Australia's First Native Bee Field Guide!

A practical, colour guide to help wildlife enthusiasts, bushwalkers, gardeners, beekeepers and students to identify our dazzling native bees.

* Describes 31 of the most easily-recognised Sydney species
* Includes over 20 species also found in Queensland and Victoria
* Colour photographs, common and scientific names, pronunciation guide and nesting habits
* Comprehensive section on garden plants loved by native bees
* Designs for artificial nests

"Bee-lovers rejoice! Here at last is the help we've long needed, a field guide that's not only authoritative, but clearly written and beautifully illustrated."
Densey Clyne, Naturalist and Author

"An excellent glimpse into the private lives of our fascinating native bees."
John Dengate,
Media Naturalist (ABC and Burke's Backyard)

Dr Anne Dollin, Australian Native Bee Research Centre, has been studying Australian native bees for 38 years. She has revised the species names of all of Australia's stingless social bees and has built *Aussie Bee*, a public education website on native bees.

Dr Michael Batley, a former lecturer at Macquarie University, has a keen interest in natural history and Australian native bees. He has published revision papers on the *Trichocolletes* and *Amegilla* species and is cataloguing the bee collection of the Australian Museum.

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Dr Brian Faulkner has researched the pollination biology of bumble bees at the University of Exeter, UK. He is currently a freelance journalist in horticulture and entomology, with major articles published in *Australian Horticulture*.

Native Bees of the Sydney Region: A Field Guide will help you to explore and enjoy Australia's remarkable native bees, vital pollinators of our wildflowers, gardens and crops.

3rd Edition
ISBN
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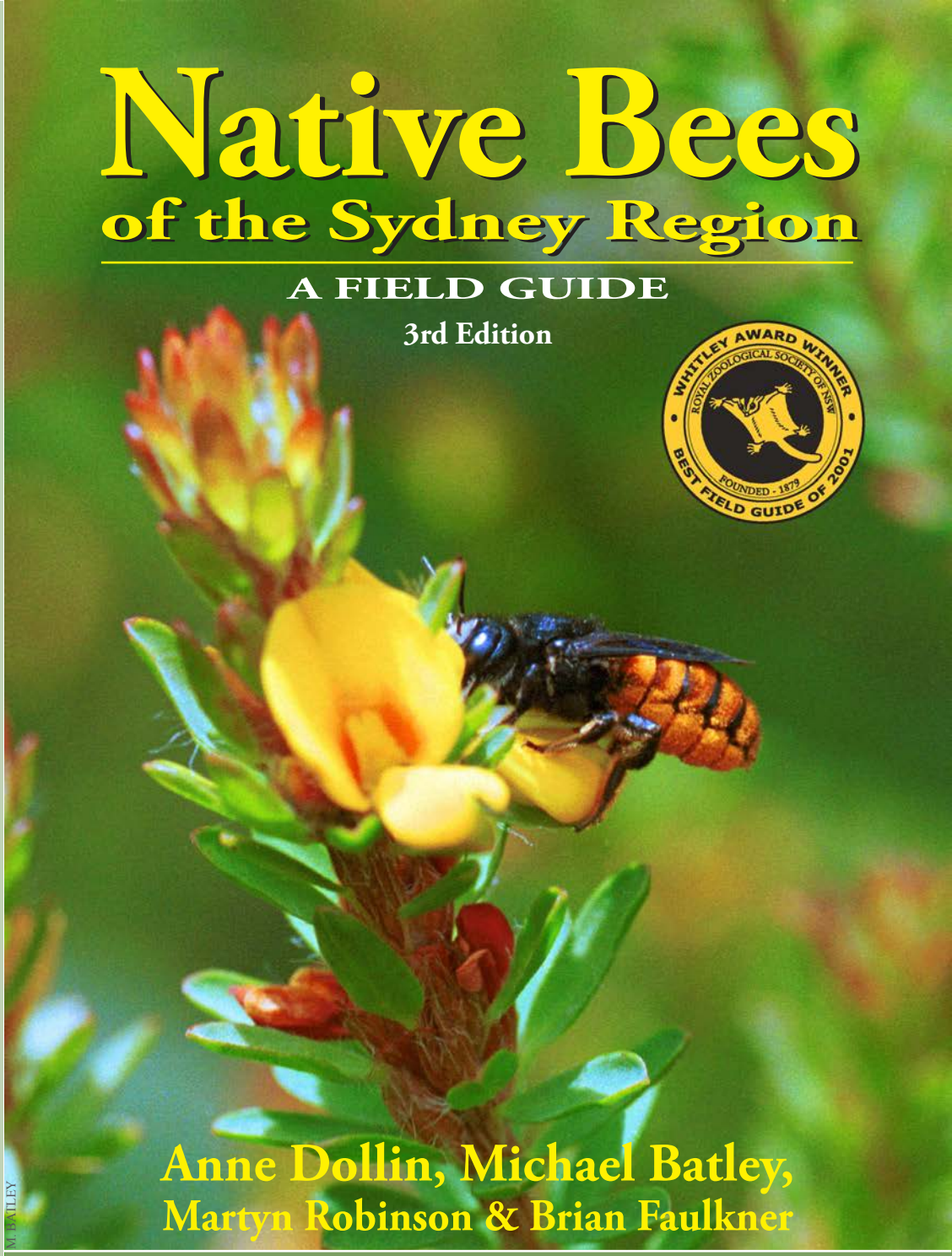
Nature / Field Guides

Native Bees
of the Sydney Region
A FIELD GUIDE
3rd Edition

WHITLEY AWARD WINNER
ROYAL ZOOLOGICAL SOCIETY OF NSW
FOUNDED - 1879
BEST FIELD GUIDE OF 2001



Anne Dollin, Michael Batley,
Martyn Robinson & Brian Faulkner

FOREWORD BY ERIC ROLLS

Native Bees
of the Sydney Region

A FIELD GUIDE
3rd Edition

Anne Dollin, Michael Batley,
Martyn Robinson & Brian Faulkner

FOREWORD BY ERIC ROLLS
Author of *A Million Wild Acres*

Updated Ebook Edition, 2017

The names of 10 of the 31 key species featured in this guide were changed in a major revision of the world's bees by CD Michener in 2000 (see Appendix 1). This updated ebook edition provides the new names for these bees. However, the original order in which the species are presented in this guide has not been changed, so these 10 species may no longer be in alphabetical order within their family groups.

An Australian Native Bee Research Centre Publication

Acknowledgements

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Photographs are by M Batley and drawings by M Robinson, except where otherwise acknowledged in the text.

FRONT COVER
A fire-tailed resin bee (*Megachile mystaceana*) foraging.
Photograph by Michael Batley.

BACK COVER
A blue-banded bee (*Amegilla (Zonamegilla) pulchra*) resting at night.
Photograph by Anne Dollin.

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Contents

Foreword

I once saw a bee so big and noisy and outrageously coloured I wrote a poem about it:

Bumble bee or be whatever,
Makes this lonely grass blade quiver.
Crimson head and body purple,
Take your fiery head and dabble
In the nearest waterhole.
I've no time for fighting fires
Set by some outrageous joke
Conjured out of flame and smoke.

That was fifty years ago and I have never found the name of the spectacular creature. Very likely it did not have one and the species disappeared with the grass that supported them. That rich pasture, studded with sprawling Yellow Boxes and busy with insects, now supports nothing but a monoculture of cotton.

If anyone in the Sydney region sees a big, brightly-coloured bee, it is sure to be in this excellent guide. Although it deals with only thirty-one of the hundreds of species in the region, it comprises many of those that can be identified in the field. Because of the ugly government attitude to science that the only worthwhile knowledge leads to greater monetary profit, many bees are still unknown. As well, in the Sydney area alone, the majority are no more than a few millimetres long and require examination with a magnifying glass to identify them.

All bees are important. Until the advent of feral European bees, they were significant pollinators, sometimes specialising to the extent of a single plant within a species. Unspecialised collection of pollen and nectar by feral European bees has confused pollination and produced hybrid species.

The majority of bees live as individuals; and not all make honey for their larvae. The beautiful Banksia Bee described here furnishes its cells with a mixture of pollen and nectar. *Tetragonula carbonaria*, also described, make a delicious honey with an acid finish. They are one of the best known of the stingless native bees and live in complex social groups with active queens. Other bees like company, sometimes thousands of their fellows, though each female makes an individual tunnel or burrow to furnish with food for its young.

Carpenter bees of the *Xylocopa* genus bore living and breeding tunnels in trees. Like the beautiful Blue-banded Bees of the *Amegilla* genus they are buzz pollinators of those plants which secure their pollen from all those who do not know the trick of opening them. These bees light on a flower, hold on with their jaws, then shiver the powerful muscles used in flight. The whole body of the bees vibrates so passionately it buzzes loudly. Sound waves and shock waves excite the flower. Pores in the top of the anthers burst open and fine pollen spurts all over the bees.

This book brings new excitement and new understanding to Sydney bush and garden.

Eric Rolls

Introduction

Australia has over 1,600 species of native bees. What an astonishing array – glossy metallic-green bees, bees with brilliant gold or blue stripes, black bees with bright blue spots, furry bees, shiny bees, delicate 2 mm midgets and robust 24 mm giants!

Many Australians know only of the introduced commercial honeybee, but our native bees are a valuable national resource and deserve more recognition. Many of our beautiful Australian wildflowers depend on native bees for their pollination; Aboriginal people have treasured the aromatic honey of our stingless native bees for thousands of years; and our agricultural industries are just starting to realise the potential of native bees as crop pollinators.

This book, Australia's first field guide to native bees, presents an introduction to the world of these marvellous insects – the major types of native bees, their mysterious nesting habits, and ways to conserve and support native bees.

This guide covers the Sydney region from Gosford to Wollongong and westwards to the Blue Mountains, but many of the species covered are common in other states and regions of Australia.

There are about two hundred species of native bees in the Sydney region. Unfortunately many are tiny and similar in appearance and it is not possible to identify these species simply from a colour photograph. Many can only be identified by microscopic examination of their wings or bodies. So, for this guide we have chosen 31 species or species-groups that are relatively easy to recognise in the field. All the major native families and most of the larger, more obvious species have been included as well as a few chosen for their distinctive colouring or fascinating behaviour.

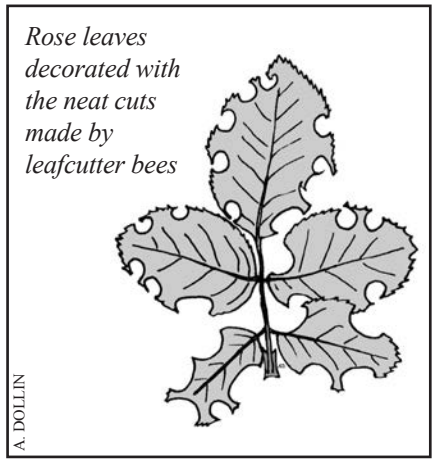
The first section of this book provides tips on supporting native bees in your garden and on observing them in the wild. The second section, Guide to Bee Species, presents a description of each species, its nesting habits, known distribution and related species. The actual size of each bee is indicated by a silhouette (see note on page 81) and its colouring is shown in the colour plates. Both scientific and suggested common names are given – many creative common names were contributed by our colleagues and supporters. A guide to the pronunciation and meaning of the scientific names is also provided at the end of the book.

If you would like to contribute to Australia's knowledge about native bees, please submit your bee photos and observations to BowerBird website and/or the Atlas of Living Australia website (see links on page 67). Information about the abundance, distribution and seasonal activity of many species in Sydney is very patchy and incomplete. The species covered in this guide are relatively common yet the nests of some of these species have never been described! Your observations could be most valuable and could help fill in these important gaps.

Native bees are wonderful examples of the diversity and sheer beauty of our world. If this guide can provide an entry point to this entrancing microcosm, it will have fulfilled its purpose.

1. Native Bees in Your Garden

Urban development has destroyed countless colonies of native bees. Land clearing and landscaping destroy nest sites and remove food supplies. Insecticides kill friend and foe alike. Yet some species of native bees have managed to thrive, even in the inner city. Blue-banded bees (*Amegilla* (*Zonamegilla*) sp.) still nest in Sydney's Royal Botanic Gardens, ground dwelling colletid bees nest in Coogee, teddy bear bees (*Amegilla bombiformis*) nest under suburban houses, and gardeners often see the round holes left in rose leaves by leafcutters (*Megachile*). However, there is much the Sydney gardener can do to assist native bees to survive in the Sydney region.


A. DOLLIN

Rose leaves decorated with the neat cuts made by leafcutter bees

The rich arrays of flowers in an urban garden make an ideal year-round food supply for native bees – at times, better than the 'feast-or-famine' flowering in our natural bushland. Flowers in a group of gardens could support an entire native bee population, since most bees have a foraging range of less than 2 km. It is not even necessary to be adjacent to bushland. In a park in Concord seven species have been seen in half an hour, and over a two year period a pair of flowering angophoras at Carlingford were visited by at least 35 different species.

It is believed that the relationship between bees and flowers is very ancient and that flower features, such as petals, stamens and nectar, have evolved as a result of interaction between plants and insects. The huge array of flower shapes and colours is testimony to the fact that efficient pollination can be achieved in many different ways.[1] Some plants attract many insects by means of massed displays, while others prevent some insects from reaching their nectar by producing tubular flowers. Some plants, such as eucalypts, are adapted to pollination by bats or birds, but are still very important to many bee species.

When considering plants that may be attractive to bees, it must be remembered that bees visit flowers for both nectar and pollen, not necessarily at the same time. It is, however, broadly true that bees with short tongues will prefer shallow, open flowers like those of the myrtle family, while long-tongued bees will favour tubular blooms. Some native bees are selective and visit only native plants, but others, like the stingless and blue-banded bees, happily forage from introduced species as well. There are many trees, shrubs, climbers and ground covers that will produce a beautiful garden buzzing with native bees.

Bee-Attracting Plant Families

Myrtles: Australia has a particularly rich selection of plants in the myrtle family (Myrtaceae) which are very attractive to short-tongued bees in particular. Ranging in size from dwarf shrubs such as the heath myrtles (*Baeckea*) through to towering eucalypts, this family is enormously important to humans as a source of ornamental garden plants, timber, essential oils, bush tucker (e.g. lilly pillies) and commercial honey production.

Most trees in this family are excellent nectar and pollen sources. They include *Angophora* and *Eucalyptus*, brush box (*Lophostemon confertus*), water gum (*Tristaniopsis laurina*), lilly pillies (*Syzygium*) and *Backhousia*. The resin of the turpentine tree (*Syncarpia glomulifera*) is also highly attractive to stingless bees.

Some smaller, shrubby species of the myrtle family that could be included in a bee-friendly garden are *Astartea astarteoides, Calytrix tetragona, Homoranthus flavescens, Kunzea ambigua, Leptospermum polygalifolium subsp tropicum cv* Cardwell*, Melaleuca thymifolia* and *Thryptomene saxicola*. All of these low-growing plants flourish in Sydney gardens and are very popular with native bees.

Mints and Herbs: Long-tongued and stingless bees are especially fond of flowers in the mint family (Lamiaceae). Most of the plants in this family have strongly fragrant foliage and colourful blooms, and are equally popular with humans. Well known examples include the herbs basil, bergamot, catmint, lavender, thyme, sage, rosemary, hyssop, lemon balm, savory and, of course, the many different kinds of mint.

Native members of the mint family include native rosemaries (*Westringia*) and mint bushes (*Prostanthera*). Coastal native rosemary (*Westringia fruticosa*) is a particularly good shrub to grow because it is hardy and flowers almost all year round, and blue-banded and teddy bear bees (*Amegilla*) love it.

Daisies: The daisy family (Asteraceae) is another group of plants that flower for extended periods and are attractive to bees. Two of the best are the common cut-leaf daisy (*Brachyscome multifida*) and the golden everlasting (*Xerochrysum bracteatum*).

Citrus: Most backyards have one or more citrus trees and if there are stingless bees (*Tetragonula*) in the neighbourhood, they will pillage the blossoms enthusiastically at flowering time. *Boronia*, diosma (*Coleonema pulchellum*), *Correa alba, Eriostemon, Melicope, Murraya paniculata, Philotheca, Phebalium* and *Zieria* are other members of the citrus family (Rutaceae) that are equally enticing to stingless bees.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Stingless bees (Tetragonula) on citrus blossom

Wattles: If you want your local reed bees (*Exoneura*) to get off to a flying start each year, consider planting wattles (Acacia, family Fabaceae). Most wattles bloom in late winter and early spring, providing abundant pollen at a time of year when bees are becoming active again, as cold, bleak winter gives way to glorious sunny spring.

Peas: Closely allied to the wattles are the peas and beans (family Fabaceae). Plants in this group have complex flowers adapted to bee pollination. Many other flower-visiting insects such as beetles, flies and moths find it difficult to reach the nectar and pollen concealed within the blooms. The flowers present pollen to the underside of a visiting insect, making bees with pollen brushes beneath the abdomen, like the leafcutters and resin bees (*Megachile*), particularly effective pollinators.

