A guide to Australian crop pollinating insects

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AgriFutures™ Securing Pollination

Australian Government
Department of Agriculture, Water and the Environment

Know the pollinators in your crops

In Australia, a wide range of native insects provide pollination services to crops.

Many Australian fruit, nut and seed crops benefit from insects pollinating their flowers. Of these insect pollinators, the introduced European honey bees (*Apis mellifera*) are among the most well-known and widely utilised, yet Australia is home to over 1600 species of native bees. Becoming familiar with native bees and other insects that pollinate crops will help to us to provide habitats and resources that support these species into the future.

Native bees that visit and pollinate crops require local nesting opportunities and food. Their nesting habits are diverse. For example, several bee species dig burrows in the ground and need access to open soil, others use narrow crevices, dead hollow canes or beetle bores in dead wood, or they dig their own nest in plant stems or dead branches. Pollen and nectar from flowers are the main food sources for bees, so they benefit from access to a diverse range of flowering plants.

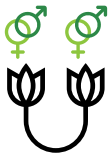
The vast majority of Australian native bees that visit crops are wild bees. Only a very small number are currently managed for crop pollination. In northern parts of Australia, the native stingless bees (*Tetragonula* and *Austroplebia*) are managed and utilised for crop pollination. Hives of these bees can be purchased or hired.

In addition to native bees and honey bees, crops are visited and pollinated by a vast range of other insects including flies, butterflies, moths and beetles. These other species may visit crop flowers more frequently than bees. For example, flies are the most abundant flower visitors in avocado crops in the Sunraysia region (VIC, NSW & SA) and mango crops in the Mareeba region (QLD).

Very little is known about just how important these other insects are to crop pollination, but given their abundance in some regions, more research is required to understand this and the habitats and resources needed to support them.

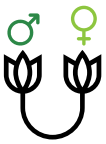
Recent research on Australian crops has shown that many native bees and other insects play an important role in crop pollination.

Plant breeding systems



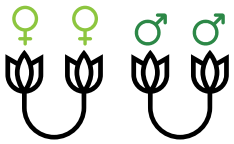
Hermaphrodite

Each plant has individual flowers that are **both** male (produce pollen) and female (produce ovaries). These flowers often require insects to move pollen from the male parts of the flower to the female parts to set fruit. Fruit set can also be limited by the degree of pollen self-compatibility. Examples include blueberry and apple.



Monecious

Each plant has individual flowers that are **either** male or female. These flowers often require insects to move pollen from the male flowers that are separate to the female flowers to set fruit. Fruit set can also be limited by the degree of pollen self-compatibility. Examples include watermelon and pumpkin.



Dioecious

Each plant has individual flowers that are **exclusively** either male or female. These flowers often require insects to move pollen from the male plants that are separate to the female plants to set fruit. Examples include kiwifruit and asparagus.

Pollen compatibility

Self-compatible

Pollen self-compatible crops can successfully develop fruit and seeds when the flowers are fertilised with pollen from the **same** flower, plant or cultivar as the mother plant, or other compatible cultivars. The degree of self-compatibility can vary between cultivars. Many cultivars that are self-compatible still show increases in yield and/or fruit quality when cross-pollinated (pollen from a different plant, cultivar or variety).

Cultivar dependent

Different cultivars of the same crop **vary** in the degree of pollen self-compatibility. Some cultivars of a crop may require abundant pollen to be transferred from a different variety to successfully develop fruit and seeds, while other cultivars do not. The degree of cultivar-dependent pollen self-compatibility influences the extent of mixed variety plantings and the number of insect visits required to successfully produce fruit and seeds.

Self-incompatible

Pollen self-incompatible crops only develop fruit and seeds when the flowers are fertilised with pollen from a **different** cultivar to the mother plant. Pollen self-incompatible crops require mixed cultivar planting arrangements and often benefit from a high abundance of insect pollinators to transfer pollen between plants for successful fruit and seed formation.

Nectar production

The quantity and quality of nectar a flower produces can influence how attractive the flower is to insect pollinators, as nectar is a major source of energy for many pollinators. The attractiveness of crop flowers to specific pollinators can in turn influence decisions such as hive stocking densities, placement timing and spatial arrangement in order to get the best pollination service to the crop.

