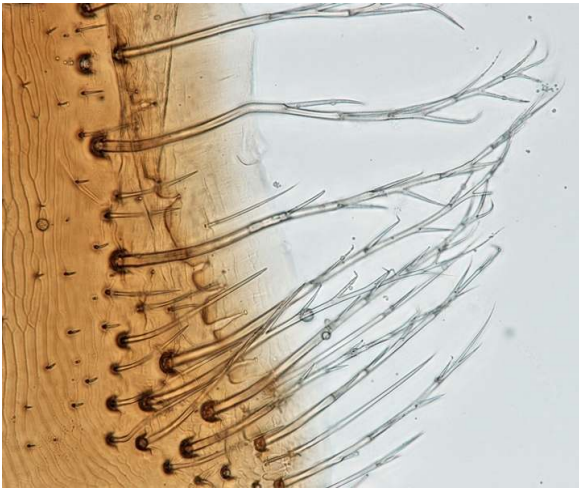




Native Bees

Australia is inhabited by an estimated 2000 species of native bees, many of which have yet to be scientifically named and described. Discoveries of new species are not uncommon, so the total number of species may be much higher. Approximately 800 species occur in Western Australia and many of them are endemic.

Bees are actually specialised wasps closely allied to predatory wasps known as 'sphecoids'. They have given up their ancestors' predatory habits and, instead of storing paralysed insect or spider prey as food for their larvae, they collect and store pollen and nectar. This transition to vegetarianism was accomplished with only minor structural changes one of which was the development of plumed or branched bristles and hairs (setae).



Branched hairs (setae) from a bee's abdomen. Visible only under a microscope, branched or plumed setae distinguish all bees from wasps.

Australian bees are extremely diverse in terms of size, form, colouration, degree of sociality and behaviour and relatively few resemble the familiar honeybee. Our tiniest bees are only about 2.5 mm long while our largest are about ten times as long. Body form varies from broad and rotund to slender and delicate. Some bees are densely hairy while others are sparsely hairy or almost hairless and some are very wasp-like. Our bees are classified into five families, three of which are known as 'short-tongued' and two as 'long-tongued'. The 'tongue' is a flexible hairy extension of the proboscis used for lapping up

nectar and for applying secretions during nest-building.



A long-tongued bee, Amegilla (Asaropoda) sp. Long tongues enable nectar-extraction from deep, tubular flowers.



Head of a short-tongued bee, Homalictus sp., showing the short, pointed tongue at the end of the proboscis. Either side of the mouth are the jaws or mandibles which are used for excavating burrows, carrying nesting materials or fighting.

While both sexes feed on nectar (a dilute solution of sugars in water), females usually thicken it into honey before taking it back to their nests. They do this by regurgitating the nectar

from the honey stomach onto their mouthparts, exposing it to the air to evaporate excess water. They alternately regurgitate and re-swallow droplets of nectar until it reaches the required consistency.



A female bee (Hylaeus cyaneomicans) holding a droplet of nectar on her mouth-parts as she thickens it to honey.

Females of most kinds of bees carry their pollen loads on specialized sets of hairs (termed 'scopae') on either the hind legs or the underside of the abdomen. Such pollen loads immediately distinguish the insects as bees.



A female bee (Ctenocolletes smaragdinus) carrying yellow pollen on the hairs of her hind legs.

Other bees, usually sparsely hairy species, lack scopae and swallow pollen, carrying it mixed with nectar in the stomach. At the nest, they regurgitate the combined pollen and nectar as a semi-fluid paste. Even when carried separately, pollen and honey are usually combined in the nest to form the larval food, either as a solid, rounded mass or as a fluid or semi-fluid paste. Either way, the egg is deposited on top of the completed provision. Separate storage of honey and pollen is practised only by highly social bees.



A female bee (Megachile mystaceana) carrying a full load of cream pollen on the underside of her abdomen.

Australia's bees are predominantly solitary, each female building one or more nests in which to rear her offspring without the aid of 'workers'. Many burrow in the ground though a few bore in dead, rotting wood or pithy stems. Most others are 'lodgers', utilizing existing hollows such as borer holes in dead wood, hollow stems and abandoned burrows of other bees and wasps. Lodger bees will also utilize man-made cavities such as nail and bolt holes, pipes and cut bamboo. A few species build free-standing nests on stems or rocks. A variety of materials may be used in nest construction including soil, plant fibre, leaf pieces, leaf pulp, resin and secretions such as wax and silk. Typically, each brood cell is an urn-shaped cavity providing a protective environment for the development of a single individual; it is stocked with sufficient food to enable development from egg to adult and is sealed once it receives an egg.



Completed brood cell of a soil-nesting bee (Stenotritus greavesi) showing yellow pollen mass and white egg. The cell walls are varnished with a waterproofing secretion making them shiny.

Young bees must bore their way out of their cells and find their way to freedom. In ground nests, the cells may occur singly, each with a separate connection to the main shaft, but bees that nest in hollow stems and borer holes construct series of cells, end to end along the galleries.