Australian native plants in the family Fabaceae are well worth growing, both for their ornamental value and as a food source for bees. They may support not only long-tongued bees (eg *Megachile*) but even some short-tongued species from the genera *Trichocolletes* and *Lipotriches*. Plants in the following genera are all worth trying: *Bossiaea, Daviesia, Dillwynia, Eutaxia, Gompholobium, Hardenbergia, Hovea, Indigofera, Jacksonia, Oxylobium, Pultenaea, Swainsona* and *Viminaria*.

Another pea is the introduced alfalfa or lucerne plant (*Medicago sativa*) which is an important agricultural crop in Australia. Alfalfa is pollinated by robust leafcutter bees. When alfalfa is grown for seed, overseas farmers encourage leafcutter bees by providing nesting sites and protection from enemies. Australian native leafcutter bees enthusiastically visit alfalfa that has become a roadside weed in some areas of south-west Sydney.

Buzz Pollinated Flowers

Some bee pollinated flowers have modified *anthers* (the male parts of the flower that produce the pollen). The anthers of these blooms need to be vibrated at high frequency before they will freely release their pollen.

Many Australian bees have developed a special behaviour, called *buzz pollination,* to release the pollen from these flowers. A buzz pollinator clings to the flower and vigorously vibrates its thorax, making a distinctive buzzing sound. The pollen shoots from the anther and is attracted back onto the bee's body by static electricity.

Our large Australian carpenter bees, blue-banded bees and teddy bear bees are expert buzz pollinators but many medium to small colletid and halictid bees can also perform this trick. European bumblebees can also buzz pollinate but commercial honeybees and the stingless native bees (*Tetragonula*) cannot.

From a human point of view, the most important examples of buzz pollinated plants are in the family Solanaceae, which includes many food crops such as tomatoes, capsicums, eggplants, chilli peppers, bush tomatoes, tamarillos and cape gooseberries. The Solanaceae also features many ornamental garden plants such as the potato vine (*Solanum laxum*) and the Brazilian nightshade (*Solanum seaforthianum*).

Buzz pollination has also evolved independently in several other unrelated families of plants. One such

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A teddy bear bee (Amegilla) on an Abelia flower

plant enjoyed by teddy bear bees is the vigorous climber, *Hibbertia scandens* (family Dilleniaceae). It bears large yellow flowers throughout the warmer months, provides good ground cover and is tolerant of salt-laden breezes. Other popular buzz pollinated plants include the flax lilies, *Dianella* (family Hemerocallidaceae) and the herb borage.

Other Favourites

Abelia: As well as the plant families described above, some individual plants from other families deserve a special mention. Top of the list would have to be *Abelia* x *grandiflora* and *Abelia schumannii.* These are medium-sized shrubs with attractive glossy green leaves. They have pretty white or pink bell-shaped flowers and bloom prolifically throughout summer. Teddy bear, blue-banded and stingless bees adore these plants.

Weigela: Closely related to *Abelia* is the genus *Weigela* and these attractive spring flowering shrubs are equally popular with teddy bear and blue-banded bees. Several cultivars of *Weigela* are available, with flowers ranging from pure white to dark red.

Buddleja: If you have plenty of space to fill, a *Buddleja davidii* or two will form a majestic spectacle. These tall shrubs produce long sprays of small, sweetly perfumed, tubular flowers that attract a host of long-tongued insects, including butterflies, moths and bees. The leaves of the *Buddleja* are popular with leafcutter bees as nesting material. Reed bees (*Exoneura*) will also use pithy *Buddleja* canes as nesting sites.

Grevillea: Although most *Grevillea* species are primarily bird pollinated, many are also very attractive to bees. *Grevillea* hybrids such as 'Robyn Gordon', 'Ned Kelly', 'Moonlight', 'Honey Gem' and 'Coconut Ice' are particularly useful because they produce abundant nectar and flower throughout the year.

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Leafcutter bees have cut leaf pieces from this Buddleja for their nests

Polyscias: For a slightly shaded corner try *Polyscias sambucifolia*. This elegant, ferny-leaved native shrub will create a real talking point in your garden. It thrives in moist soils and will fill out to form a large bush about 3 m high and 2 m wide. Although the individual flowers are small and greenish, they are produced in massed flower heads during spring and some *Leioproctus* species visit them in large numbers. The flowers are followed by highly ornamental sprays of blue berries in summer.

Pomaderris: Natural bushland in the Sydney region is home to several species of *Pomaderris*. These evergreen native shrubs in the family Rhamnaceae bear masses of small cream or pale yellow flowers, with most species blooming prolifically in spring. The massed flower heads are borne on the ends of the branches and are highly attractive to native bees and other insects. *Pomaderris* species are easy to grow but are usually only available through specialist native plant nurseries.

Ornamental Trees: Finally, several ornamental trees are excellent sources of nectar and pollen. These include the silky oak (*Grevillea robusta*), crepe myrtle (*Lagerstroemia indica*), Chinese tallow (*Triadica sebifera*), kurrajongs (*Brachychiton*), apples (*Malus*), plums and cherries (*Prunus*), pears (*Pyrus*), camellias (especially *Camellia sasanqua*), macadamia (*Macadamia integrifolia*) and white cedar (*Melia azedarach*). (Note: after flowering, white cedar trees produce abundant small yellow fruits which are attractive to birds and possums, but are poisonous to humans. These trees should not be planted in areas where children play.)

M. BATLEY

A stingless bee (Tetragonula) gathering pollen from a Grevillea flower

Growing a selection of the plants described above should create a beautiful garden with blossoms in every season of the year. It could also become a haven for native bees, giving keen bee-watchers a great deal of pleasure.

M. BATLEY

A Leioproctus bee on Polyscias blossom

Ten of the Best Plants for Attracting Native Bees

Plant	Growth Form	Main Flowering Time
Abelia x *grandiflora*	Medium shrub	Summer
Angophora & *Eucalyptus* sp	Trees	Spring and summer
Baeckea species	Dwarf shrubs	Spring and summer
Brachyscome species	Ground covers	All year
Buddleja davidii	Tall shrub	Summer
Grevillea hybrids	Medium/tall shrubs	All year
Hardenbergia violacea	Ground cover/climber	Spring
Lavandula species	Dwarf shrubs	Spring and summer
Leptospermum species	Shrubs & trees	Spring and summer
Westringia species	Medium shrubs	All year

2. Homes and Habitat for Native Bees

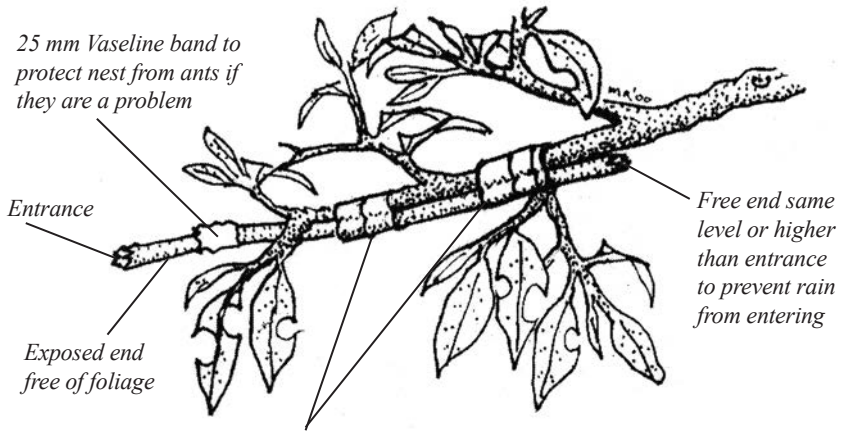
Native bees not only need a reliable food supply for survival, they also need suitable places to nest. Native bees nest in a wide variety of places including burrows in the ground, mudbricks, holes in dead timber and dead pithy stems. Many nest sites are reused year after year by bee populations. Nest sites can be difficult to see but some may be discovered by looking for the bees flying back and forth. Protecting or providing homes and habitat for native bees will help them to survive.

Natural Nest Sites

Many species of native bees nest in the ground. The nests may be shallow or deep, in vertical banks or in flat clay pans, in dry sheltered spots or out in the full sun. Ground-dwelling bees can be helped by protecting existing colonies from disturbance and preserving potential sites such as creek banks.

Blue-banded bees (*Amegilla*) and leafcutters (*Megachile*) sometimes take up residence in mudbrick houses. Blue-banded bees may burrow into soft, low-concrete bricks or old mortar, and leafcutters may build their intricate nests in narrow crevices or gaps. Home owners sometimes become concerned if blue-banded bee population numbers become high. But fortunately these nests are quite shallow and often the owners generously accept their uninvited guests when they understand that these magnificent native bees can be great pollinators for the 'vegie garden'.

Fallen logs provide good nesting sites for other species of native bees and should be preserved if possible. Some bees, such as resin bees, nest in narrow holes in the timber, and other species favour the sheltered ground underneath the log.



A reed bee nest relocated from a Lantana clump to a Buddleja shrub

Reed Bees and Lantana

Dead pithy stems form nesting sites for the fascinating reed bees (*Exoneura*). Dead canes in clumps of *Lantana* are particular favourites, but sadly nests are often destroyed during bush regeneration campaigns. Fortunately it is possible to recognise and rescue such nests *before* removing *Lantana* infestations.

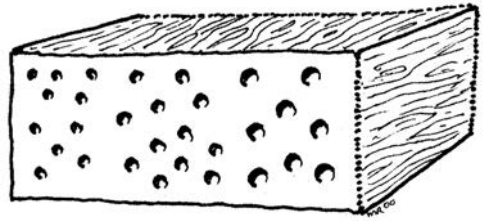
Reed bees favour *Lantana* clumps that are in or near bushland and have clear space (e.g. a path or road) in front of them. The nests will usually be in dead broken-off stems although the dead end of a living stem may also be used. Look for a small hole, perhaps no more than a millimetre or two in diameter, in the pithy centre of the stem. If the light is good you may even see the abdomen of a bee blocking the entrance. However, do not rely on this – regard all dead stems with such a hole as inhabited until proven otherwise.

Cut or break off this stem 30–40 cm from the inhabited end to be sure you get all the nest. It is recommended that this be done at dusk or during rain so all the bees are at home. Trim off side twigs after making sure they are uninhabited. Press some Blutack or tape a piece of damp tissue over the hole to prevent the bees escaping. The nest can now be transported to nearby suitable shrubs or further afield without difficulty. To install, fix the nest firmly to a suitable branch at more or less the same angle, height – and orientation if possible – as it was found, using waterproof tape, wire or plant ties.

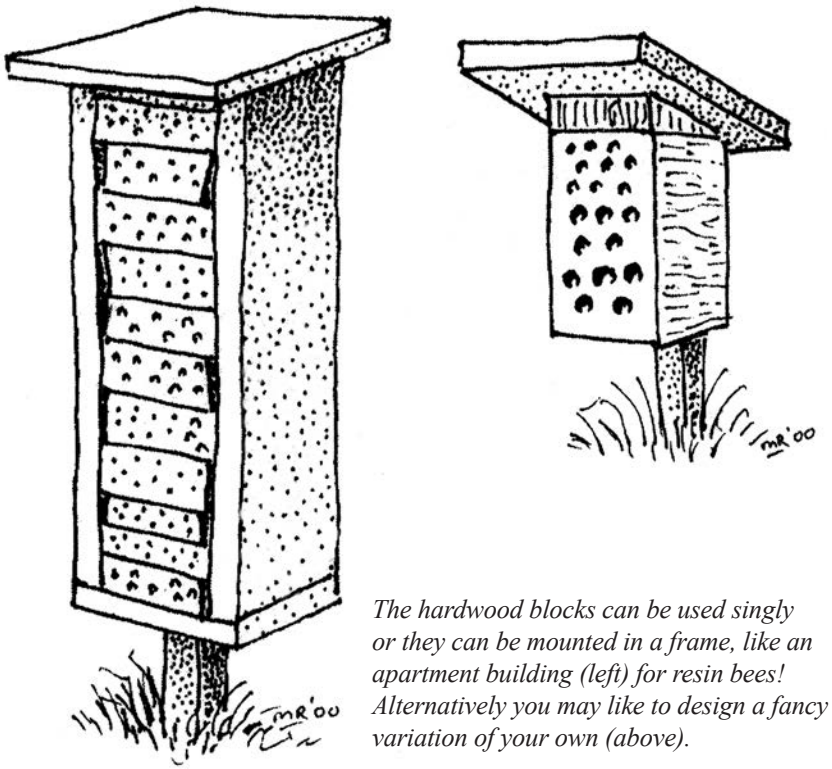
Make sure that the nest end is free of overhanging vegetation otherwise spiders can build webs to snare the bees. Unplug the entrance (once again at dusk or during rain is best) and the bees will start foraging again. To check if a nest is occupied, shine a torch into the entrance at night. The dark abdomen of a guard bee will be clearly visible in an occupied nest's entrance while in an empty nest you will just see the pale interior of the pithy walls. Uninhabited dry stems attached nearby will usually become occupied as the nests grow and new bees are produced. Often a small 'starter hole' of the same diameter will speed this up and frequently both ends of the same stick will become nests! The bees can be watched during sunny weather but as only one or two workers per nest are usually active, patience is required and the time between comings and goings is often fairly long. Placing several nests together will help to maintain an observer's interest.

Artificial Nest Sites

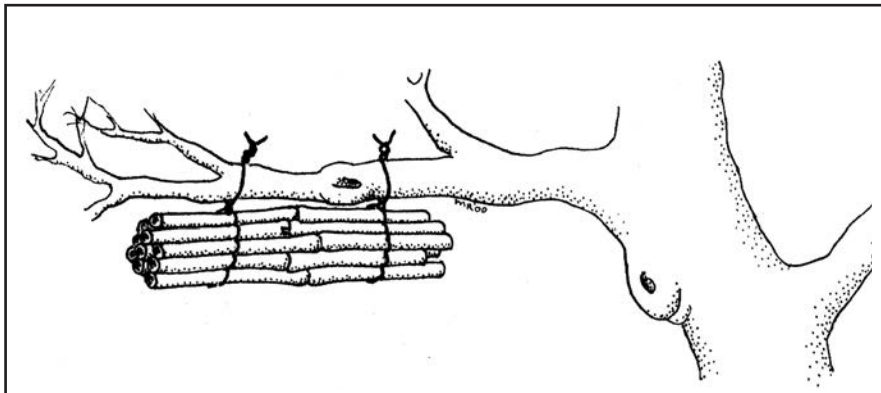
You could also help your local native bees by creating artificial nest sites in your garden. Here are some suggestions:



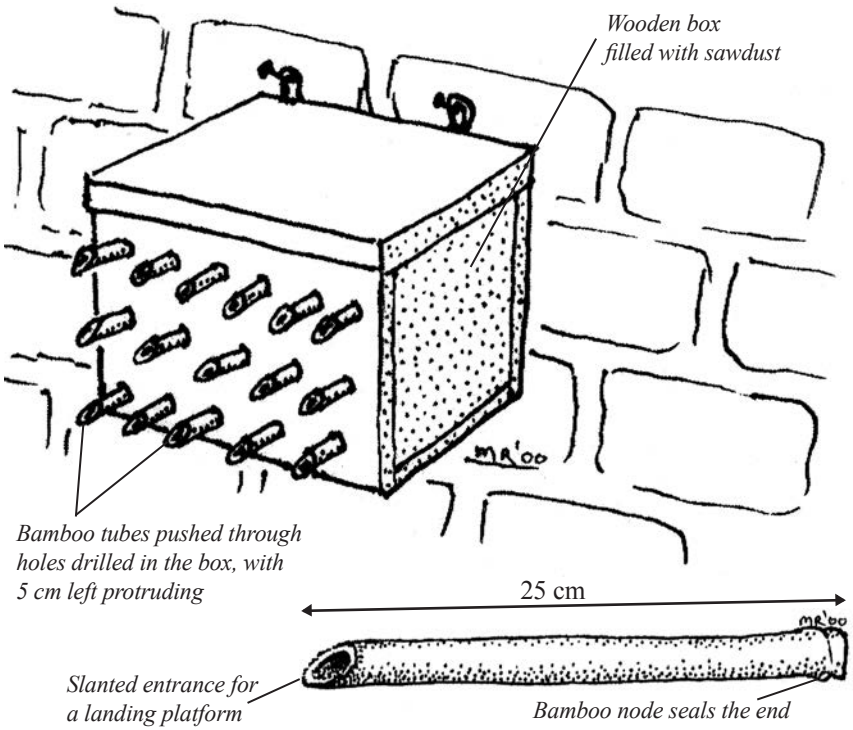
Holes drilled in blocks of old hardwood can make great homes for resin bees (Megachile). Drill holes ranging from 3 mm to 10 mm wide, and 100 to 150 mm deep. Smooth off any rough edges.



The hardwood blocks can be used singly or they can be mounted in a frame, like an apartment building (left) for resin bees! Alternatively you may like to design a fancy variation of your own (above).



