THE Oceania Pollinator Initiative OPI

Composite Profiles

for the Oceania Pollinator Initiative

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Introduction

Information on pollinators is accumulating at an accelerating rate due to recent events in the unfolding global pollinator crisis, such as further losses of honey bees due to the global spread of varroa mite (Varroa destructor, Acari) and the dramatic and mysterious Colony Collapse Disorder (CCD) on several continents. Since 1999, the International Pollinator Initiative based on the Sao Paulo Declaration (Convention for Biological Diversity, coordinated by the Food and Agriculture Organisation) has prompted the formation of five regional scale groups for the sustainable use and conservation of pollinators in Brazil, North America, Europe, Africa and most recently Oceania. The Oceania Pollinator Initiative (OPI) faces challenges because it is comprised of numerous isolated small island nations (with one island continent, Australia) which are located primarily in the southern hemisphere where pollination systems are poorly known. A bioinformatics approach with leveraging and repatriating existing information and exchanging data via the internet is most efficient. We are proposing a system for integrating and delivering information via federated distributed databases (see companion poster "Integrated Information System for OPI"). We are in the process of constructing a prototype for the content to be delivered that has dynamic integration of data from many sources according to transparent rules of interpretation created by experts. The data and information can be re-used, updated and traced to original sources for multiple purposes that target audiences at various technical levels and relies on sound scientific evidence.

Pollinator Profiles for the Public

Purpose:
Members of the public want to know what flowers attract which type of pollinator in their area so that they can create "pollinator gardens" to help support and conserve pollinator diversity.

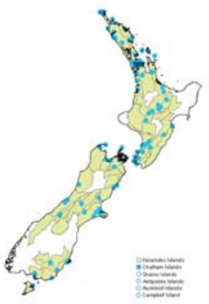
Drone Fly (*Eristalis tenax*)

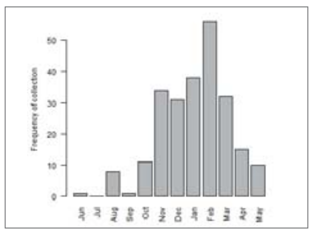
[name data source 1 Names]

Dronefly collecting pollen

Commentary:
European drone flies are actually in the same family as hoverflies (Syrphidae) which are pollen eating flies. They are commonly found on a wide array of flowers. You can easily recognize them once you become familiar with them. However at first, you might mistake them for a honey bee which they mimic in general appearance, but they are distinguished by their larger eyes and their habit of moving their abdomens up and down in a distinctive bobbing motion when resting on flowers. They also have a more darting flight than honey bees, and generally appear less "busy" when working flowers. The pattern on the abdomen is also distinctive, although it varies in intensity. Drone flies seem particularly attracted to daisy-like flowers with a strong yellow component but they are seen visiting nearly any type of flower. They are more abundant in places that have a water course for their larvae and can be collected from August to May in urban, rural and natural habitats.
[text data source 3 Traits]

Locations in New Zealand where specimens have been collected.
[location map data source 4 Specimens]





Months when specimens have been collected in New Zealand.
[phenology chart data source 4 Specimens]

Checklist of plants visited based on observations:

In our surveys at 9 sites (cultivated and semi-natural, we observed *Eristalis tenax* (Drone Fly) visiting the flowers of these 71 plant species

1. Achillea millefolium L.
2. Anethum graveolens L.
3. Asparagus scandens Thunb.
4. Berberis glaucocarpa Stapf
5. Brachyglottis greyi (Hook.f.) B.Nord.
6. Brassica nigra (L.) Koch
7. Brassica oleracea L.
8. Calendula offi cinalis L. ...
9. Callistemon rigidus R.Br.
10. Calystegia sepium (L.) R.Br.
11. Carmichaelia stevensonii (Cheeseman) Heenan

... contd. to 71 plants

Sources of data for profiles

Source 1 NAMES
Scientific names are critical for users because they are the primary key to accessing biological information. Scientific nomenclature used in the profiles is derived from authoritative names databases for plant and pollinator species. If these names databases are dynamically linked to the profiles then synonyms and changes can be updated in the profiles. The names databases hold the relevant ranks (e.g., family, genus, species) as well as relevant common names

Source 2 IMAGES
Images such as photos or other Illustrations enable users to confirm the identity of organisms and to visualize other information. Photographic vouchers of plant-pollinator interactions are an important source of reliable data. Multiple photos of the same flower visitor can reveal behaviours and morphological fit as evidence that the visitor is capable of pollination. Photo databases can include flower structures to illustrate access to nectar and pollen resources as well as inflorescences and whole plant images to aid identification.

Source 3 TRAITS
Traits are critical attributes of the organism's biology, morphology, or ecology that are needed to understand the potential for a plant-pollinator partnership. They are stored in databases along with reference to source and date of the information. Tracing information to original sources is critical for users to evaluate the reliability and strength of the evidence for a plant-pollinator association. Traits can include many types of data such as flight periods, nesting habits, and life cycles, and quality and quantity of nectar and pollen rewards. Data is captured electronically or manually from literature and other databases including electronic floras and faunas which can be searched for information on habitat, distribution, biostatus or phenology (seasonality) of a plant or pollinator.

Source 4 SPECIMENS
Specimen data provides a physical voucher that can be verified at any time by experts to confirm the identity of the organism. Digitisation of data associated with the specimen enables further analysis for standardising (e.g. Darwin Core), sharing (e.g. GBIF), updating and analysing the information. For example, maps are electronically generated to show known collection locations to estimate distributions. Charts can be generated to show known collection times indicating pollinator flight periods or plant flowering times to estimate phenology. Specimen data does not confirm complete distributions or phenology because absences are not verified but they give reliable estimates of presences.

