



Insects of the Villa Bank Garden

Prepared for: Phibsboro' Village Tidy Towns

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8 June 2023

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ACKNOWLEDGEMENTS

My sincere thanks to the following, without whom this project would not have been possible: Susan Dawson, Amanda Hughes, Mary Kinsella, Elias Borel, Oisín Slator, Camille Soson-TeXereau, Raphael Darcy. This project was generously funded by Community Foundation Ireland and the Department of Rural and Community Development.

CITATION

Darcy, N., 2023. Insects of the Villa Bank Garden. Report prepared for Phibsboro' Village Tidy Towns. Unpublished Report.

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1. INTRODUCTION

1.1. Study Sites

1.1.1. History and Management

The present study focuses on Villa Bank Garden, situated on the stretch of Royal Canal Bank between Phibsboro Library and the Royal Canal, in Dublin, Ireland. Villa Bank Garden is a project implemented by Phibsboro' Village Tidy Towns, a group of volunteers who, through various actions, want to make a difference to the global environment and the community of Phibsboro.

Phibsboro is an urban area just north of Dublin's city centre. Between 2019 and 2021, Phibsboro' Village Tidy Towns commissioned research to develop a Biodiversity Action Plan (BAP) to protect and increase the diversity of green spaces in the area. The results of the fieldwork highlighted some specific areas of biodiversity interest and green spaces where biodiversity could be better supported. The fieldwork for the BAP recorded the presence of 94 native plants (and 28 non-natives) growing in the area and 30 different bird species (Tubridy, 2021).

The Villa Bank Garden runs along the outside of the Mountjoy Prison staff car park. It consists of a linear area of grassland, with a narrow gravel laneway leading to a small gravel courtyard just behind the main visible area of the garden. The garden is entered, by the volunteers who tend to it, through a gate located at grid reference O 15161 35991.

Phibsboro' Village Tidy Towns took the opportunity to develop this space in 2019 after receiving permission from the Governor of Mountjoy Prison. Previously, the area was rough waste ground with primarily nettle and dock. Since then, the space has been cared for by the Tidy Towns volunteers, who planted some small native trees and shrubs (including willow, hawthorn and wild rose) that year, sowed more wildflower seeds in 2020, and planted silver birch trees in 2021 to create a more biodiversity rich space.

Attempts to plant Irish wildflower seeds in the Villa Bank Garden have competed with a luxuriant growth of creeping buttercup which took over following the first planting. This growth may have been stimulated by the tilling of soil and clearing of rubble from the site. Attempts were made to deal with the buttercups in the second year of the project before more wildflower seeds were sown in 2021, but it is apparent that the creeping buttercup will be an ongoing challenge to establishing a diverse range of wildflowers in the garden.

The volunteers strim and rake the garden each autumn, sometimes carrying out a second strim if there is growth before the first frost. The removal of cuttings is intended to reduce the nutrient content of the soil, making it less suitable for the creeping buttercup and more suitable for other wildflowers. The volunteers strim a path through the garden during the summer, but allow the grass and herbaceous plants to grow tall and bloom on either side.

Another plant species which requires careful management in the garden is buddleia (*Buddleja davidii*), also known as the butterfly bush. This invasive shrub has colonised the courtyard at the back of the garden, inspiring volunteers to nickname this area "The Buddleia Room". The volunteers cut down the buddleias every autumn or winter, to encourage strong regrowth. This also prevents it from going to seed and spreading further. While buddleia is an attractive source of nectar for butterflies and bees, it spreads rampantly, crowding

out other plants. A greater diversity of plant species, especially native species, would support a wider range of insects and have more benefit to local biodiversity.

The Villa Bank Garden has social and educational importance, revealing the diversity and importance of nature to people living in urban areas. The Biodiversity Action Plan delivers an expert evaluation of the biodiversity value in the region and shows the path to implementing actions that will protect it and raise local awareness on the matter.



Fig. 1. (L - R) The Villa Bank Garden in 2019, 2020, 2021 and 2022.

1.1.2. Importance for Biodiversity

The WWF (2022) reports that there has been an average decline of 69% in species populations around the planet since 1970. Ireland's biodiversity has not been spared from this loss. While only about 10% of Ireland's known 31,000 species have been assessed, we know that one-fifth of those assessed are threatened with extinction. This includes many insect species, as the following examples highlight.

One-third of Ireland's bee species and more than half of our bumblebee species are threatened with extinction, and 45% of our solitary bee species are in decline (Fitzpatrick et al., 2006). Four of our 24 species of damselfly and dragonfly have been IUCN Red List assessed as Threatened, and one as Near Threatened, due to habitat loss and the alteration of hydrology and nutrient levels in wetlands (Nelson et al., 2011). 37% of Europe's hoverfly species are threatened with extinction due to changes in farming approaches, urban development, pesticides, unsustainable forestry methods, and climate change (International Union for Conservation of Nature, 2022).

Insect populations are negatively impacted by global changes, and the systematic use of pesticides as well as environmental pollution are responsible for impacts on their population dynamics, distribution, abundance, intensity, and feeding behaviour (Khaliq et al., 2019; Alstad et al., 1982). Habitat fragmentation is a major issue for urban biodiversity. Many species use more than one type of habitat during their life cycle, in different seasons, or even at different times of the day, and as a result are especially impacted by habitat loss. Development and land use change are dividing large habitats into smaller, more isolated, and lower-quality fragments where species may not have access to all the resources they need.

In 2019, Ireland declared a biodiversity crisis, and Dublin City Council followed suit shortly after. This was followed by the publication of the Dublin City Biodiversity Action Plan 2021 - 2025 (Dublin City Council, 2021). To reduce risks to the environment, the council is phasing out glyphosates and began to implement alternative methods for herbicide between 2018 and 2020. The council is also working to reverse the decline in species populations by allowing areas of parkland to grow wild and encouraging pollinator-friendly gardening (Dublin City Council, 2018). These efforts are welcomed and necessary given the scale of population decline, where scientists warn that up to 40% of all insect species are on a downward trajectory to extinction (Sánchez-Bayo and Wyckhuys, 2019).

