BUSINESS

New Zealand beekeepers now have a pollen analysis manual

Natasha Abram

Have you ever wondered which plants your bees are collecting pollen or nectar from or how conveniently your hives are located to the plants your bees prefer to visit? You may also want to know if your bees are actually collecting pollen and nectar from all those plants you have spent so much time planting and nurturing to feed your bees.

Rapata (Rab) Kaa, the late Wiremu (Willie) Kaa, Xun Li.

The best way to discover which sources your bees are using for pollen is to identify the pollen pellets that your bees are bringing back to the hive (Raine et al., 2022a) While individual bees usually load up from a single species at a time, at the whole hive level, bees will forage on a wide mix of floral sources. Since bees forage in a radius of up to five kilometres, it is not possible to explore everywhere they may be foraging to see what plants they are visiting. You can collect a sample of the pollen your bees are gathering by using a pollen trap to collect pollen pellets as bees enter their hive.

The nectar of flowers contains a large number of pollen grains which have been dislodged by the activities of bees and other insects, and to a degree, by the wind. While some of the pollen is filtered out from the nectar by bees during their flight back to the hive, much is retained, especially in the case of smaller pollen grains. The pollen is preserved in the honey and is easily concentrated for analysis.

Learning how to identify pollen is a fascinating exercise. Different plants produce pollen of different colours. Some are distinctive, but many are shades of white, cream, yellow or orange and cannot be identified with certainty on the basis of colour alone. Very few flowers have purple or red pollen. Individual pellets can be picked out from a trap sample and the pollen can be made up into either a microscope slide for identification, or into an aggregate microscope sample to identify percentages of the pollen components. Another option is to sample and microscopically analyse bee bread—the pollen stored in the honey comb.

HOW TO ANALYSE POLLEN

The Trees for Bees team has recently released a manual (Raine et al., 2022b) that explains how to do pollen analysis yourself. You can download the manual from https://treesforbeesnz.org/

The manual describes methods for sampling bee pollen loads, bee bread, and honey, preparing microscope slides of pollen from the samples, and making relative or absolute estimates of the abundance of pollen. While the manual goes into detail about these methods, you can get started with a microscope, a few microscope slides and coverslips, and some glycerine jelly. A hotplate and almost everything else can be improvised until you decide to go in 'boots and all'.

The online New Zealand Bee Pollen Catalogue has an identification key to help you identify the pollen once you

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have collected it. You can gain access to the bee pollen catalogue at https://keys.landcareresearch.co.nz/nzbeepollen/key/nzbeepollen/media/index.htm

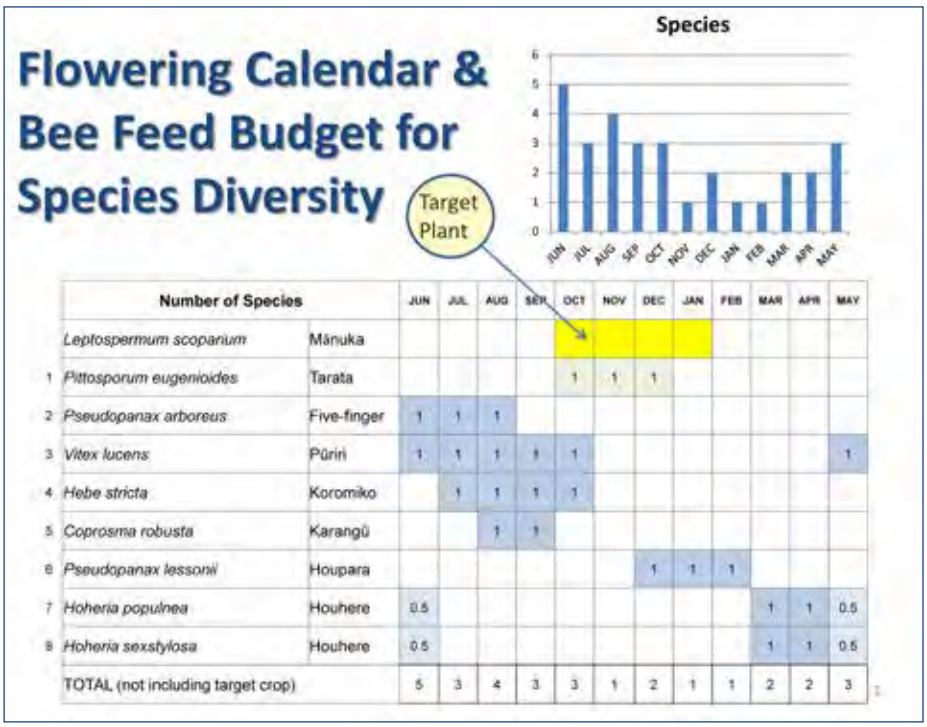
The team is continuing to add to this catalogue as they have the opportunity. If you keep bees locally, it is not a big challenge to learn the main sources of pollen your bees are gathering as there probably will be relatively few different plant species that the bees forage. You can also make up your own reference collection of pollen from different species of local flowers and compare this to the pollen you have collected from your pollen traps. If you find pollen that is not yet included in the pollen catalogue, you can contact Ian Raine and Trees for Bees on info@treesforbees.org and they will add it to the catalogue.

