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
3309	9-Jun-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
3310	9-Jun-16	SC	5	Andrena	Andrenidae	Andrena6	Female	3.0
3311	9-Jun-16	SC	5	Halictus	Halictidae	Halictus3	Female	1.5
3312	9-Jun-16	SC	5	Osmia	Megachilidae	Osmia5	Male	2.9
3313	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.5
3314	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.6
3315	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3316	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.6
3317	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.6
3318	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.6
3319	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.6
3320	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
3321	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
3322	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
3323	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
3324	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.7
3325	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
3326	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
3327	9-Jun-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
3328	9-Jun-16	SD	1	Halictus	Halictidae	Halictus2	Female	1.4
3329	9-Jun-16	SD	2	Osmia	Megachilidae	Osmia5	Female	2.7
3330	9-Jun-16	SD	3	Bombus	Apidae	Bombus7	Female	3.6
3331	9-Jun-16	SD	3	Lasioglossum	Halictidae	Lasioglossum3	Female	1.6
3332	9-Jun-16	SD	4	Halictus	Halictidae	Halictus2	Female	1.0
3333	9-Jun-16	SD	4	Halictus	Halictidae	Halictus3	Female	1.5
3334	9-Jun-16	SD	4	Nomada	Apidae	Nomada2	Female	1.0
3335	9-Jun-16	SE	3	Bombus	Apidae	Bombus7	Female	4.3
3336	9-Jun-16	SE	3	Dasypoda	Melittidae	Dasypoda7	Female	3.6
3337	9-Jun-16	SE	3	Panurgus	Andrenidae	Panurgus3	Female	1.8
3338	9-Jun-16	SE	4	Bombus	Apidae	Bombus7	Female	4.2
3339	9-Jun-16	SE	4	Halictus	Halictidae	Halictus2	Female	1.1
3340	9-Jun-16	SE	4	Stelis	Megachilidae	Stelis6	Female	3.3
3341	9-Jun-16	SE	5	Bombus	Apidae	Bombus7	Female	4.4
3342	9-Jun-16	SE	5	Eucera	Apidae	Eucera6	Male	3.0
3343	8-Jul-16	SA	1	Halictus	Halictidae	Halictus3	Female	1.5
3344	8-Jul-16	SA	2	Halictus	Halictidae	Halictus2	Female	1.3
3345	8-Jul-16	SA	2	Halictus	Halictidae	Halictus3	Female	1.5
3346	8-Jul-16	SA	2	Halictus	Halictidae	Halictus3	Female	1.7
3347	8-Jul-16	SA	2	Lasioglossum	Halictidae	Lasioglossum3	Female	1.5
3348	8-Jul-16	SA	2	Osmia	Megachilidae	Osmia6	Male	3.0
3349	8-Jul-16	SA	3	Eucera	Apidae	Eucera5	Female	2.8
3350	8-Jul-16	SA	3	Halictus	Halictidae	Halictus2	Female	1.0
3351	8-Jul-16	SA	3	Halictus	Halictidae	Halictus2	Female	1.1
3352	8-Jul-16	SA	3	Heriades	Megachilidae	Heriades2	Female	1.2
3353	8-Jul-16	SA	5	Andrena	Andrenidae	Andrena4	Female	2.4
3354	8-Jul-16	SA	5	Halictus	Halictidae	Halictus2	Female	1.2
3355	8-Jul-16	SA	5	Lasioglossum	Halictidae	Lasioglossum4	Female	2.1
3356	8-Jul-16	SA	5	Nomada	Apidae	Nomada2	Male	1.4
3357	8-Jul-16	SB	1	Andrena	Andrenidae	Andrena3	Male	1.7

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3358	8-Jul-16	SB	1	Andrena	Andrenidae	Andrena3	Male	1.9
3359	8-Jul-16	SB	1	Bombus	Apidae	Bombus7	Female	3.5
3360	8-Jul-16	SB	1	Halictus	Halictidae	Halictus1	Female	0.8
3361	8-Jul-16	SB	1	Halictus	Halictidae	Halictus1	Female	0.8
3362	8-Jul-16	SB	1	Halictus	Halictidae	Halictus2	Female	1.0
3363	8-Jul-16	SB	1	Halictus	Halictidae	Halictus2	Female	1.0
3364	8-Jul-16	SB	1	Halictus	Halictidae	Halictus3	Female	1.6
3365	8-Jul-16	SB	2	Halictus	Halictidae	Halictus2	Female	1.1
3366	8-Jul-16	SB	2	Melitta	Melittidae	Melitta4	Female	2.4
3367	8-Jul-16	SB	2	Nomada	Apidae	Nomada1	Male	0.8
3368	8-Jul-16	SB	3	Andrena	Andrenidae	Andrena4	Female	2.3
3369	8-Jul-16	SB	3	Halictus	Halictidae	Halictus2	Female	1.1
3370	8-Jul-16	SB	4	Andrena	Andrenidae	Andrena4	Female	2.2
3371	8-Jul-16	SB	4	Andrena	Andrenidae	Andrena5	Female	2.6
3372	8-Jul-16	SB	4	Bombus	Apidae	Bombus7	Female	4.3
3373	8-Jul-16	SB	4	Bombus	Apidae	Bombus7	Female	4.3
3374	8-Jul-16	SB	4	Halictus	Halictidae	Halictus2	Female	1.0
3375	8-Jul-16	SB	4	Halictus	Halictidae	Halictus2	Female	1.0
3376	8-Jul-16	SB	4	Halictus	Halictidae	Halictus2	Female	1.0
3377	8-Jul-16	SB	4	Halictus	Halictidae	Halictus2	Female	1.1
3378	8-Jul-16	SB	4	Halictus	Halictidae	Halictus2	Female	1.1
3379	8-Jul-16	SB	4	Halictus	Halictidae	Halictus2	Female	1.1
3380	8-Jul-16	SB	4	Halictus	Halictidae	Halictus2	Female	1.1
3381	8-Jul-16	SB	4	Halictus	Halictidae	Halictus2	Female	1.1
3382	8-Jul-16	SB	4	Nomada	Apidae	Nomada2	Male	1.0
3383	8-Jul-16	SB	4	Nomada	Apidae	Nomada2	Male	1.0
3384	8-Jul-16	SB	4	Panurgus	Andrenidae	Panurgus3	Female	1.5
3385	8-Jul-16	SB	5	Andrena	Andrenidae	Andrena3	Male	1.8
3386	8-Jul-16	SB	5	Andrena	Andrenidae	Andrena4	Female	2.2
3387	8-Jul-16	SB	5	Andrena	Andrenidae	Andrena4	Female	2.2
3388	8-Jul-16	SB	5	Andrena	Andrenidae	Andrena4	Female	2.4
3389	8-Jul-16	SB	5	Andrena	Andrenidae	Andrena6	Female	3.1
3390	8-Jul-16	SB	5	Bombus	Apidae	Bombus7	Female	3.6
3391	8-Jul-16	SB	5	Bombus	Apidae	Bombus7	Female	4.3
3392	8-Jul-16	SB	5	Bombus	Apidae	Bombus7	Female	4.3
3393	8-Jul-16	SB	5	Halictus	Halictidae	Halictus1	Female	0.8
3394	8-Jul-16	SB	5	Hoplitis	Megachilidae	Hoplitis2	Male	1.2
3395	8-Jul-16	SB	5	Panurgus	Andrenidae	Panurgus3	Female	1.5
3396	8-Jul-16	SC	1	Halictus	Halictidae	Halictus1	Female	0.8
3397	8-Jul-16	SC	1	Halictus	Halictidae	Halictus1	Female	0.8
3398	8-Jul-16	SC	1	Halictus	Halictidae	Halictus1	Female	0.9
3399	8-Jul-16	SC	1	Halictus	Halictidae	Halictus2	Female	1.4

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3400	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3401	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3402	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3403	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3404	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3405	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.5
3406	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.6
3407	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.7
3408	8-Jul-16	SC	1	Panurgus	Andrenidae	Panurgus3	Female	1.9
3409	8-Jul-16	SC	2	Andrena	Andrenidae	Andrena4	Female	2.4
3410	8-Jul-16	SC	2	Andrena	Andrenidae	Andrena4	Female	2.4
3411	8-Jul-16	SC	2	Andrena	Andrenidae	Andrena4	Female	2.4
3412	8-Jul-16	SC	2	Panurgus	Andrenidae	Panurgus3	Female	1.5
3413	8-Jul-16	SC	2	Panurgus	Andrenidae	Panurgus3	Male	1.7
3414	8-Jul-16	SC	3	Halictus	Halictidae	Halictus1	Female	0.9
3415	8-Jul-16	SC	3	Halictus	Halictidae	Halictus2	Female	1.4
3416	8-Jul-16	SC	3	Halictus	Halictidae	Halictus3	Female	1.5
3417	8-Jul-16	SC	3	Halictus	Halictidae	Halictus3	Female	1.5
3418	8-Jul-16	SC	3	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
3419	8-Jul-16	SC	3	Megachile	Megachilidae	Megachile5	Male	2.9
3420	8-Jul-16	SC	3	Megachile	Megachilidae	Megachile6	Female	3.4
3421	8-Jul-16	SC	3	Panurgus	Andrenidae	Panurgus3	Female	1.7
3422	8-Jul-16	SC	3	Panurgus	Andrenidae	Panurgus3	Female	1.7
3423	8-Jul-16	SC	3	Panurgus	Andrenidae	Panurgus3	Female	1.7
3424	8-Jul-16	SC	4	Halictus	Halictidae	Halictus3	Female	1.5
3425	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus2	Female	1.4
3426	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus2	Female	1.4
3427	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.5
3428	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.6
3429	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
3430	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
3431	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.7
3432	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
3433	8-Jul-16	SC	4	Panurgus	Andrenidae	Panurgus3	Female	1.8
3434	8-Jul-16	SC	5	Andrena	Andrenidae	Andrena2	Male	1.0
3435	8-Jul-16	SC	5	Andrena	Andrenidae	Andrena4	Female	2.4
3436	8-Jul-16	SC	5	Andrena	Andrenidae	Andrena4	Female	2.4
3437	8-Jul-16	SC	5	Bombus	Apidae	Bombus7	Female	5.8
3438	8-Jul-16	SC	5	Halictus	Halictidae	Halictus3	Female	1.5
3439	8-Jul-16	SC	5	Halictus	Halictidae	Halictus3	Female	1.7
3440	8-Jul-16	SC	5	Halictus	Halictidae	Halictus4	Female	2.0
3441	8-Jul-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.6

