Powerful pollinators

Encouraging insect pollinators in rural and urban landscapes



Pollinators are an essential component of healthy, biodiverse landscapes and provide critical pollination services to native flora and agriculture production across the country.

This guide provides information on ways to encourage a diverse range of insect pollinators across all properties, and includes a planting calendar to help select plants to support diverse pollinators throughout the year.



The power of pollinators

Pollinators – mostly insects, but also birds and mammals – assist the production of seeds and fruit in many plant species by visiting flowers in search of food (nectar and/or pollen). Whilst foraging they transfer pollen from one flower to another, facilitating fertilisation, which results in fruits and seeds.

Honey bees, native bees and other native insects like hoverflies, wasps and butterflies provide essential pollination services for native plants, pastures, crops, fruits and vegetables.

Pollinators and food security

Without insect pollinators, the quantity and diversity of food grown for humans in contemporary agricultural systems would be severely restricted. Many of the food crops we eat, as well as pasture and fodder crops, benefit from pollination by insects.

Pollinator-dependent crops include citrus and vegetables, as well as many crops grown for seed production, such as canola and lupins.

The quantity and diversity of insect pollinators are key drivers of production as they influence both crop yields and quality. Under-pollination results in smaller and misshapen fruit or seed that isn't viable.

Grazing enterprises can also suffer from a reduction in the abundance or diversity of pollinators, due to the role these insects play in the persistence of nitrogen-fixing pasture legumes such as clover.

A diverse and healthy community of pollinators generally provides more effective and consistent pollination than relying on any single species.



Native vegetation supports pollinators by providing food and nesting sites. Nearby crops and pastures will benefit from the increased abundance and diversity of pollinators in the landscape.

Insect populations are in decline worldwide due to land clearing, intensive or monocultural agriculture, pesticide use, pollution, colony disease, increased urbanisation and climate change. Low pollinator numbers mean not all flowers are pollinated, leading to low fruit or seed set. This in turn reduces fruit and vegetable harvest yields, and decreases food supply.



Under-pollination results in smaller, misshapen fruit such as this strawberry.

Healthy ecosystems

Pollinators are both essential to, and depend upon, healthy ecosystems. A growing human population and increasing demand for food puts pressure on ecosystems, while declining ecosystem function will in turn negatively impact food production.

Insect pollinators are a prime example of this — without healthy ecosystems and the presence of patches of native vegetation to support insect populations, pollination will decline. This will threaten both crop productivity and the persistence of native, pollinator-dependent flowering plants.

Pollinators require habitat that contains year-round food sources, breeding resources and nesting sites. The presence of pollinator habitat adjacent to food crops has been shown to improve food production by enabling a greater variety and number of pollinators to persist year-round, providing pollination services when required.

Turn to the centre of this brochure for a guide to planting for pollinators.

Diapause or diet? Where are the insects?

Many insect pollinators undergo a diapause during colder winter months. Diapause is a period of suspended development during unfavourable environmental conditions, and during this period insect pollinators do not need flowers. Birds and other small mammals will continue to benefit from available pollen and nectar during this time.

If there are low numbers of insect pollinators in your local area, it is important to determine whether this is because of diapause, or because of an inadequate availability of nectar and pollen, creating a 'food desert' where insect pollinators cannot survive.

There are still many unknowns about insect pollinators in Australia. Take part in Australian Pollinator Week or in the annual Australian Pollinator Count to learn more about pollinators in your area – visit: **AustralianPollinatorWeek.org.au** and **AustralianPollinatorCount.au**

Encouraging pollinators on your property

Create pollination reservoirs

Pollination reservoirs are areas of native plant species that provide floral resources for pollinators. They can be new plantings or existing habitat, such as shelterbelts or remnant vegetation. A high diversity of plant species is essential to provide nectar, pollen and nesting sites throughout the year. Pollination reservoirs need to be close enough to crops to ensure that pollinators can fly easily to them.