Nest of a resin-using bee (*Megachile* sp.) constructed in an abandoned wood-boring beetle gallery in dead wood. Two brood cells constructed end to end are on the right and the plugged nest entrance is on the left.

Small carpenter bees (*Exoneura* and *Braunsapis* species) nest in hollow stems and borer holes but have forsaken the construction of cells. Instead, small groups of adults share the tunnels with immature stages and feed the larvae small meals periodically.



Eggs of a small carpenter bee (*Exoneura* sp.), left, and larvae of another kind (*Braunsapis* sp.) in hollow stems. No cells are constructed by these bees.

Bees' worst enemies are parasitic insects (certain wasps, flies and beetles), mites and moulds that develop in or on their immature stages and food stores. Among the enemies are 'cuckoo bees', females of which break into their host's freshly completed brood cells to deposit their eggs. The cuckoo bee larvae, upon hatching, destroy the host egg or young larva and take over the food store. The white-spotted species of *Thyreus*, for example, develop in nests of blue-banded bees (*Amegilla* spp).



A male cuckoo bee (*Thyreus* sp.) at rest. Males of many bees and wasps spend the night in this way, gripping stems or leaves with their jaws alone.

Australian bees occupy most terrestrial habitats including the arid inland. Providing there are flowers, bee activity may be observed throughout the year, although, in southern Australia, activity peaks in spring and summer. While most species are active during the middle hours of the day, some summer-active bees confine their flights to the cooler mornings and evenings and a few tropical species are known to fly only at night.

In terms of flower visitation, some bees are generalists while others display varying degrees of specialization. They may confine their foraging to flowers of one family, one to a few genera, or occasionally a single species of plant. Consequently, their geographic ranges and flight seasons are correspondingly restricted. Between activity periods, bee populations usually survive in a dormant larval stage. Floral specialists commonly display structural adaptations to their forage plants (e.g. an elongated proboscis in bees specializing in tubular flowers). Special behaviours may also be evident. For example, many species shake dry pollen from tubular anthers (such as those of *Solanum*) by vibrating their wing muscles, audibly buzzing as they do so.

Male bees play no part in nest construction or brood care, their sole function being to locate and fertilise females. Typically, they do this by patrolling the preferred forage flowers or the nesting areas. Competition for females can be intense and males may fight each other to gain access to virgin females. Territorial behaviour is quite common where males defend a patch of habitat, often containing forage flowers, and drive off rival males and any other flying insects. The yellow spotted males of certain *Hylaeus* species, for example, establish and vigorously defend territories on fresh *Banksia* flower heads. The males vary in size and larger males tend to dominate in violent skirmishes with rivals.

Despite their day-time rivalry, male solitary bees commonly cluster together on vegetation to rest for the night. They probably gain some defensive advantage in doing so.



Males of a solitary bee (*Lipotriches* sp.) clustered on a plant stem where they habitually spend the night.

Among the exclusively Western Australian bees are some very notable species. Dawson's Burrowing Bee (*Amegilla dawsoni*) inhabits areas of the north-west and mid-west of WA and is among the State's largest bees (see separate information sheet). The genus *Ctenocolletes* contains ten species of large size including *C. smaragdinus*, notable for its wholly iridescent green body.



Female of the green burrowing bee, *Ctenocolletes smaragdinus*. This species is restricted to inland heaths of southern Western Australia.

Females of *Ctenocolletes* are ground-nesting and two species are known to burrow to depths of 2.7-3.2 metres, the deepest known burrows of any Australian bee. Males are 'super bees' that patrol areas of heath so fast that they may scarcely be glimpsed, although they are clearly audible.

At least fifty species of bees inhabit the bushlands around Perth and several occur quite commonly in suburban gardens and city parks.

Blue-banded bees (*Amegilla* species) are the most likely to be seen. About the size of a honeybee, they are distinguished by their rotund form and black-and-white-banded abdomen, the white bands often tinged with a bluish iridescence. They visit flowers of many garden ornamentals, both native and exotic, in spring and summer. Their flight is noisy and characterised by alternate hovering and darting. Our commonest species, *A. chlorocyanea*, makes its shallow nests in sandy soil while a related species in the Darling Range nests in harder soils and may colonize mud-brick walls.



A blue-banded bee, *Amegilla chlorocyanea*.

Leaf-cutter bees (belonging to the large genus *Megachile*) build linear nests in any suitable hollows using pieces of soft, thin leaves. They cut circular or oval pieces from leaves with their mandibles and curl them between their legs for the flight back to the nest. While nest sites are frequently existing holes above ground, some species excavate shallow burrows in soil.

Many other species of *Megachile* chew the leaf-tissue into a paste or scrape resin from plant stems and use these materials to build their cells in borer holes in dead wood or any other suitable holes they can locate.



Rose leaves damaged by a leaf-cutter bee.



A brood cell of a leaf-cutter bee opened to show pollen provision and egg.

Burrowing bees of the very large genus *Leioproctus* push up conical heaps of loose soil at the entrances of their shafts as they burrow down to depths of up to a metre. They prefer bare ground and often nest close together. Their males may hover about over the nesting areas awaiting the emergence of unmated females. A species with a blue-black abdomen commonly nests in Perth lawns in spring creating volcano-like mounds of yellow sand.