Bundles of bamboo canes can provide nest sites for resin bees and leafcutters.



An artificial nest box designed for the colletid bee Hyleoides concinna by the naturalist Tarlton Rayment

A word of caution: Native Bees Can Sting!

Many people think all native bees are stingless. In fact, in the Sydney region, only one species, the social native bee *Tetragonula carbonaria*, is stingless. *The females of all the other species possess a functional sting.* However, in most species the bee is too small to deliver an effective sting and none of our native bee species is aggressive.

Nevertheless, if one of the larger native bees is grasped or trodden on, it is quite capable of delivering a painful sting. Most stings are not as painful as that of a bull ant or paper wasp and last for only a few minutes. However, unlike the introduced honeybee, native bees do not have barbs on their stings and they can sting more than once. It is possible to be allergic to the sting of a native bee in the same way as some people are allergic to honeybee stings. Native bees should be treated with respect.

3. Observing Native Bees in the Wild

What a delight it is to see hundreds of native bees swarming around a richly blossoming tree, to discover a nest of native bees in the bush, or to spot hundreds of male bees clustering on a shrub at dusk to sleep. Such sights, however, often require luck and not a little patience. Here are some field observation tips to increase your chances.

Remember that most native bees are seasonal creatures. During the warm months flying adults can be seen on the flowers as they mate and forage, and the females busily build nests and lay eggs. However, most of this frantic activity ceases as the weather cools down.

Left to right: An Amegilla larva, pupa and adult bee

In many species, all the adults die before winter begins. Inside their nests, the eggs hatch into tiny *larvae* (or grubs). These larvae eat the provisions stored in their cell by their mother and grow into large mature larvae. The immature bees often cease development at this stage and remain dormant for the entire winter. It is only when the warm weather returns, that these large larvae complete their development into pupae, and then into adults. They emerge to build nests of their own and once again we see the adult bees on the flowers.

In other groups such as the social stingless bees (*Tetragonula*), reed bees (*Exoneura*), carpenter bees (*Xylocopa* (*Lestis*)) and possibly many halictid bees, the adults survive the winter inside their nests. However, few species are active below 20°C, so warm to hot weather is usually needed to find flying native bees.

The season of peak activity in native bees varies with the species. Some species emerge at the first sign of spring and have completed their full activity cycle by late spring. Others do not appear until late summer. Still others are active throughout the warm months.

Many species prefer to forage in the morning when the nectar supplies of the flowers are most abundant. So an early start on a warm morning is best for the bee-watcher.

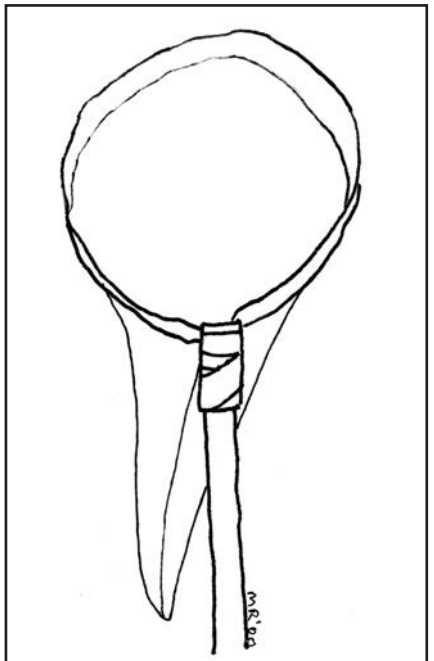
Some native bee species will forage on any available food source while others (e.g. the banksia bee and the persoonia bee) have strong food preferences. Flowering eucalypts and angophora act as a magnet for many species and the yellow pea flowers (*Gompholobium, Pultenaea,* etc) are favourites with most resin bees.

Essential Equipment for the Bee-Watcher

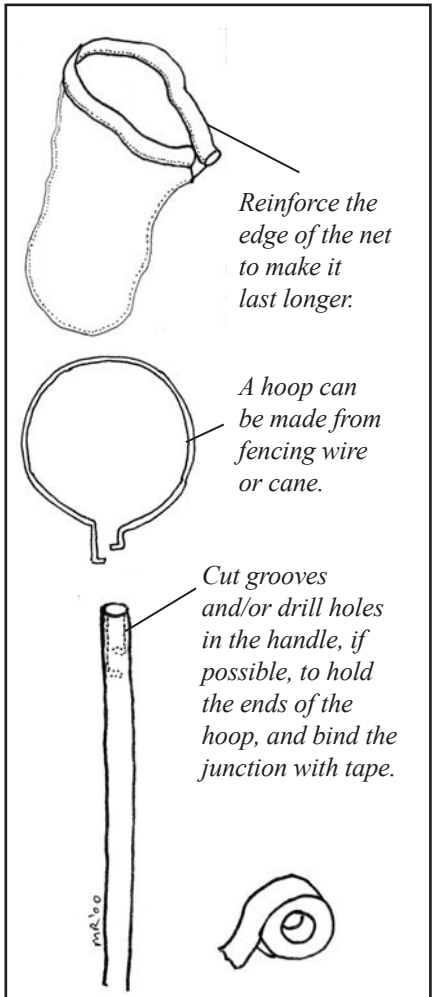
Once you have located a shrub swarming with native bees, how can you get a close look at these creatures? Here are some items of essential equipment for the bee-watcher:

1. Bee Net

A child's 25 cm diameter butterfly net (available from toy stores) or an old badminton racket can provide a satisfactory frame. Alternatively, you may prefer to make a larger hoop (e.g. 45 cm diameter) from cane or heavy fencing wire and attach it to a dowelling or aluminium handle (75–150 cm long). Many native bees are tiny, so it is best to make the net out of very fine gauze fabric. Stingless bees can crawl through mosquito netting! Make a 50 cm long net for a 25 cm hoop or a 70 cm long net for a 45 cm hoop.



A completed bee-net



To reach bees on extra-high flowers, an aluminium handle can be fitted with a collapsable extension, made from smaller diameter tubing that fits inside the main handle.

2. Transparent Plastic Bags

Bags can be used to catch bees or to transfer them from a net. To avoid stings, it is a good idea to try to release any honeybees that are caught. They will fly out of the net or bag if it is held open briefly with the opening upward. Bees are attracted to light. So you can often gather your catch in a corner of the net or bag by holding that corner towards the light. A good way to examine a native bee without hurting it is to hold it in the corner of a transparent plastic bag.

3. Glass or Plastic Jars

Jars are useful for catching and transferring bees. You can also get a good close-up look at a bee inside a clean jar.

4. Refrigerator, or Esky with Ice Bricks

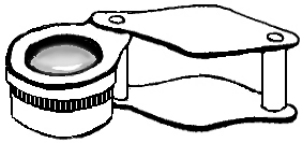
The detailed colours and structures of a native bee can be more easily seen if the bee is quietened down by briefly chilling it. Place the bee in a container in your refrigerator or esky at 4ºC (*not your freezer!*) for about five minutes. Larger bees may need slightly longer. This will cause the bee to gradually go to sleep. Bees are cold-blooded and naturally become sleepy or torpid like this on cold nights.

5. Ice Brick Wrapped in a Tea Towel

Examine the bee on a cool surface such as an ice brick wrapped in a tea towel. When you have finished your study, return the bee to the container and let it warm back up to room temperature. It is best to release the bee where you found it, and to warm it up at the release site so that it does not damage itself while being carried there.

6. Hand Lens or Microscope

Magnifying glasses (2x and 4x magnification) are inexpensive and easy to use, but they show little of the beautiful detail of our tiny bees. With a professional entomology hand lens (10x magnification), you need to hold both the bee and the lens close to the eye, but much fine detail is visible. Hand lenses can be purchased from many optometrists.



A professional hand lens

Remember, all of Sydney's female native bees are capable of stinging, except for the social native bee, Tetragonula carbonaria. So please handle them with care.

4. Flower Visitors Which Are Not Native Bees

Not every insect you find feeding on our Australian wildflowers will be an Australian native bee. Beetles, flies and wasps are some other common visitors to flowers and there are also some introduced species of bees and wasps in Australia. Here are some tips on distinguishing these insect visitors.

Beetles

Beetles have hardened fore-wings — bees have four membranous wings.

A beetle's hardened fore-wings form a shield protecting its hind-wings and body. In Australia there are many thousands of species of beetles which feed on plant sources such as fruit, flowers and leaves, so it is not surprising that beetles are commonly seen on flowers. Beetles prefer shallow flowers with strong scents and some species are important pollinators.

Flies

Flies have two wings — bees have four wings.

Many of the thousands of species of flies in Australia feed on the nectar or pollen of flowers and are important pollinators. The pollen-seeking hover flies (Colour Plate 49) are often mistaken for native bees because of their yellow and black bands. Hover flies are easily recognised by the characteristic way they hover, apparently motionless, above flowers.

Wasps

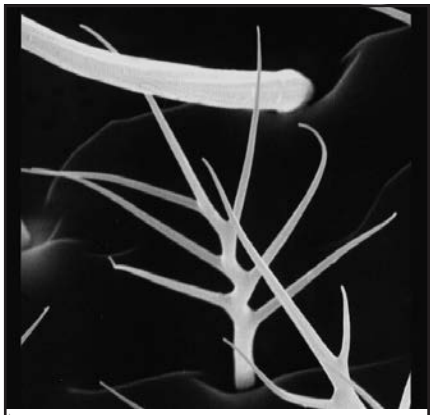
Most wasps are either carnivorous or parasitic — bees are vegetarian.

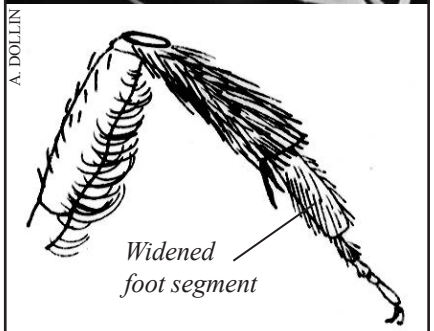
Generally, wasps feed their young with insects or spiders while bees feed their young with pollen. Unfortunately this is not much help unless you actually see the insect collecting these foods. Wasps often eat nectar too so, like bees, they are common flower visitors.

Insects carrying pollen on their legs or bodies can easily be identified as bees, but we can also use some specialised body structures that bees have to make pollen collection

B. FAULKNER

Nests of native paper wasps, with their grey, hexagonal cells, are often mistaken for nests of native bees.





Above:A finely-branched feathered hair and a simple hair or bristle on a stingless bee (1300x magnification). Below: The furry leg of a bee, with a wide first segment of the foot.

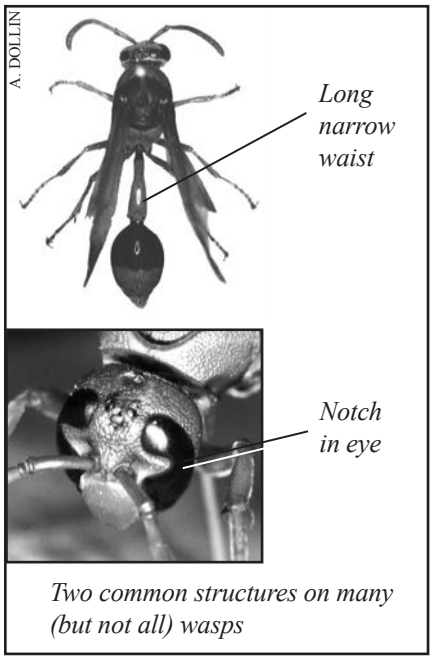
more efficient, to help us distinguish bees from wasps.

Two structures which can indicate that an insect is a bee are:
(1) feathery or branched hairs, and
(2) broadened segments on the hind foot.

Bees are generally more furry than wasps. All bees have some feathery hairs, although these may be hard to find even with a good microscope. Feathery hairs help to trap the pollen grains. Wasps have only simple hairs or bristles on their bodies.

About half the species of Australian bees have broad furry hind legs which help them transport pollen, while wasps tend to have long, slender, almost bare legs. Some bees also have almost bare legs, but the first segment of the foot is noticeably wider than the rest of the foot.

Two other structures which can indicate that an insect is a wasp are:
(1) a long narrow waist between the thorax and the abdomen, and
(2) a notch in the margin of the eye.



Two common structures on many (but not all) wasps

Introduced Wasps and Bees

European Wasps: These wasps (*Vespula germanica,* Colour Plate 50) first appeared in mainland Australia in Melbourne in 1977 and since then have spread to Perth, Adelaide and Sydney. They are more aggressive than our native wasps and there can be several thousand individuals in each colony. They can sting a victim repeatedly if disturbed.

Their taste for both sweet foods and meat sometimes makes them unwelcome guests at Aussie barbecues! They nest in sheltered areas such as in the ground, rockeries or rubbish heaps, under shrubs, or in the walls or roofs of buildings. Exposed nests may be larger than a football and are covered with a pale grey, cardboard-like sheath.

Honeybees: Introduced to Australia from Europe in the 1820s, commercial honeybees (*Apis mellifera*, Colour Plate 51) play a vital role in Australian agriculture, as major crop pollinators and honey producers. However, feral colonies are now widespread in the bushland throughout most of Australia. They are usually found inside hollow trees or rock crevices, but may also be found in exposed locations such as on fences or in tree canopies.

Honeybees are often the most common visitors to Australian wildflowers. Some plants may benefit from the presence of honeybees, especially if local native pollinators have been lost, but other plants may suffer. For example, many wildflower species from the genera *Senna, Hibbertia, Solanum* and *Tetratheca* require a specialised method of pollination called *buzz pollination*, which native bees such as carpenter bees and blue-banded bees can perform, but honeybees cannot. Furthermore, in times of nectar or pollen scarcity, the highly efficient foragers from feral honeybee colonies can harvest the bulk of the available resources early in the morning before the native bees even start flying.

Bumblebees: Although not yet present in the Sydney area, these large, colourful, furry bees (*Bombus*, Colour Plate 52) may turn up in the future, so be on the look-out. They are 20 to 25 mm long, and black with yellow and white bands. Although bumblebees are not native to Australia, two species have recently invaded this country. A European species, *Bombus terrestris*, was found in Tasmania in 1992 and since has spread throughout most of the state. A North American bumblebee, *Bombus vosnesenskii*, was also found in Buderim, southeast Queensland in 1997 but fortunately does not seem to have become established.

Vast numbers of bumblebee colonies are raised annually in Europe and New Zealand for use in commercial pollination of crops such as tomatoes, capsicums, strawberries and blueberries. Several studies have shown that the bumblebees significantly increase crop yields. They have also had a major influence in reducing pesticide usage, because growers cannot spray poisons when the bees are pollinating their crops. However, a controversial proposal to deliberately introduce bumblebees into mainland Australia was rejected by the Government in 2008 for environmental reasons.

Bumblebees are highly efficient and can forage in cold, wet conditions (down to 6°C) where other bees are incapacitated. Unfortunately, if bumblebees do establish on the mainland, it is likely that they will spread widely, compete with our native bees and may even drive some species to extinction. Furthermore, bumblebees could become ideal pollinators of some serious agricultural weeds and could greatly assist their spread. Examples include foxgloves (a severe pest in New Zealand), many prickly solanaceous species, blackberries, nightshades and gorse.

5. The Native Bee Family Tree

Australia's native bees vary widely in their body structures and behaviour. At one extreme we have bees that are nearly wasp-like in their body structure, with short tongues and little fur, and at the other, we have bees with long tongues and furry bodies. Some bees lead primitive solitary lives while others show quite advanced and complex social behaviour.

It is easier to keep track of these variations and to recognise species if one is familiar with the group or family to which each bee belongs. Australian bees have been divided into four major families:*

Family Colletidae
- about 50% of Australia's species, including *Leioproctus* and masked bees
- have short blunt tongues and feed on simple shallow flowers
- almost all build solitary nests in the ground, in wood or in pithy stems

Family Halictidae
- over 20% of Australia's species, including *Homalictus* and *Lasioglossum* bees
- have short pointed tongues and feed on a variety of shallow flowers
- some are solitary, some have shared nests, often in the ground

Family Megachilidae
- over 10% of Australia's species, including resin and leafcutter bees
- have long tongues and feed on deep or shallow flowers
- all build solitary nests in cavities or in burrows in the ground

Family Apidae**
- over 10% of Australia's species, including blue-banded and stingless bees
- have long tongues and feed on deep or shallow flowers
- some are solitary, some have shared nests, others are fully social – nest sites include the ground, soft timber and hollow trees

* A small group of about 20 species, living mainly in Western Australia, have been classified as belonging to a fifth family called Stenotritidae.

** A major revision (Roig-Alsina and Michener 1993) transferred all bees in the former family Anthophoridae (including the blue-banded bees, teddy bear bees, reed bees and carpenter bees) into the family Apidae. However, the major texts, *The Insects of Australia* (1991) and *Zoological Catalogue of Australia* (1993 printed edition) use the old classification structure.