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3442	8-Jul-16	SC	5	Panurgus	Andrenidae	Panurgus3	Female	1.8
3443	8-Jul-16	SC	5	Panurgus	Andrenidae	Panurgus5	Female	2.6
3444	8-Jul-16	SD	1	Andrena	Andrenidae	Andrena4	Male	2.1
3445	8-Jul-16	SD	1	Bombus	Apidae	Bombus7	Female	3.7
3446	8-Jul-16	SD	1	Dasypoda	Melittidae	Dasypoda5	Male	2.7
3447	8-Jul-16	SD	1	Halictus	Halictidae	Halictus3	Female	1.5
3448	8-Jul-16	SD	2	Bombus	Apidae	Bombus6	Female	3.3
3449	8-Jul-16	SD	2	Bombus	Apidae	Bombus6	Female	3.4
3450	8-Jul-16	SD	2	Halictus	Halictidae	Halictus1	Female	0.9
3451	8-Jul-16	SD	2	Halictus	Halictidae	Halictus2	Female	1.0
3452	8-Jul-16	SD	2	Halictus	Halictidae	Halictus2	Female	1.1
3453	8-Jul-16	SD	2	Halictus	Halictidae	Halictus3	Female	1.5
3454	8-Jul-16	SD	3	Bombus	Apidae	Bombus7	Female	4.2
3455	8-Jul-16	SD	3	Bombus	Apidae	Bombus7	Female	6.3
3456	8-Jul-16	SD	3	Halictus	Halictidae	Halictus3	Female	1.7
3457	8-Jul-16	SD	4	Bombus	Apidae	Bombus7	Female	4.2
3458	8-Jul-16	SD	4	Halictus	Halictidae	Halictus1	Female	0.8
3459	8-Jul-16	SD	4	Halictus	Halictidae	Halictus2	Female	1.1
3460	8-Jul-16	SD	4	Halictus	Halictidae	Halictus3	Female	1.5
3461	8-Jul-16	SD	4	Halictus	Halictidae	Halictus3	Female	1.6
3462	8-Jul-16	SD	4	Xylocopa	Apidae	Xylocopa7	Female	6.3
3463	8-Jul-16	SD	5	Bombus	Apidae	Bombus7	Female	3.5
3464	8-Jul-16	SD	5	Halictus	Halictidae	Halictus3	Female	1.5
3465	8-Jul-16	SD	5	Halictus	Halictidae	Halictus3	Female	1.5
3466	8-Jul-16	SD	5	Halictus	Halictidae	Halictus3	Female	1.5
3467	8-Jul-16	SD	5	Halictus	Halictidae	Halictus3	Female	1.6
3468	8-Jul-16	SD	5	Halictus	Halictidae	Halictus3	Female	1.6
3469	8-Jul-16	SD	5	Halictus	Halictidae	Halictus4	Female	2.0
3470	8-Jul-16	SD	5	Halictus	Halictidae	Halictus4	Male	2.1
3471	8-Jul-16	SD	5	Lasioglossum	Halictidae	Lasioglossum2	Female	1.4
3472	8-Jul-16	SD	5	Megachile	Megachilidae	Megachile6	Female	3.1
3473	8-Jul-16	SE	1	Andrena	Andrenidae	Andrena4	Male	2.1
3474	8-Jul-16	SE	1	Andrena	Andrenidae	Andrena5	Female	2.6
3475	8-Jul-16	SE	1	Halictus	Halictidae	Halictus4	Female	2.3
3476	8-Jul-16	SE	1	Hoplitis	Megachilidae	Hoplitis3	Female	1.6
3477	8-Jul-16	SE	1	Melitta	Melittidae	Melitta2	Male	1.1
3478	8-Jul-16	SE	1	Nomada	Apidae	Nomada2	Female	1.0
3479	8-Jul-16	SE	1	Panurgus	Andrenidae	Panurgus3	Female	1.6
3480	8-Jul-16	SE	2	Andrena	Andrenidae	Andrena4	Female	2.3
3481	8-Jul-16	SE	2	Andrena	Andrenidae	Andrena5	Female	2.6
3482	8-Jul-16	SE	2	Andrena	Andrenidae	Andrena6	Female	3.0
3483	8-Jul-16	SE	2	Halictus	Halictidae	Halictus3	Female	1.9

	Date	Site	Quadrat	Genus	Family	Morphospecies	Sex	ITD (mm)
3484	8-Jul-16	SE	3	Halictus	Halictidae	Halictus2	Female	1.1
3485	8-Jul-16	SE	4	Andrena	Andrenidae	Andrena5	Female	2.7
3486	8-Jul-16	SE	4	Andrena	Andrenidae	Andrena6	Female	3.0
3487	8-Jul-16	SE	4	Halictus	Halictidae	Halictus2	Female	1.0
3488	8-Jul-16	SE	5	Andrena	Andrenidae	Andrena3	Male	1.8
3489	8-Jul-16	SE	5	Halictus	Halictidae	Halictus2	Female	1.2

APPENDIX G

Visual Observations

Table A. All wild bees observed foraging on open flowers.

Date	Site	Observation Plot	Size/Genus	#	Plant Species
15-May-14	A3	2	Small	1	Papaver rhoeas
15-May-14	A3	3	Small	2	Anacyclus clavatus
15-May-14	A3	5	Small	2	Anacyclus clavatus
15-May-14	G4	3	Small	1	Papaver rhoeas
15-May-14	G4	4	Small	1	Papaver rhoeas
15-May-14	G4	5	Small	3	Papaver rhoeas
15-May-14	G5	3	Medium	5	Rosa canina
16-May-14	G1	1	Medium	1	Papaver rhoeas
16-May-14	G1	1	Small	2	Sonchus oleraceus
16-May-14	G6	1	Bombus	1	Jasminum fruticans
16-May-14	G6	5	Small	1	Erucastrum nasturtiifolium
16-May-14	G7	1	Small	1	Anacyclus clavatus
16-May-14	G8	1	Medium	1	Erucastrum nasturtiifolium
16-May-14	G8	1	Small	5	Erucastrum nasturtiifolium
16-May-14	G8	2	Small	1	Papaver rhoeas
16-May-14	G8	3	Small	3	Erucastrum nasturtiifolium
22-May-14	M	5	Medium	1	Veronica persica
22-May-14	P1	1	Bombus	1	Papaver rhoeas
22-May-14	P1	1	Medium	4	Papaver rhoeas
22-May-14	P1	2	Bombus	1	Papaver rhoeas
22-May-14	P1	4	Bombus	3	Papaver rhoeas
22-May-14	P1	4	Medium	1	Papaver rhoeas
22-May-14	P1	5	Medium	1	Papaver rhoeas
22-May-14	P2	5	Small	1	Crepis sp.
10-Jun-14	A2	1	Medium	1	Papaver rhoeas
10-Jun-14	A2	5	Medium	1	Malva sylvestris
10-Jun-14	A2	5	Small	10	Malva sylvestris
10-Jun-14	A3	2	Medium	1	Hypericum perforatum
10-Jun-14	A3	3	Small	3	Scabiosa atropurpurea
10-Jun-14	A3	4	Medium	3	Seseli tortuosum
10-Jun-14	A3	4	Small	1	Seseli tortuosum
10-Jun-14	G2	5	Medium	2	Reseda lutea
10-Jun-14	G2	5	Small	1	Reseda lutea
10-Jun-14	G4	2	Medium	1	Scabiosa atropurpurea
10-Jun-14	G4	2	Small	1	Anacyclus clavatus
12-Jun-14	G1	2	Medium	1	Papaver rhoeas
12-Jun-14	G1	3	Medium	2	Bryonia dioica
12-Jun-14	G1	3	Small	8	Bryonia dioica
12-Jun-14	G1	3	Small	1	Diplotaxis erucoides

Date	Site	Observation Plot	Size/Genus	#	Plant Species
12-Jun-14	G1	3	Small	2	Papaver rhoeas
12-Jun-14	G5	4	Medium	1	Convolvulus arvensis
12-Jun-14	G5	4	Small	1	Convolvulus arvensis
12-Jun-14	G6	3	Medium	1	Centaurea aspera
12-Jun-14	G8	1	Bombus	2	Echium vulgare
12-Jun-14	G8	1	Medium	2	Hypericum perforatum
12-Jun-14	G8	1	Medium	4	Malva sylvestris
12-Jun-14	G8	1	Small	1	Erucastrum nasturtiifolium
12-Jun-14	G8	1	Small	1	Verbascum pulverulentum
12-Jun-14	G8	2	Medium	3	Erucastrum nasturtiifolium
12-Jun-14	G8	2	Medium	2	Reseda lutea
12-Jun-14	G8	2	Small	3	Erucastrum nasturtiifolium
19-Jun-14	CA	1	Small	1	Convolvulus arvensis
19-Jun-14	CA	1	Small	1	Papaver rhoeas
19-Jun-14	CA	1	Small	2	Veronica persica
19-Jun-14	CA	2	Small	2	Papaver rhoeas
19-Jun-14	CA	3	Small	1	Convolvulus arvensis
19-Jun-14	CA	4	Small	1	Convolvulus arvensis
19-Jun-14	CA	5	Medium	1	Convolvulus arvensis
19-Jun-14	CO	2	Bombus	2	Phlomis herba-venti
19-Jun-14	CO	4	Medium	1	Daucus carota
19-Jun-14	CO	5	Bombus	1	Malva sylvestris
19-Jun-14	CO	5	Medium	1	Anthemis cotula
19-Jun-14	M	1	Medium	2	Sambucus nigra
19-Jun-14	M	3	Bombus	6	Ligustrum vulgare
19-Jun-14	M	3	Bombus	5	Malva sylvestris
19-Jun-14	M	3	Medium	10	Ligustrum vulgare
19-Jun-14	M	3	Medium	1	Malva sylvestris
19-Jun-14	M	3	Medium	2	Psoralea bituminosa
19-Jun-14	M	4	Bombus	3	Malva sylvestris
19-Jun-14	M	5	Medium	40	Ligustrum vulgare
19-Jun-14	M	5	Small	1	Torilis arvensis
19-Jun-14	P2	2	Bombus	1	Knautia dipsacifolia
19-Jun-14	P2	2	Bombus	1	Trifolium pratense
19-Jun-14	P2	2	Medium	1	Knautia dipsacifolia
19-Jun-14	P2	3	Medium	2	Knautia dipsacifolia
19-Jun-14	P2	3	Medium	1	Onobrychis saxatilis
19-Jun-14	P2	4	Bombus	10	Rubus sp.
19-Jun-14	P2	4	Medium	10	Rubus sp.
8-Jul-14	A2	5	Small	1	Malva sylvestris
8-Jul-14	G1	1	Medium	1	Sonchus oleraceus
8-Jul-14	G1	2	Medium	2	Sonchus oleraceus
8-Jul-14	G1	2	Small	3	Sonchus oleraceus