Source 5 OBSERVATIONS
Observation data from systematic surveys form the basis for monitoring pollinator populations over time. Although observations are not always substantiated by a specimen or photographic voucher, they complement these by providing information on absences and quantification of frequency of floral visits which are important for assessing the status and trends of potential pollinators. Databases holding survey data provide checklists of flowering species that are visited by a potential pollinator and of pollinators or flower visitors that are visiting a given plant species. Survey data provides summaries at different spatial and temporal scales. The resolution or level of analysis will depend on how well the different insects can be recognised on the wing since some groups of pollinators cannot be reliably identified to species during observations.

Source 6 LITERATURE
Literature stored in a reference database is important for users to access, verify and evaluate information in the traits databases and can provide text summaries by experts that can be used as commentaries in the profiles. Peer-reviewed scientific literature is important for users as a key point of access to biological, morphological and ecological information on the organisms in the plant-pollinator partnerships. Tracing information to source is critical for developing evidence-based risk assessments and predictions for sustaining and conserving pollinators.

Plant Profiles as Floral Resources for Honey Bees

Purpose
New and continuing beekeepers need to identify and select flowers that provide nutritious pollen and nectar at the right time for their honey bees.

Manuka (*Leptospermum scoparium*)

[name data source 1 Names]

Honey bee on Manuka flower

[photo data source 2 Images]
Manuka is one of the most highly valued honey producing plants in New Zealand because of its medicinal properties and export value. It is native to New Zealand and forms large tracts as a shrubby tree with a brilliant display of numerous white flowers. The nectar and pollen are highly attractive to honey bees and other floral visitors such as native bees, flies, moths, some butterflies and at times also bumble bees. Nectar is produced in the disk in the center of the cup shaped flowers. The disk changes from green to a deep red as the flower matures and the flowers remain on the branch for over a week. The numerous anthers are arranged in a ring around the nectar disk. The demand for Manuka honey has prompted the development of cultivated Manuka orchards in some areas. Medicinal properties of Manuka see (http://maoriplantuse.landcareresearch.co.nz/WebForms/default.aspx)

DISTRIBUTION of Leptospermum scoparium in New Zealand is:
North Island, South Island, Stewart Island, Chatham Islands. Throughout in lowland to subalpine areas, in many habitats, often forming extensive thickets. Type locality: Dusky Sound ? Type: In the type cover at K is one Forster sheet with one large and one small branching piece.

Leptospermum scoparium common names are:
Manuka, Kahikatoa, Tea-tree.
Fruit has 9-6 (capsules often not dehiscing till succeeding year).

Information taken from E-Flora of New Zealand:
http://floraseries.landcareresearch.co.nz/pages/Taxon.aspx?id=_61c128d2-61c3-4870-a083-3f512632287f&fileName=Flora%201.xml

[text on distribution from E-Flora link data source 3 TRAITS]

Locations in New Zealand where specimens have been collected.

Checklist of flower visitors to Manuka.

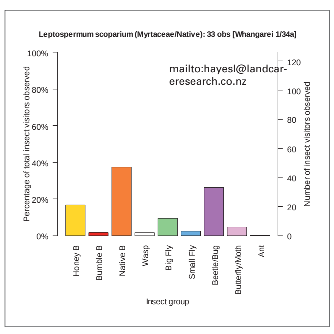
In our surveys at 9 sites (cultivated and semi-natural), we observed the following groups of flower visitors in the Manuka flowers (Leptospermum scoparium).

Bees
Bumble bee (*Bombus*)
Honey bee (*Apis*)
Native bees (*Leioproctus* and *Lassioglossum*)
Flies (Diptera)
- Drone Fly (*Eristalis tenax*)
- Bibionid Fly (Bibionidae)
- Hover Flies (Syrphidae)
- Crane Flies (Tabinidae)
- Large Flies (Calliphoridae, Tachinidae etc.)
- Small Flies (various)

Lepidoptera
Moths
Butterflies
Beetles (e.g., Zorion, Navomorpha)
Ants
Thrips

[checklist of floral visitors data source 5 OBSERVATIONS]

Frequency of flower visits
For one site in natural ecosystem at Whangarei, New Zealand based on pollinator observation survey 2005



[chart of floral visitor frequency data source 5 OBSERVATIONS]

Combining profiles to create plant-pollinator association profiles

Scientific researchers, agronomist, conservationists and policy makers need plant-pollinator association profiles to monitor and predict the status and trends in pollinator populations to make robust and defensible management decisions for agriculture and natural systems.

They therefore need:

- evidence based information that can be traced to source
- ability to assess the quality and strength of evidence
- explicit summaries of all information available and what gaps remain
- ability to filter data according to properties such as geographic or ecological context in which the data was gathered

Combining a plant and a pollinator profile will reveal important contextual information such as

- plant and potential pollinator overlap in space (overlay of distribution maps)
- plant and potential pollinator overlap in time (matching of phenologies)
- degree of specialisation for the plant or potential pollinator (checklists)
- morphological and behavioural match of the flower and floral visitor (images, traits)

This will generate profiles specific to a plant-pollinator association in the context of variation across seasons and sites ranging in scale from local, to regional. Combined with experimental information on pollinator effectiveness and preferences, this contextualised information will facilitate an evidence-based predictive understanding of pollination systems that can be aggregated at successively larger temporal and spatial scales.

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