Use existing habitat

Protect and improve existing habitat where possible. Roadsides, shelterbelts, dam margins, woodlands, grasslands, rocky areas, river and creek edges can all be important pollinator-attracting areas, bringing valuable pollination services to your property.

Native vegetation stands provide habitat for pollinators, and special attention should be paid to enhance and protect these areas.

Get to know your local flora

Each property and region will have distinct populations of insects, based on the plants and climate. Identifying and understanding the insects in your area will help you develop better plantings.

The plants growing in nearby bush will be well suited to the climate and soils in your region. Local community groups and specialist native nurseries can provide useful information and usually produce local plant species.

Plant trees, shrubs and groundcovers

Planting a variety of species of groundcovers, shrubs and trees on your property will further attract pollinators to your area. Use a combination of direct seed sowing and planting tube stock to establish new vegetation. Initial watering and protection from grazing will improve the success rate of young plants. Wildflowers, including our native pea species, are excellent at attracting a diverse range of native pollinators.

Connectivity counts

Insect pollinators benefit from greater connectivity of habitat in a landscape, which allows them to forage over a wider radius and increase in numbers in a local area. Encourage neighbours and other landholders to plant for pollinators and create connections across your landscape.

Utilise ecotones

Ecotones are the margins between two different habitats. Ecotones often contain a more diverse mixture of pollinator species because they are inhabited by pollinators from both habitats. Protect and utilise ecotones such as the transition zones between woodland and grassland, or heath and shrubland, to create highly diverse floral and insect communities.

Amplify the flower signal

Plants have evolved large flowers or clusters of smaller flowers which attract more pollinator visits. Large, colourful and diverse plantings attract more pollinators. Ideally, plant in groups that contain different vegetation layers – combine a species-rich mixture of wildflowers, groundcovers, herbs, lilies, rushes, climbers, shrubs and trees.

Plant for the future

When establishing pollinator habitat, consider including species that are indigenous to your area and can tolerate increasingly warmer and drier (or wetter) conditions, to improve resilience to climate change. Rehabilitate weedy areas into managed pollination reservoirs by introducing lots of flowering plant diversity. Be careful not to plant invasive or listed weeds, and look for suitable replacements.

Double the crop value

Plants that are pollinator-attracting may be commercially viable crop species in their own right and can be used to diversify farm production. Bush foods such as Woody Pear, Flax Lily's and many more are in high demand for use in fresh and manufactured products. Native plant seed is also needed for revegetation projects. Farmers can also support beekeepers by hosting beehives to increase pollinator numbers on a farm.

Reduce chemical use

Insecticides, fungicides and herbicides all affect the health of bees, bee colonies and native pollinators. Herbicides can impact pollinators by reducing the availability and diversity of flora and removing vegetation that helps support insect life. Some herbicides can also harm the beneficial microbes in the insect gut. In many circumstances, beneficial insects will, in healthy numbers, help control pest insects, ultimately reducing the need for insecticide use.

When chemical pest control is unavoidable, select products that are least harmful for pollinators and apply insecticides in the evening or at night when pollinators are not active.

Always use according to directions, especially for withholding periods, and notify beekeepers a few days before spraying chemicals so beehives can be safely relocated away from harm.

Be a citizen scientist and do some detective work to discover local pollinators on your property. Visit **inaturalist.ala.org.au** to be involved.

Safeguard the bees? The best way to 'save the bees' and protect our pollinators is to create an abundance of diverse habitat – from the ground up! There is much interest in keeping a beehive to promote pollinators, but there are serious legal and biosecurity responsibilities that must be considered, and that the introduction of a beehive does not displace existing native pollinators and insects. Be a friend of pollinators and say it with flowers!

A guide to planting for pollinators for the Avon Wheatbelt region, Western Australia

Healthy populations of insect pollinators are important for sustainable and resilient farms, orchards, gardens, and native flora.

This Guide will help you select plant species to attract and sustain pollinators in agricultural areas and gardens throughout the year.