Actions such as these can provide buffer zones around and corridors between ecologically significant habitats. The Royal Canal, a unique habitat in North Dublin, provides a corridor along which species can safely migrate between other habitats in search of food, mates and breeding sites. As a constant presence of water and cool, sheltering vegetation, it is particularly important for biodiversity as it faces the challenges of climate change. The Villa Bank Garden and other green spaces under the care of Phibsboro' Village Tidy Towns provide useful buffer habitats for this ecologically significant corridor, and bolster populations of the insects that use the canal. They help to protect the canal against the pressures of its urban surroundings.

Green spaces such as these, if not too heavily managed, can host less-recognised wildflowers like nettles, which are vital food plants for several Irish butterfly species, as well as dandelions, an essential early source of nectar and pollen for bees and hoverflies. Additionally, certain Near Threatened bumblebee species can utilize high floristic grassland and urban gardens (e.g., *Bombus muscorum* and *Bombus lapidarius*).

Green spaces are considered Nature-Based Solutions that enhance quality of life by providing various ecosystem services, including regulating, provisioning, cultural, and supporting services (Millennium Ecosystem Assessment, 2005). These services are particularly crucial in urban contexts where changes in land use and scarcity can significantly impact biodiversity (OECD, 2020). Furthermore, the creation and maintenance of green spaces play a vital role in climate change adaptation within urban areas. They mitigate flooding risks by improving groundwater infiltration (Zimmerman et al., 2016).

1.2. Choice of Study Subjects

The present survey is part of a series being commissioned by Phibsboro Village Tidy Towns to inform the actions and objectives of a management plan for the green areas around Phibsboro. Their Biodiversity Action Plan currently includes checklists of plant and bird species in the area, a water quality assessment of Blessington Basin, and guidelines for biodiversity management (Tubridy, 2021).

Baseline information is essential for any long-term monitoring or management programme. Habitat management plans based on a single taxon (e.g. plant species) may not always be appropriate for the conservation of invertebrates (Gardner, 1991; York, 1999). Therefore, it is prudent of Phibsboro' Village Tidy Towns to commission a survey of invertebrates in conjunction with those of other flora and fauna. Including multiple taxa of invertebrates is particularly useful for monitoring the effects of changes in management practices (Pedley, et al., 2013).

Carabid beetles and hoverflies in particular can be used as bioindicators to monitor the effectiveness of a habitat management plan in maintaining the biodiversity of a site. They fit the criteria for a suitable bioindicator as summarised by Rainio and Niemelä (2003): the group must be well known and its ecology and distribution reasonably well understood; it should have specialist habitat requirements; it should respond rapidly to changes in environmental factors; and it needs to be simple and inexpensive to sample.

Ground beetles respond rapidly to changes in vegetation structure, disturbance, hydrology and other influences which can alter microclimate conditions (Darcy, 2012; Rushton, et al., 1990; Vessby, et al., 2002). These changes can influence the presence or absence of sensitive species, abundance, diversity, distribution and the composition of species assemblages (Luff, 1996; New, 2010). Hoverflies can reflect similar changes both at microhabitat and landscape scales (Speight, 2008). Therefore, gathering data on these two insect groups will provide an effective baseline with which to compare the results of any management interventions at the Villa Bank Garden and along the Phibsboro stretch of the Royal Canal.

The other insect groups included in this study are butterflies, bumblebees, shield bugs, ladybirds, dragonflies, and damselflies. These were chosen for their popularity among the public, ease of capture and identification in the field, sensitivity to changes (dragonflies also make suitable bioindicators), evidence of their declining populations (e.g., bumblebees), and to contribute records to ongoing citizen science recording schemes.

1.3. Primary Aims

This study aims to achieve the following outcomes:

- To gather baseline data on bioindicator species with which to compare the outcomes of any future management interventions at the Villa Bank Garden.
- To identify any uncommon or specialist species for which the site may provide suitable habitat conditions and which may need protection.
- To provide general recommendations for conservation of insects in the green spaces of Phibsboro.
- To compile a species list of macro-invertebrates which are easily visible to human visitors, with the aim of raising awareness among the residents of Phibsboro about the biodiversity in their neighbourhood.

2. METHODOLOGY

2.1. Survey Methodology

2.1.1. Pitfall Traps

During this survey, five pitfall traps were set at the Villa Bank Garden to catch ground beetles. The locations of the traps were chosen to represent as varied a range of vegetation structure (height, density, type of plant) and to cover as much of the area of the garden as possible.

The traps consisted of opaque plastic 350 ml cups, yellow and light green, 7 cm in diameter at the top, 5 cm at the base. These were set in the ground up to the rim. They were placed at least 10 metres apart from each other. A piece of chicken wire was placed in the mouth of each cup to prevent small mammals and frogs from becoming trapped.

To each cup, approximately 100 ml of a mixture of propylene glycol (50%) and water (50%) were added. A 20 cm x 20 cm lid was secured 5 - 10 cm above each trap using bamboo skewers. These lids were cut from old plastic election campaign posters. A notice was written on the back explaining their purpose and providing contact details.

The author accidentally omitted to label the traps upon collection at the end of the second round of trapping, but the locations of the first round of traps (VB1 - VB5) can be seen in the map in Fig. X.