Scientific Names of Species

The bees within each family are further divided into successively smaller groups called genera (plural of 'genus'), subgenera and species as illustrated in the following chart using the Harlequin Bee (see page 34) as an example:

Family	Genera	Subgenera	Species
Colletidae	*Hylaeus*	*Euprosopis*	*elegans*
	Leioproctus	*Macrohylaeus*	*honestus*
	& Others	& Others	& Others

The Harlequin Bee's full scientific name is a combination of its genus, subgenus and species names: *Hylaeus* (*Euprosopis*) *elegans*.

The Guide to Bee Species

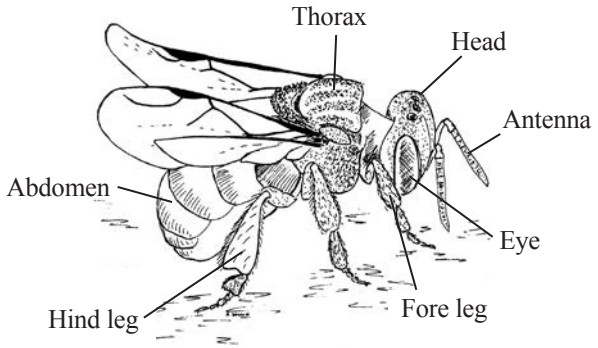
In the next section of the field guide we present descriptions of 31 species or groups of species of native bees which occur in the Sydney region. They have been arranged in family order as shown on the previous page.

A list of suggested pronunciations for the scientific names is given at the end of this book. Pronunciation does vary widely, so the list is only intended to be a guide.

Very few bee species have become sufficiently well-known to earn common names through widespread usage. Two exceptions are the alfalfa bee (*Megachile rotundata*) from North America and the banksia bee (*Hylaeus alcyoneus*) from Australia. Groups of species, however, have acquired well-recognised common names, for example in Australia, the masked, resin, leafcutter, blue-banded, cuckoo, carpenter and stingless bees. The term reed bees was suggested by Tarlton Rayment[2] and has been used extensively in the Sydney area by Landcare groups and others.

We have provided some suggestions for common names, mostly based on the accepted group names, for the species in this guide. Unlike the names given above, these common names do not come with the authority of widespread usage, but are the result of discussion within a small group of interested people. We fully expect that many will change with time.

Some of the terms which will be used in the descriptions are explained in this diagram:



Family Colletidae

- about 50% of Australia's species, including *Leioproctus* and masked bees
- have short blunt tongues and feed on simple shallow flowers
- almost all build solitary nests in the ground, in wood or in pithy stems

Australia has more numerous and varied colletid species than anywhere else in the world.

Flower Preferences: Colletid bees have short, usually broad, tongues and most visit shallow flowers, particularly eucalypts and their relatives in the myrtle family. It is unlikely to be a coincidence that Australia, which has such an abundance of flowering plants in the myrtle family, also has an abundance of colletid bees.

Nesting Habits: Nearly all colletids are solitary bees, each female building a nest by herself. Colletid females apply a special substance to the walls of their nesting chambers. It dries to form a cellophane-like lining that can often be peeled away from the chamber wall. It comes from a gland in either the abdomen or thorax, and bees apply it with their tongues.

Major Groups and Physical Appearance: Family Colletidae is further divided into three groups with approximately equal numbers of species, the colletine, the euryglossine and the hylaeine bees:

The **colletine bees**, mostly members of the genus *Leioproctus*, are generally medium-sized and are moderately to very hairy. The females carry pollen on long branched hairs that cover the inside of their hind legs. Many species are black, but several are distinctly metallic. *Leioproctus* females commonly have a brush of stiff hair near the end of the abdomen. In Australia there are over 200 species in the genus *Leioproctus* and about a quarter of these may be found near Sydney.

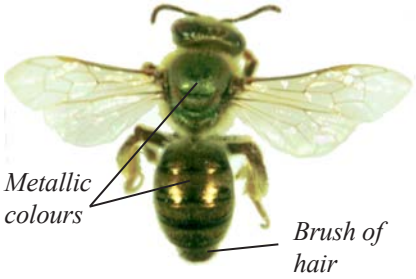
The brush of hair on the tip of the abdomen of a Leioproctus bee

The **euryglossine bees** are minute (3 mm) to medium-sized (8 mm) bees that are usually smooth in appearance and lack specialised hairs for carrying pollen. Instead they swallow the pollen and take it back to the nest in their *crops* (special stomachs). Flowering eucalypts and angophoras are often surrounded by clouds of these tiny bees, which are found only in Australia and New Zealand.

The **hylaeine bees**, too, are smooth and carry pollen in their crops. They range in length from 4 mm to 12 mm or more. They are known as masked bees because many are black with pale markings on the face. Often there is also a large patch of yellow on top of the thorax. Many are found on eucalypts, but hylaeine bees visit a wider range of flowers than do euryglossine bees. They occur in many other countries, but in Australia they form a larger fraction of the total number of bee species than they do in the rest of the world.

Colletine bees

Leioproctus (Leioproctus) amabilis — Lovely Leioproctus



From a distance this bee may look like just another medium-sized dark bee, but closer inspection reveals it to have beautiful metallic colouring. The head and thorax are metallic green with dull brownish hair. The abdomen may be gold, green, blue or reddish. The two forms most commonly seen are brassy green and metallic red-purple. Females have the brush of stiff hair at the tip of the abdomen that is typical of many members of the genus *Leioproctus*.

Colour Plates: 1 and 2.

Nests: Nest unknown, probably solitary.

Distribution: Qld, NSW, ACT, Vic, SA.

Similar Local Species: *L. plumosus* is a larger bee (12 mm) with a dark blue metallic abdomen and greenish metallic thorax. *L. carinatus* is similar, but is entirely dark metallic blue and has dark hair on the hind legs. *L. spatulatus* is all black, but the abdomen can look slightly metallic if viewed from the right angle.

Actual Size

Leioproctus (Leioproctus) irroratus — Golden-shouldered Leioproctus

This slim black bee is readily distinguished by the spectacular yellow areas, looking like shoulder pads, on the front corners of the thorax. Close inspection reveals that the colour is due to dense moss-like patches of highly branched hair. The colour is usually bright yellow, but may be anything from off-white to orange-yellow. Both males and females have the yellow patches, but the males can be distinguished by their relatively slender abdomens.

There are several other *Leioproctus* species that are about the same size as *L. irroratus* but are completely black. Not surprisingly, it is difficult to tell those species apart.

Colour Plate: 3.

Nests: Nest unknown, probably solitary.

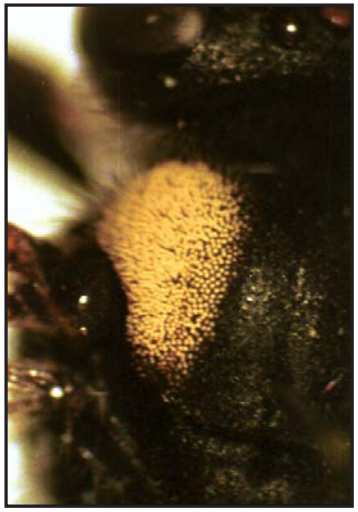
Distribution: Qld, NSW, Vic.

Similar Local Species: None.

Actual Size

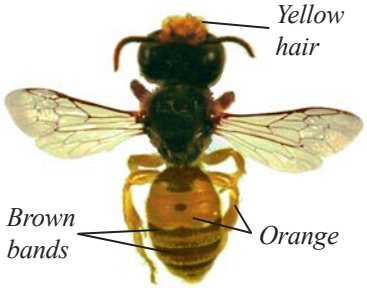
Female

Male



Detail of the moss-like shoulder hair of L. irroratus

Leioproctus (Andrenopsis) flavorufus — Ginger Leioproctus



This busy little bee is a real local. As far as we know, it is found only in the Sydney region, but it is quite noticeable in midsummer. Related species live in Western Australia, Victoria and southern Queensland. The bright orange-brown males draw attention to themselves by their constant activity. They fly around flower bushes and are often are so keen to find a mate that they will pounce on female bees of any species, even ones twice their size. Closer inspection reveals that they have long yellow hair on the face and a large swollen spur inside the hind leg.

The females are less brightly coloured, being mostly dark brown with a bit of orange hair at the tip of the abdomen. They often fly rather slowly as though uncertain where they are going. At a distance, females could be mistaken for a sluggish *Trichocolletes*.

In some years male *L. flavorufus* are numerous, but in other years few are seen. More information is needed about the exact limits of its range and what affects the size of its population.

Colour Plate: 4.

Nests: The species is solitary, nesting in 15 cm deep burrows in the ground. In one location, about 20 burrows were found close together.[3] Three or four sealed cells branched off the main shaft and were lined with a cellophane-like coating. Each cell contained a dry ball of pollen mixture on which the egg was laid.

Distribution: NSW (Sydney region).

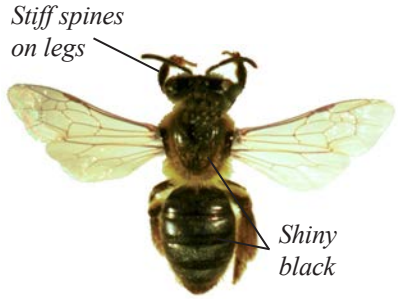
Similar Local Species: None.

Actual Size

The swollen spur inside the hind leg of the male

Leioproctus (Cladocerapis) carinatifrons

Persoonia Bee



Some bees have specialised feeding habits. The subgenus *Cladocerapis* is a group of nine species that have adapted to visiting *Persoonia* flowers (geebungs or snottygobbles), though they have been shown to visit other types of flower as well. Five *Cladocerapis* species may be found in the Sydney area.

At first glance, bees of all five species look similar. They are moderately large (10 mm), black, and somewhat shiny. Closer inspection reveals a flat glossy face, which they slide down the style of the flower as they push down to reach the nectar. The females have rows of stiff golden-brown bristles on the front legs, presumably for raking pollen from the flowers.

Persoonia flowers

If you stand near a flowering *Persoonia* in mid summer or autumn, you are likely to see one of these bees within ten minutes. Both sexes fly rapidly, but males alight less often and generally move faster. Females can often be distinguished by the large amount of pollen carried on their hind legs. Sometimes they are so heavily laden that you could be forgiven for thinking they were black and yellow bees.

Colour Plates: 5 and 6.

Nests: Although these bees are solitary (each female builds a nest by herself), over 1,000 nests may be built in close proximity to each other.

In one dense group of nest burrows in the ground at Narrabeen,[4] each 5 mm wide burrow was topped by a 3 cm high mound of spoil from the excavation. The tunnel went down vertically for a few cm, made a sloping detour for about 8 cm, then continued vertically again. At a depth of about 80 cm, the burrow divided into a set of short side branches, each leading to a 12 mm pear-shaped cell. The bee lined each cell with a silvery cellophane-like secretion, then sealed an egg and provisions of pollen mixed with nectar inside each cell and refilled the side branch with soil.

There was one generation per season and the adult bees were most common in midsummer.

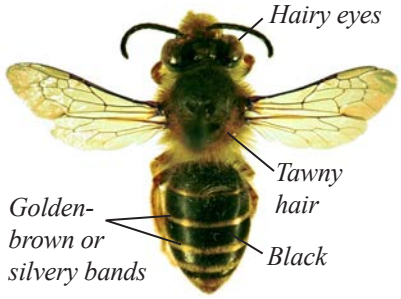
Distribution: NSW, Vic, SA.

Similar Local Species: *L. bipectinatus, L. incanescens, L. raymenti, L. speculiferus.*

Actual Size

Trichocolletes venustus

Common Spring Bee

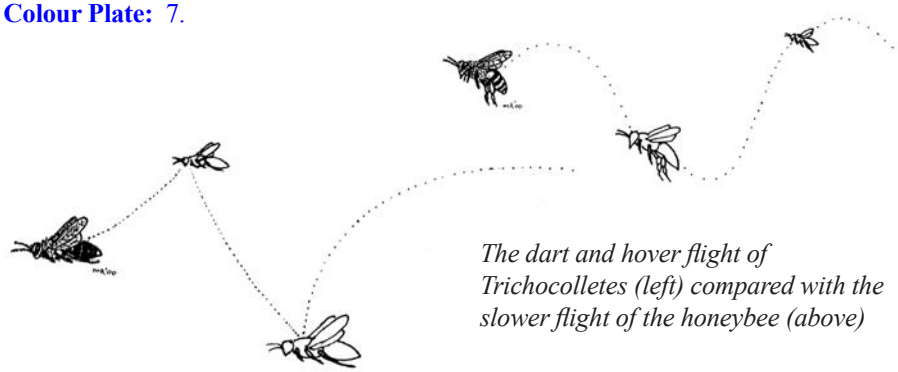


Some of the first native bees to appear in spring are *Trichocolletes*. They are commonly observed near pea flowers such as *Daviesia* or *Hardenbergia*.

Superficially, they appear like smallish honeybees, but *Trichocolletes venustus* has a black abdomen with a golden-brown or silvery band on the rear edge of each segment, whereas the honeybee has orange and brown bands. Both species have a lot of tawny hair on the thorax and both have hairy eyes (which can just be seen with a hand lens). The genus *Trichocolletes* received its scientific name because a number its species have conspicuously hairy eyes (*tricha* is Greek for a hair or bristle).

Trichocolletes fly faster than honeybees and their flight pattern is generally dart and hover. They approach flowers with legs held close to the body and the body held parallel to the ground. Honeybees often fly slowly between flowers with their legs trailing.

Colour Plate: 7.



The dart and hover flight of Trichocolletes (left) compared with the slower flight of the honeybee (above)

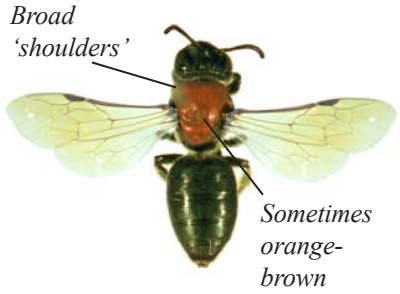
Nests: The solitary nests of this species are built in the ground and have long entrance shafts. Some shafts have been recorded that were over 150 cm deep.[5] The shafts were topped by a small mound of solid excavated soil. At the bottom of each shaft were brood cells, lined with a cellophane-like material and provisioned with pollen and nectar.

Distribution: Qld, NSW, Vic, SA, Tas.

Similar Local Species: The two most common species in the Sydney region are *T. venustus* and *T. orientalis*, but *T. fuscus* and three other species may be found..

Actual Size

Euryglossa ephippiata — SADDLEBACK EURYGLOSSINE



This medium-sized (9 mm) bee has a distinctive cylindrical body shape. The thorax of most bees is narrower near the head than it is at the base of the wings. In *E. ephippiata* the thorax does not taper, making it look broad and solid behind the head. Females are rather variable in colour. Some are black with large sections of the thorax orange-brown, but others are all black. Presumably, Frederick Smith, who named the species, thought that the orange-brown form seemed to have a saddle on its back. (He mistakenly thought that the all-black form was a separate species and named it *Euryglossa nigra*.) Males are always black but can be distinguished by a conspicuous yellow-orange band near the outer ends of the antennae.

Colour Plate: 8.

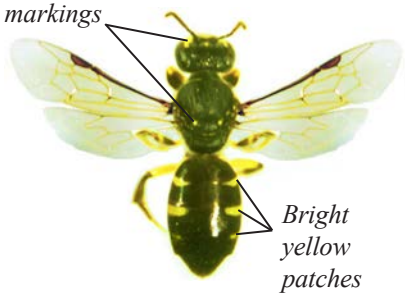
Nests: These bees dig solitary nesting burrows in soil but the nests may be clustered in dense groups. The shafts go down for a short distance and then terminate in lateral tunnels. In a set of nests observed at Mt Canobolas, NSW,[6] the number of brood cells attached to each shaft was difficult to determine because the shafts were so close together. Each 10 mm brood cell was lined with a cellophane-like material formed from a secretion produced by the bee. A single egg was laid on a ball of pollen and nectar in each brood cell.

Distribution: Qld, NSW, ACT, Vic, Tas.

Similar Local Species: *E. adelaidae, E. capitata, E. depressa, E. nigrocaerulea, E. subsericea. Lasioglossum callomelittinum* has similar colouring and is superficially similar to *Euryglossa ephippiata*. However, it does not have the broad shoulders and it has different wing venation, with three submarginal cells instead of two (see page 62).

Actual Size

Callohesma calliopsiformis — SIX-SPOTTED EURYGLOSSINE



Many of the smaller euryglossine bees are dark brown or black, but under the microscope they are seen to be attractively patterned with yellow, especially on the face. *C. calliopsiformis* is not particularly small, but illustrates one of the many types of pattern found.

It is quite common in suburban Sydney and the bright yellow patches on the sides of the abdomen make it easy to identify, but the yellow coloration on the thorax varies in brightness and extent. For complete identification, the pattern of colour on the face is important because there are other species with black and yellow on the abdomen.

This species was previously known as *Euryglossa (Callohesma) calliopsiformis*.