The Avon Wheatbelt is an area of active drainage dissecting a Tertiary plateau in Yilgarn Craton and is defined by its gently undulating landscape of low relief. Soil profiles in this region are primarily lateritic uplands with weathered colluvial lowlands between the upland breakaways. Prominent flora in the region consists of mixed *Eucalypts* and Casuarina in sandy colluvial breakaways. On lateritic uplands there are endemic Proteaceous scrub species residing in the iron rich soils. The climate is characteristic of coastal Mediterranean seasons – hot dry summers and cool wet winters.

The plants listed in this Guide will help supply rewards to pollinators, with an emphasis on species that are indigenous and suited to local climates.

Garden centres sell many common pollinator-attracting ornamental flowers and herbs labelled as 'bee-friendly'.

The eucalypt species in this Guide are mostly large trees, and not suitable for all local environment groups. If you can't gardens, but have been included for their source these plants at your local garden value as good nectar producing species. centre, or indigenous nursery, ask them Most eucalypts do not flower every year, to contact the local wholesale nursery so choosing diverse species will help create continuously flowering habitat.





The pollinator plant list

To create pollinator-attracting plantings, use the Guide to choose a selection of plants with a variety of flower colours, different growth habits and a range of flowering seasons.

For each species, the planting Guide lists:

- life-form/'habit' (climber, herb, shrub or tree) and height (m).
- the vegetation type in which they naturally occur
- flower colour and flowering season
- growth requirements (sun/shade, moist/dry)
- insect groups that may visit each plant and the floral reward (pollen and/or nectar).

The coloured bars indicate the flowering months for each species. Darker shading denotes the peak flowering period, with a lighter shading for non-peak flowering months. Flowering dates may differ between regions and seasons, particularly for non-peak times, if your local climate is consistently warmer or cooler than average, with earlier or later flowering.

Sourcing plants

Most of the plant species listed are available from retail or wholesale nurseries or native plant growers, and suppliers and plant growers listed online. See the reverse of the Guide for details.