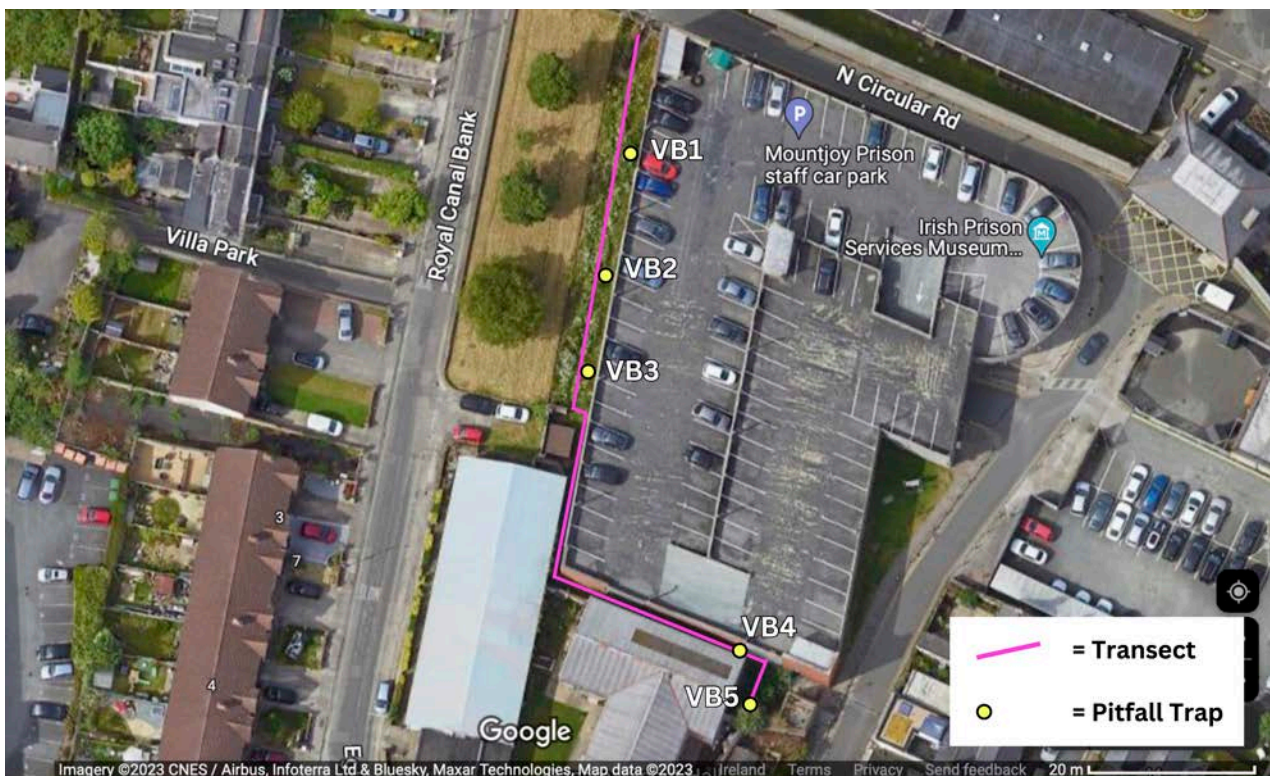


Fig. 2. Map of the transect and locations of pitfall traps at the Villa Bank Garden.

2.1.2. Transect

In order to survey butterflies, bees and hoverflies, a transect was mapped along the middle of Villa Bank Garden. The transect monitoring method was based on recording guidelines in the National Biodiversity Data Centre's Five Visit Monitoring Scheme for Butterflies (2022) and their Bumblebee Monitoring Scheme (2022a).

The transect was surveyed only between the hours of 11:00 and 17:00, between the months of April and August, when the temperature was above 13°C, and during good weather conditions. The habitat was searched visually within a "box" of 2.5m to either side of the recorder and 5m in front. This covered the entire garden. Sightings of insects from all of the survey target groups were recorded. Any chance sightings of other invertebrates which could be easily identified in the field were also recorded, but a comprehensive survey was not taken of these groups. They included moths, true bugs, earwigs, snails and spiders.

Two visits to the transect were made, one at the start and one at the end of the survey period, to increase the chances of recording species which are active at different times of the season. Anything which could not be identified in the field was taken in a sample jar and placed in a freezer overnight, before being stored in alcohol.

2.1.3. Sweep Netting

A medium sweep net (40 cm at widest point) was used to collect target insect groups from the vegetation alongside the transect. This was achieved by sweeping the net back and forth twelve times (in a 1 m span), taking a step forward between each. The contents of the net were emptied into a white dissection tray, and all insects from the survey target groups were identified and recorded, or removed for identification under the microscope. The latter were placed into the freezer overnight, and then stored in alcohol.

2.2. Identification and Ecology

The contents of each pitfall trap were emptied into a white tray and sorted by Nessa Darcy and Elias Borel. The invertebrates were divided into two categories (Coleoptera and miscellaneous) and stored in alcohol. All specimens of the target insect groups were identified by Nessa Darcy, with assistance from Elias Borel and Oisín Slator. The insects were examined under an Optika Lab-20 stereo microscope (7x...45x magnification).

Identification and notes on ecology and conservation status are taken from the following sources for each insect group:

Bees

Field Guide to the Bees of Great Britain and Ireland (Falk and Lewington, 2015).

Beetles

The Ground Beetles of Ireland website by the National Museums Northern Ireland (2006); The Carabidae (ground beetles) of Britain and Ireland by Martin L. Luff (2007); The Ladybirds of Ireland website (National Museums Northern Ireland, 2009); Ladybirds (Coccinellidae) of Britain and Ireland (Roy et al., 2012); and the Species Profiles on the National Biodiversity Data Centre (2022b) website.

Butterflies

The Irish Butterfly Book (Harding, 2021) and the Species Profiles on the National Biodiversity Data Centre (2022b) website.

Dragonflies

Identification Guide to Ireland's Dragonflies and Damselflies (Regan and Nelson, 2013); Ireland Red List No.6: Damselflies & Dragonflies (Odonata) (Nelson et al., 2011); and Dragonfly Ireland (National Museums Northern Ireland, 2012).

Hoverflies

Britain's Hoverflies: A field guide (Ball and Morris, 2015) and Species Profiles on the National Biodiversity Data Centre (2022b) website.

Moths

Field Guide to the Moths of Great Britain and Ireland (Third Edition) (Waring et al., 2017), the Irish Moths and Butterflies website (Seawright, 2010) and Ireland Red List No. 9: Macro-moths (Lepidoptera) (Allen et al., 2016).

True Bugs

British Bugs, an online identification guide to UK Hemiptera (Bantock and Botting, 2018)

A full list of sources can be found in the references section of this report.

3. RESULTS

3.1. Sampling Effort

Five pitfall traps were set for two time periods. The first round was from 6 June 2022 - 17 June 2022, the second was from 15 August 2022 - 29 August 2022. A total of forty-six individual adult ground beetles were caught in the pitfall traps. The pitfall traps also contained beetles of other families and other miscellaneous invertebrates. These groups were not included in the scope of this survey, but the specimens have been preserved by the author.