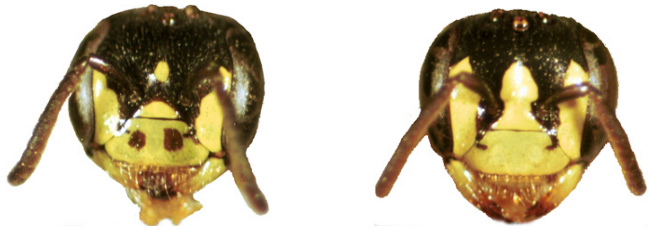
Colour Plate: 9.

Nests: Nest unknown, probably solitary.

Distribution: Qld, NSW, ACT, Vic, WA.

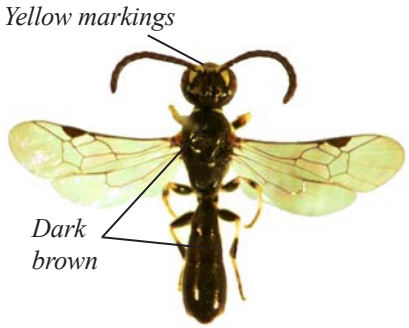
Similar Local Species: *C. quadrimaculata* is a bit larger and has four yellow patches at the side of the abdomen, while *C. calliopsella* (Colour Plate 10) is a bit smaller and has yellow bands right across the abdomen.

Actual Size



Face markings of E. calliopsiformis (left) and E. calliopsella (right)

Hylaeus (Heterapoides) delicatus — DELICATE MASKED BEE



This tiny, slender bee is only 3.5 mm long. Both sexes are understandably hard to see, but males tend to be more noticeable as they fly in small clouds near flowering eucalypts. Presumably they are *lekking* (competing with each other to attract a mate).

Viewed from above, they are uniformly dark brown, but seen head on, the males are quite attractive with the lower half of their face being bright yellow. This is only one example of the many tiny species that visit flowering eucalypts.

This species was previously known as *Heterapoides delicata*.

Colour Plates: 11 and 12.

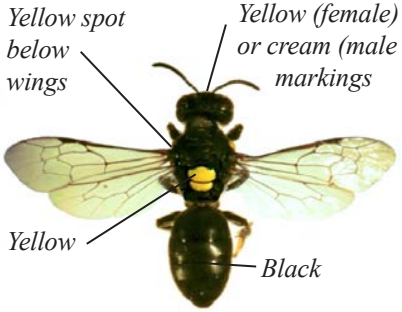
Nests: Nest unknown, probably solitary.

Distribution: Qld, NSW, Vic (coast and tablelands).

Similar Local Species: *Hylaeus (Heterapoides) bacillarius, Hylaeus (Heterapoides) extensus*, and approximately six other *Hylaeus* species. Two additional species, *Hylaeus ofarrelli* and *Hylaeus minusculus,* are similarly small and slender, but do not possess the characteristic wing venation of *Hylaeus (Heterapoides)* species. Many euryglossine bees are similar in size and colour but are generally more stoutly built.

Actual Size

Amphylaeus (Amphylaeus) morosus — LEAF-FACED BEE



This large black bee is an excellent example of the black-and-yellow pattern that is widespread among hylaeine species. Individual species can be identified from the colour pattern on the face.[7,8] *A. morosus* has a bright yellow mark like an inverted spade (female) or a wrinkled, pale cream mask covering the face (male). Females are observed more often than males. They visit a range of flowering species including *Xanthorrhoea, Styphelia, Melaleuca* and *Pultenaea*.

Colour Plates: 13 and 14.

Nests: Nests of this species have been found in dead, dry, erect flower stalks of the grass tree (*Xanthorrhoea*),[9] in *Tristania* twigs[10] and in broken *Cyathea* tree fern fronds.[11]

In the nests observed in *Xanthorrhoea*, the bees had cut through the hard outer walls of the stalk or had entered through a broken end, then had excavated a nest burrow in the pithy core of the stalk. The burrows were 65 to 270 mm long and 4 to 4.5 mm wide. Nests may be reused for a few generations.

The bees lined the burrows completely with a secretion that hardens to form a cellophane-like material. A series of up to eight brood cells was then made in the lower part of the burrow. Each was between 11.5 and 14 mm long, separated from those on either side by partitions made of the cellophane-like material, often supplemented with particles of pith taken from adjacent walls. The cells were half-filled with whitish to yellow liquid provisions on which the young larvae floated as they grew.

It was reported in 1999[11] that this species sometimes demonstrates a type of simple social behaviour. In nests shared by two females, one would lay all the eggs and gather all the provisions while the other would guard the nest entrance and mix the larval food. This was the first time that social behaviour has been directly observed in any species in the family Colletidae.

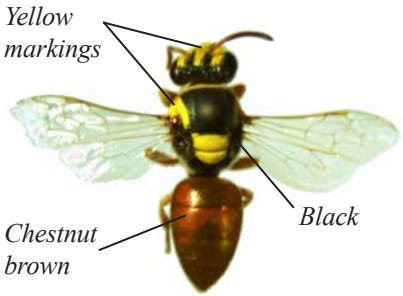
Distribution: Along the eastern and southern coast, from Brisbane to western Victoria.

Similar Local Species: In the Sydney area, there are twelve hylaeine species of moderate size that are black with a large yellow patch on the top of the thorax, and seven species that are black, without the patch.

Actual Size

Hylaeus (Euprosopis) elegans

Harlequin Bee



This is not only one of our prettiest bees, it is also one of the most widespread and, in arid or semi-arid regions, one of the most numerous. Although it visits other flowers, the best place to look for it is on a flowering eucalypt.

Not all species in the genus *Hylaeus* are black and yellow as this bee demonstrates. The dark chestnut of the abdomen contrasts attractively with the black thorax and its pattern of yellow lines and patches. The only bee with which it might be confused, *H. husela*, is restricted to northern Queensland and the Northern Territory.

Colour Plates: 15 and 16.

Nests: These bees build their solitary nests in any suitable cavity in posts, plant-tubes, or in the abandoned galleries of other bees. Favoured nesting sites are the deserted tunnels of longicorn beetles.[12] The bees line the cells with a cellophane-like secretion and provision them with a thin mixture of pollen and nectar. A single egg is laid in each cell.

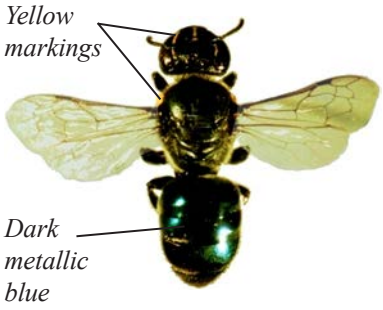
Distribution: Throughout Australia, with the exception of Tasmania and the far North.

Similar Local Species: None.

Actual Size

Hylaeus (Macrohylaeus) alcyoneus

Banksia Bee



This large bee (12 mm) is usually found on or near *Banksia* flowers. It is easily identified by its dark metallic blue abdomen and yellow face markings. The males stake out territories around a *Banksia* spike and compete for the best positions. Potential competitors are warned off by vigorous wing whirring, but occasionally that is insufficient and brief bouts of wrestling take place on the flower spikes. Larger males have a pair of stout spines on the underside of the abdomen that may be of use in such wrestling matches. Both sexes collect nectar from the *Banksia* flowers and may disappear completely from view as they burrow into the flower.

Colour Plates: 17, 18 and 55.

Nests: This species builds solitary nests in widely scattered locations. The usual sites are cavities in wood.[13] One 60 mm long nest was reported in a piece of hard, dead Acacia twig.[14] Inside were four cells, each 12 mm long and 5 mm wide, separated from each other by thin, clear, cellophane-like membranes. The base of the cell was filled with a mass of loose wood parings, covered by a more solid plug.

The cells of this species are provisioned with a semi-liquid paste of pollen and nectar[15] and a single egg is placed on top.

Distribution: Coastal areas of southern Qld, NSW, Vic, Tas, SA and southern WA.

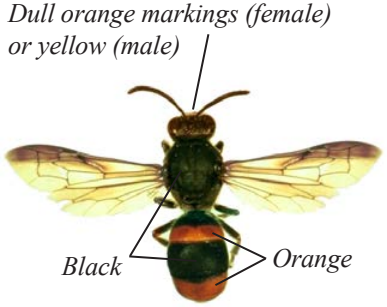
Similar Local Species: This is the only big local hylaeine with a metallic-blue abdomen.

Actual Size

M. BATLEY

A banksia bee (top left) staking out its territory on a banksia flower. A honeybee is foraging on the adjacent flower (right).

Hyleoides concinna — Common Wasp-mimic Bee



This black and orange bee looks so like a wasp that it was initially classified as one. Not only does it have the colouring and shape of a mason wasp (Eumenidae), but when it alights it holds its wings up in a wasp-like V-shape. The front half of the wing is darkened, creating the impression that it has been folded lengthwise, like those of some wasps. Only by careful examination can you see the small tufts of branched hairs on the thorax that confirm that this is a bee.

They visit a variety of flowers and can be seen near peas (*Pultenaea flexilis* in spring, *Pultenaea tuberculata* in summer), angophoras and eucalypts.

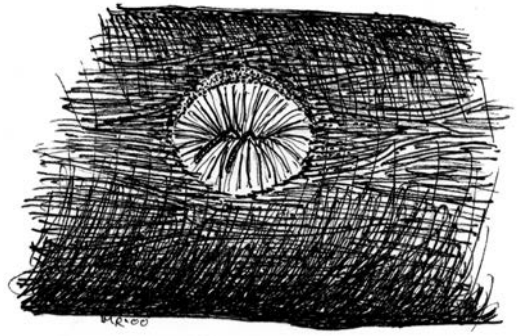
Colour Plates: 19 and 20.

Nests: This species is reported to build its solitary nests in old longicorn-beetle tunnels in stumps, logs or fallen branches.[16] The female first constructs a protective curtain, like an iris, across the tunnel entrance. The strands of cellophane-like material are nipped at the centre of the curtain so that the bee can push her way in and out. She often rests behind this curtain during nest building, with only her antennae protruding through the opening.

The whole tunnel and the brood cells are lined with the cellophane-like waterproof material. The cells are half-filled with a fluid provision of nectar and pollen, and an egg is laid on the mixture. Up to eight cells may be provisioned and closed before the nest is sealed with a strong solid wall against predators.

Distribution: Along the east coast from Brisbane to Tasmania, and across to South Australia. They have also been introduced accidentally into New Zealand.

Similar Local Species: *H. bivulnerata.*



Actual Size

A Hyleoides concinna bee resting in her nest behind her iris-like curtain

Colletidae – Hylaeine Bees

Family Halictidae

- over 20% of Australia's species, including *Homalictus* and *Lasioglossum* bees
- have short pointed tongues and feed on a variety of shallow flowers
- some are solitary, some have shared nests, often in the ground

This is a huge family of small to medium sized bees with a worldwide distribution.

Flower Preferences: Halictid bees have short tongues, but the shape of the tongue and changes to other mouthparts allow them to forage from a wider range of flower types than the colletids.

Nesting Habits: Some species build solitary nests while others have many females sharing a nest, although each bee still provisions her own cells and lays eggs. Most nest in the ground, but a few use rotten wood. Like the colletids, halictid bees apply a secretion to the walls of the nesting chamber, but the secretion tends to soak into the walls and cannot be peeled off. It leaves the walls looking dark and waxy.

Major Groups and Physical Appearance: About 20% of the species in the family Halictidae are members of the genus *Homalictus*, about 60% are in the genus *Lasioglossum* and about 20% are in the genera *Lipotriches* and *Nomia* (the Australian species in these two genera were previously all in genus *Nomia*).

Homalictus (above) and Lasioglossum (below) species

Homalictus bees are generally small. The scopa (main set of pollen-carrying hairs) of the females is located under the abdomen. Females of the other two genera carry pollen mainly on the hind legs. Another characteristic feature of *Homalictus* bees is that the abdomen of the female is distinctly flattened on the underside.

Lasioglossum is a large genus containing two major subgenera, *Chilalictus* and *Parasphecodes*. Separating the species of these subgenera is quite difficult, so only one example has been chosen from each.

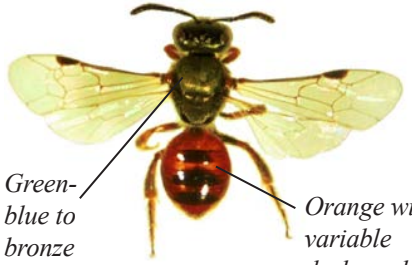
Females from both genera, *Homalictus* and *Lasioglossum*, have a characteristic V-shaped notch, fringed with hairs, on the edge of the second last segment of the abdomen. It may be difficult to see without a hand lens, but once recognised, it can provide a useful means of identification.

Lipotriches* and *Nomia species are solid-looking bees ranging in length from 7 to 12 mm. Most are dark coloured with lighter bands on the abdomen. Many have short furry hair on the thorax.

Halictidae

Homalictus (Homalictus) brisbanensis

Amber Homalictus



Most of the thorax of this tiny (5 mm) bee is a deep green-blue with various degrees of bronze tinting. The abdomen is orange-brown with dark patches that vary in size from bee to bee. Sometimes they are almost absent. The head is black and the legs are red-brown with various amounts of darker brown on the upper segments. This bee is found on a wide range of flowering species. Despite its bright colours, it is easily overlooked because of its small size.

Pollen is carried mostly on three rows of very long, branched, curly hairs on the underside of the abdomen. Tarlton Rayment called it a "belly-brush".[5]

Colour Plate: 21.

Nests: The nest of this particular species has not been described, but related *Homalictus* species build large nests in the soil.[17] Each nest has a vertical shaft leading down to an area of brood cells and may be occupied by over 30 females. The females take turns at guarding the nest entrance but they all lay eggs.

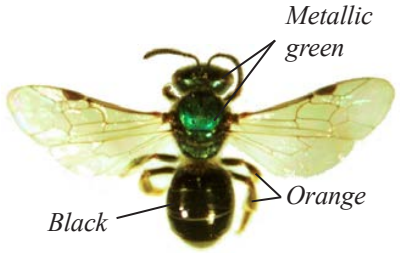
Distribution: From North Queensland to Victoria, mostly near the coast.

Similar Local Species: *H. megastigmus, H. niveifrons, H. punctatus, H. sphecodoides.*

Actual Size

Homalictus (Homalictus) urbanus

Emerald Homalictus



H. urbanus is one of the most common and widely distributed members of the genus. It is another tiny gem with its shiny black abdomen contrasting with a metallic green head and thorax and orange legs. Actually, the colour of the legs is quite variable and may be either orange or black. The metallic coloration of the thorax can also vary quite a lot and has been reported[17] as being blue-green, blue, green, or green tinged with purple, red or gold. The green form seems to be the most common around Sydney.

Colour Plate: 22.

Nests: Many females live together in large nests in the soil, though they all lay eggs. One nest was reported to be occupied by at least 160 females.[17] The nests have a single entrance shaft that follows an irregular path downwards. The brood cells of *Homalictus* are usually found singly, lying horizontally at the end of lateral burrows, but pairs of cells separated by soil plugs have been found in a *H. urbanus* nest.[17] Depending on the nature of the soil, the brood cells may be only 10 cm below the surface or over a metre down. They are provisioned with a moist soft pollen ball.

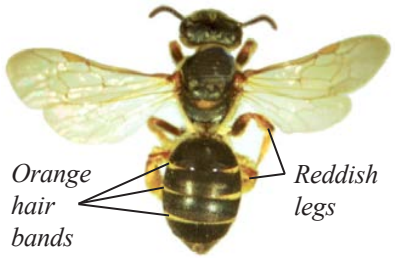
A helpful tip for finding nests is that swarms of males often hover close to the nest entrances.[17]

Distribution: Throughout Australia except in Tasmania.

Similar Local Species: *H. holochlorus* is indistinguishable to the naked eye.

Actual Size

Lasioglossum (Chilalictus) bicingulatum — Yellow-banded Chilalictus



There are many species in the subgenus *Chilalictus* that look very much alike, but *L. bicingulatum* is easily recognised by the orange hair bands on the abdomen. The reddish legs also help to distinguish it from its many relatives with white hair bands and dark legs. It is common among the swarms of bees that gather on flowering eucalypts, wattles and kunzeas. *Chilalictus* species, and others such as *Nomia*, tend to curl their abdomens around the blossom on which they have landed. It can look as though they have put their tails between their legs.

Colour Plates: 23 and 24.

Nests: This species builds burrow nests in the soil.[18, 19] The nest entrance is rimmed with a turret made of cemented soil particles up to 15 mm high and 4 mm wide. A sloping burrow leads to a network of side branches terminating in chains or clusters of oval brood cells. Each brood cell is provisioned for a single egg with a round ball of pollen and thickened nectar.

Females which hatch from the cells may remain in the nest, living together but they all lay eggs. One study found that nests may contain between 2 and 23 bees.[19] The bees use their middle legs to push themselves through their tunnels.