Managed pollinators

***Apis mellifera* (European honey bees)**

Social. Present as managed hives or feral colonies that often nest in the hollows of old trees.
Can forage long distances.

***Tetragonula* & *Austroplebeia* spp. (native stingless bees)**

Social. Present as managed hives or wild colonies that often nest in the hollows of old trees. Found in warm areas of northern and eastern Australia.

Australian native bee pollinators

***Xylocopa* spp. (Carpenter bees)**

Solitary. Tree nesting
(old, dead, soft timber).

***Leioproctus* spp. (Silk bees)**

Solitary. Ground nesting.

***Amegilla* spp. (Blue-banded bees)**

Solitary, sometimes aggregated.
Ground nesting (clay soil, mudbricks).

***Megachile* spp. (Leafcutter & resin bees)**

Solitary. Nests in the ground, hollow stems, beetle bores
and in narrow crevices.

***Lipotriches* spp.**

Solitary or communal, occasionally subsocial. Ground nesting.

***Lasioglossum* spp. (Furrow bees)**

Solitary or communal. Ground nesting.

***Hylaeus* spp. (Masked bees)**

Solitary, sometimes aggregated.
Diverse nesting strategies including stems, logs or ground nesting.

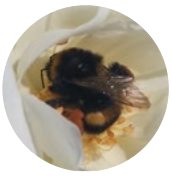
***Exoneura* spp. (Reed bees)**

Solitary, subsocial or social. Only occurs within certain habitats providing nesting resources (for example, dried tree ferns or berry canes).

***Homalictus* spp.**

Solitary or communal. Ground nesting.

Other Exotic Bee species present in Australia



***Bombus* spp. (Bumble bees)**

Social. Present as ground-nesting colonies.Found in Tasmania.

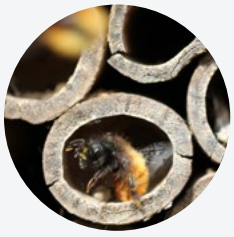
***Apis cerana* (Asian honey bees)**

Social. Present as colonies that often nest in the hollows of old trees.Found in Far North Queensland.

Bee Terms:

Social

Lives in a colony with a social structure consisting of queens and workers. Managed species live in hives; wild or feral (honey bee) colonies typically nest in tree hollows. Some native bees are 'subsocial' or 'semisocial' , with females sharing a nest with sisters or offspring but without a clear division of labour.



Solitary

Does not live in a colony. Females live and build nests alone, although some species have communal nesting habits where more than one female will share a burrow. Solitary nests can be found in aggregations, sometimes with hundreds of nests at the same site.

Apple:

Honey bees were the most common visitors across all sites. In the Adelaide Hills (SA), native bees could make up a third of all flower visitors. There were 16 species recorded, and they varied between orchards. The most common native bees were furrow bees, (*Lasioglossum* spp.), closely followed by Green and Gold Nomia bees (*Lipotriches australica*). These bees nest in soil in or around the orchard. Other occasionally common visitors were thynnid and scoliid wasps, and hoverflies.

On apple in the Yarra Valley (VIC), native bees could make up almost half of all visitors, though this varied between sites and time periods. Reed bees (*Exoneura* sp.) were the dominant native bees at some sites, while furrow bees (*Lasioglossum* sp.) were dominant at others. Reed bees were observed nesting in fern fronds and wild blackberry canes in some orchards. Green and Gold Nomia bees (*Lipotriches australica*) and slender furrow bees (*Homalictus* sp.) were occasional apple visitors.

On apple in southern Tasmania, a range of native bees including reed bees, *Exoneura spp.* and *Lasioglossum* spp. were observed, along with occasional visits from exotic bumble bees, *Bombus terrestris*. Flies also occasionally visited apple flowers.