The transect was surveyed on 6 June between 11:55 and 12:46, and again on 29 August between 13:47 and 15:02. Walking the transects resulted in seventy-five insect records, between those identified in the field and samples collected and identified under the microscope.

Ten sweep samples were taken on 6 June 2022, and another ten were taken on 29 August 2022. This resulted in thirty-eight records of insects from the groups covered by this survey.

In addition to the sampling methods above, four opportunistic records (random sightings of identifiable species) were made throughout the survey.

A total of one hundred and sixty-three individual insects were identified to species or genus level and recorded during the present survey. The species identified from all of the methods above are outlined in the sections below.



Fig. 3. (L - R) Bees at the Villa Bank Garden: *Bombus pascuorum*, *Megachile centuncularis*, *Bombus lucorum* agg.

3.2. Bees (Apidae)

In total, five different bee species were recorded during this survey of Villa Bank Garden (Table 1). Thirty-two of the individuals recorded were found during the monitoring of the transect, and one was recorded opportunistically at another time. This survey focused on bumblebees and honeybees, not solitary bees, but one solitary leaf cutter bee, *Megachile centuncularis*, was seen by chance and recorded.

While this survey was qualitative, not quantitative, it is worth noting that honeybees were the most frequently recorded bee species during this survey, with 24 individuals, while only 1 - 5 individuals of each of the other species were recorded.

Species	Common Name	Comments on Irish Distribution, Conservation Status and Habitat	Sampling Method
<i>Apis mellifera</i>	Honey bee	Not evaluated in the Irish Red List, “due to the difficulty of distinguishing native populations from those imported into Ireland by beekeepers”.	Transect
<i>Bombus lucorum</i> agg.	White tailed bumblebee	Extremely common, Least Concern.	Transect
<i>Bombus pascuorum</i>	Common carder bumblebee	One of Ireland’s commonest bumblebees. Least Concern.	Transect and opportunistic find
<i>Bombus pratorum</i>	Early-nesting bumblebee	First recorded here in 1947, now common throughout.	Transect
<i>Megachile centuncularis</i>	Patchwork leafcutter bee	Near Threatened.	Transect

Table 1. Bee species recorded at the Villa Bank Garden.



Fig. 4. (L - R) Beetles recorded at the Villa Bank Garden: *Loricera pilicornis* and *Adalia bipunctata*.

3.3. Ground Beetles (Carabidae)

Seven species of ground beetle were identified from the pitfall traps. *Notiophilus biguttatus* was also observed opportunistically. Common names are not listed in Table 2 as most ground beetles do not have one. The

present study did not aim to measure the populations of insects at the site, but *Pterostichus madidus* was captured most often (37 individuals), compared to the other species, which were represented by one to three individuals each.

Ground Beetle Species	Comments on Irish Distribution, Conservation Status and Habitat	Pitfall Traps Containing This Species
<i>Amara aenea</i>	Widespread and common in gardens and on sandy soils with sparse vegetation, especially near the coast.	VB1
<i>Amara ovata</i>	Widespread and locally common. Dryish places in arable fields, gardens and quarries. Open ground with sparse vegetation	VB1
<i>Anchomenus dorsalis</i>	Widespread, sometimes abundant, in fields, gardens (including urban), and waste ground with dry soil. Especially seen around piles of dead wood or stones at the base of hedges.	VB3
<i>Loricera pilicornis</i>	Very common everywhere but especially gardens, open gravelly or sandy sites and streamsides in mountains.	Unmarked trap
<i>Nebria brevicollis</i>	Very common.	VB2, VB3
<i>Notiophilus biguttatus</i>	Widespread and often abundant in grasslands, gardens, woods and arable fields. Mainly shaded habitats.	VB1, VB2 and opportunistic find
<i>Pterostichus madidus</i>	Found in a wide variety of open and shaded habitats, including peatlands, lowland pasture, hay meadows, drier woodlands and dry heath. Shelters under stones, loose bark and grass tussocks. Widespread and common	Four unmarked traps, and VB1, VB2, VB3

Table 2. Ground beetle species recorded at the Villa Bank Garden.

3.4. Ladybirds (Coccinellidae)

The single species of ladybird recorded during the survey of Villa Bank Garden was caught in a sweep net.

Ladybird Species	Common Name	Comments on Irish Distribution, Conservation Status and Habitat	Sampling Method
<i>Adalia bipunctata</i>	2-spot ladybird	Common in houses, gardens, vegetation on wet water margins, pasture, trees (especially willow) or scrub. Feeds on aphids. Decreasing in the UK following the arrival of the harlequin ladybird.	Transect

Table 3. Ladybird species recorded at the Villa Bank Garden.

3.5. Butterflies and Moths (Lepidoptera)

Surveying the transect during this study at the Villa Bank Garden resulted in a list of four butterfly species and five moth species. All of these were identified in the field or from photographs. Most were temporarily captured using a butterfly net, for closer inspection.

Butterfly/Moth Species	Common Name	Comments on Irish Distribution, Conservation Status and Habitat	Sampling Method
<i>Anthophila fabriciana</i>	Nettle tap moth	Widespread where its food plant, nettle (<i>Urtica dioica</i>), is found.	Transect
<i>Emmelina monodactyla</i>	Common plume moth	Common and widespread. Gardens, parks, fields, hedges, roadsides, railway banks, and other disturbed habitats where its food plant bindweed (<i>Convolvulus</i>) grows, as it does in the Villa Bank Garden.	Transect
<i>Epiphyas postvittana?</i>	Light brown apple tortrix moth	Difficult to confirm the exact species, as it is very variable and similar to others, but <i>E. postvittana</i> is common. Larvae will feed on most plants.	Transect
<i>Pararge aegeria</i>	Speckled wood butterfly	Least Concern. Woodland, hedgerow, scrub. Larvae feed on damp wild grasses. Its habitat is abundant in Ireland so it is common, but in decline.	Transect
<i>Pieris brassicae</i>	Large white butterfly	Least Concern but in decline, possibly due in part to fewer brassicas being grown by gardeners. In open habitats anywhere it has larval food plants and nectar sources.	Transect
<i>Pieris rapae</i>	Small white butterfly	Least Concern. Open, dry, habitats including gardens and coastal dunes.	Transect
<i>Tyria jacobaeae</i>	Cinnabar moth	Least Concern. Larvae observed in the garden on ragwort (<i>Jacobaea vulgaris</i>). Common and well distributed in Ireland. The larvae eat common ragwort, which is classified as a noxious weed and frequently eradicated from farmland in Ireland. Commonly found in well-drained, open, grassy areas such as waste grounds, railway banks, gardens, woodland clearings, sand dunes, and heaths.	Transect
<i>Udea lutealis</i>	Pale straw pearl moth	Very common. Rough ground with herbaceous plants such as bramble, thistle, plantain (<i>Plantago</i>), knapweed.	Transect
<i>Vanessa atalanta</i>	Red admiral butterfly	Widespread migrant, wherever sources of nectar are available.	Transect

Table 4. Butterfly and moth species recorded at the Villa Bank Garden.