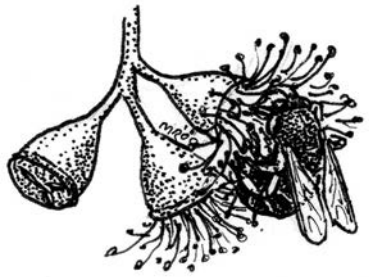
Distribution: Along the east coast from Brisbane to Victoria and Tasmania.

Similar Local Species: Over 20 species of *Chilalictus* have been found in the Sydney area. Most are similar in appearance, being black with whitish hair bands on the abdomen, but they vary in size. A related bee, *Lasioglossum (Australictus) peraustrale* (Colour Plate 25), has orange bands on the abdomen like *L. bicingulatum*, but can be distinguished by the prominent orange markings on its thorax.

Actual Size

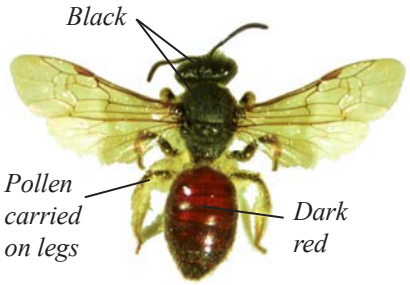
Female

Male



A Chilalictus bee foraging with its 'tail between its legs'

Lasioglossum (Parasphecodes) hiltacum — Rayment's Red Bee



This medium-sized bee (8 mm) with a black head and thorax and a dark red abdomen is one of several species belonging to the subgenus *Parasphecodes* that Tarlton Rayment* called red bees.[5] They may be encountered on eucalypts, dandelions or wherever pollen is abundant.

Another common bee, *Callomelitta antipodes*, from the family Colletidae, has similar colours, but is smaller, has dark wings and no notch in a segment near the end of the abdomen.

Nests: Nest unknown, probably solitary in soil.

Colour Plate: 26.

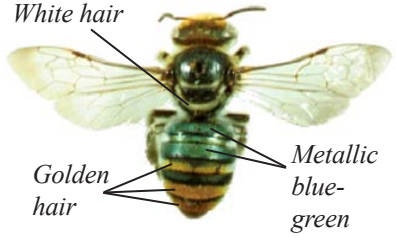
Distribution: Qld, NSW, Vic, SA, WA.

Similar Local Species: A number of similar looking species are found in the Sydney area, as well as two or three species that are all black. The most common are *L. (Parasphecodes) sulthicum* which is slightly larger than *L. hiltacum* but almost indistinguishable; *L. (Parasphecodes) carbonarium* which is all black; and *L. (Parasphecodes) waterhousei* which is black with orange-brown hair on the thorax.

Actual Size

* Tarlton Rayment (1882–1964) was a naturalist who wrote extensively about native bees. His publications include hundreds of scientific and magazine articles and a classic book of essays entitled *A Cluster of Bees*.

Lipotriches (Austronomia) australica — Green and Gold Nomia



This is a large dark bee (10 mm) with broad bands of golden hair on the abdomen, the first few segments of which have a blue-green metallic lustre. It has a patch of white mossy hair at the rear of the thorax. It is fairly common and visits many different flower species.

At night hundreds of males from nearby nests may cluster together on grass stems. The reason for this behaviour is still not known, but it is found in several species including blue-banded bees and *Lasioglossum (Chilalictus)* species.

Lipotriches species are found worldwide and are noted for the greatly modified hind legs of the males. One of the segments is often swollen and triangular in cross-section.

This species was previously known as *Nomia (Austronomia) australica*.

Colour Plate: 27.

Nests: These bees dig burrows in soil. The nest consists of a vertical shaft leading to one or more cavities containing clusters of vertical brood cells.[20] During the adults' active season, the shaft entrance may be surrounded by a low mound of excavated soil, but during their dormant season it is closed with an earthen plug.

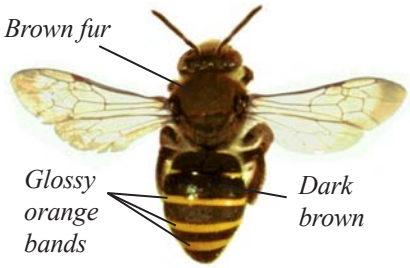
As many as three females may occupy a single nest. They may take turns guarding the entrance, retreating into a small chamber about 5 cm below the surface when a nestmate wants to enter. During the day the guard blocks the entrance with its face but at night uses its abdomen. Each urn-shaped brood cell is lined with a waterproof secretion and is provisioned with a thick disk of pollen and nectar for a single egg. A nest site may be used for several years – successive generations clean debris out of the brood cells and reuse them.[20]

Distribution: Qld, NSW, Vic, SA, WA.

Similar Local Species: *L. flavoviridis* and *L. phanerura* are metallic green and yellow but quite small (7 mm, Colour Plate 28), while *L. moerens* (10 mm, Colour Plate 29) is all black with white hair bands (sometimes stained with pollen). *L. ferricauda* is also moderately large and black black with white bands, but the end of the abdomen is orange.

Actual Size

Nomia (Paulynomia) swainsoniae — Tiger Nomia



This species is one of the most beautiful bees in the area. A little smaller (11.5 mm) than a honeybee, it is dark brown with glossy orange-yellow bands on the abdomen. Its appearance is quite distinctive. Most *Lipotriches* species have bands of pale hair, but *N. swainsoniae* has coloured cuticle, like painted enamel. The thorax is covered with short brown hair giving it a mossy appearance. Males and females are similar in appearance apart from the swollen rear legs of the male.

Around Sydney this species is most likely to be seen visiting one of the summer-flowering peas. The bees mate on the flowers.

This bee was first collected from *Swainsona galegifolia*. It may have become more common in Sydney over recent years as Norman Rodd* believed it used to be rare in the area.

This species was previously known as *Nomia (Curvinomia) swainsoniae.*

Colour Plate: 30.

Nests: Nest unknown, probably solitary.

Distribution: Qld, NSW.

Similar Local Species: *N. aurantifer* is similar in appearance, but lacks the brown hair on the thorax. It has been found north and south of the Sydney area in the vicinity of rainforests.

Actual Size

* Norman Rodd (1913–2010) did extensive research on native bees, especially in the Sydney area, for six decades. His data and collections have been used by Tarlton Rayment and by professional entomologists throughout Australia.

Family Megachilidae

- over 10% of Australia's species, including resin and leafcutter bees
- have long tongues and feed on deep or shallow flowers
- all build solitary nests in cavities or in burrows in the ground

Megachilid bees are more frequently observed than one might expect from the small number of Australian species. The reason may be that many are large and noisy and they often nest in holes and crevices around houses.

Flower Preferences: They have long tongues which allow them to reach the nectar in tubular flowers. In the Sydney region, they are commonly observed on pea flowers, but this may not be true in other areas.

Nesting Habits: They generally build solitary nests in pre-existing cavities and do not line the nest with secreted material.

Major Groups and Physical Appearance: The two main groups are the resin bees and the leafcutter bees.

Resin bees construct nests from resins, pebbles or chewed leaf material while **leafcutter bees** weave nest cocoons from precisely-cut pieces of leaf. Female resin bees typically have long cylindrical abdomens, while leafcutters have flatter, leaf-shaped abdomens.

Many bees of both groups have a smoky grey appearance, resulting from white or pale hair over a black cuticle. It is also common for there to be pale bands of hair across the abdomen. The females of most species have broad, often huge, mandibles for cutting or manipulating nesting material and they transport pollen on rows of stiff bristles covering the underside of the abdomen.

The resin bees formerly in genus *Chalicodoma* are now in genus *Megachile*.

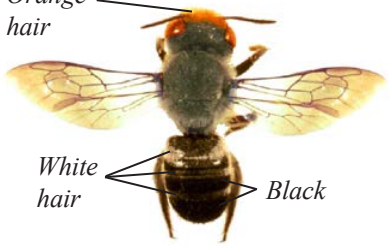
A. DOLLIN

Above: A leafcutter bee cuts a neat piece of leaf from a Buddleja leaf, for use in nest building.

Below: A sealed brood cell built by the leafcutter bee from oval and circular leaf pieces. It contains provisions of nectar and pollen, and a single egg.

A. DOLLIN

Megachile aurifrons — Golden-browed Resin Bee



The *M. aurifrons* female has spiky orange hair on her face like a punk rocker. This is unusual for a female resin bee. The males of many species have long orange facial hair, but the corresponding females usually have white or off-white hair on the face.

The female *M. aurifrons* also has red eyes, and a facial projection with a flat front surface similar to a pig's snout. Females of several species have projections that come in a variety of shapes. They are presumably used for carrying and manipulating resin and other material used in nest building. The black abdomen, with three narrow white bands and long white hair on the first segment after the waist, can be used to confirm identification, but such features are not unique to this species.

M. aurifrons is found right across mainland Australia, even in the most arid areas. It is less abundant on the east coast, but does occur in parts of the Sydney area.

This species was previously known as *Chalicodoma aurifrons*.

Colour Plates: 31 and 32.

Nests: *M. aurifrons* usually nests in existing cavities and so is often observed around holes in fence posts, mortar or sandstone. The Australian Native Bee Research Centre (ANBRC) has found that this species readily accepts drilled holes (5 mm diameter) in hardwood timber for building its solitary nests. There have also been reports of nests in abandoned mud-wasp cells. The nest entrances are sealed with a resin plug, sometimes mixed with chewed leaf pulp.

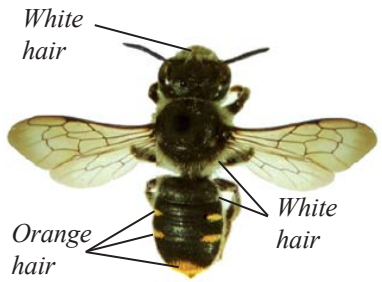
Firm, moist cakes of pollen and nectar are provided for the larvae. The bee enters the nest hole head-first then backs out, turns around and re-enters the hole tail-first, scraping the pollen into the nest. Normally single eggs and their provisions are sealed into individual cells separated by resin partitions. One unusual nest found at the ANBRC had five immature bees in a single cavity 10 mm wide, feeding on a 20 mm long communal provision store. Fully grown larvae spin firm, brown, multilayered cocoons and develop into pupae, then into adults.

Distribution: Qld, NSW, Vic, WA.

Similar Local Species: *M. erythropyga* females have red hair on the face, but the abdomen also has a red tip.

Actual Size

Megachile leucopyga — Gold-barred Resin Bee



Although the Latin name suggests that this species has a white tail, it has, in fact, a bright round orange spot on the tip of the abdomen. (Perhaps the specimen in the British Museum had faded before it was named.) Along each side of the abdomen are two broadly rectangular orange bars and there is a tuft of white hair on the first segment after the waist. Apart from some white hair on the face and around the edges of the thorax, the rest of the bee is shiny black.

This bee is commonly found on pea flowers of the genus *Pultenaea*. When seen alongside *Megachile chrysopyga*, which often visits the same flowers, it appears to be quite small, but this is due mostly to its slender build. It is, in fact, only 20% shorter than *M. chrysopyga*.

This species was previously known as *Chalicodoma leucopyga*.

Colour Plate: 33.

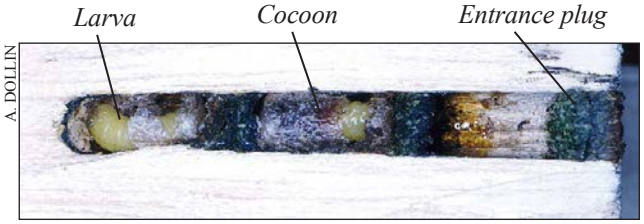
Nests: The ANBRC has found that this species readily builds its solitary nests in drilled holes (4–5 mm diameter) in hardwood timber. The nest entrances are sealed with a solid resin plug.

A firm, moist cake of pollen and nectar is provided for each egg. The bee enters the nest hole head-first then backs out, turns around and re-enters the hole tail-first, scraping the pollen into the nest. The first egg and its provisions are sealed in an individual cell with a resin partition. If space allows, further cells are constructed. Once each larva is fully grown it spins a firm, brown, multilayered cocoon and develops into a pupa, then into an adult.

Distribution: NSW, Vic, Tas.

Similar Local Species: *M. leucopyga* has broad bars on the sides of the abdomen. Other species, such as *M. heliophila, M. tasmanica* and *M. tosticauda*, have narrow white bands across the width of the abdomen.

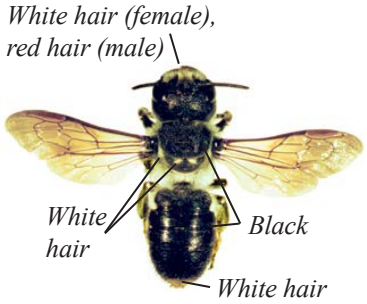
Actual Size



A resin bee's nest in a hole drilled in a piece of timber

Megachilidae

Megachile punctata — Big Black Resin Bee



There are two large black and white resin bee species commonly found around Sydney. Both have dark wings and some long white hair at the base of the abdomen. *M. punctata*, the more common of the two, can be distinguished by the presence of two white spots on the top of the thorax. Males are similar to the females but have long orange or orange-yellow hair on the face. They do not have expanded front feet like *Megachile chrysopyga*.

M. punctata is a common visitor to pultenaeas and often betrays its presence by the drone of its wings. The sound is slightly louder and deeper in pitch than that of a honeybee.

This species was previously known as *Chalicodoma punctata*.

Colour Plates: 35 and 36.

Nests: The ANBRC has found that this species will use drilled holes (5–6 mm diameter) in hardwood timber for building its solitary nests. The entrances are sealed with a resin plug, often mixed with chewed leaf pulp; so fresh seals are often light green, changing to dark grey with time. The bee carries fragments of leaf material to the nest in her jaws.

A firm, moist cake of pollen and nectar is provided for each egg. The bee first enters the nest hole head-first then backs out, turns around and re-enters the hole tail-first, scraping the pollen into the nest. The first egg and its provisions are sealed in an individual cell closed by a resin partition. Then further cells are constructed if there is enough room. The mature larva spins a firm, brown, multilayered cocoon and develops into a pupa, then into an adult.

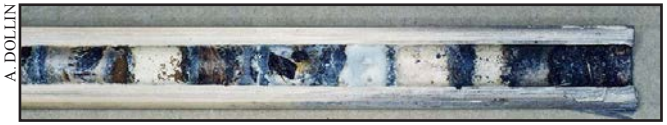
Actual Size

Distribution: Qld, NSW.

Similar Local Species: *M. lucidiventris* is slightly larger, has more white hair on the first segment of the abdomen after the waist, and lacks the white spots on the thorax. The facial hair of *M. lucidiventris* males is usually tawny rather than orange and they have expanded front feet. *M. punctata* is usually found visiting peas whereas *M. lucidiventris* prefers eucalypts, angophoras and tea trees.

Female

Male

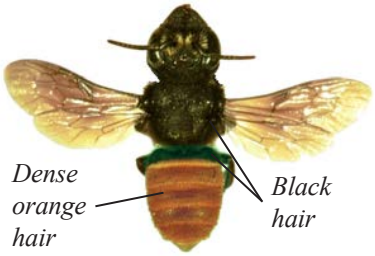


A resin bee's nest inside a piece of bamboo

Megachilidae

Megachile (Callomegachile) mystaceana

Fire-tailed resin bee



This strikingly-coloured resin bee is often seen in pockets of bushland within suburban Sydney. The head and thorax are jet black while the abdomen is bright orange (apart from a black band at the front). Thick black hair on the thorax heightens the contrast. Even the wings are strongly tinted with dark brown. The colour of the abdomen is due to dense orange hair which covers the underlying black cuticle. Occasionally the black shows through if the bee has suffered scratches or scrapes, or its hair is wearing thin with age. In Sydney this bee appears around December and favours *Pultenaea* flowers.

This species was previously known as *Chalicodoma (Callomegachile) mystaceana*.

Colour Plates: 34 and front cover.

Nests: This bee builds solitary nests of resin, gum or mud in enclosed spaces. Nests have been found between folds of fabric, in old mud-wasp (*Sceliphron laetum*) nests, in artificial nests of rolled cardboard tubes (7–8 mm internal diameter),[21] in drilled wooden blocks and in polystyrene bee boards.

The individual brood cells are completely surrounded by a mass of dark brown, resinous nest material collected in tiny blobs. The ANBRC has found that firm provisions of pollen and nectar for each egg are stored in unlined oval cavities (about 11 mm long) inside the resinous nesting material. When the larva is fully grown it spins a firm, brown, multilayered cocoon and develops into a pupa, then into an adult.

Distribution: Coastal NSW and Qld.

Similar Local Species: None.

Actual Size

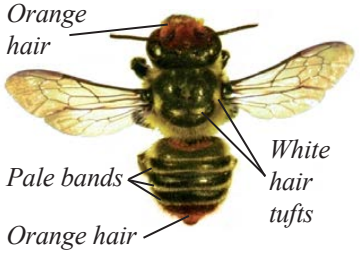
The resinous nest of Megachile mystaceana, with a cocoon (left) and a mature larva (right) in their separate cells.