Pear:

On pear in the Adelaide Hills (SA), honey bees were the most common visitors, but native bees could make up a third of all visitors. There were 16 species, and they varied between orchards. The most common native bees were furrow bees, (*Lasioglossum* spp.), but silk bees (*Leioproctus*) and Green and Gold Nomia bees (*Lipotriches australica*) were also observed. These bees nest in soil in or around the orchard. Other occasionally common visitors were thynnid and scoliid wasps, and hoverflies.

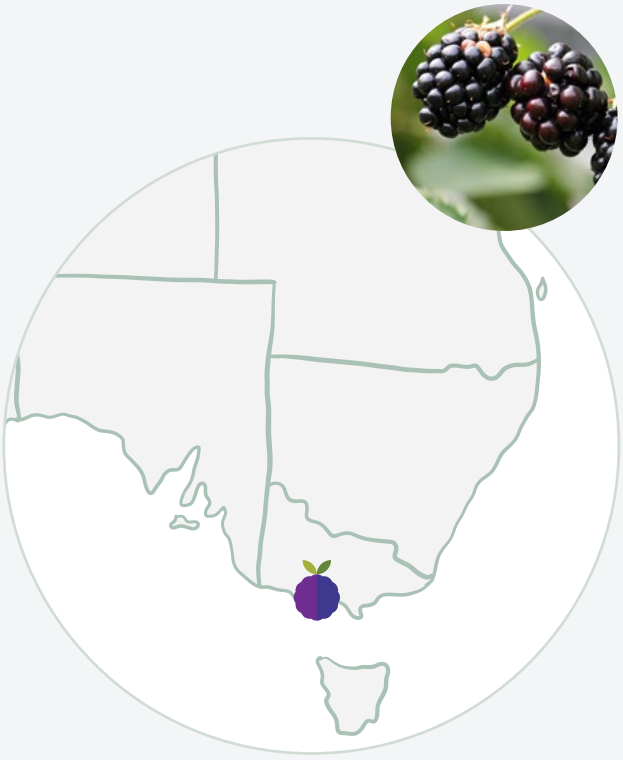
Raspberry:

On raspberry in the Yarra Valley (VIC), honey bees were the most common visitors, but at some sites native bees could make up more than half of all visitors. The dominant native bees were either Reed bees (*Exoneura* spp.) or slender furrow bees (*Homalictus* sp.), depending on the site. Reed bees were observed nesting in old raspberry and blackberry canes within crop rows. Green and Gold Nomia bees (*Lipotriches australica*) and furrow bees (*Lasioglossum* sp.) were occasional raspberry visitors.

In the Coffs Harbour region, honey bees were the most common visitor to raspberry flowers. Native bees, including *Tetragonula* spp. and *Homalictus* spp., were also observed visiting flowers.

Blackberry:

On blackberry in the Yarra Valley (VIC), honey bees were most common but native bees could make up more than half of all visitors. Reed bees (*Exoneura spp.*) were the dominant native bees at some sites, while slender furrow bees (*Homalictus* sp.) were dominant at others. Reed bees were observed nesting in old blackberry canes within crop rows. Green and Gold Nomia bees (*Lipotriches australis*) and furrow bees (*Lasioglossum* sp.) were occasional blackberry visitors.

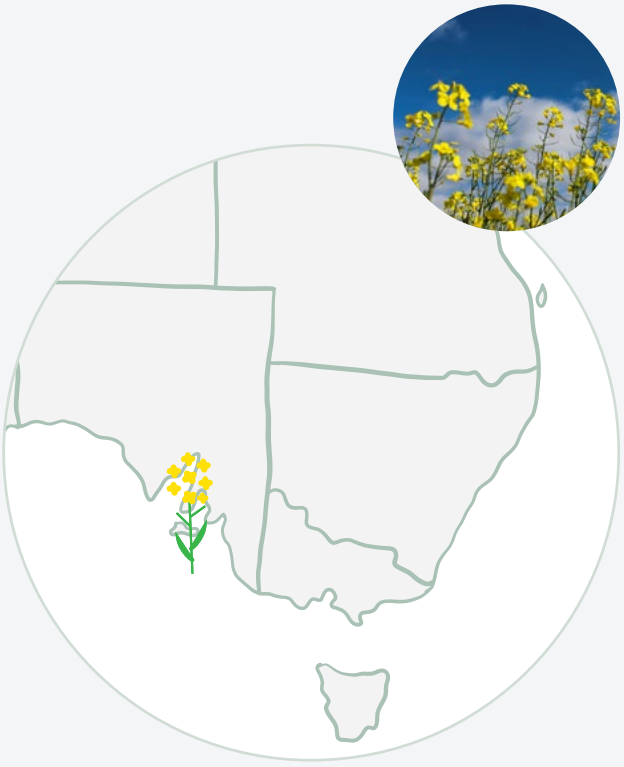


Avocado:

Avocado in Bundaberg (QLD) was visited by a range of pollinator species. Wild native stingless bees, *Tetragonula* spp., honey bees and a fly, *Stomorhina discolor* were observed regularly visiting flowers. In the Sunraysia region, flies were dominant visitors to avocado. However, honey bees and *Lassioglossum* spp. were occasional visitors.

Canola:

In canola on the Yorke Peninsula (SA), honey bees were the most common visitors. Furrow bees (*Lasioglossum*) and slender furrow bees (*Homalictus*) were the dominant native bees. *Leioproctus* bees, flies, beetles and butterflies were occasional visitors . The native bees nest in the crop, as the ground surface is easily accessible, but only in no-till areas. They would struggle to reproduce during grain rotations, and in particular in large fields with no surrounding flowering plants.



Blueberry:

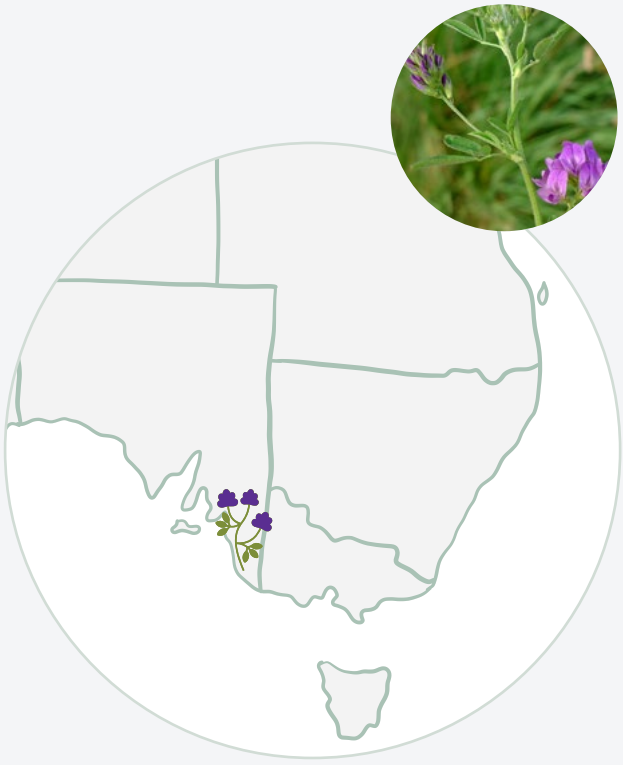
In the Coffs Harbour region (NSW), the two most abundant pollinators on blueberry farms were managed honey bees and wild stingless bees (i.e. *Tetragonula carbonaria*, and to a lesser extent, *Austroplebeia australis*). Other species observed foraging on blueberry flowers included carpenter bees (*Xylocopa* spp.), reed bees (*Exoneura* spp.), allodapine bees (*Braunsapis* spp.) and very occasional flies and butterflies (eg. *Delias nigrina*).

On blueberry in the Yarra Valley (VIC), honey bees were the most common visitors, but native bees could make up over one third of all visitors. Reed bees (*Exoneura*) were the dominant native bees at all sites. Furrow bees (*Lasioglossum* sp.) and slender furrow bees (*Homalictus* sp.) were occasional blueberry visitors.

On blueberry in southern Tasmania, honey bees were the most common visitors, followed by exotic bumble bees and flies. Four species of native bees were observed visiting flowers including *Lasioglossum* (*L. mundulum* and *L. sculpturatum*) and two species of reed bees, *Exoneura* spp. (including *E. bicolor*).