Date	Site	Observation Plot	Size/Genus	#	Plant Species
8-Jul-14	G1	3	Medium	1	Papaver rhoeas
8-Jul-14	G1	3	Medium	4	Sonchus oleraceus
8-Jul-14	G1	3	Small	2	Sonchus oleraceus
8-Jul-14	G1	4	Medium	1	Convolvulus arvensis
8-Jul-14	G1	4	Medium	1	Crepis biennis
8-Jul-14	G1	5	Medium	3	Sonchus oleraceus
8-Jul-14	G1	5	Small	1	Sonchus oleraceus
8-Jul-14	G4	2	Medium	2	Scabiosa atropurpurea
8-Jul-14	G5	1	Medium	1	Centaurea linifolia
8-Jul-14	G5	1	Medium	2	Cirsium arvense
8-Jul-14	G6	3	Medium	1	Petroselinum crispum
8-Jul-14	G8	1	Bombus	2	Echium vulgare
8-Jul-14	G8	1	Bombus	1	Hypericum perforatum
8-Jul-14	G8	1	Medium	3	Echium vulgare
8-Jul-14	G8	1	Medium	2	Hypericum perforatum
8-Jul-14	G8	1	Medium	4	Malva sylvestris
8-Jul-14	G8	1	Medium	1	Verbascum pulverulentum
8-Jul-14	G8	1	Small	1	Malva sylvestris
8-Jul-14	G8	2	Medium	1	Hypericum perforatum
8-Jul-14	G8	2	Small	5	Daucus carota
8-Jul-14	G8	3	Medium	1	Centaurea aspera
8-Jul-14	G8	3	Medium	1	Convolvulus arvensis
8-Jul-14	G8	3	Small	1	Centaurea aspera
8-Jul-14	G8	3	Small	1	Convolvulus arvensis
8-Jul-14	G8	3	Small	1	Daucus carota
8-Jul-14	G9	2	Bombus	1	Malva sylvestris
8-Jul-14	G9	2	Small	2	Malva sylvestris
8-Jul-14	G9	3	Small	3	Crepis pulchra
8-Jul-14	G9	3	Small	3	Diplotaxis erucoides
9-Jul-14	CO	1	Medium	1	Cirsium monspessulanum
9-Jul-14	CO	1	Medium	1	Daucus carota
9-Jul-14	CO	1	Small	1	Tordylium maximum
9-Jul-14	CO	5	Small	1	Convolvulus arvensis
9-Jul-14	M	3	Bombus	3	Malva sylvestris
9-Jul-14	M	4	Bombus	3	Malva sylvestris
9-Jul-14	M	4	Bombus	5	Teucrium chamaedrys
9-Jul-14	M	4	Medium	1	Cirsium arvense
9-Jul-14	M	4	Medium	4	Malva sylvestris
9-Jul-14	M	4	Medium	1	Psoralea bituminosa
9-Jul-14	P2	1	Small	1	Plantago lanceolata
9-Jul-14	P2	3	Bombus	1	Knautia dipsacifolia
9-Jul-14	P2	3	Bombus	1	Rubus sp.
9-Jul-14	P2	4	Bombus	2	Rubus sp.

Date	Site	Observation Plot	Size/Genus	#	Plant Species
30-Jul-14	G4	2	Medium	3	Chondrilla juncea
30-Jul-14	G4	2	Medium	1	Convolvulus arvensis
30-Jul-14	G4	2	Small	1	Convolvulus arvensis
30-Jul-14	G4	4	Small	1	Convolvulus arvensis
30-Jul-14	G4	5	Small	1	Chondrilla juncea
31-Jul-14	G1	1	Small	2	Convolvulus arvensis
31-Jul-14	G1	5	Small	1	Convolvulus arvensis
31-Jul-14	G6	2	Medium	1	Petroselinum crispum
31-Jul-14	G6	3	Medium	1	Sedum sediforme
31-Jul-14	G6	3	Small	1	Sedum sediforme
31-Jul-14	G6	4	Medium	1	Sedum sediforme
31-Jul-14	G7	1	Medium	1	Sedum sediforme
31-Jul-14	G7	5	Medium	1	Sedum sediforme
31-Jul-14	G8	2	Small	1	Daucus carota
31-Jul-14	G8	3	Medium	4	Centaurea aspera
31-Jul-14	G8	3	Medium	1	Convolvulus arvensis
31-Jul-14	G9	2	Medium	1	Portulaca oleracea
1-Aug-14	CA	3	Small	3	Cirsium arvense
1-Aug-14	CO	1	Medium	4	Carduus tenuiflorus
1-Aug-14	CO	1	Small	2	Carduus tenuiflorus
1-Aug-14	CO	2	Small	1	Daucus carota
1-Aug-14	CO	3	Small	2	Daucus carota
1-Aug-14	CO	5	Bombus	3	Echium plantagineum
1-Aug-14	CO	5	Bombus	1	Malva sylvestris
1-Aug-14	CO	5	Medium	3	Carduus tenuiflorus
1-Aug-14	M	3	Bombus	5	Malva sylvestris
1-Aug-14	M	4	Bombus	9	Malva sylvestris
1-Aug-14	M	4	Small	1	Polygonum convolvulus
1-Aug-14	M	5	Bombus	1	Malva sylvestris
1-Aug-14	P2	3	Bombus	2	Trifolium pratense
1-Aug-14	P2	3	Medium	1	Onobrychis saxatilis
1-Aug-14	P2	4	Bombus	1	Rubus sp.
14-May-15	S2	1	Small	3	Carduus pycnocephalus
14-May-15	S4	5	Small	1	Euphorbia serrata
11-Jun-15	S5	1	Bombus	1	Rubus sp.
11-Jun-15	S5	1	Medium	1	Carduus pycnocephalus
11-Jun-15	S5	4	Bombus	1	Rubus sp.
12-Jun-15	S5	3	Medium	1	Centaurea Aspera
13-Jun-15	S5	5	Medium	3	Centaurea Aspera
14-Jun-15	S3	2	Medium	1	Torilis arvensis
15-Jun-15	S3	2	Medium	3	Torilis arvensis
16-Jun-15	S3	3	Medium	5	Torilis arvensis
17-Jun-15	S3	4	Medium	1	Torilis arvensis

Date	Site	Observation Plot	Size/Genus	#	Plant Species
18-Jun-15	S3	5	Medium	1	Torilis arvensis
19-Jun-15	S2	5	Medium	2	Dorycnium hirsutum
03-Jul-15	S2	1	Big	2	Malva sylvestris
03-Jul-15	S2	1	Small	1	Malva sylvestris
03-Jul-15	S2	1	Small	1	Malva sylvestris
03-Jul-15	S5	1	Small	3	Malva sylvestris
27-Jul-15	S2	1	Bombus	1	Malva sylvestris
27-Jul-15	S2	1	Medium	1	Malva sylvestris
27-Jul-15	S2	1	Small	1	Malva sylvestris
26-Apr-16	SC	1	Medium	1	Diplotaxis erucoides
26-Apr-16	SC	1	Medium	2	Diplotaxis erucoides
26-Apr-16	SC	2	Medium	2	Diplotaxis erucoides
26-Apr-16	SC	4	Medium	2	Diplotaxis erucoides
26-Apr-16	SC	4	Medium	1	Diplotaxis erucoides
19-May-16	SB	1	Medium	1	Fumaria officinalis
19-May-16	SC	1	Medium	1	Diplotaxis erucoides
19-May-16	SC	4	Medium	1	Papaver rhoeas
19-May-16	SC	4	Medium	1	Papaver rhoeas
19-May-16	SC	5	Medium	1	Cirsium vulgare
19-May-16	SD	1	Medium	1	Thymus vulgaris
19-May-16	SD	1	Medium	2	Thymus vulgaris
19-May-16	SD	3	Medium	1	Thymus vulgaris
9-Jun-16	SA	5	Medium	1	Torilis arvensis
9-Jun-16	SB	1	Bombus	1	Linum usitatissimum
9-Jun-16	SB	2	Bombus	10	Vicia villosa
9-Jun-16	SB	3	Medium	17	Vicia villosa
9-Jun-16	SB	4	Bombus	7	Vicia villosa
9-Jun-16	SB	5	Bombus	2	Bryonia dioica
9-Jun-16	SD	1	Medium	3	Convolvulus arvensis
9-Jun-16	SD	1	Medium	1	Crepis bursifolia
9-Jun-16	SD	2	Bombus	3	Vicia villosa
9-Jun-16	SD	2	Medium	1	Convolvulus arvensis
9-Jun-16	SD	2	Medium	3	Vicia villosa
9-Jun-16	SD	3	Bombus	8	Vicia villosa
9-Jun-16	SD	3	Medium	2	Vicia villosa
9-Jun-16	SD	4	Bombus	2	Vicia villosa
9-Jun-16	SD	4	Medium	1	Ranunculus bulbosus
9-Jun-16	SD	4	Medium	1	Vicia villosa
9-Jun-16	SD	5	Bombus	4	Vicia peregrina
9-Jun-16	SD	5	Medium	1	Campanula rapunculus
9-Jun-16	SD	5	Medium	3	Vicia peregrina
9-Jun-16	SE	1	Medium	1	Papaver rhoeas
9-Jun-16	SE	3	Bombus	1	Vicia villosa

Date	Site	Observation Plot	Size/Genus	#	Plant Species
9-Jun-16	SE	5	Medium	1	Bryonia dioica
9-Jun-16	SE	5	Medium	2	Geranium robertianum
8-Jul-16	SB	1	Bombus	2	Phlomis herba-venti
8-Jul-16	SB	1	Bombus	1	Torilis arvensis
8-Jul-16	SB	1	Medium	1	Torilis arvensis
8-Jul-16	SB	2	Bombus	1	Teucrium chamaedrys
8-Jul-16	SB	4	Medium	9	Achillea millefolium
8-Jul-16	SB	5	Bombus	8	Rubus sp.
8-Jul-16	SB	5	Medium	3	Campanula ranunculoides
8-Jul-16	SB	5	Medium	4	Rubus sp.
8-Jul-16	SD	1	Bombus	1	Sedum sediforme
8-Jul-16	SD	2	Bombus	1	Sedum sediforme
8-Jul-16	SD	3	Bombus	1	Sedum sediforme
8-Jul-16	SD	4	Bombus	1	Allium sphaerocephalon
8-Jul-16	SD	4	Bombus	1	Sedum sediforme
8-Jul-16	SD	5	Bombus	3	Sedum sediforme
8-Jul-16	SE	1	Medium	2	Torilis arvensis
8-Jul-16	SE	2	Medium	1	Torilis arvensis
8-Jul-16	SE	3	Medium	5	Torilis arvensis
8-Jul-16	SE	4	Medium	4	Torilis arvensis
8-Jul-16	SE	5	Medium	1	Hedera helix
8-Jul-16	SE	5	Medium	3	Torilis arvensis

Table B. All other wild flower visiting insects observed foraging on open flowers.