Tumuli of a burrowing bee (*Leioproctus* sp.) in a garden rockery. Each yellow mound marks the entrance to a nest burrow which is typically vertical and may be up to a metre or more deep.

Members of the large genus *Hylaeus* are typically small to medium-sized bees with black, relatively hairless bodies and most species have characteristic white, cream or yellow marks on the face and thorax. For this reason, they are sometimes referred to as 'masked bees'. They are also referred to as 'lodger bees' as females seek out existing hollows in which to construct their nests. Vacated borer holes in tree trunks and dead branches, hollow pithy stems and the vacated burrows of other bees or wasps are commonly used. A few species utilize the vacated nests of potter

wasps. Nail holes and other man-made hollows can also suit their purposes.



A yellow-spotted bee, *Hylaeus violaceus*, male.

Females line their nest cavities with a clear salivary secretion applied from the proboscis. This hardens into a shiny, waterproof film. The brood cells made of the same material look like tiny clear plastic bags and serve to contain the semi-fluid larval food. Completed nests usually have a shiny, cellophane-like seal across the tunnel entrance.

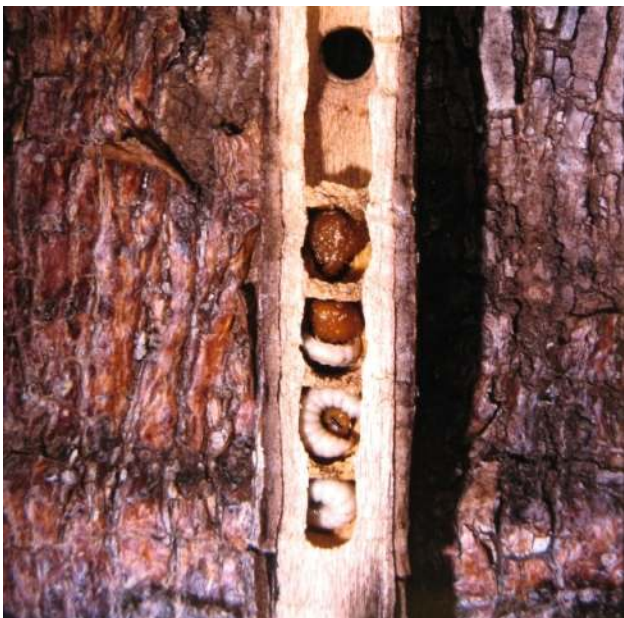


This vacated potter wasp nest had been used as a nesting site by a *Hylaeus* species as revealed by the clear, cellophane-like membrane sealing the entrance.

The large carpenter bees, *Xylocopa* species, with body lengths of up to 20 mm, are found in the Kimberley Division and parts of the northern Pilbara. Females have black bodies and wings and a covering of yellow hair over the thorax while males are wholly covered with yellow hair. Nesting females bore into standing, dead, partly decayed tree branches and partition their galleries into series of brood cells with neatly tailored discs of compacted wood particles. Small groups of adults are sometimes found in nest galleries.



Female (top) and male of a large carpenter bee, *Xylocopa* sp.



Branch split to reveal burrow and brood cells of a large carpenter bee, *Xylocopa* sp. The lateral entrance hole may be seen at the top of the picture.

Western Australia's only highly social native bees are the tiny 'stingless bees' or 'sugarbag bees' (*Trigona* and *Austroplebeia* species) found only in the tropical north. They are no larger than bushflies and can be as much of a nuisance – workers commonly land on humans to lick sweat. The bees live in colonies of hundreds of

individuals in 'hives' in tree or rock hollows. As with the honeybee, each colony has a single egg-laying queen and innumerable sterile female workers (her daughters) that co-operate to build the nest, forage for food and other raw materials and tend the brood. They have a communication system but it is less efficient than that of the honeybee. The hives are built of 'cerumen', a brownish mixture of secreted wax and plant resin. The brood cells (forming an irregular comb) and the larger pollen pots and honey pots are held together by a complex system of struts and pillars composed of cerumen and the whole is enclosed in a sheet of the same material. The brood cells are mass-provisioned and are capped once they have received an egg. Stingless bee hives have traditionally been sought by aboriginal people for their stores of honey.



A stingless or sugarbag bee, *Trigona* sp.

The honeybee, *Apis mellifera*, was introduced to Australia by the first European settlers to pollinate their fruit trees and to provide honey and beeswax. Honeybees have become feral throughout Western Australia wherever they have access to water. The honeybee is the only bee in Australia that will attack and sting aggressively and is the only species to leave a sting in the victim. While the majority of native bees are capable of stinging, they do so only under duress.

The five Australian bee families are Stenotritidae, Colletidae, Halictidae, Megachilidae and Apidae. The first, comprised of about 50 species in two genera, *Ctenocolletes* and *Stenotritus*, is restricted to Australia. The remaining families occur world-wide. Oddly, two virtually world-wide families (Andrenidae and Melittidae) are absent from Australia.

Further reading: Michener, C.D (2007). *The Bees of the World*, 2nd edition (John Hopkins University Press).

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