Fig. 5. (L - R) Large white butterfly, nettle tap moth and common plume moth, at the Villa Bank Garden.

3.6. Dragonflies and Damselflies (Odonata)

One species of damselfly was observed at the Villa Bank Garden but no dragonflies. The species was identified from photographs.

Dragonfly Species	Common Name	Comments on Irish Distribution, Conservation Status and Habitat	Sampling Method
<i>Ischnura elegans</i>	Blue-tailed damselfly	Least Concern. Widespread, common, in a wide range of lowland water bodies, including polluted or brackish water. Prefers well vegetated habitat.	Transect

Table 5. Damselfly species recorded at the Villa Bank Garden.

3.7. Hoverflies (Syrphidae)

Seven species of hoverfly were recorded during the present survey (Table 6), from nineteen individuals found on the transect and opportunistically. The most abundant was *Sphaerophora scripta*, with nine individuals recorded along the transect, followed by *Merodon equestris*, with three.

Hoverfly Species	Common Name	Comments on Irish Distribution, Conservation Status and Habitat	Sampling Method
<i>Epistrophe nitidicollis</i>		Frequently recorded primarily woodland and scrub species, especially likes to visit Garlic Mustard. Also visits hawthorns, roses, brambles and umbellifers.	Transect
<i>Episyrphus balteatus</i>	Marmalade hoverfly	Anthropophilic, almost ubiquitous.	Opportunistic find
<i>Eupeodes luniger</i>		Widespread, but not common. Some migration of this species to Ireland occurs. Likes open ground, grassland, woodland clearings and tracks. Strongly anthropophilic, also occurring in farmland, orchard, suburban gardens and parks. Its larvae eat aphids.	Transect
<i>Merodon equestris</i>	Large Narcissus fly	Widely distributed, almost entirely anthropophilic in Ireland, most frequently found in urban/suburban areas, because it relies on certain types of bulbiferous plants such as Narcissus.	Transect
<i>Platycheirus albimanus</i>		Possibly the most abundant and generally distributed hoverfly in Ireland. Common in gardens. Among low foliage such as brambles, nettles, low growing flowers.	Opportunistic find
<i>Sphaerophoria scripta</i>	Long hoverfly/ Common twist-tail	Primarily coastal species in Ireland, in contrast to the rest of Western Europe where it is widespread. Open ground, grassland, heath, gardens, saltmarsh. Possibly a non-resident migrant here.	Transect
<i>Syritta pipiens</i>	Thick-legged hoverfly	Ubiquitous, anthropophilic and hygrophilous.	Transect

Table 6. Hoverfly species recorded at the Villa Bank Garden.

3.8. Terrestrial True Bugs (Hemiptera)

Shieldbugs were a target group of this study. No shieldbug species were found in Villa Bank Garden during this survey, but it was possible to identify one other common species of true bug (Hemiptera) which was present in abundance (Table 7).

True Bug Species	Common Name	Comments on Irish Distribution, Conservation Status and Habitat	Sampling Method
<i>Philaenus spumarius</i>	Common froghopper	Common.	Sweep netting and transect

Table 7. Terrestrial true bug species recorded at the Villa Bank Garden.



Fig. 6. (L - R) Hoverfly larva (possibly *Episyrphus balteatus*), mating *Sphaerophoria scripta*, and an abundance of aphids, the larval food source of many hoverfly species.

3.9. Miscellaneous Other Invertebrates

A number of records were made of other invertebrate species which could be easily identified, but which were not in the target groups for this survey (Table 8).

Species	Common Name	Comments on Irish Distribution, Conservation Status and Habitat	Sampling Method
<i>Cornu aspersum</i>	Common garden snail	Widespread and common.	Sweep netting
<i>Forficula auricularia</i>	Common earwig	Common and widespread. Eats decaying plant and animal matter and return nutrients to the soil.	Sweep netting and transect
<i>Lucilia</i> sp.	Greenbottle fly	Unable to identify to species level	Transect
<i>Porcellio scaber</i>	Common rough woodlouse	Very common, often in gardens. Under stones and logs, in walls and crevices of bark. Can tolerate drier conditions than some other species.	Opportunistic
<i>Salticus scenicus</i>	Zebra spider	Common and widespread in Ireland. Often seen on garden walls and houses.	Sweep netting
<i>Vesputa</i> sp.	Paper wasps	Unable to identify to species level	Transect

Table 8. Miscellaneous other invertebrates recorded at the Villa Bank Garden.

4. DISCUSSION

4.1. Conservation Status and Distribution

Most of the species recorded at Villa Bank Garden during this survey are common and widely recorded habitat generalists. However, some species with localised distribution or restricted habitat requirements were recorded, and a number of species are in decline, reflecting the importance of the specific habitats present in Phibsboro, in the context of an urban environment. These species are outlined below.

All of the butterfly and macro moth species recorded have been assessed using the IUCN Red List criteria as being of Least Concern in Ireland. However, the large white butterfly is in decline, likely due to fewer brassicas being grown by gardeners. The speckled wood is common but also in decline, and its presence here is noteworthy because its typical habitat is woodland, hedgerow, scrub.

All of the ground beetle species recorded in this survey are common and widespread. The particular assemblage of ground beetle species found during this survey are supported by the present vegetation structure of the Villa Bank Garden. Diversification of vegetation structure in the garden over the coming years is likely to bring about changes in the composition of the ground beetle community and an increase in species diversity.