Date	Site	Quadrat	Pollinator	#	Plant Species
15-May-14	A1	1	Beetle/True Bug	1	Malva sylvestris
15-May-14	A1	5	Beetle/True Bug	1	Anacyclus clavatus
15-May-14	A2	1	Beetle/True Bug	4	Papaver rhoeas
15-May-14	A2	2	Beetle/True Bug	1	Papaver rhoeas
15-May-14	A2	3	Beetle/True Bug	8	Papaver rhoeas
15-May-14	A2	4	Beetle/True Bug	2	Papaver rhoeas
15-May-14	A2	5	Beetle/True Bug	1	Malva sylvestris
15-May-14	A2	5	Beetle/True Bug	1	Papaver rhoeas
15-May-14	A3	1	Beetle/True Bug	1	Anacyclus clavatus
15-May-14	A3	1	Hoverfly	1	Papaver rhoeas
15-May-14	A3	2	Beetle/True Bug	1	Papaver rhoeas
15-May-14	A3	3	Beetle/True Bug	1	Anacyclus clavatus
15-May-14	A3	4	Beetle/True Bug	10	Dorycnium pentaphyllum
15-May-14	A3	5	Beetle/True Bug	3	Anacyclus clavatus
15-May-14	A3	5	Hoverfly	8	Anacyclus clavatus
15-May-14	A3	5	Other	1	Anacyclus clavatus
15-May-14	G2	3	Beetle/True Bug	13	Papaver rhoeas

Date	Site	Quadrat	Pollinator	#	Plant Species
15-May-14	G2	4	Beetle/True Bug	6	Papaver rhoeas
15-May-14	G2	5	Beetle/True Bug	8	Anacyclus clavatus
15-May-14	G2	5	Other	1	Anacyclus clavatus
15-May-14	G2	5	Other	2	Reseda lutea
15-May-14	G3	1	Hoverfly	1	Jasminum fruticans
15-May-14	G3	2	Beetle/True Bug	1	Euforbia serrata
15-May-14	G3	3	Beetle/True Bug	1	Erucastrum nasturtiifolium
15-May-14	G3	3	Other	1	Erucastrum nasturtiifolium
15-May-14	G3	4	Beetle/True Bug	1	Anacyclus clavatus
15-May-14	G3	4	Other	1	Anacyclus clavatus
15-May-14	G3	5	Beetle/True Bug	10	Erucastrum nasturtiifolium
15-May-14	G3	5	Hoverfly	1	Erucastrum nasturtiifolium
15-May-14	G4	2	Beetle/True Bug	3	Anacyclus clavatus
15-May-14	G4	2	Beetle/True Bug	2	Papaver rhoeas
15-May-14	G4	3	Beetle/True Bug	1	Fumaria officinalis
15-May-14	G4	3	Beetle/True Bug	2	Papaver rhoeas
15-May-14	G4	4	Beetle/True Bug	2	Papaver rhoeas
15-May-14	G4	5	Beetle/True Bug	1	Anacyclus clavatus
15-May-14	G4	5	Beetle/True Bug	1	Papaver rhoeas
15-May-14	G4	5	Other	1	Papaver rhoeas
15-May-14	G4	5	Beetle/True Bug	120	Quercus ilex
15-May-14	G5	3	Beetle/True Bug	2	Rosa canina
15-May-14	G5	4	Beetle/True Bug	1	Euforbia serrata
15-May-14	G5	4	Hoverfly	1	Euforbia serrata
15-May-14	G5	4	Other	1	Euforbia serrata
15-May-14	G5	5	Beetle/True Bug	1	Euforbia serrata
15-May-14	G5	5	Other	100	Euforbia serrata
15-May-14	G5	5	Beetle/True Bug	50	Quercus coccifera
16-May-14	G1	1	Beetle/True Bug	6	Papaver rhoeas
16-May-14	G1	1	Beetle/True Bug	6	Sonchus oleraceus
16-May-14	G1	1	Other	1	Sonchus oleraceus
16-May-14	G1	2	Beetle/True Bug	15	Papaver rhoeas
16-May-14	G1	2	Hoverfly	3	Papaver rhoeas
16-May-14	G1	2	Other	1	Papaver rhoeas
16-May-14	G1	3	Hoverfly	1	Diplotaxis erucoides
16-May-14	G1	3	Other	1	Diplotaxis erucoides
16-May-14	G1	3	Beetle/True Bug	7	Papaver rhoeas
16-May-14	G1	3	Hoverfly	2	Papaver rhoeas
16-May-14	G1	3	Other	1	Papaver rhoeas
16-May-14	G1	3	Beetle/True Bug	2	Sonchus oleraceus
16-May-14	G1	4	Beetle/True Bug	2	Malva sylvestris
16-May-14	G1	4	Beetle/True Bug	6	Papaver rhoeas
16-May-14	G1	4	Hoverfly	1	Papaver rhoeas

Date	Site	Quadrat	Pollinator	#	Plant Species
16-May-14	G6	1	Beetle/True Bug	9	Quercus helix
16-May-14	G6	1	Other	1	Quercus helix
16-May-14	G6	2	Beetle/True Bug	1	Anacyclus clavatus
16-May-14	G6	2	Beetle/True Bug	5	Papaver rhoeas
16-May-14	G6	4	Beetle/True Bug	3	Erucastrum nasturtiifolium
16-May-14	G6	4	Hoverfly	11	Erucastrum nasturtiifolium
16-May-14	G6	4	Other	1	Erucastrum nasturtiifolium
16-May-14	G6	4	Beetle/True Bug	1	Papaver rhoeas
16-May-14	G6	5	Beetle/True Bug	2	Anacyclus clavatus
16-May-14	G6	5	Beetle/True Bug	7	Erucastrum nasturtiifolium
16-May-14	G7	4	Beetle/True Bug	1	Anacyclus clavatus
16-May-14	G7	5	Other	1	Anacyclus clavatus
16-May-14	G8	1	Beetle/True Bug	7	Erucastrum nasturtiifolium
16-May-14	G8	1	Hoverfly	2	Erucastrum nasturtiifolium
16-May-14	G8	1	Other	1	Erucastrum nasturtiifolium
16-May-14	G8	1	Beetle/True Bug	3	Papaver rhoeas
16-May-14	G8	2	Beetle/True Bug	1	Erucastrum nasturtiifolium
16-May-14	G8	2	Beetle/True Bug	3	Fumaria officinalis
16-May-14	G8	2	Beetle/True Bug	1	Papaver rhoeas
16-May-14	G8	3	Beetle/True Bug	6	Erucastrum nasturtiifolium
16-May-14	G8	3	Hoverfly	2	Erucastrum nasturtiifolium
16-May-14	G8	3	Beetle/True Bug	2	Malva sylvestris
16-May-14	G8	5	Beetle/True Bug	6	Erucastrum nasturtiifolium
22-May-14	CO	4	Beetle/True Bug	2	Tordylium maximum
22-May-14	CO	5	Beetle/True Bug	1	Diplotaxis erucoides
22-May-14	CO	5	Beetle/True Bug	1	Papaver rhoeas
22-May-14	CO	5	Beetle/True Bug	1	Sonchus oleraceus
22-May-14	P1	1	Beetle/True Bug	4	Papaver rhoeas
22-May-14	P1	1	Hoverfly	1	Papaver rhoeas
22-May-14	P1	2	Beetle/True Bug	3	Papaver rhoeas
22-May-14	P1	2	Hoverfly	3	Papaver rhoeas
22-May-14	P1	3	Beetle/True Bug	1	Papaver rhoeas
22-May-14	P1	3	Hoverfly	1	Papaver rhoeas
22-May-14	P1	4	Beetle/True Bug	2	Papaver rhoeas
22-May-14	P1	5	Beetle/True Bug	10	Papaver rhoeas
22-May-14	P1	5	Hoverfly	3	Papaver rhoeas
22-May-14	P2	1	Beetle/True Bug	2	Blackstonia perfoliata
22-May-14	P2	2	Beetle/True Bug	1	Helianthemum oelandicum
22-May-14	P2	5	Beetle/True Bug	1	Crepis sp.
22-May-14	P2	5	Beetle/True Bug	8	Euforbia peplus
22-May-14	P2	5	Beetle/True Bug	3	Helianthemum oelandicum
10-Jun-14	A1	5	Beetle/True Bug	2	Malva sylvestris
10-Jun-14	A2	1	Beetle/True Bug	2	Papaver rhoeas