A. DOLLIN

Megachilidae

Megachile (Eutricharaea) maculariformis (previously *chrysopyga*)

Gold-tipped Leafcutter



This is one of the most frequently seen native bees in the Sydney area. It is a large, greyish bee with orange hair on the face and an orange tip to the abdomen. Closer inspection reveals that it has a slightly flattened leaf-shaped abdomen with a pale hair band on the rear edge of each segment (except the last). Seen from above, the thorax has four small tufts of white hair.It makes quite a lot of noise, slightly higher in pitch than a honeybee, as it bustles from flower to flower. It is not particularly choosy and will visit different flower species in the same foraging trip.

Males spend most of their time patrolling flowering plants, stopping occasionally to consume nectar. They have a patch of orange hair on the last segment of the abdomen and yellow-orange hair on the face. Even more remarkable are the modified front feet of the male. The first three sections of the foot are hugely expanded into broad white plates. On the rear edge they are fringed with white hair tipped with black. On the inner surface of the second segment there is a large black spot and on the outside there is a bulbous chestnut projection (rather as though the insect is suffering from tennis elbow). These features are barely visible to the naked eye, but can be seen easily with a hand lens. In courtship, the male places his fore feet over the eyes of the female and the pattern of dark areas is important in helping the female recognise that her potential partner is of the correct species.

Colour Plates: 37 and 38.

Nests: The various species of leafcutter bees build solitary nests using pieces of cut leaf. They may be constructed in a crevice (e.g. under loose bark, under exposed roots or in cracks in rocks or mudbrick buildings) or in the soil. One set of leafcutter nests were reported in 10 mm wide holes in a concrete wall.[5] The bee constructed a series of leafy brood cells, one for each young bee, until all the available space was used. A rough plug of leaf clippings sealed the entrance hole.

The leafcutter bee favours soft leaves of plants such as roses, *Buddleja, Bauhinia, Desmodium* and wisteria to build her brood cells. She cuts each leaf piece precisely with her jaws and then carries it back to the nest, held between her legs. Each brood cell may start with a set of 10 mm circles woven together with a secretion. Then the sides are formed from regular, oval pieces. The bee provisions the brood cell and lays an egg. Finally the cell is finished with another stack of circular leaf pieces (see photographs on page 44).

Actual Size

Distribution: Qld, NSW, Vic, Tas.

Similar Local Species: *M. serricauda* is smaller and is not orange-tailed.

Megachilidae

Family Apidae

- over 10% of Australia's species, including blue-banded and stingless bees
- have long tongues and feed on deep or shallow flowers
- some are solitary, some have shared nests, others are fully social – nest sites include the ground, soft timber and hollow trees

The apid family contains some of Australia's best known bees and includes species with a wide range of behaviour.

Flower Preferences: All apid bees have long tongues and visit a variety of flower types. Many apid species have potential value as crop pollinators – the blue-banded, teddy bear and carpenter bees are capable of buzz pollinating crops such as tomatoes and the social stingless bees are efficient pollinators of some crops such as macadamias.

Nesting Habits: Many different types of nests are built, including shallow burrows in the soil, mudbricks or soft mortar; narrow burrows inside pithy stems; larger burrows in soft timber; and large resinous nests inside hollow trees. Some species build solitary nests. Others have shared nests with some division of labour. The stingless bees build fully social nests with queens, workers and males.

Major Groups and Physical Appearance: The blue-banded, teddy bear, reed, carpenter bees and stingless bees are Australia's best known native apid bees. The introduced honeybees (*Apis*) and bumblebees (*Bombus*) also belong to this family.

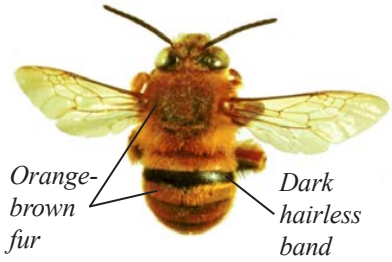
The teddy bear and blue-banded bees (***Amegilla***), and the cuckoo bees (***Thyreus***) that invade their nests, are well known because they are large and brightly coloured. The reed bees (***Exoneura***) are tiny, but they are numerous and are seen visiting a wide range of flower species. The metallic-green carpenter bees (***Xylocopa*** (***Lestis***)) are less numerous, but their sheer size and spectacular colouring make them difficult to miss.


A. DOLLIN

Blue banded bees roosting on grass at night

The tiny, black stingless social bees (***Tetragonula*** and ***Austroplebeia***), are our best known native bees even though they are less than 1% of Australia's species. Aboriginal people called the nests of many species 'sugar bag' and prized the tangy honey as a rare carbohydrate food and medicinal remedy.

Amegilla (Asaropoda) bombiformis — Common Teddy Bear Bee



This close relative of the blue-banded bees looks like an orange-brown, furry bumblebee. It has one broad dark band on the abdomen, but the rest of it is covered with soft orange hair. It is not much longer than the introduced honeybee, but appears bigger because of its bulk. Males and females look similar to the naked eye, but can be distinguished by counting the number of visible segments on top of the abdomen following the waist (6 for females, 7 for males) and examining the antennae (females have the third segment elongated). Neither of these things is hard to see, but practice and a hand lens will help.

In most years teddy bear bees are common in suburban Sydney and can often be seen visiting *Abelia* and *Buddleja* flowers. Male bees will cluster together at night, clinging to plant stems or leaves with their jaws.

Colour Plate: 39.

Nests: This bee builds solitary nests but groups frequently nest close together. In the wild it often builds in the soil of creek banks. In urban areas favoured nest sites are in rubble or soil, usually with some shelter, such as underneath a shed or behind a retaining wall.

Each nest consists of a cluster of urn-shaped brood cells at the bottom of a short entrance burrow (about 10 cm long). The cells are 20 mm long and are formed from mud, with a waterproof lining. Provisions of a fairly firm paste of pollen and nectar are added and then one egg. The cell is sealed with a round earthen cap.[22]

Actual Size

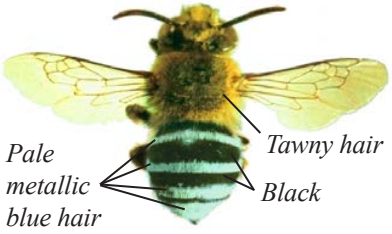
Distribution: Qld, NSW, Vic.

Similar Local Species: None.


A. DOLLIN

A teddy bear bee resting for the night, clinging to a stem by its jaws.

Amegilla (Zonamegilla) asserta — Common Blue-banded Bee



The beautiful blue-banded bees are regular visitors in gardens. The tawny hair that covers their thoraxes makes an attractive contrast with the pale metallic-blue bands on their black abdomens. They also attract attention with their dart-and-hover flight pattern, which is faster and more jerky than that of the honeybee.

There is a widespread view that these bees visit only blue and purple flowers, but in fact they frequently feed from the grey spider flower, *Grevillea buxifolia*, and white *Abelia* flowers and, less frequently, will visit pultenaeas and collect pollen from mountain devil flowers (*Lambertia formosa*). They do, however, go out of their way to inspect blue objects or clothing and are particularly fond of lavender (*Lavandula*) flowers.

Male and female blue-banded bees can be distinguished by means of the same features of the antennae and abdomen used to separate the sexes of teddy bear bees, but the task is made easier by the blue bands on their abdomens. Males have five complete bands, while females have only four. The fifth band is reduced to a central patch on females. Male blue-banded bees will cluster for the night hanging onto fine stems or leaves by their jaws (see photograph on page 50).

Colour Plates: 40, 53 and back cover (*A. pulchra*).

Nests: Each female digs a branched burrow for her solitary nest, often in soft, decomposing sandstone. So many bees may build together that the sandstone becomes totally riddled with nesting tunnels. At the end of each tunnel is an 8 mm wide, oval-shaped brood cell with a waterproof, multilayered shell. Each cell contains a liquid mixture of nectar and pollen plus a single egg. The cell is sealed with an earthen cap.

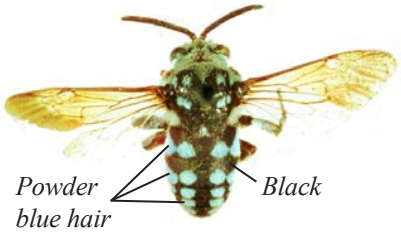
Blue-banded bees have also found that mudbrick houses can make ideal nest sites, especially in sheltered locations where low-concrete mud mixtures have been used. Soft mortar in old brick buildings is another favoured nest site.

Distribution: Blue-banded bee species are found in Qld, NSW, Vic, SA, WA. Closely related species occur in parts of Asia, including India and China.

Similar Local Species: The two species found in the Sydney area are *A. asserta*, with yellow face marks and *A. pulchra* with white face marks that may darken when the bee dies.

Actual Size

Thyreus caeruleopunctatus — Chequered Cuckoo Bee



All cuckoo bees have a large, strong thorax, with a flat projection covering the waist. These structures are presumably for protection when the females invade the nests of blue-banded bees (see below).

The spots on this cuckoo bee are a soft powder blue, which distinguishes it from the metallic-blue neon cuckoo bee (*T. nitidulus*). The pattern of spots is also distinctive. In addition to the four rows of spots on top of the abdomen, there are two short rows of spots underneath. It has pale blue hair on the face, on the outside of all its legs and on the sides of the thorax. There is even a small blue spot on the thoracic shield. The wings are strongly tinted with brown.

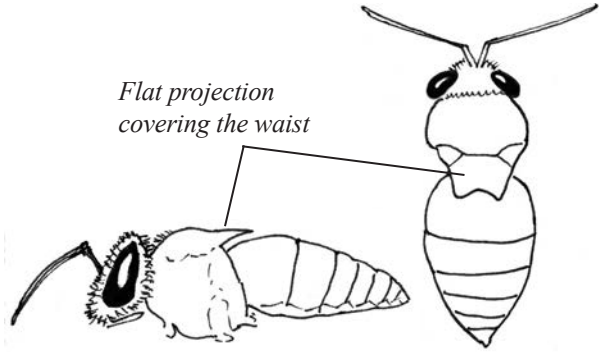
Colour Plate: 41.

Nests: Like other cuckoo bees, this species does not construct a nest of its own. Instead females stalk the nests of blue-banded bees. If she can sneak into an unguarded nest, she will lay an egg in a brood cell being constructed by the blue-banded bee. After the blue-banded bee seals the brood cell, the cuckoo bee egg will hatch into a grub which will consume the provisions stored by blue-banded bee.

Distribution: Extends throughout Australia, with the exception of Tasmania, and into New Guinea and neighbouring islands.

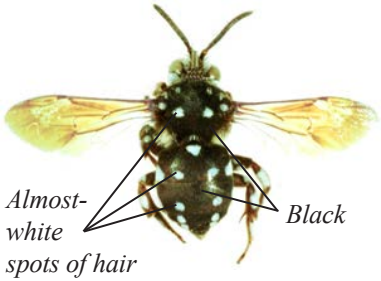
Similar Local Species: None.

Actual Size



The specialised thorax of the cuckoo bee

Thyreus lugubris — Domino Cuckoo Bee



This bee, with its drab colouring and parasitic habits, deserves its species name – *lugubris* is Latin for 'mournful' or 'mourning dress'. It is much larger than the other two cuckoo bees, adding to the sinister nature of its appearance.

Like the chequered cuckoo bee (*T. caeruleopunctatus*), it has four rows of spots on the top of its abdomen but the spots are much smaller with wide spaces between them. From a distance the spots appear to be white but they are, in fact, very pale blue when observed at certain angles. The face is also covered in pale hair and there are pale spots on the sides of the thorax, on all legs and under the abdomen. The wings are strongly tinted with brown with a slight purplish sheen.

It has a large, powerful thorax with a flat projection covering the waist.

Colour Plate: 42.

Nests: This species exploits the nests of teddy bear bees. Females can be observed inspecting holes along banks and stone walls, even along the walls of houses. If she can sneak into an unguarded nest, she will lay an egg in a brood cell being constructed by the teddy bear bee. After the teddy bear bee seals the brood cell, the cuckoo bee egg will hatch into a grub which consumes the provisions stored by the teddy bear bee.

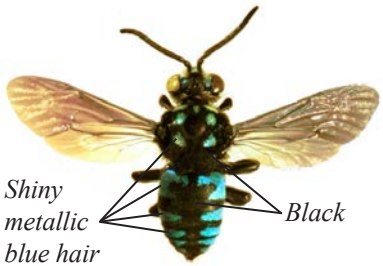
This cuckoo bee was reported[5] to approach with an unusual 'noiseless flight' and hover over a teddy bear bee's nest until the owner departed. She would then enter the nest briefly to lay her egg. This species is also reported to stalk blue-banded bee nests.[5]

Distribution: Qld, NSW.

Similar Local Species: None.

Actual Size

Thyreus nitidulus — Neon Cuckoo Bee



The metallic blue and black colours of this bee make it the most spectacular of the three cuckoo bee species. In sunlight it can be seen with the naked eye from a considerable distance. The colour patches are produced by highly branched hairs (see page 20) that lie flat on the surface like scales. The black areas, too, are covered with such hairs so that they are dull black, not shiny. The face is covered with pale hair and there are pale spots on the sides of the thorax and on the legs. The wings are strongly tinted with brown with a slight purplish sheen. The bee has a large and powerful thorax with a flat projection covering the waist.

Its full name is *Thyreus nitidulus nitidulus*, the second *nitidulus* indicating that it belongs to a subspecies found in Australia and nearby islands. Other subspecies are found throughout the islands of Southeast Asia.

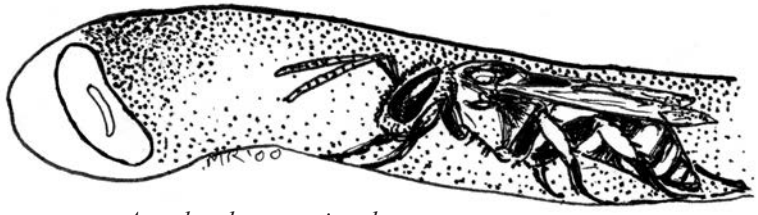
Colour Plates: 43 and 56.

Nests: Like *T. caeruleopunctatus*, this bee lays eggs in the nests of blue-banded bees. Females place an egg in a partially completed brood cell. After the blue-banded bee seals the brood cell, the cuckoo bee egg hatches into a larva which consumes the provisions stored by blue-banded bee.

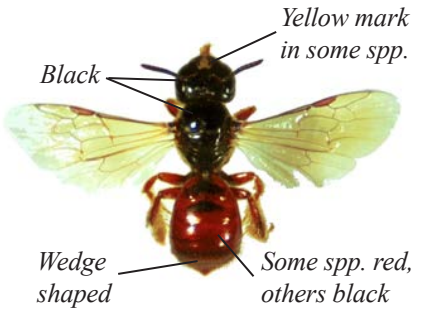
Distribution: Qld, NSW, SA, NT. Also New Guinea and neighbouring islands.

Similar Local Species: None.

Actual Size



A cuckoo bee entering the nest of a blue-banded bee



Next to honeybees and *Tetragonula*, *Exoneura* are probably the most numerous bees in the Sydney area. There are several species, ranging in size from small (8 mm) to very small (5 mm). They collect pollen from most flowers.

Many *Exoneura* species have a glossy black head and thorax, and a red abdomen with a distinctive wedge shape. The face of females often has a pale yellow T-shaped mark. Some species are hard to tell apart and have been classified largely by examining the larvae.

Other *Exoneura* species are all black but close relatives in the genus *Braunsapis* also look like black *Exoneura*. (Details of the wing veins are used to distinguish them.) Then there are *Exoneura* (*Inquilina*) species that closely resemble *Exoneura*, and live inside *Exoneura* nests as cuckoo bees.

Added to all this, the species names are currently being revised and many significant changes are expected. Hence we have illustrated one of the common red and black *Exoneura* from the area, but have not attempted to state its species name.

Colour Plates: 45, 46 and 54.

Nests: *Exoneura* bees hollow out a nest burrow in dead dry pithy stems (e.g. *Erythrina*), in flowering stalks of grass trees (*Xanthorrhoea*) or dry leafstems of tree ferns. *Exoneura* nests are also found in dead, previously-pruned or broken canes of roses, hydrangeas and the introduced weeds *Lantana* and blackberry (*Rubus*). Sadly, populations of this fascinating bee are often destroyed when Lantana is removed for bush regeneration. Details of how to relocate a nest are given in Chapter 2.

Some *Exoneura* species show signs of cooperative nesting – two or more adult females sharing a nest with some not laying eggs. One bee usually guards the nest entrance by blocking it with her abdomen. One way to recognise an *Exoneura* nest is to look for the guard's abdomen, which looks like a 2 mm wide red or black spot at the end of the pithy cane. However, sometimes the guard's face will be seen blocking the entrance.

Exoneura nests are unusual in that the larvae are not reared in separate, pre-provisioned cells.[23] In the most common species, the larvae and pupae lie instead in a jumbled pile at the bottom of the nest.[24] The young larvae have unusual arm-like lobes which they wave about actively and the adults feed them regularly with moistened pollen.