Lifeform	Common name	Scientific name	Family	Vagatation type	Height	Flower colour		Flowering		Aspect	Soil moisture	Pollinator	reward			Visitatior	n by pollin	ator		
	Common name	Scientific name	ramity	Vegetation type	пеідпі	Flower colour	Jan Feb Mar Apr May	Jun Jul Aug Sep O	ct Nov Dec	Aspect	Soli moisiure	Pollen	Nectar	Native bees H	loney bees	Hoverflies	Wasps B	utterflies I	Moths Beetl	es Flies
Crop plants Tree	Oranges, Manderins	Citrus sp.	Rutaceae	Orchard	4–10 m	White				Sun	Well drained	•	•	•	•					
Сгор	Alfalfa / Lucerne	Medicago sativa	Fabaceae	Cropping	0.6 m	Purple				Sun	Well drained	•	•	•	•					
Herb Tree	Clover Sandplain Woody Pear	Trifolium repens Xylomelum angustifolium	Fabaceae Proteaceae	Cropping Horticulture	< 0.15 2–7 m	White, Pink Cream, White				Sun Sun	Well drained Well drained	•	•	•	•		•	•		•
Indigenous plants		Aylomelum ungusinolium	Froiedcede	Hornculture	2-7 111					Sun	weir drained	•	•		•					
Climber	Silky Glycine	Glycine canescens	Fabaceae	Shrubland	Climber	Pink, Blue, Purple				Sun	Moist to dry	•	•	•	•					
Climber Climber	Kanna / Karna Paterson's Fringed Lily	Platysace cirrosa Thysanotus patersonii	Apiaceae Asparagaceae	Slopes, Drainage Lines Variable	Climber Climber	Yellow Purple				Sun Sun	Dry, Well Drained Well drained	•	•	•						•
Forb / Herb	Swan River Daisy	Brachyscome iberidifolia	Asteraceae	Coastal, Heathlands	< 0.45 m	White, Blue, Purple				Sun	Moist, Well drained	-	•	•	•	•		•		
Herb / Forb	Pincushions	Borya sphaerocephala	Boryaceae	Granite Outcrops	< 0.2 m	White				Sun	Moist, Well drained	•	•		•					
Herb / Forb Herb / Forb	Blue Pincushion Mat Cottonheads	Brunonia australis Conostylis prolifera	Goodeniaceae Haemodoraceae	Sandplains & Dunes Flats, Plains	< 0.4 m < 0.2 m	Blue				Sun to semi-shade	Well Drained Moist, Well drained	•	•	•						
Herb / Forb	Flax Lily	Dianella brevicaulis	Asphodelaceae	Sandy Ranges	< 0.2 m	Blue, Purple				Sun to semi-shade	,	•*	•	•	•					
Forb / Herb	Purple Chocolate Lily	Dichopogon capillipes	Asparagaceae	Forest	0.3–1 m	Purple, Pink				Sun to semi-shade		•*		•						
Herb / Forb Herb / Forb	Golden Long-Heads Pink & White Everlasting	Podotheca gnaphalioides Rhodanthe chlorocephala	Asteraceae Asteraceae	Coastal, Open Shrubland Floodplains, Salt Lakes		Yellow, Orange				Sun to semi-shade Sun to semi-shade		•	•	•	•	•				•
Herb / Forb	Pink Sunray	Rhodanthe manglesii	Asteraceae	Shrub & Woodland	0.1–0.6 m	, , ,				Sun	Well drained	•	•	•	•	•	•	•		
Herb / Forb	Orange Immortelle	Waitzia acuminata	Asteraceae	Shrub & Woodland	< 0.6 m	Red, Orange, Yellow, White, Pink 🌔				Sun	Well drained	•	•	•		•		•		
Herb / Forb	Dwarf Grasstree	Xanthorrhoea nana	Asphodelaceae	Sandplains, Scrub Coastal, Heathland	<1m	White, Cream Yellow				Sun Sun to semi-shade	Dry, Well Drained	•	•	•						
Shrub (Small) Shrub (Small)	Panjang Prickly Moses	Acacia lasiocarpa Acacia pulchella	Fabaceae Fabaceae	Shrubland	< 1.5 m 1.5 m	Yellow				Sun	Moist, Well drained Well Drained	•		•	•				•	•
Shrub (Small)	Narrow Winged Wattle	Acacia stenoptera	Fabaceae	Heath & Woodland		Yellow, Cream				Sun to semi-shade		•		•	•					
Shrub (Small)	Honeypot Dryandra	Banksia nivea	Proteaceae	Shrub & Woodland		Cream, Yellow, Orange, Pink, Brown				Sun	Moist to dry	•	•	-	•					