Date	Site	Quadrat	Pollinator	#	Plant Species
10-Jun-14	A2	5	Beetle/True Bug	10	Malva sylvestris
10-Jun-14	A3	3	Beetle/True Bug	2	Scabiosa atropurpurea
10-Jun-14	G2	2	Beetle/True Bug	5	Anacyclus clavatus
10-Jun-14	G2	2	Beetle/True Bug	1	Papaver rhoeas
10-Jun-14	G2	3	Beetle/True Bug	2	Convolvulus arvensis
10-Jun-14	G2	3	Beetle/True Bug	2	Elaeagnus angustifolia
10-Jun-14	G2	4	Beetle/True Bug	2	Convolvulus arvensis
10-Jun-14	G2	4	Beetle/True Bug	2	Elaeagnus angustifolia
10-Jun-14	G2	5	Beetle/True Bug	3	Reseda lutea
10-Jun-14	G3	5	Beetle/True Bug	8	Ruta montana
10-Jun-14	G4	2	Beetle/True Bug	1	Carduus tenuiflorus
12-Jun-14	G1	1	Other	1	Convolvulus arvensis
12-Jun-14	G1	1	Beetle/True Bug	1	Papaver rhoeas
12-Jun-14	G1	2	Beetle/True Bug	1	Convolvulus arvensis
12-Jun-14	G1	2	Beetle/True Bug	1	Papaver rhoeas
12-Jun-14	G1	3	Hoverfly	1	Anacyclus clavatus
12-Jun-14	G1	3	Hoverfly	1	Bryonia dioica
12-Jun-14	G1	3	Beetle/True Bug	3	Diplotaxis erucoides
12-Jun-14	G1	4	Beetle/True Bug	2	Convolvulus arvensis
12-Jun-14	G1	4	Beetle/True Bug	2	Eryngium campestre
12-Jun-14	G1	4	Other	1	Eryngium campestre
12-Jun-14	G1	4	Beetle/True Bug	1	Papaver rhoeas
12-Jun-14	G5	1	Other	1	Centaurea linifolia
12-Jun-14	G5	2	Beetle/True Bug	4	Cirsium arvense
12-Jun-14	G5	2	Hoverfly	1	Cirsium arvense
12-Jun-14	G5	2	Hoverfly	1	Hypericum perforatum
12-Jun-14	G5	4	Beetle/True Bug	1	Convolvulus arvensis
12-Jun-14	G5	4	Beetle/True Bug	1	Euforbia serrata
12-Jun-14	G5	4	Beetle/True Bug	1	Papaver rhoeas
12-Jun-14	G5	5	Beetle/True Bug	5	Fumaria officinalis
12-Jun-14	G5	5	Beetle/True Bug	1	Papaver rhoeas
12-Jun-14	G6	2	Beetle/True Bug	1	Centaurea aspera
12-Jun-14	G6	3	Beetle/True Bug	1	Centaurea aspera
12-Jun-14	G8	1	Other	2	Echium vulgare
12-Jun-14	G8	1	Beetle/True Bug	3	Erucastrum nasturtiifolium
12-Jun-14	G8	1	Hoverfly	2	Erucastrum nasturtiifolium
12-Jun-14	G8	1	Beetle/True Bug	6	Malva sylvestris
12-Jun-14	G8	1	Hoverfly	1	Malva sylvestris
12-Jun-14	G8	1	Other	2	Malva sylvestris
12-Jun-14	G8	1	Beetle/True Bug	3	Verbascum pulverulentum
12-Jun-14	G8	1	Hoverfly	1	Verbascum pulverulentum
12-Jun-14	G8	2	Beetle/True Bug	3	Convolvulus arvensis
12-Jun-14	G8	2	Hoverfly	2	Convolvulus arvensis

Date	Site	Quadrat	Pollinator	#	Plant Species
12-Jun-14	G8	2	Other	2	Convolvulus arvensis
12-Jun-14	G8	2	Beetle/True Bug	7	Erucastrum nasturtiifolium
12-Jun-14	G8	2	Hoverfly	3	Erucastrum nasturtiifolium
12-Jun-14	G8	2	Beetle/True Bug	1	Papaver rhoeas
12-Jun-14	G8	2	Beetle/True Bug	2	Reseda Lutea
12-Jun-14	G8	2	Hoverfly	3	Reseda Lutea
12-Jun-14	G8	3	Beetle/True Bug	5	Centaurea aspera
12-Jun-14	G8	3	Beetle/True Bug	1	Cirsium arvense
12-Jun-14	G8	3	Beetle/True Bug	1	Papaver rhoeas
12-Jun-14	G8	4	Hoverfly	1	Convolvulus arvensis
12-Jun-14	G9	3	Beetle/True Bug	2	Diplotaxis erucoides
12-Jun-14	G9	3	Beetle/True Bug	1	Papaver rhoeas
19-Jun-14	CA	1	Beetle/True Bug	2	Convolvulus arvensis
19-Jun-14	CA	1	Hoverfly	1	Polygonum aviculare
19-Jun-14	CA	2	Hoverfly	1	Polygonum aviculare
19-Jun-14	CA	3	Hoverfly	1	Convolvulus arvensis
19-Jun-14	CA	4	Other	1	Convolvulus arvensis
19-Jun-14	CA	5	Other	1	Convolvulus arvensis
19-Jun-14	CO	1	Hoverfly	1	Daucus carota
19-Jun-14	CO	2	Beetle/True Bug	1	Daucus carota
19-Jun-14	CO	2	Butterfly/Moth	2	Malva sylvestris
19-Jun-14	CO	2	Hoverfly	2	Malva sylvestris
19-Jun-14	CO	2	Butterfly/Moth	2	Phlomis herba-venti
19-Jun-14	CO	2	Hoverfly	1	Phlomis herba-venti
19-Jun-14	CO	2	Hoverfly	1	Potentilla reptans
19-Jun-14	CO	3	Beetle/True Bug	2	Onobrychis saxatilis
19-Jun-14	CO	3	Beetle/True Bug	8	Tordylium maximum
19-Jun-14	CO	3	Hoverfly	2	Tordylium maximum
19-Jun-14	CO	3	Other	2	Tordylium maximum
19-Jun-14	CO	5	Beetle/True Bug	2	Anthemis cotula
19-Jun-14	CO	5	Beetle/True Bug	3	Malva sylvestris
19-Jun-14	CO	5	Beetle/True Bug	1	Tordylium maximum
19-Jun-14	CO	5	Hoverfly	4	Tordylium maximum
19-Jun-14	M	1	Hoverfly	2	Sambucus nigra
19-Jun-14	M	1	Beetle/True Bug	1	Torilis arvensis
19-Jun-14	M	2	Beetle/True Bug	4	Malva sylvestris
19-Jun-14	M	3	Hoverfly	1	Ligustrum vulgare
19-Jun-14	M	3	Beetle/True Bug	4	Malva sylvestris
19-Jun-14	M	3	Butterfly/Moth	1	Psoralea bituminosa
19-Jun-14	M	3	Beetle/True Bug	5	Torilis arvensis
19-Jun-14	M	3	Hoverfly	4	Torilis arvensis
19-Jun-14	M	3	Beetle/True Bug	1	Vicia pannonica
19-Jun-14	M	4	Beetle/True Bug	5	Torilis arvensis

Date	Site	Quadrat	Pollinator	#	Plant Species
19-Jun-14	M	4	Butterfly/Moth	1	Torilis arvensis
19-Jun-14	M	4	Hoverfly	7	Torilis arvensis
19-Jun-14	M	5	Beetle/True Bug	1	Ligustrum vulgare
19-Jun-14	M	5	Hoverfly	2	Torilis arvensis
19-Jun-14	P1	3	Beetle/True Bug	2	Papaver rhoeas
19-Jun-14	P1	4	Beetle/True Bug	4	Papaver rhoeas
19-Jun-14	P1	5	Beetle/True Bug	1	Papaver rhoeas
19-Jun-14	P2	1	Beetle/True Bug	1	Blackstonia perfoliata
19-Jun-14	P2	2	Beetle/True Bug	4	Knautia dipsacifolia
19-Jun-14	P2	2	Butterfly/Moth	3	Knautia dipsacifolia
19-Jun-14	P2	2	Other	1	Knautia dipsacifolia
19-Jun-14	P2	3	Butterfly/Moth	2	Knautia dipsacifolia
19-Jun-14	P2	4	Butterfly/Moth	2	Rubus sp.
19-Jun-14	P2	4	Hoverfly	1	Rubus sp.
8-Jul-14	A3	4	Beetle/True Bug	1	Seseli tortuosum
8-Jul-14	G3	3	Beetle/True Bug	2	Sonchus oleraceus
8-Jul-14	G6	1	Beetle/True Bug	4	Petroselinum crispum
8-Jul-14	G6	1	Wasp	2	Petroselinum crispum
8-Jul-14	G8	1	Beetle/True Bug	1	Echium vulgare
8-Jul-14	G8	1	Butterfly/Moth	1	Echium vulgare
8-Jul-14	G8	1	Other	1	Malva sylvestris
8-Jul-14	G8	1	Wasp	1	Verbascum pulverulentum
8-Jul-14	G8	3	Hoverfly	1	Daucus carota
9-Jul-14	CA	3	Beetle/True Bug	1	Convolvulus arvensis
9-Jul-14	CA	5	Hoverfly	2	Convolvulus arvensis
9-Jul-14	CO	1	Beetle/True Bug	20	Cirsium monspessulanum
9-Jul-14	CO	1	Hoverfly	1	Daucus carota
9-Jul-14	CO	1	Beetle/True Bug	10	Tordylium maximum
9-Jul-14	CO	2	Beetle/True Bug	1	Convolvulus arvensis
9-Jul-14	CO	2	Butterfly/Moth	2	Phlomis herba-venti
9-Jul-14	CO	3	Beetle/True Bug	5	Tordylium maximum
9-Jul-14	CO	5	Hoverfly	1	Convolvulus arvensis
9-Jul-14	CO	5	Beetle/True Bug	5	Tordylium maximum
9-Jul-14	M	2	Beetle/True Bug	1	Torilis arvensis
9-Jul-14	M	3	Beetle/True Bug	1	Malva sylvestris
9-Jul-14	M	3	Butterfly/Moth	1	Malva sylvestris
9-Jul-14	M	3	Hoverfly	1	Malva sylvestris
9-Jul-14	M	4	Beetle/True Bug	8	Cirsium arvense
9-Jul-14	M	4	Beetle/True Bug	5	Malva sylvestris
9-Jul-14	M	4	Butterfly/Moth	2	Malva sylvestris
9-Jul-14	M	4	Butterfly/Moth	1	Psoralea bituminosa
9-Jul-14	M	4	Butterfly/Moth	1	Teucrium chamaedrys
9-Jul-14	M	4	Beetle/True Bug	8	Torilis arvensis