Lucerne:

In South Australia, honey bees were the most common visitors to lucerne flowers. In total, lucerne was visited by 20 species, including blue-banded bees (*Amegilla chlorocyanea*), furrow bees (*Lasioglossum* spp.), resin and leafcutter bees (*Megachile* spp.), and several large mud dauber wasps (Sphecidae).



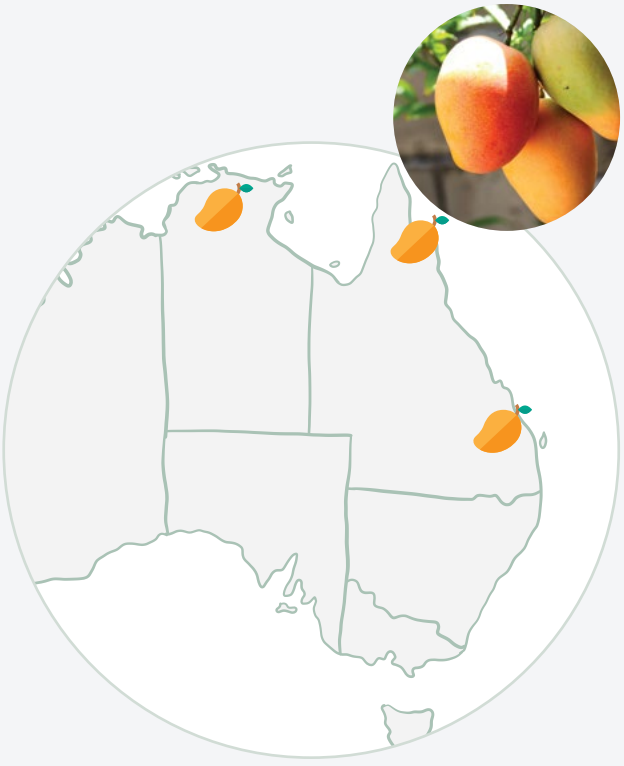
Cherry:

On cherry in the Yarra Valley (VIC), honey bees were the main visitors. Native bees could make up almost one quarter of all visitors. Reed bees (*Exoneura* spp.) were the dominant native bees, with occasional visits from furrow bees (*Lasioglossum* sp.).

In the Adelaide Hills (SA), honey bees were the most common visitors, followed by furrow bees (*Lassioglossum* sp.).

Mango:

Wild native stingless bees, *Tetragonula carbonaria* (Mareeba & Bundaberg, QLD) and *Tetragonula mellipes* (Katherine, NT) were common visitors to mango flowers. Other native bees observed in mango orchards include *Homalictus* spp. (all regions), *Lasioglossum* spp. and *Megachile* spp. (Katherine), *Hylaeus* spp. (Mareeba) and *Xylocopa* spp. (Bundaberg & Mareeba). Flies were also frequent visitors to mango flowers in all three regions. Other less frequent visitors included beetles, ants and wasps. The exotic Asian honey bee (*Apis cerana*) was observed occasionally on mango in the Mareeba region.

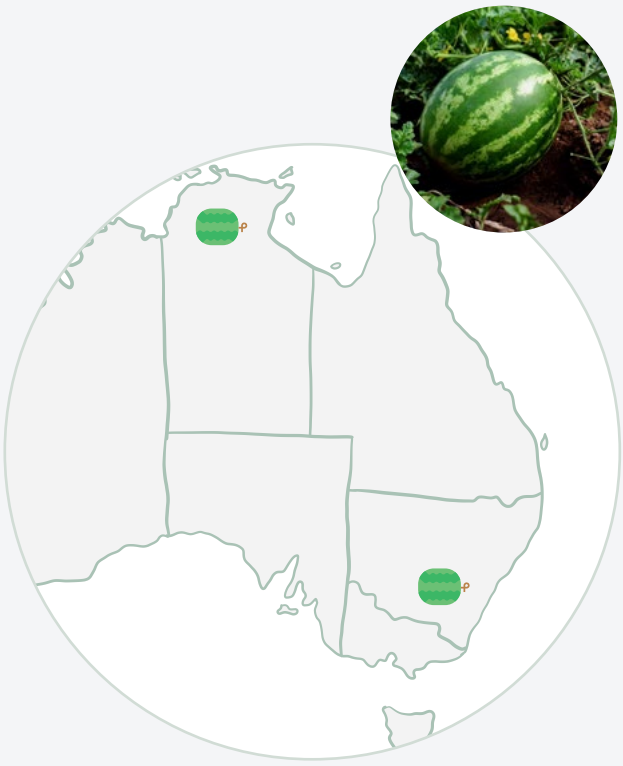


Macadamia:

Macadamia in Bundaberg (QLD) was primarily visited by honey bees, accounting for 80-90 % of visits. A range of flies, beetles and moths were also observed visiting macadamia flowers. Native stingless bees, *Tetragonula* spp., were only observed visiting flowers occasionally.

Watermelon:

Honey bees were the most common visitor to watermelon flowers in both Katherine (NT) and Griffith (NSW). A range of native bees were found visiting watermelon flowers including *Homalictus*, *Lasioglossum* and *Megachile* species in Griffith (NSW), and *Homalictus*, *Megachile* and *Tetragonula* species in Katherine (NT).

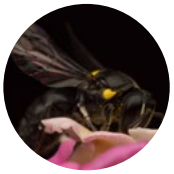


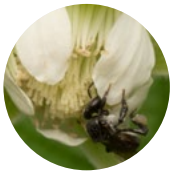
What native bees should I expect to see in my crops?




Region	Crops	*Xylocopa* spp. (14-26mm)	*Leioproctus* spp. (4-16mm)	*Amegilla* spp. (7-15mm)	*Megachile* spp. (6-15mm)
Katherine (NT)	Watermelon				■
	Mango				■
Mareeba (QLD)	Mango	■			
Bundaberg (QLD)	Avocado	■			
	Macadamia				
	Mango	■			
Stanthorpe (QLD)	Apple	■			
Coffs Harbour (NSW)	Blueberry	■			■
	Raspberry				
Griffith (NSW)	Watermelon				■
Yarra Valley (VIC)	Apple				
	Blackberry				
	Blueberry				
	Cherry				
	Raspberry				
Tasmania	Apple				
	Blueberry				
Renmark (SA)	Avocado				
Keith (SA)	Lucerne			■	■
Adelaide Hills (SA)	Apple		■	■	
	Pear				
Yorke Peninsula SA)	Canola				





Lasioglossum spp. (<12mm)	*Lipotriches* spp. (6-11mm)	*Hylaeus* spp. (<10mm)	*Exoneura* spp. (<8mm)	*Homalictus* spp. (<8mm)	*Tetragonula* spp. (3-5mm)
				■	■
■				■	■
				■	■
■				■	■
					■
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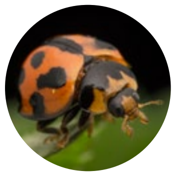
What other pollinators should I expect to see in my crops

Flies

Region	Crops	Calliphoridae spp. (Blowflies)	Syrphidae spp. (Hoverflies)	Rh
Katherine (NT)	Watermelon		■	
	Mango	■	■	
Mareeba (QLD)	Mango	■	■	■
Bundaberg (QLD)	Avocado	■	■	■
	Macadamia	■	■	■
	Mango	■	■	■
Stanthorpe (QLD)	Apple			
Coffs Harbour (QLD)	Blueberry			
	Raspberry			
Griffith (NSW)	Watermelon			
Yarra Valley (VIC)	Apple		■	
	Blackberry			
	Blueberry			
	Cherry			
	Raspberry			
Tasmania	Apple			
	Blueberry			
Renmark (SA)	Avocado	■	■	■
Keith (SA)	Lucerne			
Adelaide Hills (SA)	Apple		■	
	Pear		■	
Yorke Peninsula (SA)	Canola			

		Wasps	Beetles
			
hinniidae spp. (Noseflies)	Bibionidae spp. Flies (Bibionid Flies)	Thynnidae, Scoliidae & Tiphiidae spp. (Flower Wasps)	Coccinellidae spp. (Lady Beetles)

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