The two-spot ladybird was the only ladybird species recorded in this survey. Populations of this species are declining in the United Kingdom while the Irish range of the two-spot ladybird is expanding (National Biodiversity Data Centre, 2022b). The two-spot ladybird is associated with riverside vegetation and gardens, meaning that proximity to a well-vegetated stretch of the Royal Canal and the buffering effect of local parks and gardens may play an important role in the survival of this species at this site. The author has also observed two-spot ladybirds breeding in the St. Anne's Road Pocket Park in Drumcondra.

One individual of *Epistrophe nitidicollis* was recorded during this survey. The National Biodiversity Data Centre has only ten records of this species, three of which were taken from the Greater Dublin Area. It is typically associated with woodland, visiting a variety of flowers along woodland rides, such as roses, hawthorn, brambles and umbellifers, all present at the Villa Bank Garden. It particularly likes the flowers of Garlic Mustard (*Alliaria petiolata*), which the author has seen growing abundantly under the trees in Blessington Street Park, approximately 500m away. It has been suggested that *E. nitidicollis* should be a protected species, as its populations are small, localised, fragmented and therefore potentially susceptible to extirpation (National Biodiversity Data Centre, 2022b).

The other hoverfly species recorded during this study of the Villa Bank Garden are common and widespread, and many of them can use human-made habitats. However, some, such as *Syrirta pipiens*, require humid habitats, which are not found everywhere. *Sphaerophoria scripta* is normally restricted to coastal areas of Ireland, unlike elsewhere in its European range. This, among other clues, indicates that it may be a migrant on this island.

Only the most common and widespread bumblebee species were recorded during this survey. The honey bee, whose conservation status has not yet been fully assessed, was also present. In addition, the solitary bee *Megachile centuncularis*, a Near Threatened species, was observed.

Ischnura elegans, a widespread species of damselfly, was observed at Villa Bank Garden. It probably travelled from the nearby canal, to hunt for insects in the garden. This demonstrates that gardens can provide important buffer zones for more significant ecological sites.

4.2. Hydrology

It appears that the Villa Bank Garden has areas of relatively dry habitat with open ground, suitable for a number of the ground beetles recorded in this study. *Amara ovata*, *Anchomenus dorsalis* and *Pterostichus madidus* are characteristic of places with dry, well-drained soils. *Amara* species in particular, like open, sunny ground. Dry, open soil can provide nest sites for certain species of solitary bees, although none of these species were observed during the present survey.

Due to the proximity of the Royal Canal, insects that have a preference or need for wet or damp habitats are also found in the Villa Bank Garden, particularly those that use more than one type of habitat. For example, the damselfly *Ischnura elegans* uses the canal as a habitat in its nymphal form, but the adults may venture further afield to hunt for insects. The hoverfly *Syrirta pipiens* also prefers damp habitats.

The speckled wood butterfly requires tall, damp grass to feed its larvae. Such habitat can be found along the canal, and the adult butterfly which was observed in the Villa Bank Garden may have been visiting to avail of its abundant nectar sources or the sugary deposits that aphids excrete on the leaves. As the Villa Bank Garden develops over the coming years, the vegetation may become more dense, the soil may retain more moisture, and a damp grassy habitat may develop, which may provide suitable for the larvae of this declining butterfly species.

Particularly as the climate becomes warmer and drier, insects need water sources to drink and dense or overshadowing vegetation structures to provide cool microhabitats for insects which would otherwise dry out.

4.3. Interspecies Interactions

A number of species identified in this survey have interesting interactions with other specific insects and plants. Many insects are obligate feeders of specific types of plants, insects or substances, and require different food sources at different stages of their lives. The larvae of the speckled wood butterfly, for example, need wild grasses to feed on, but as adults they feed on nectar from hedgerow or forest edge plants such as bramble, or drink the sugary substance excreted by aphids, known as honeydew.

The cinnabar moth is an obligate feeder on ragwort (*Jacobaea vulgaris*). Its larvae were seen on this plant in the Villa Bank Garden. The author has also seen eggs on ragwort at the nearby St. Anne's Road Pocket Park, and an adult cinnabar on the banks of the Royal Canal. These urban sources of their larval food plant are important, as ragwort is routinely eradicated from farmland where it can be toxic to livestock when mixed into hay or silage. Research has shown that while the cinnabar moth's UK distribution has not changed significantly

between 1968 and 2022, their population numbers have decreased dramatically in response to the routine eradication of ragwort from farmland due to its toxicity to livestock (Buglife, n.d.).

The larvae of several of the hoverfly species found in the present survey, such as *Episyrphus balteatus*, are voracious predators of aphids and other insects that might be considered plant pests. Gardeners in the surrounding area will be pleased to know that populations of these beneficial species are supported by the high floristic vegetation and aphid population of the garden. Hoverfly larvae were present in large numbers on the wild roses along the garden railings during this survey.

Adult hoverflies have a preference for flat, open flowers, which are often white or yellow. These tend to have shallower nectar sources, suitable for their short mouthparts. In contrast, bees and butterflies can make use of deeper flowers by using their proboscises. The Villa Bank Garden contains a diverse range of flowers of different shapes and colours, from oxeye daisies and umbellifers to knapweed and thistles, catering to a wide range of pollinators. Plants which attract bees, hoverflies, wasps, moths and butterflies will benefit in return from the pollination services of these insects. Pollinator populations are generally declining, thus any habitat that provides forage for them, such as the Villa Bank Garden, is important for their conservation.

The insects and other invertebrates supported by the Villa Bank Garden, and private wildlife-friendly gardens in the area, also provide a source of prey for many birds, mammals and fish which use the canal, and other local green spaces and corridors.