Date	Site	Quadrat	Pollinator	#	Plant Species
9-Jul-14	P1	4	Beetle/True Bug	1	Papaver rhoeas
9-Jul-14	P1	5	Beetle/True Bug	3	Papaver rhoeas
9-Jul-14	P2	1	Beetle/True Bug	3	Blackstonia perfoliata
9-Jul-14	P2	1	Hoverfly	1	Convolvulus arvensis
9-Jul-14	P2	2	Beetle/True Bug	1	Plantago lanceolata
30-Jul-14	A3	4	Beetle/True Bug	1	Seseli tortuosum
30-Jul-14	G4	3	Beetle/True Bug	3	Daucus carota
30-Jul-14	G4	4	Beetle/True Bug	2	Daucus carota
31-Jul-14	G6	1	Beetle/True Bug	1	Petroselinum crispum
31-Jul-14	G6	2	Beetle/True Bug	1	Daucus carota
31-Jul-14	G6	3	Beetle/True Bug	1	Petroselinum crispum
31-Jul-14	G6	4	Beetle/True Bug	1	Centaurea aspera
31-Jul-14	G8	1	Beetle/True Bug	4	Daucus carota
31-Jul-14	G8	1	Beetle/True Bug	1	Lactuca serriola
31-Jul-14	G8	2	Butterfly/Moth	1	Convolvulus arvensis
31-Jul-14	G8	2	Beetle/True Bug	9	Daucus carota
31-Jul-14	G8	2	Beetle/True Bug	4	Daucus carota
31-Jul-14	G8	3	Beetle/True Bug	1	Centaurea aspera
31-Jul-14	G8	3	Butterfly/Moth	1	Centaurea aspera
31-Jul-14	G8	3	Wasp	1	Centaurea aspera
31-Jul-14	G8	3	Beetle/True Bug	1	Convolvulus arvensis
31-Jul-14	G8	3	Beetle/True Bug	5	Daucus carota
31-Jul-14	G9	2	Wasp	1	Portulaca oleracea
1-Aug-14	CA	1	Beetle/True Bug	4	Convolvulus arvensis
1-Aug-14	CA	2	Beetle/True Bug	1	Cirsium arvense
1-Aug-14	CA	2	Beetle/True Bug	2	Convolvulus arvensis
1-Aug-14	CA	3	Beetle/True Bug	2	Cirsium arvense
1-Aug-14	CA	3	Butterfly/Moth	1	Cirsium arvense
1-Aug-14	CA	3	Beetle/True Bug	3	Convolvulus arvensis
1-Aug-14	CA	3	Beetle/True Bug	1	Diplotaxis erucoides
1-Aug-14	CA	4	Beetle/True Bug	1	Convolvulus arvensis
1-Aug-14	CA	5	Beetle/True Bug	1	Convolvulus arvensis
1-Aug-14	CO	1	Beetle/True Bug	8	Carduus tenuiflorus
1-Aug-14	CO	1	Beetle/True Bug	6	Carduus tenuiflorus
1-Aug-14	CO	1	Beetle/True Bug	2	Daucus carota
1-Aug-14	CO	1	Beetle/True Bug	1	Tordylium maximum
1-Aug-14	CO	2	Beetle/True Bug	6	Daucus carota
1-Aug-14	CO	3	Beetle/True Bug	2	Daucus carota
1-Aug-14	CO	3	Butterfly/Moth	1	Daucus carota
1-Aug-14	CO	3	Beetle/True Bug	3	Tordylium maximum
1-Aug-14	CO	5	Beetle/True Bug	1	Carduus tenuiflorus
1-Aug-14	CO	5	Beetle/True Bug	2	Daucus carota
1-Aug-14	CO	5	Beetle/True Bug	1	Picris echioides

Date	Site	Quadrat	Pollinator	#	Plant Species
1-Aug-14	CO	5	Beetle/True Bug	2	Tordylium maximum
1-Aug-14	M	1	Beetle/True Bug	2	Polygonum convolvulus
1-Aug-14	M	1	Beetle/True Bug	3	Torilis arvensis
1-Aug-14	M	2	Beetle/True Bug	1	Convolvulus arvensis
1-Aug-14	M	2	Beetle/True Bug	1	Malva sylvestris
1-Aug-14	M	2	Beetle/True Bug	3	Polygonum convolvulus
1-Aug-14	M	3	Beetle/True Bug	2	Malva sylvestris
1-Aug-14	M	3	Beetle/True Bug	1	Malva sylvestris
1-Aug-14	M	3	Hoverfly	1	Malva sylvestris
1-Aug-14	M	3	Beetle/True Bug	1	Polygonum convolvulus
1-Aug-14	M	3	Beetle/True Bug	1	Polygonum convolvulus
1-Aug-14	M	4	Beetle/True Bug	1	Malva sylvestris
1-Aug-14	M	4	Hoverfly	1	Malva sylvestris
1-Aug-14	M	4	Wasp	1	Polygonum convolvulus
1-Aug-14	M	4	Beetle/True Bug	1	Torilis arvensis
1-Aug-14	M	4	Hoverfly	1	Torilis arvensis
1-Aug-14	P1	5	Wasp	1	Viola tricolor
1-Aug-14	P2	1	Butterfly/Moth	1	Teucrium fruticans
1-Aug-14	P2	3	Beetle/True Bug	5	Daucus carota
14-May-15	S1	2	Beetle	4	Papaver rhoeas
14-May-15	S1	3	Beetle	5	Papaver rhoeas
14-May-15	S1	4	Beetle	11	Papaver rhoeas
14-May-15	S1	5	Beetle	1	Papaver rhoeas
14-May-15	S2	3	Beetle	1	Plantago lanceolata
14-May-15	S3	4	Beetle	7	Carduus pycnocephalus
14-May-15	S3	4	Butterfly/Moth	2	Carduus pycnocephalus
14-May-15	S4	5	Beetle	1	Euphorbia serrata
14-May-15	S5	1	Beetle	4	Carduus pycnocephalus
14-May-15	S5	1	Beetle	1	Rubus sp.
14-May-15	S5	2	Beetle	2	Malva sylvestris
14-May-15	S5	3	Beetle	2	Carduus pycnocephalus
14-May-15	S5	5	Beetle	1	Tordylium maximum
11-Jun-15	S1	1	Other	1	Papaver rhoeas
11-Jun-15	S1	2	Beetle	2	Papaver rhoeas
11-Jun-15	S1	3	Beetle	2	Papaver rhoeas
11-Jun-15	S1	4	Beetle	2	Papaver rhoeas
11-Jun-15	S1	5	Beetle	1	Papaver rhoeas
11-Jun-15	S2	1	Beetle	4	Carduus pycnocephalus
11-Jun-15	S2	1	Beetle	1	Carduus pycnocephalus
11-Jun-15	S2	1	Hoverfly	2	Carduus pycnocephalus
11-Jun-15	S2	1	Hoverfly	1	Malva sylvestris
11-Jun-15	S2	2	True Bug	1	Galium lucidum
11-Jun-15	S2	2	Hoverfly	2	Knautia dipsacifolia

Date	Site	Quadrat	Pollinator	#	Plant Species
11-Jun-15	S2	3	Butterfly/Moth	1	Knautia dipsacifolia
11-Jun-15	S2	3	Hoverfly	1	Torilis arvensis
11-Jun-15	S2	4	Beetle	5	Galium lucidum
11-Jun-15	S3	1	Beetle	3	Torilis arvensis
11-Jun-15	S3	2	Hoverfly	1	Torilis arvensis
11-Jun-15	S3	3	Beetle	6	Torilis arvensis
11-Jun-15	S3	3	Hoverfly	3	Torilis arvensis
11-Jun-15	S3	3	True Bug	1	Torilis arvensis
11-Jun-15	S3	5	Beetle	1	Torilis arvensis
11-Jun-15	S3	5	Hoverfly	2	Torilis arvensis
11-Jun-15	S4	3	Hoverfly	1	Unknown
11-Jun-15	S5	1	Beetle	2	Carduus pycnocephalus
11-Jun-15	S5	1	Beetle	5	Malva sylvestris
11-Jun-15	S5	1	Beetle	2	Rubus sp.
11-Jun-15	S5	3	Butterfly/Moth	2	Carduus pycnocephalus
11-Jun-15	S5	3	Beetle	2	Centaurea Aspera
11-Jun-15	S5	3	Butterfly/Moth	1	Centaurea Aspera
11-Jun-15	S5	5	Beetle	2	Centaurea Aspera
11-Jun-15	S5	5	Butterfly/Moth	8	Centaurea Aspera
3-Jul-15	S2	4	Beetle	1	Daucus Carota
3-Jul-15	S2	4	Hoverfly	1	Daucus Carota
3-Jul-15	S2	5	Beetle	1	Tordylium maximum
3-Jul-15	S2	5	Hoverfly	1	Tordylium maximum
27-Jul-15	S2	1	Beetle	1	Malva sylvestris
27-Jul-15	S2	1	Hoverfly	1	Malva sylvestris
27-Jul-15	S2	1	True Bug	1	Malva sylvestris
26-Apr-16	SA	1	Other	1	Cerastium cerastoides
26-Apr-16	SB	1	Hoverfly	2	Crataegus monogyna
26-Apr-16	SB	1	Other	25	Crataegus monogyna
26-Apr-16	SC	1	Hoverfly	10	Diplotaxis erucoides
26-Apr-16	SC	2	Hoverfly	4	Diplotaxis erucoides
26-Apr-16	SC	3	Beetle	1	Diplotaxis erucoides
26-Apr-16	SC	3	Hoverfly	5	Diplotaxis erucoides
26-Apr-16	SC	3	Other	1	Diplotaxis erucoides
26-Apr-16	SC	3	Hoverfly	1	Fumaria officinalis
26-Apr-16	SC	4	Hoverfly	6	Diplotaxis erucoides
26-Apr-16	SC	5	Beetle	7	Diplotaxis erucoides
26-Apr-16	SD	5	Beetle	1	Helianthemum apenninum
19-May-16	SA	1	Beetle	1	Torilis arvensis
19-May-16	SA	1	Other	1	Torilis arvensis
19-May-16	SA	1	Other	4	Torilis arvensis
19-May-16	SA	1	Other	2	Torilis arvensis
19-May-16	SA	1	Other	1	Torilis arvensis