Shrub (Small) Shrub (Small)	Common Brown Pea One-Sided Bottlebrush	Bossiaea eriocarpa Calothamnus quadrifidus	Fabaceae Myrtaceae	Variable Variable	0.2–1 m 0.9–2 m	Yellow, Brown, Red				Sun to semi-shade Sun to semi-shade		•	•	•						
Shrub (Small)	Silky-Leaved Blood Flower	Calothamnus sanguineus	Myrtaceae	Sand Plains, Ridges, Outcrops		Deep Red, White				Sun to semi-shade		•	•		•					
Shrub (Small)	Tinsel-Flower	Cyanostegia angustifolia	Lamiaceae	Mallee, Heathland		Blue, Purple				Sun	Dry, Well drained	•	•	•	•			•		
Shrub (Small)	Bottlebrush Grevillea	Grevillea paradoxa	Proteaceae	Mallee, Scrub & Shrubland Heath & Shrubland	0.5-2 m	Pink, Red, Purple				Sun	Well Drained Well Drained	•	•	•	•					
Shrub (Small) Shrub (Small)	Woolly-Flowered Grevillea Honey Bush	Grevillea pilulifera Hakea lissocarpha	Proteaceae Proteaceae	Heath or Woodland	0.2–1 m 0.4–1.5 m	White, Cream, Yellow, Pink				Sun Sun	Well Drained	•	•	•	•					•
Shrub (Small)	White Myrtle	Hypocalymma angustifolium		Shrubland	1.5 m	White, Cream, Pink				Sun to semi-shade		•	•	•	•	•	•		•	•
Shrub (Small)	Yellow Featherflower	Verticordia chrysantha	Myrtaceae	Variable	0.3–1 m	Yellow				Sun	Dry, Well drained	•	•	•			•			
Shrub (Small) Shrub (Large)	Pink Woolly Featherflower Gold Carpet Wattle	Verticordia monadelpha Acacia spathulifolia	Myrtaceae Fabaceae	Sand Plains, Hills, Outcrops Sand Plains, Heath, Shrubland	0.3–2 m	Pink, Red				Sun Sun	Well Drained Well Drained	•	•	•						
Shrub (Large)	Native Hibiscus	Alyogyne hakeifolia	Malvaceae	Plains	1–3 m	Blue, Purple, Cream, Yellow				Sun	Well Drained	•	•	•	•				•	
Shrub (Small)	Prickly Dryandra	Banksia armata	Proteaceae	Shrub & Woodland	0.2–3 m	Yellow, Cream				Sun	Well Drained	•	•		•					
Shrub (Large) Shrub (Large)	Golden Dryandra Parrot Bush	Banksia nobilis Banksia sessilis	Proteaceae Proteaceae	Shrub & Woodland Shrub & Woodland, Forest	0.6–4 m < 5 m	Yellow, Orange, Green, Pink				Sun Sun to semi-shade	Well Drained Well drained	•	•	•	•				•	
Shrub (Large)	Pingle / Pingli Bush	Banksia squarrosa	Proteaceae	Woodland, Forest	1-4 m	Yellow				Sun to semi-shade		•	•	•	•				-	
Shrub (Large)	Tar Bush	Eremophila glabra	Scrophulariaceae	Variable	0.1–3 m	Green, Yellow, Orange, Red, Brown 🔫				Sun	Well Drained	•	•	•	•					
Shrub (Large)	Weeooka	Eremophila oppositifolia	Scrophulariaceae		1–4 m	White, Cream, Yellow, Pink, Red				Sun	Well Drained	•	•	•	•					
Shrub (Large) Shrub (Large)	Ridge-Fruited Mallee Oldfield's Mallee	Eucalyptus incrassata Eucalyptus oldfieldii	Myrtaceae Myrtaceae	Sandplains, Hillsides Mallee, Sandplains, Ridges	2–5 m 2–6 m	Cream, White, Yellow				Sun Sun to semi-shade	Well Drained Well Drained	•	•	•	•		•		•	
Shrub (Large)	Box poison	Gastrolobium parviflorum	Fabaceae	Woodland		Red, Orange				Sun to semi-shade		•	•	•	•					_
Shrub (Large)	Prickly Poison	Gastrolobium spinosum	Fabaceae	Variable	3.5 m	Yellow, Orange, Red				Sun	Well drained	•	•	•	•					
Shrub (Large) Shrub (Large)	Two-Leaf Hakea Stinkwood	Hakea trifurcata Jacksonia sternbergiana	Proteaceae Fabaceae	Mallee, Heath Shrubland	1.5–3 m 1.5–5 m	White, Cream, PinkYellow, Orange				Sun Sun	Well Drained Well Drained	•	•	•	•			•		•
Shrub (Large)	Narrow-Leaved Paperbark	Melaleuca laxiflora	Myrtaceae	Heathland, Flats	0.5–3 m	Pink, Purple				Sun	Well Drained	•	•	•	•					
Shrub (Large)	Silver Cassia	Senna artemisioides	Fabaceae	Variable	0.2–3 m	Yellow				Sun	Well Drained	•*		•						