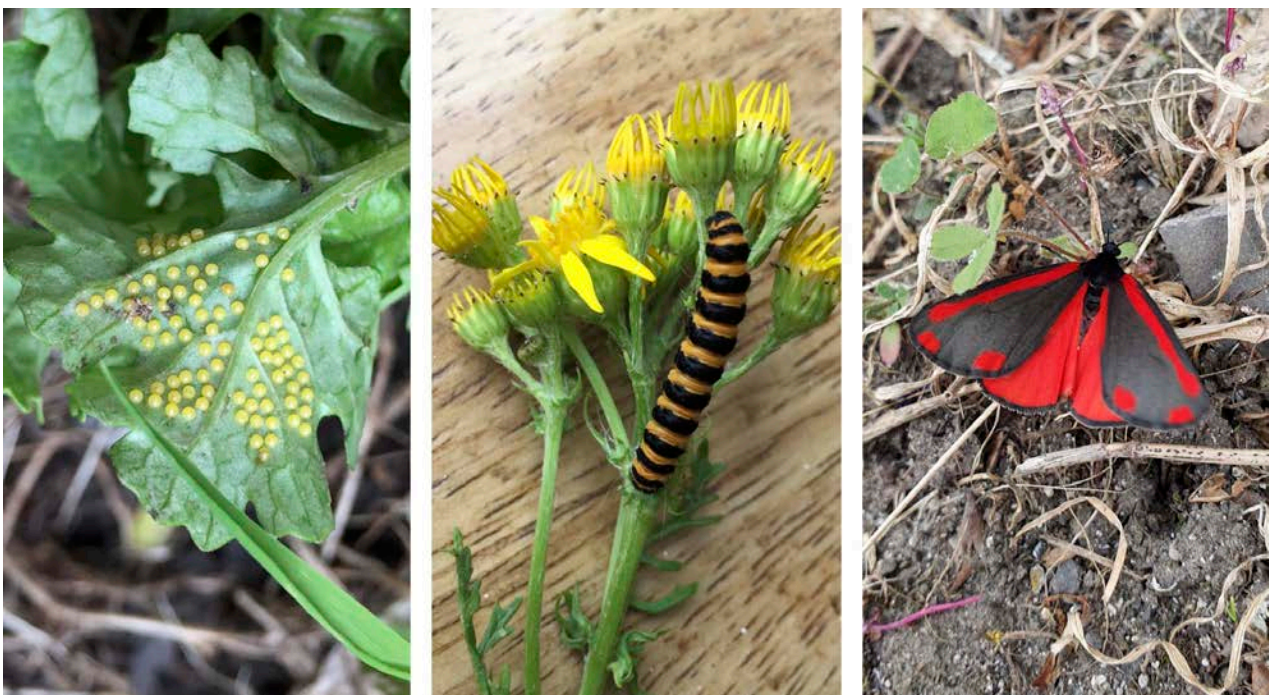


Fig. 7. (L - R) The eggs, larva (on its food plant, ragwort), and adult of the cinnabar moth.

4.4. Habitat Heterogeneity

Many insect species require the use of different habitats at different stages of their life cycle, at different seasons or even at different times of the day. Providing diversity of vegetation structure and micro-habitats in the Villa Bank Garden therefore has the potential to support more insect species in its environment. Such

provisions might include cutting the grass and herbaceous vegetation to varying heights and densities, rotational cutting of vegetation (leaving areas of long, dense vegetation in place year round), allowing areas of scrub to develop, supporting the growth of the trees already planted in the space, allowing leaf litter and dead wood to remain in place. These habitats enable insects to nest, hunt, overwinter, take shelter from dry weather and meet their larval and adult food requirements. This habitat heterogeneity allows many of the species recorded in this study to exist on the site. Some examples are given below.

In the warmer seasons, ladybirds and their larvae eat aphids, which they find on herbaceous plants and trees. However, they need to overwinter in sheltered places in log piles, dead leaves, pine cones, and nooks and crannies in tree bark and stone walls. Grass tussocks and leaf litter provide essential overwintering habitat for shield bugs. The fact that the Villa Bank Garden is newly established and does not yet provide these microhabitats all year round may explain the absence of shield bugs and scarcity of ladybirds.

Many hoverfly species feed on aphids while in their larval stage, feed on nectar from flowers in adulthood, and overwinter either as larvae in the soil or as adults in sheltered spots such as those where ladybirds can be found. Other species have larvae which develop in water or damp decaying plant matter, and some even develop inside the nests of bees or wasps. Ground beetles might need open areas in which to hunt, but shelter under logs or in grass tussocks at other times.

The Royal Canal is the primary habitat for *Ischnura elegans*, the blue-tailed damselfly which was found at the Villa Bank Garden, but the garden provides it with a hunting ground with abundant insect prey. The bees and other pollinators in the garden are supported by the nearby source of water, particularly in warmer weather as the climate changes, but the garden provides them with different sources of nectar and pollen from the flowering plants found along the canal banks. These contrasting and complementary habitats contribute significantly to the diversity of species encountered in the Villa Bank Garden and along the canal.



Fig. 8. (L - R) Common rough woodlouse, zebra jumping spider, garden snail.

5. RECOMMENDATIONS

While carrying out fieldwork, the author frequently encounters members of the public who lament the decline of butterflies, bees and other popular representatives of our natural heritage which they remember fondly from their childhood experiences of the outdoors. The Villa Bank Garden is a haven for these insects in the midst of a built-up suburban area where public access to nature is limited, and it should be championed and protected as such. Below are some recommendations for the management of the garden and its promotion as a resource for education and wellbeing.

1. Promote habitat heterogeneity.

Heterogeneity of vegetation structure and plant species composition, as well as transitional areas between different microhabitats, are essential for insects. The Villa Bank Garden can be mowed in a way that creates a diversity of sward height and density, encourages floral diversity and leaves some areas of open ground. Any vegetation cutting should be carried out as late as possible in the season to allow plants to set seed and associated invertebrates to complete their life cycles.

Mowing should be carried out on a rotational schedule if possible, leaving areas of long tussocky grass and herbaceous plants available to insects year round. This approach provides insects with places to overwinter, under the tussocks or in the dead plant stems, as adults and pupae. Some light disturbance (e.g. by volunteers walking around the site) is beneficial for plants to set seed, but any major soil disturbance such as extensive digging should be avoided, as many insects spend a portion of their lifecycle under the soil.