Date	Site	Quadrat	Pollinator	#	Plant Species
19-May-16	SA	1	Wasp	1	Torilis arvensis
19-May-16	SA	5	Beetle	1	Torilis arvensis
19-May-16	SA	5	Hoverfly	1	Torilis arvensis
19-May-16	SA	5	Other	6	Torilis arvensis
19-May-16	SC	1	Beetle	1	Diplotaxis erucoides
19-May-16	SC	1	Beetle	2	Diplotaxis erucoides
19-May-16	SC	2	Hoverfly	1	Cirsium vulgare
19-May-16	SC	2	Hoverfly	1	Diplotaxis erucoides
19-May-16	SC	3	Beetle	1	Diplotaxis erucoides
19-May-16	SC	3	Hoverfly	1	Diplotaxis erucoides
19-May-16	SC	4	Beetle	1	Diplotaxis erucoides
19-May-16	SC	4	Beetle	1	Diplotaxis erucoides
19-May-16	SC	4	Beetle	5	Papaver rhoeas
19-May-16	SC	4	Beetle	1	Papaver rhoeas
19-May-16	SC	4	Hoverfly	1	Papaver rhoeas
19-May-16	SD	1	Other	1	Thymus vulgaris
19-May-16	SD	3	Other	1	Thymus vulgaris
19-May-16	SD	3	Hoverfly	1	Torilis arvensis
19-May-16	SE	4	Hoverfly	1	Geranium robertianum
9-Jun-16	SA	1	Beetle	1	Torilis arvensis
9-Jun-16	SA	1	Other	1	Torilis arvensis
9-Jun-16	SA	4	Beetle	5	Torilis arvensis
9-Jun-16	SA	4	Beetle	1	Torilis arvensis
9-Jun-16	SA	4	Other	1	Torilis arvensis
9-Jun-16	SA	5	Beetle	1	Papaver rhoeas
9-Jun-16	SA	5	Beetle	13	Torilis arvensis
9-Jun-16	SA	5	Beetle	1	Torilis arvensis
9-Jun-16	SA	5	Beetle	1	Torilis arvensis
9-Jun-16	SA	5	Hoverfly	1	Torilis arvensis
9-Jun-16	SA	5	Other	1	Torilis arvensis
9-Jun-16	SA	5	Wasp	1	Torilis arvensis
9-Jun-16	SC	2	Other	1	Diplotaxis erucoides
9-Jun-16	SC	4	Beetle	4	Papaver rhoeas
9-Jun-16	SD	1	Hoverfly	2	Crepis bursifolia
9-Jun-16	SD	1	Beetle	1	Helianthemum apenninum
9-Jun-16	SD	1	Hoverfly	1	Helianthemum apenninum
9-Jun-16	SD	1	Other	1	Helianthemum apenninum
9-Jun-16	SD	3	Hoverfly	2	Thymus vulgaris
9-Jun-16	SD	3	Hoverfly	2	Vicia villosa
9-Jun-16	SD	5	Hoverfly	1	Geranium robertianum
9-Jun-16	SE	1	Beetle	10	Papaver rhoeas
9-Jun-16	SE	1	Beetle	8	Papaver rhoeas
9-Jun-16	SE	2	Hoverfly	2	Galium aparine

Date	Site	Quadrat	Pollinator	#	Plant Species
9-Jun-16	SE	2	Beetle	3	Papaver rhoeas
9-Jun-16	SE	2	Beetle	2	Papaver rhoeas
9-Jun-16	SE	2	Other	1	Veronica persica
9-Jun-16	SE	3	Hoverfly	1	Galium aparine
9-Jun-16	SE	3	Beetle	1	Papaver rhoeas
9-Jun-16	SE	4	Other	1	Fumaria officinalis
9-Jun-16	SE	4	Beetle	4	Papaver rhoeas
9-Jun-16	SE	4	Beetle	3	Papaver rhoeas
9-Jun-16	SE	5	Beetle	6	Bryonia dioica
9-Jun-16	SE	5	Hoverfly	1	Galium aparine
9-Jun-16	SE	5	Beetle	1	Papaver rhoeas
8-Jul-16	SB	2	Beetle	3	Achillea millefolium
8-Jul-16	SB	2	Hoverfly	1	Achillea millefolium
8-Jul-16	SB	2	Other	1	Achillea millefolium
8-Jul-16	SB	2	True Bug	1	Achillea millefolium
8-Jul-16	SB	2	Butterfly/Moth	4	Dianthus seguieri
8-Jul-16	SB	4	Beetle	4	Achillea millefolium
8-Jul-16	SB	4	Butterfly/Moth	3	Achillea millefolium
8-Jul-16	SB	4	Other	7	Achillea millefolium
8-Jul-16	SB	4	Wasp	1	Achillea millefolium
8-Jul-16	SB	4	Hoverfly	1	Torilis arvensis
8-Jul-16	SB	4	Other	1	Torilis arvensis
8-Jul-16	SD	3	Beetle	1	Knautia dipsacifolia
8-Jul-16	SD	4	Butterfly/Moth	1	Allium sphaerocephalon
8-Jul-16	SD	5	Other	1	Sedum sediforme
8-Jul-16	SE	1	Beetle	9	Torilis arvensis
8-Jul-16	SE	1	Hoverfly	3	Torilis arvensis
8-Jul-16	SE	1	Other	17	Torilis arvensis
8-Jul-16	SE	1	Wasp	3	Torilis arvensis
8-Jul-16	SE	2	Hoverfly	5	Torilis arvensis
8-Jul-16	SE	2	Other	6	Torilis arvensis
8-Jul-16	SE	2	Other	2	Torilis arvensis
8-Jul-16	SE	3	Beetle	3	Torilis arvensis
8-Jul-16	SE	3	Hoverfly	1	Torilis arvensis
8-Jul-16	SE	3	Other	7	Torilis arvensis
8-Jul-16	SE	4	Beetle	1	Torilis arvensis
8-Jul-16	SE	4	Hoverfly	3	Torilis arvensis
8-Jul-16	SE	4	Other	16	Torilis arvensis
8-Jul-16	SE	5	Beetle	1	Torilis arvensis
8-Jul-16	SE	5	Hoverfly	8	Torilis arvensis
8-Jul-16	SE	5	Other	9	Torilis arvensis
9-Jun-16	SB	1	Beetle	1	Linum usitatissimum
9-Jun-16	SB	2	Beetle	2	Linum usitatissimum

Date	Site	Quadrat	Pollinator	#	Plant Species
9-Jun-16	SB	2	Other	2	Linum usitatissimum
9-Jun-16	SB	3	Beetle	1	Linum usitatissimum
9-Jun-16	SB	5	Beetle	1	Bryonia dioica

APPENDIX H

Relative Visitation Rates for Each Flower Species (and Mixed Plots)

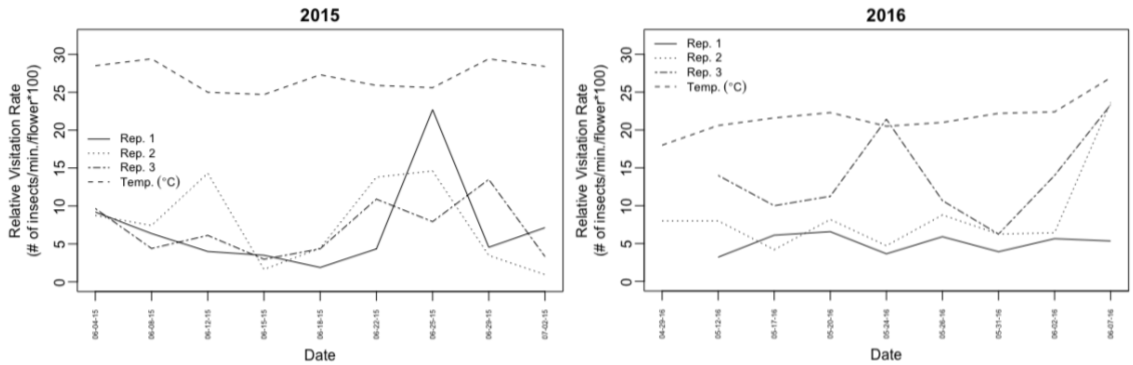

Figure A. Relative visitation rates of all flower visiting insects to ***P. rhoeas***, and temperature, throughout the flowering periods of 2015 (left) and 2016 (right).

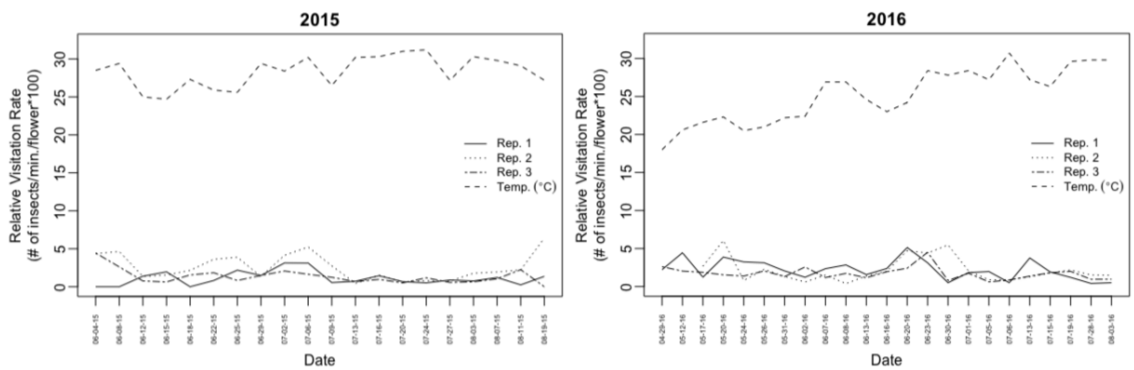

Figure B. Relative visitation rates of all flower visiting insects to ***C. arvensis***, and temperature, throughout the flowering periods of 2015 (left) and 2016 (right).