Shrub (Large) Tree (Small)	Thryptomene Nealie	Thryptomene costata	Myrtaceae Fabaceae	Granite Outcrops Mallee, Woodland	1–3 m 1.5–6 m	White, Pink Yellow				Sun to semi-shade Sun	Well Drained Well Drained	•	•	•	•					_
Tree (Small)	Rock Sheoak	Acacia rigens Allocasuarina huegeliana	Casuarinaceae	Woodlands	4–10 m	Red, Brown				Sun to semi-shade		•		•	•					
Tree (Small)	Frasers Dryandra	Banksia fraseri	Proteaceae	Shrub & Woodland	0.5–6 m	Yellow, Green				Sun	Well Drained	•	•		•					
Tree (Small)	Orange Banksia Powderbark Wandoo	Banksia prionotes	Proteaceae	Dunes, Shrub & Woodland	< 10 m 2.5–15 m	Cream, Orange				Sun Sun to semi-shade	Well Drained Well Drained	•	•	•	•					
Tree (Small) Tree (Small)	Burracoppin Mallee	Eucalyptus accedens Eucalyptus burracoppinensis	Myrtaceae Myrtaceae	Forest Sandplains	2.5–15 m 1–6 m	White, Cream, Yellow			- C	Sun to semi-shade		•	•		•					
Tree (Small)	Wheatbelt Wandoo	Eucalyptus capillosa	Myrtaceae	Heath, Mallee, Woodland	5–20 m	White, Cream				Sun	Well Drained	•	•	•	_					
Tree (Small)	Drummond's Gum	Eucalyptus drummondii	Myrtaceae	Sandplains, Hills	8 m	White, Cream				Sun to semi-shade		•	•	•	•			•		
Tree (Small) Tree (Small)	Silver Mallet Merrit	Eucalyptus falcata Eucalyptus flocktoniae	Myrtaceae Myrtaceae	Sandplains, Hills Woodland, Forest	6 m 2.5–15 m	White, Cream White, Cream, Yellow				Sun Sun	Well drained Well drained	•	•		•					•
Tree (Small)	Red Morrel	Eucalyptus longicornis	Myrtaceae	Woodland	2–24 m	White				Sun	Well drained	•	•	•	•					
Tree (Small)	York gum	Eucalyptus loxophleba	Myrtaceae	Woodland	< 15 m	White				Sun	Well drained	•	•		•					
Tree (Small)	Swamp Yate Flooded / River Gum	Eucalyptus occidentalis	Myrtaceae	Woodland	4-20 m	Cream, White				Sun	Moist, Well drained	•	•		•				• •	_
Tree (Small) Tree (Small)	Gimlet	Eucalyptus rudis Eucalyptus salubris	Myrtaceae Myrtaceae	Open Woodlands, Floodplains Woodland, Plains	5–20 m 4–15 m	White White, Cream				Sun Sun to semi-shade	Moist to dry Well drained	•	•	•	•	•	•	•	• •	
Tree (Small)	Ribbon-Barked gum	Eucalyptus sheathiana	Myrtaceae	Woodland, Mallee	3–15 m	White O				Sun to semi-shade		•	•	•						
Tree (Small)	Wandoo / White Gum	Eucalyptus wandoo	Myrtaceae	Heath and Woodland		White, Cream				Sun	Well drained	•	•	•	•		•	•	•	•
Tree (Small) Tree (Small)	Flame Grevillea Gold Dust Hakea	Grevillea excelsior Hakea laurina	Proteaceae Proteaceae	Mallee Heath Sandplains	1–8 m 2–6 m	Yellow, Orange				Sun Sun	Well Drained Well Drained	•	•	•	•		•		•	•
Tree (Small)	Grass-Leaved Hakea	Hakea multilineata	Proteaceae	Sandplains, Mallee, Heath	1.5–6 m	Pink				Sun	Well Drained	•	•	•	•				-	
Tree (Small)	Saltwater Paperbark	Melaleuca cuticularis	Myrtaceae	Coastal, Swamps	1–7 m	White, Cream				Sun	Moist, Well drained	•	•	•	•					
Tree (Small)	Quandong Marri / Pod Gum	Santalum acuminatum	Santalaceae	Variable	1–7 m 50 m	Green, White, Red, Brown				Sun	Well Drained	•	•	•	•		•			•
Tree (Large) Tree (Large)	Marri / Red Gum Blue-Leaved Jarrah	Corymbia calophylla Eucalyptus marginata	Myrtaceae Myrtaceae	Coastal, Forest Forest	50 m < 40 m	White, Pink				Sun to semi-shade Sun to semi-shade	,	•	•	•	•	•	•	•	• •	•
Tree (Large)	Salmon gum	Eucalyptus salmonophloia		Woodland		White, Cream				Sun to semi-shade		•	•	•	•					
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WheenBeeFoundation.org.au