POLLEN ANALYSIS PILOT PROJECT

A pilot project in 2016 to assess local sources of pollen and nectar in native plants was run in Rangitukia, near Tikitiki, on the East Coast north of Gisborne (Raine et al., 2016). The project was run with Naati Beez and funding from the Ministry for Primary Industries' Sustainable Farming Fund, GNS Science, Eastland Community Trust, Ngati Porou and the Native Garden Nursery in Gisborne and support from Trees for Bees. The aim of this project included providing more pollen for bees to collect from locally sourced native plants to avoid the costs of moving hives to external pollen sources and using artificial pollen products.

The hives were placed in a small apiary on the margin of a forest in an area of re-growth of mixed mānuka and gorse. Pollen pellets were collected from traps at fortnightly intervals in the winter and spring period, and monthly during the summer and autumn period. Honey samples were also collected, and observations were made of nearby plants in flower.

The preliminary pollen calendar shows major (H), moderate (M), and minor (L) pollen sources. In any trap period, pollen collection varied between hives, and trace quantities of pollen from other plants also occurred. Many of the major sources were introduced plants.



Flowering calendar.

PLANT	AUG	SEP	OCT	DEC	JAN	FEB	MAR	APR	MAY	JUN
Ulex	H	H	M			H	H	H	H	H
Pinus	L	M								
Vitex	L	L								L
Nothofagus		H								
Salix		L								
Populus		L	H							
Cytisus			H			H				
Knightia			H							
Coriaria			H				M			
Pittosporum			H							
Macropiper			M							
Hedycarya			M							
Dodonaea			M							
Dacrycarpus			M							
Phyllocladus			L							
Freycinetia			L							
Coprosma			L							
Clematis				M	M					
Asteraceae				M	L	L	L			
Trifolium				H	M	M	L			
Pelargonium				L						
Cordyline				L	M					
Taraxacum				L	L	L	H	L		
Plantago					M		L			
Apiaceae						H	H	H		
Rhopalostylis						M	M	L	L	
Lamiaceae						L		L		
Schefflera							M	H	M	
Lotus							L			
Vicia							L			
Hoheria/Plagianthus									L	
Metrosideros									L	

Preliminary pollen calendar by month.

During the late winter to early spring interval, as the team expected, *Ulex* (gorse) was an important pollen source. The team was surprised, however, that *Pinus* and *Nothofagus* pollen were also collected by the bees during this time. Pollen sources collected by the bees diversified considerably in the late spring period. Important native sources included *Knightia*, *Coriaria*,