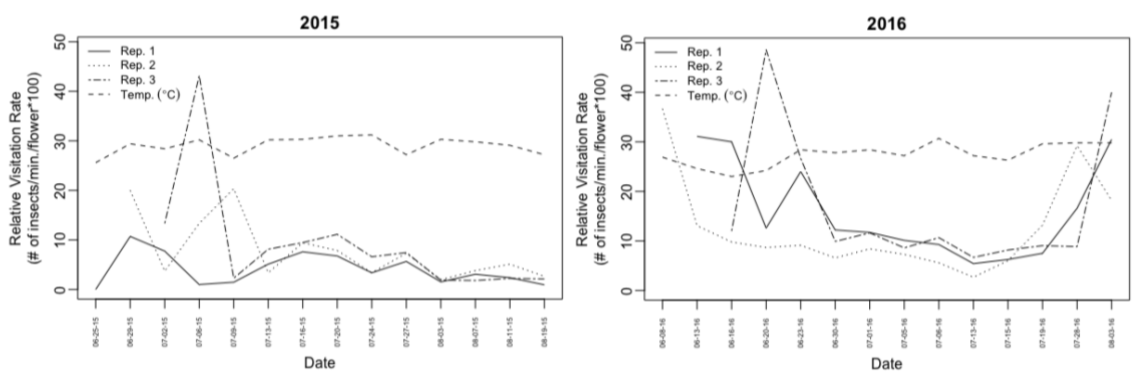

Figure C. Relative visitation rates of all flower visiting insects to ***D. carota***, and temperature, throughout the flowering periods of 2015 (left) and 2016 (right).

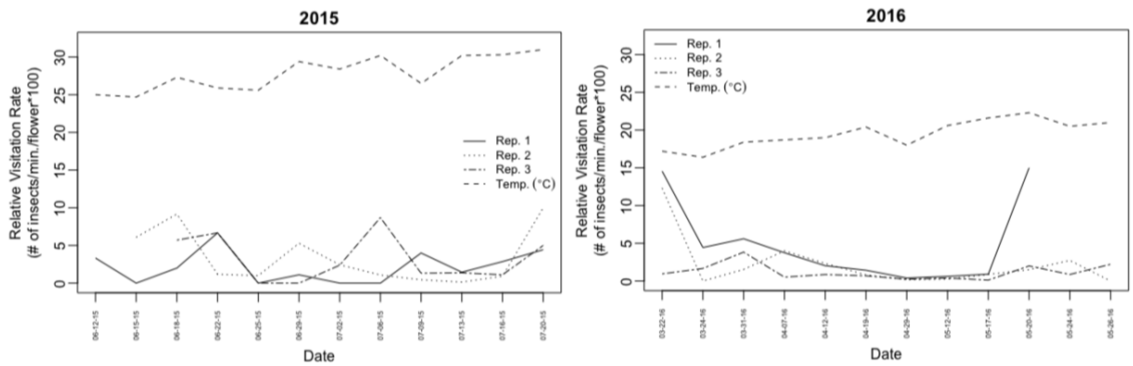

Figure D. Relative visitation rates of all flower visiting insects to ***M. sylvestris***, and temperature, throughout the flowering periods of 2015 (left) and 2016 (right).

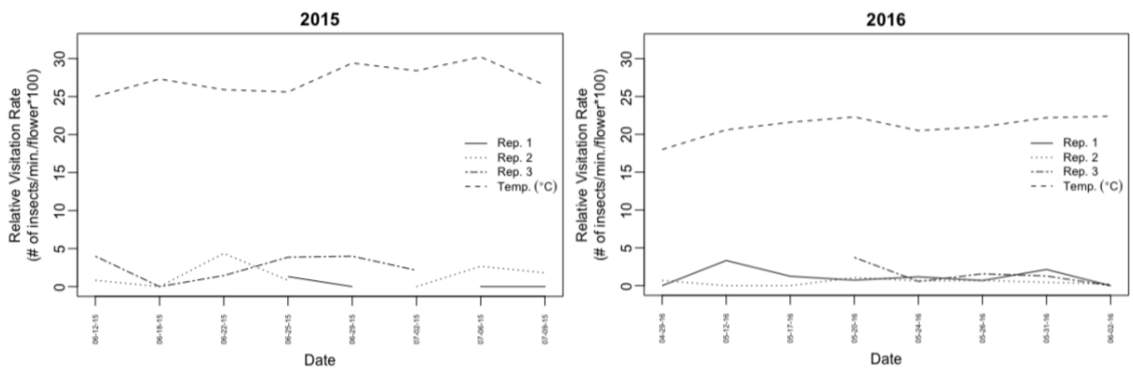

Figure E. Relative visitation rates of all flower visiting insects to ***S. oleraceus***, and temperature, throughout the flowering periods of 2015 (left) and 2016 (right).

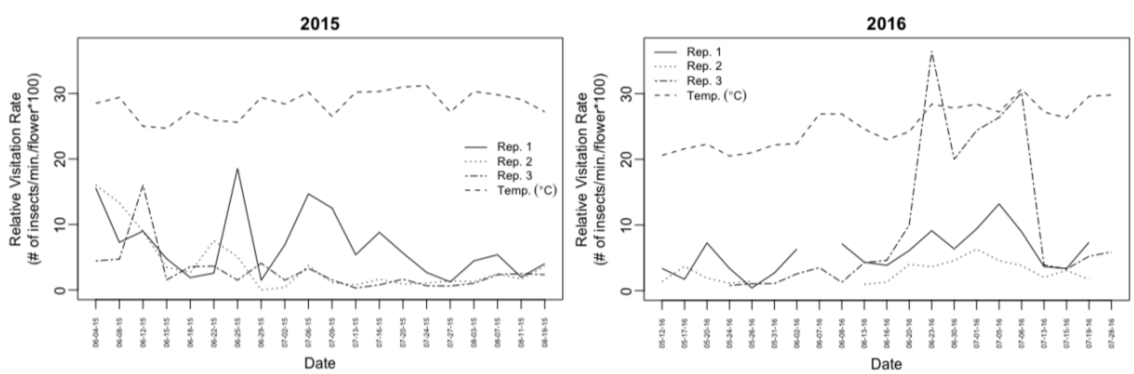

Figure F. Relative visitation rates of all flower visiting insects to **mixed plots**, and temperature, throughout the flowering periods of 2015 (left) and 2016 (right).

APPENDIX I

Observed Insect Visits

Table A. Total visits and mean relative visitation rates from insect groups to different flower species.

	2015		***2016***	
	Total Visits	**Mean Relative Visitation Rate ± SD (imf*100)**	**Total Visits**	**Mean Relative Visitation Rate ± SD (imf*100)**
Bees:				
P. rhoeas	934	6.37±0.61	209	6.80±3.61
C. arvensis	502	0.95±0.39	306	0.64±0.25
D. carota	655	3.26±2.24	371	3.25±0.62
M.sylvestris	98	2.04±0.63	116	2.02±1.68
S. oleraceus	100	1.61±1.13	42	0.49±0.36
Mixed	624	2.71±0.45	150	1.00±0.36
Beetles:				
P. rhoeas	78	0.90±0.22	51	1.80±0.68
C. arvensis	231	0.54±0.35	568	1.30±0.17
D. carota	509	1.51±0.11	954	9.75±1.85
M.sylvestris	4	0.20±0.18	58	0.46±0.25
S. oleraceus	0	0.00	7	0.22±0.18
Mixed	288	1.48±1.48	534	3.15±1.38
Butterflies/Moths:				
P. rhoeas	0	0.00	0	0.00
C. arvensis	55	0.11±0.04	9	0.01±0.01
D. carota	0	0.00	0	0.00
M.sylvestris	2	0.03±0.05	0	0.00
S. oleraceus	0	0.00	0	0.00
Mixed	6	0.01±0.01	0	0.00
Hoverflies:				
P. rhoeas	0	0.00	0	0.00
C. arvensis	37	0.05±0.01	4	0.01±0.01
D. carota	349	1.35±0.64	3	0.07±0.11
M.sylvestris	10	0.17±0.14	0	0.00
S. oleraceus	0	0.00	3	0.02±0.03
Mixed	39	0.15±0.14	6	0.02±0.03
True bugs:				
P. rhoeas	1	0.00±0.01	0	0.00
C. arvensis	3	0.00	1	0.00
D. carota	86	0.26±0.19	387	1.33±0.46
M.sylvestris	15	0.34±0.26	10	0.09±0.02
S. oleraceus	0	0.00	0	0.00
Mixed	10	0.05±0.03	390	2.11±1.99

Wasps:				
P. rhoeas	0	0.00	0	0.00
C. arvensis	8	0.02±0.03	5	0.01±0.02
D. carota	36	0.38±0.29	9	0.14±0.15
M.sylvestris	6	0.13±0.24	0	0.00
S. oleraceus	0	0.00	0	0.00
Mixed	6	0.03±0.02	0	0.00
Other insects:				
P. rhoeas	0	0.00	6	0.24±0.25
C. arvensis	6	0.01±0.01	34	0.06±0.05
D. carota	61	0.14±0.04	27	0.39±0.11
M.sylvestris	0	0.00	10	0.07±0.01
S. oleraceus	0	0.00	1	0.01±0.01
Mixed	13	0.06±0.05	18	0.09±0.01
All flower visiting insects:				
P. rhoeas	1013	7.27±0.39	266	8.84±4.38
C. arvensis	842	1.68±0.78	927	2.04±0.29
D. carota	1696	6.90±2.62	1751	14.93±2.27
M.sylvestris	135	2.91±0.69	194	2.64±1.90
S. oleraceus	100	1.61±1.13	53	0.74±0.31
Mixed	986	4.49±2.00	1098	6.37±3.68

Table B. For the insect group 'other insects', total visits from different insects to different flower species.

	2015		**2016**	
	Total Visits	**%**	**Total Visits**	**%**
Genus: Chrysopa:				
P. rhoeas	0	0	1	11
C. arvensis	0	0	0	0
D. carota	23	96	8	89
M. sylvestris	0	0	0	0
S. oleraceus	0	0	0	0
Mixed	1	4	0	0
Total	24	100	9	100
Order: Diptera (not Syrphidae):				
P. rhoeas	0	0	3	5
C. arvensis	4	8	21	38
D. carota	38	72	14	25
M. sylvestris	0	0	7	13
S. oleraceus	0	0	0	0
Mixed	11	21	11	20
Total	53	100	56	100

Other:				
P. rhoeas	0	0	2	6
C. arvensis	0	0	13	42
D. carota	0	0	5	16
M. sylvestris	0	0	3	10
S. oleraceus	0	0	1	3
Mixed	1	100	7	23
Total	1	100	31	100