*Buzz Pollinated

Know your pollinators



European honey bees have two pairs of wings and long, segmented antennae. They are daytime-flying and feed on nectar and pollen. They are generalist pollinators and provide the bulk of pollination services for horticulture and crop plants. Honey bees and native bees are both essential to functioning ecosystems and food security in Australia.

Honey bees have become an important part of the Australian landscape. Honey bees live as colonies, and have a long history of coexistence with humans, including in domestic gardens.





Hoverfly [Family Syrophidae] © Karen Betra **Australian native bees** comprise more than 2000 species, which provide essential pollination services. Native bees are generally solitary and live in nests in the ground or in hollow stems, old borer holes and other cracks and crevices, and some have evolved to pollinate particular native flowers through 'buzz pollination'. Although many Australian native bees are generalist foragers, some species have co-evolved with native plants and adapted to be the most effective pollinators of their flowers. Many native plant species, such as *Dianella* and *Grevillea* require specially adapted insects to access their nectar and enable the transfer of pollen to the stigma. Most native bees are solitary, but some species found in northern Australia (*Tetragonula* sp. and *Austroplebeia* sp.) are social bees and are used for commercial pollination of crops like macadamia nuts.

Fly species number up to 30,000 in Australia, and can be identified by having only one pair of flight wings. A second set of wings are modified into club-shaped paddles that allow flies to hover and stabilise their flight. Unlike bees and wasps, many flies (Brachycera) have very small, clubbed antennae at the front of their head. Flies, including blowflies, are often attracted to flowers that smell like carrion. Some flower-flies, have hairy bodies that easily collect pollen while they are feeding. Flies provide a range of services in the garden, including pollination, decomposition and predation.

Hoverflies are a type of fly, distinguishable by their large eyes, short antennae, bright black and yellow abdomen and their hovering flight behaviour. Adult hoverflies are nectar and pollen feeders. Hoverfly larvae feed on pests such as aphids, thrips and leafhoppers and are excellent biocontrol agents.



Beetles have hard outer wings that form their distinctive beetle shape. Their outer wings form a T-shape where they join at the top, unlike bugs where the outer wings make an X- or Y-shape. Some beetles feed on nectar and pollen, usually by crawling over flower surfaces. There are around 30,000 species of beetles in Australia, with many yet to be formally described.



Butterflies have wings covered in tiny scales. They have clubbed antennae and hold their wings upright when at rest. They are day-flying and have long tongues that they can use to feed on nectar in flowers with deep tubes. Butterflies are usually brightly coloured, with approximately 600 species found in Australia.



Moths also have wings covered in tiny scales and tend to be subtle in colour. They have antennae without clubs and hold their wings flat when at rest. They are generally dusk- and night-flying but there are some exceptions: the grapevine moth is a commonly seen day-flying moth. Moths feed on nectar. Australia has a high diversity of moth species, with up to 22,000 species thought to exist across the continent.

Flower forms



Generalist flowers can be pollinated by many different insects and animals. They are typically saucer shaped with many stamens and have a surface that insects can walk on. *Eucalyptus* flowers and daisy flowers are generalist flowers – they can be pollinated by bees, flies, beetles and butterflies.