The removal of cuttings after mowing, which is already carried out by volunteers, reduces the nutrients in the soil, making it increasingly more suitable for wildflowers. Cuttings can be put aside in another area of the garden to form habitat piles for invertebrates. Dead wood and leaf litter should be left in place where possible to provide shelter and overwintering habitats. If they must be removed from the front of the garden for aesthetic reasons, consider also placing them in more hidden parts of the garden as habitat piles.

2. Recognise the garden's role in the ecological network.

Green spaces such as the Villa Bank Garden play a vital role in ecological networks, forming sections of wildlife corridors that connect biodiversity across urban settings, reversing some of the damage of fragmentation and bolstering populations of flora and fauna. Consider management and protection strategies from a broader perspective, both at the microhabitat level and in terms of connectivity with other habitats in Dublin City, such as Blessington Street Basin, Whitworth Cemetery, Shandon Park, the Serenity Garden, and along the full length of the Royal Canal.

3. Raise awareness of the garden among the public.

The particular style in which the Villa Bank Garden is being managed provides an ideal opportunity to raise awareness of the importance of more wild, "untidy" habitats in the urban setting. It may encourage people to change their perception of nature's aesthetic and appreciate the importance of less popular wildflowers (sometimes known as "weeds"), such as nettles, ragwort and thistles, for biodiversity conservation.

It may be useful to raise awareness about how long it can take for wildflowers to become properly reestablished on land which has previously been altered by humans. It takes patience to enjoy the gradual process of allowing wildflowers to emerge in response to a sensitive mowing regime over a number of years, and to watch insects discover this new resource and begin to use it. Local schools and community groups could be encouraged to use the space as a learning environment, raising awareness of its significant role as an

urban habitat for insect conservation, and highlighting the interesting ecology and usefulness of each new plant and insect species as they appear.

Interpretive signage, such as that already in place at the Villa Bank Garden, plays a crucial role in providing information to visitors, improving their knowledge and understanding of biodiversity and conservation as they pass by. These signs can effectively showcase the area's diversity and generate interest among local stakeholders, especially as many of the insects found during this survey provide benefits to gardeners such as pest control and pollination.

Signs can also promote actions that community members can take to support biodiversity, such as taking part in #NoMowMay or choosing specific flowers for their gardens which enhance resource availability for pollinator species. Signage could also serve as a means to gather financial support from the community for future projects dedicated to environmental protection. One common practice is to include QR codes on posters, allowing donors to scan the code and be directed to a donation page focused on local biodiversity conservation and the improvement of green spaces.

4. Support the existing flora of the site.

Sowing "wildflower" seed mixes, in a well-meaning attempt to support pollinators, does not effectively address biodiversity loss and can worsen the problem. Key issues include the presence of non-native species, the introduction of new genetic strains, the unnecessary displacement of native plants, the insufficient support for pollinators, and the mismatch between seed mixtures and natural habitats. Instead, conservation efforts should focus on working with existing natural processes and minimizing disturbance (Dublin Naturalists' Field Club, 2021).

Instead of sowing "wildflower" seed mixes, the public can support pollinators by reducing mowing, letting wildflowers naturally appear from seeds lying dormant in the soil, restoring existing natural meadows and verges, and prioritising more humble native flowers over the aesthetic of garden centre plants often preferred by humans (National Biodiversity Data Centre, 2021).

If any further planting must be carried out in the Villa Bank Garden, consider choosing plants which will provide forage for pollinators earlier and later in the year, to provide year round sources of nectar and pollen.

5. Continue to manage invasive species such as buddleia.

Buddleia (Buddleja davidii) can invade important wildlife habitats such as brownfield sites, crowding out other important plants. It cannot replace naturally occurring wildflowers and is not a food plant for the caterpillars of Irish butterfly species. On the other hand, buddleia can provide an abundant source of nectar for butterflies, bees, moths and other insects in urban settings. During the present survey, red admiral butterflies, white tailed bumble bees and honey bees were seen feeding on its flowers. Attracting such species into the garden increases the garden's potential to support pollinators and to showcase insects to the public as an educational resource (Butterfly Conservation, 2012).

Cutting back the plants after flowering, as the Phibsboro' Village Tidy Towns volunteers already do, will prevent seed production and ensure that the buddleia does not spread and take over the garden, while allowing it to remain as a food source for pollinators.

6. Consider adding a water feature.

The provision of water in a garden can attract a whole new range of insect life, and support the existing pollinators. As the gate to the Villa Bank Garden is locked except when volunteers are working there, a pond is unlikely to be interfered with by members of the public. The ground appears to be well draining and naturally

dry in the Villa Bank Garden, so it may not lend itself easily to holding a water feature, but options for a small pond or a patch of wet grassland could be considered in consultation with an expert.

Hoverfly lagoons are an easier, smaller scale option, and can be created in collaboration with local schools, as a way to highlight to pupils the importance of sites such as the Villa Bank Garden for pollinators. The lagoons consist of small containers filled with water and decaying plant matter. They provide habitat for the larvae of certain hoverfly species (Buzz Club, 2018).

7. Continue to organise litter pick-ups while preserving natural debris.

Litter pick-ups in and around the Villa Bank Garden, such as those already organised by Phibsboro Village Tidy Towns, will benefit both the biodiversity of the garden and its perception in the public eye. However, biodegradable debris that accumulates under trees and hedges, and in grass and herbaceous tussocks, such as dead leaves, dead wood and stems, can form microhabitats which support many invertebrate species and should be left in the garden wherever possible.

8. Carry out further monitoring.

Although a single survey has inherent limitations, it serves as an important resource for understanding long-term diversity changes. It can establish baseline information for the Villa Bank Garden project and contribute to the broader knowledge base of urban biodiversity studies in Dublin. As the vegetation in the Villa Bank Garden develops and becomes more established, the composition of insect communities is likely to change. Repeated surveying will enable Phibsboro' Village Tidy Towns to assess whether the project is achieving its goal of supporting insect biodiversity.

By implementing these recommendations, it is possible to improve habitat quality, increase the diversity of species supported by the Villa Bank Garden, and contribute to the conservation of local ecosystems.



Fig. 9. The Villa Bank Garden in 2023.

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Fig. 10. *Buddleja davidii*, willow and a colourful array of wildflowers at the Villa Bank Garden.