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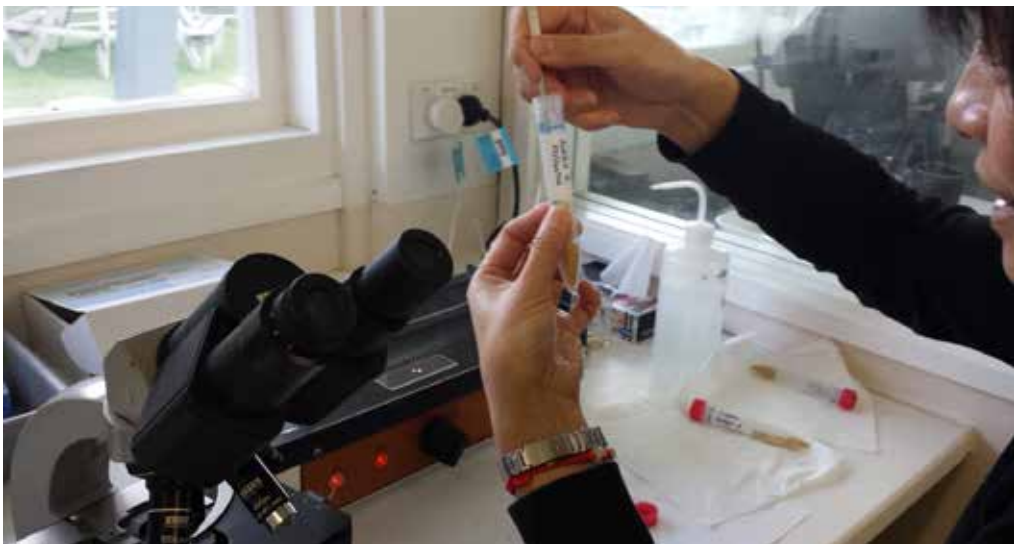
Pittosporum, *Macropiper*, *Hedycarya*, *Dodonaea*, *Dacrycarpus* and *Clematis*.

During early to mid-summer, pollen from herbaceous plants became more prominent. *Clematis*, *Cordyline* (cabbage tree) and *Rhopalostylis* (nīkau) were the most important natives. The summer pattern of pollen in bee pellets continued into late February. Among native plants, *Rhopalostylis* remained important, and *Schefflera* (patē, seven-finger) appeared. *Ulex* reappeared at this time, and became the predominant pollen source in autumn, similar to the late winter/early spring pattern. Native pollen sources in autumn included *Schefflera*, *Hoheria*, *Metrosideros* (rātā) and *Vitex* (pūriri).

Honey recovered during late winter–early spring was initially partly old honey retained in the brood comb from the previous season, but in part also reflects some nectar gathering from *Ulex* and *Calluna* (Ericaceae) which were flowering at this time. Honey recovered in late spring shows a variety of nectar sources, including the onset of mānuka/kānuka nectar gathering. Honey sampled during summer was mainly from mānuka and kānuka. It is notable that neither in late spring nor in summer was mānuka/kānuka pollen found in the bee pollen pellets. Late summer and early autumn honey continued to be derived mainly from mānuka/kānuka, but with a greater proportion of other nectar sources than in early to mid-summer.



Xun Li making up slides in the lab.

The results of this analysis were used to create a flowering calendar, a local bee plant catalogue, and planting designs for bee feed plantations that could provide plentiful sources of pollen and nectar for the nine to 12 months that mānuka does not flower. The honey and pollen analysis results provided information on what plants were the best species to plant more of in the local area. In later Sustainable Farming Fund projects, Trees for Bees has gone on to carry out similar pollen trapping projects at apiaries in Hawke's Bay, the Ureweras, Bay of Plenty, Waikato, and Southland.

While you might not want to collect pollen and honey as often or for as many months as was done in this project, collecting pollen or honey samples regularly through the year would give you some very useful information on which plants your bees are visiting in your local area at different times of the year.

REFERENCES

Raine, I., Li, X., Newstrom-Lloyd, L., McPherson, A., Kaa, W., Raroa, R., Kaa, R., & Taaremaia, M. (2016). Sustainable beekeeping by and for Maori Landowners. Available from https://treesforbeesnz.org/bees-flowers-pollen

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Sorted pollen from a hive trap.

Hive fitted with a Mann Lake Pollen trap. Images supplied.