Specialist flowers have modifications to their shape and size that only let certain pollinators access the nectar and pollen. These flowers might have deep flower tubes or narrow entry points so that only a select group of pollinators can access them. The advantage of specialisation is that pollination is very targeted and efficient, with accurate pollen placement made possible by co-evolution between flowers and insects. The disadvantage is that if the correct pollinator isn't there, the flowers aren't pollinated. Often, nectar is produced at the base of the flower, forcing pollinators to enter the flower fully and in the process, become covered in pollen.

Pollinator rewards

Nectar is a sugary solution, rich in carbohydrates, vitamins and minerals, produced by flowers and sometimes by glands on leaves or stems (called extra-floral nectaries). Nectar is attractive to insects, and provides an immediate energy source needed for tasks such as hunting pest insects, laying eggs in decomposing organic matter, collecting pollen, or parasitising other insects.

Carbohydrates alone don't support everything needed for health and growth, so insects also need pollen.

Pollen is rich in protein, fats and nutrients. Bees are vegetarian, and need to collect pollen to feed their offspring.

Buzz pollination

Some flowers do not produce any nectar; they specifically target pollencollecting bees, and only offer pollen rewards. To limit pollen loss and ensure effective pollination, some plants produce flowers with specialised, tubular anthers, that only open at the tip. To extract pollen, bees use vibrations to 'buzz' the pollen grains out of the pores of these anthers. Many crops are buzz pollinated, including tomatoes, potatoes, eggplants, capsicum, chillies, tomatillo and cranberries.

European honey bees are unable to buzz pollinate flowers, but several native bees, such as the blue-banded bee, teddy bear bee (*Amegilla* sp.) and carpenter bee (*Xylocopa* sp.) are exceptionally good large buzz pollinators, and have evolved to pollinate native plants such as flax lilies (*Dianella* sp.). Many of our smaller, ground nesting bees utilise vibration to help them excavate their burrows, and they also use that skill to buzz pollen from the anthers of native plants.

Planting buzz-pollinated species will encourage populations of buzz pollinators for successful pollination of food crops and ensure seed set in native plants. Many small ground nesting bees also buzz pollinate native flowers.

Nectar feeding

Grevillea flowers and other tubular flowers are often adapted to be successfully pollinated by birds. Pollen is 'presented' on a floral stigma that extends outside the flower. When birds feed on the nectar, pollen is deposited on their beaks or heads. Bees, also attracted to the sugary nectar, crawl into the side of the flower and feed on the nectar without encountering the pollen-laden stigma. The plant doesn't receive the pollination benefit from the insect, but flowers such Grevillea species can be a very useful source of nectar for insects in the cooler months.



Nurseries

Most of the plants shown in the planting guide will be available at nurseries that have a good stock of native plants. But if your local nursery doesn't stock the plant you're after, ask them to order it in. For a list of nurseries

that stock all the plants shown in the planting guide, plus other useful resources, visit the Wheen Bee Foundation website or scan the QR code.



WheenBeeFoundation.org.au/our-work/powerful-pollinators

Wheen Bee Foundation

Powerful Pollinators Planting Guides are produced by Wheen Bee Foundation. We fund vital strategic research and education initiatives that strengthen bees, improve pollination efficiency, and protect our food security and ecosystem health. Visit the website for more information.

WheenBeeFoundation.org.au

Far left: The spreading flax lily, *Dianella revoluta,* is buzz pollinated.

Left: This European honey bee is 'side-working': feeding on the nectar-rich flowers without coming into contact with the plant's pollen.

Front cover:

 Trichocolletes sp. on Daviesia sp. (Photo: Kit Prendergast)
 Wildflowers, Avon Wheatbelt WA. (Photo: Kit Prendergast)
 European honey bees, Apis mellifera. (Photo: Kirrily Hughes)

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