Unlike many Australian bees, *Exoneura* adults do not die in winter. Males and female adults spend the cold months dormant inside the nest chamber and begin new nests in the spring. In nearly all species, there are no immature bees present during winter. Mating occurs before and during winter.[25]

Distribution: Similar *Exoneura* species are common along the east coast in Qld, NSW and Vic but they are found in every State and Territory of Australia.

Actual Size

A. DOLLIN

Left: The entrance of a reed bee nest guarded by the abdomen of one of the inhabitants.
Below: A reed bee pupa (at left) and two larvae in an opened Lantana nest. The larva on the right is extending its unusual 'arms'.

A. DOLLIN

Xylocopa (Lestis) aeratus — Golden-green Carpenter Bee

Xylocopa (Lestis) bombylans — Peacock Carpenter Bee

[X. bombylans female]

Metallic blue-green with purple tints

These are big bees by any measure and look spectacular with their metallic-green colouring. They are easy to locate by the loud, deep drone they emit when flying between flowers. Appearing in spring when the large wedge-peas (*Gompholobium*) begin to flower, they fly right through to late autumn when the last of the *Pultenaea tuberculata* has bloomed.

Females of the two species are hard to distinguish in the field – *X. bombylans* tends to be a little bluer, but the metallic colours change with the angle at which the light is reflected. Sometimes they look yellow-green and at other times there are distinctly purple reflections. The males, however, have differently coloured faces – *X. aeratus* has yellow and *X. bombylans* white markings.

Colour Plates: 47, 48 and 57.

Nests: These species nest in dead dry flowering stalks of grass trees (*Xanthorrhoea*), or in soft wood (*Banksia, Leptospermum*). They are called carpenter bees because they cut 11–14 mm wide nest burrows[26] by ripping out the soft wood fibres, strand by strand, with their strong jaws. The nest building bee has been observed using her fore legs to collect the pith fragments and wood dust.[27] When fully laden, she climbs to the entrance, pushes her abdomen outside and cleans it off with her legs. Then she wipes her back legs clean by rubbing them against one another.

Often the nest is a single tunnel, 30 cm or more long, but if the timber is wide enough, interconnected, parallel tunnels may be built. The nest entrance is a smooth rounded hole about 7–10 mm wide and the burrow extends above and below the entrance.

Individual brood cells are formed from slightly widened sections of the tunnel. A small, moist ball of nectar and pollen is provided for each egg; then the cell is sealed with a plug of chewed timber, cemented together in a series of concentric rings with a glandular secretion.

The first bee to hatch is usually the one at the bottom. She works her way upwards, chewing through each partition in turn and letting the other pupae fall in a heap at the bottom!

During the winter the nesting tunnel may be shared by many bees, both male and female. Bees will defend the nest entrance by blocking it with their abdomens. In some nests cooperation occurs during brood rearing. The egg-laying female is the main forager while the other female guards the nest.[25]

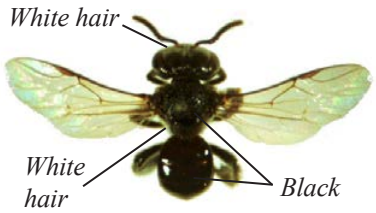
Distribution: Sydney is fortunate in being at the point where the ranges of *X. aeratus* and *X. bombylans* overlap. *X. aeratus* is distributed from Kangaroo Island in SA to northern NSW, but it has not been recorded in mainland SA or Vic since 1938. North of Gosford it is found only in the Great Dividing Range. *X. bombylans* is found mostly on the coast from the middle of NSW to Cape York Peninsula, Qld.

Similar Local Species: None.

Actual Size

Far left: A carpenter bee nest in a dead Leptospermum tree
Left: Internal view of a nest, showing larvae and pupae inside their brood cells

Tetragonula carbonaria — Carbonaria Stingless Bee



This is the only species of native bee in the Sydney area that lives in social colonies and stores honey. The workers are very small (4 mm) black bees with one of the segments of their hind legs expanded and flattened for carrying pollen. They have dense white hair on the face and the sides of the thorax. A short shelf-like projection is found at the rear of the thorax.

Similar species of Australian stingless bees are abundant in Queensland and in northern areas of NT and WA. The only other species in NSW, *Austroplebeia australis*, is black with tiny yellow markings on the rear edge of the thorax. In NSW it is only found in northern and coastal areas down to Dungog.

Although *Tetragonula* do not communicate by dancing, they can lead nestmates to a food source by leaving chemical messages along the way.

This species was previously known as *Trigona carbonaria*.

Colour Plates: 44, 58 and 59.

Nests: This species builds large nests inside the trunks of large standing trees, both dead and living.[28] They are social insects, with a queen, males and thousands of worker bees in each nest.


A DOLLIN

Stingless bees building their nest structure with tiny pieces of cerumen

The nest is constructed from *cerumen*, a dark brown mixture of wax (secreted by the workers) and resins (collected from trees). Pollen and nectar are stored in clusters of small pots, similar in appearance to bunches of grapes, near the edges of the nest. In the centre of the nest is a horizontal spiral brood comb (Colour Plate 58) surrounded by multiple insulating layers. The 3 mm wide brood cells are arranged in a hexagonal pattern. New cells are constructed in batches on the edges of the comb. They are provisioned with a mixture of honey, pollen and some worker secretions. An egg is laid in each cell by the queen bee and the cell is rapidly sealed by a worker.

Techniques have been developed for keeping this species in specially constructed hive boxes. Colonies can be propagated by splitting the hives and the commercial use of this species for gourmet honey production and crop pollination is being developed.

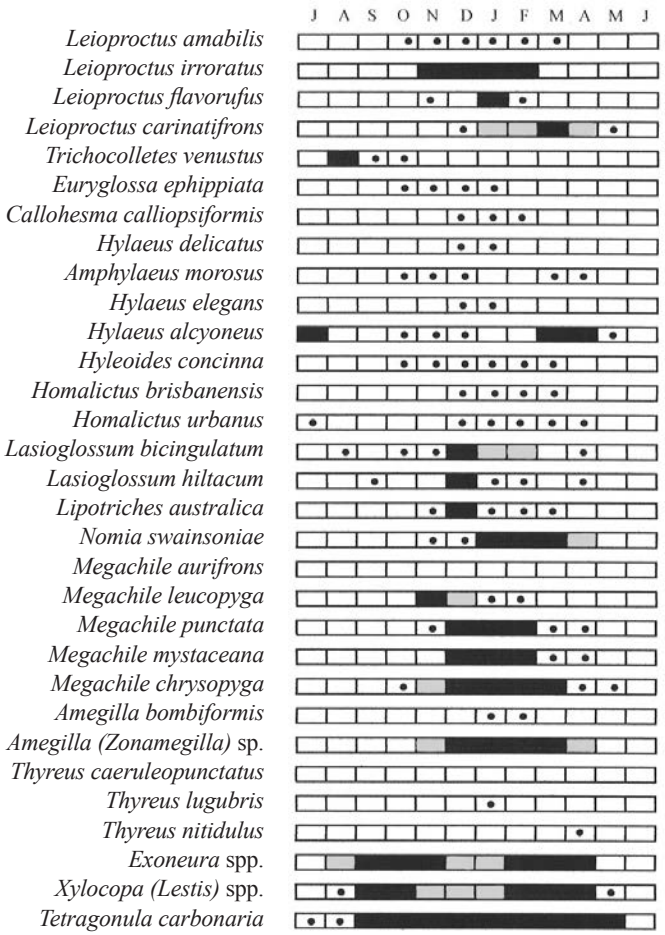
Distribution: Coastal areas from the Atherton Tablelands, Qld, to Bega, NSW.

Actual Size

Similar Local Species: None.

Apidae

Flight Records

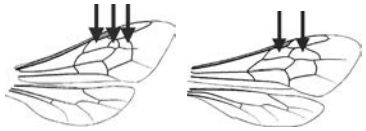
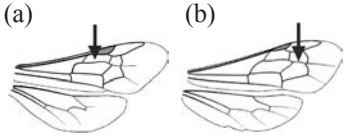
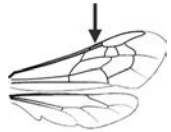
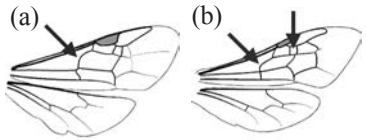
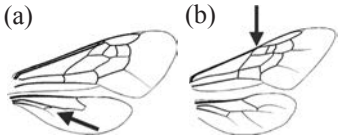


These are flight records for the Sydney region based on records of a single observer averaged over a three year period (1997–2000). Black boxes indicate numbers of sightings ranging between 50% and 100% of the maximum monthly value for that species. Grey boxes indicate between 20% and 50%, and empty boxes no sightings. A box containing the symbol • indicates that one or more specimens were observed in that month.

Data available from previously published information either included specimens from well outside the Sydney area or were even more fragmentary than the data used above. All flight records may be subject to bias. Emergence dates may vary from site to site, a change in food source may make the bees harder to see and seasonal variations may affect both flower and bee abundance. The information given should be regarded as preliminary and tentative.

Wing Venation

Details of the wing veins, especially the number of submarginal cells, N, are often used as an aid to identification. The general rules given in this table apply to Australian bee species.

Genus	N		Comments
Leioproctus	3 or 2		The majority of species have three submarginal cells, but some, including *Leioproctus flavorufus*, have only two.
(a) ***Euryglossa*** **(b)** ***Hylaeus***	2		In the wings of most Euryglossa, the first sub-marginal cell is longer than the second. In *Hylaeus (Heterapoides)* the arrowed vein is missing.
Trichocolletes	3		The stigma (coloured area) is small and parallel-sided.
(a) ***Homalictus Lasioglossum*** **(b)** ***Lipotriches Nomia***	3		These bees have a strongly bent basal vein. *Lipotriches* & *Nomia* have the 2nd submarginal cell shorter than the other two.
Megachile	2		Megachilid bees have two submarginal cells and a small, but distinct stigma.
(a) ***Amegilla*** **(b)** ***Xylocopa***	3		*Amegilla* have a strongly-sloping vein in the hind wing. *Xylocopa* have a very small stigma.
Exoneura	2		The open cell distinguishes *Exoneura* from the closely related genus *Braunsapis*
Tetragonula	0		*Tetragonula* have greatly reduced wing venation.

Glossary

abdomen: the third section of an insect's body, behind the waist. (According to strict technical definitions, the abdomen in a bee actually includes a small part of the body in front of the waist. The part behind the waist is then called the *gaster* or *metasoma*.)

antennae: a pair of feelers on an insect's head, carrying sensory organs.

brood cell: a nest compartment in which an egg is laid, the larva feeds and the pupa develops.

buzz pollination: a special method of pollination for plants that lock their pollen inside specialised capsules (e.g. *Senna, Solanum, Hibbertia*, tomatoes, kiwi fruit and blueberries). The bee must vibrate the flower to release the pollen. Australian native *Amegilla* and *Xylocopa* bees and some colletid and halictid bees can buzz pollinate, but the stingless bees (*Tetragonula*) and honeybees (*Apis*) cannot.

cocoon: a silken envelope which a larva may spin around itself before it develops into a pupa.

crop: a thin-walled stomach near the start of the digestive tract for storing nectar. (It is an expanded section of the oesophagus.)

cuckoo bee: a bee which lays its eggs in the nest of another bee species. The cuckoo bee's larva eats the provisions which the host has collected for its own larva.

cuticle: the hard outer skin of an insect. (It serves as a skeleton, protects the body and controls water loss.)

forage: to collect food.

larva: (pl: larvae) a grub that is the second of the four stages of development of a bee. (The four stages are egg, larva, pupa and adult.)

longicorn beetle: a beetle in the family Cerambycidae. The larvae burrow into wood, leaving holes which are used as nest sites by some native bees.

pupa: (pl: pupae) the third, or chrysalis, stage of development in which the bee metamorphoses from a larva to a fully developed adult.

queen: in social bees there are three classes, the queen, the workers and the males. The queen is the female that normally lays all the eggs for the colony.

resin: saps collected from trees by some native bees and used for nest construction.

scopa: a brush of long branched hairs, located either on the legs or on the underside of the body and used to carry pollen.

social: describing a group of female bees occupying the same nest and to some degree dividing the labour.

solitary: describing a female which builds a nest by herself, gathers food for the larvae and lays eggs, without help from other females.

thorax: the middle part of a bee's body, between the head and the abdomen, bearing the legs and wings.

worker: in social bees there are three classes, the queen, the workers and the males. The workers are sterile female bees that do virtually all the work of the colony, except egg laying.

Pronunciation and Meaning of Scientific Names

The pronunciation of species names is a language like any other, with regional accents and evolution over time. The following suggestions should be recognisable by Australian entomologists. They are not classical Latin pronunciations (which can be found at the front of most Latin dictionaries), but are close to the Latin accent used in 19th century England.[29] The exception is the long 'a' sound, where the classical AH is starting to replace the 19th century AY. Many scientists still use the latter.

NAME	PRONUNCIATION	MEANING
aeratus	air-AH-tus	bronze
alcyoneus	al-see-OH-nee-us	kingfisher blue
amabilis	a-MAH-billis	lovely
Amegilla	a-meg-ILL-a	with large bands
Amphylaeus	am-fill-EE-us	around *Hylaeus*
Andrenopsis	andren-OP-sis	like *Andrena*
Asaropoda	as-aro-POH-da	splayed feet
asserta	ass-SERT-a	alleged or asserted
aurifrons	ORE-ri-fronz	golden brow
australica	os-TRAH-licka	of the south
Australictus	os-tra-LICK-tus	southern *Halictus*
Austronomia	os-tron-OH-mia	southern forager
bicingulatum	bye-sing-gyoo-LAH-tum	with two bands
bombiformis	bombi-FOR-mis	like a bumblebee
bombylans	BOM-bill-anz	like a bumblebee
brisbanensis	brisban-EN-sis	from Brisbane
caeruleopunctatus	serroo-leo-punc-TAHT-us	sky-blue spotted
calliopsiformis	kalliopsi-FORM-is	like *calliopsis* (= beautiful appearance)
Callohesma	kalloh-HEZ-ma	beautifully smooth
carbonaria	karbon-AH-ria	black (literally, like coal)
carinatifrons	karin-AH-ti-fronz	keeled brow
Chalicodoma	kal-ick-oh-DOH-ma	pebble house
Chilalictus	kile-a-LICK-tus	*Halictus* with lips (mandibles)
chrysopyga	kriss-o-PIE-ga	golden buttocks
cingulata	sing-gyou-LAH-ta	banded
Cladocerapis	klad-oh-ser-AY-pis	branched bee
concinna	kon-SIN-a	beautiful
Curvinomia	kurv-in-OH-mia	curved forager
delicatus	dell-ick-AH-tus	delicate
elegans	ELL-egg-anz	elegant

NAME	PRONUNCIATION	MEANING
ephippiata	ee-fippi-AH-ta	saddled
Euprosopis	you-pros-OP-is	fair of face
Euryglossa	you-ree-GLOSS-a	broad tongue
Eutricharea	you-trick-AH-ria	very hairy
Exoneura	exon-YOU-ra	lacking (some) veins
flavorufus	flay-voh-ROO-fuss	yellow-red
flavoviridis	flay-voh-VI-ridis	yellow-green
Heterapoides	hetera-POY-deez	not bee-like
hiltacum	hill-TAH-kum	originally *hiltacus*, an anagram of *Halictus*
Homalictus	homa-LICK-tus	like *Halictus*
Hylaeus	hile-EE-us	wood cutter
Hyleoides	hile-ee-OY-deez	like *Hylaeus*
irroratus	iror-RAH-tus	bedewed
Lasioglossum	lass-ee-oh-GLOSS-um	woolly tongue
Leioproctus	lee-oh-PROCT-us	shiny rear
Lestis	LESS-tis	forgetfulness, oblivion
Lipotriches	lip-oh-TRICK-eez	bald
leucopyga	loo-koh-PIE-ga	white buttocks
lugubris	lu-GOO-briss	mournful or mourning clothes
Macrohylaeus	macroh-hile-EE-us	large *Hylaeus*
maculariformis	mac-you-lah-ri-FORM-is	spotted
Megachile	mega-KEEL-a	large lips (mandibles)
moerens	MUH-renz	Moeren's
morosus	more-OH-sus	peevish, difficult
mystaceana	miss-tay-see-AH-na	mustached
nitidulus	ni-TID-yule-us	a bit shiny
Nomia	NOH-mia	forager
Parasphecodes	para-sfek-OH-deez	near *Sphecodes* (= wasp-like)
peraustrale	per-os-TRAH-lee	all over the south
phanerura	fan-uh-ROO-ra	clear (re: plate over wing hinge)
punctata	punk-TAH-ta	spotted
swainsoniae	swain-SOWN-i-ee	of (i.e. seen on the plant) *Swainsona*
Tetragonula	tetra-GON-you-la	four cornered
Thyreus	thigh-REE-us	broad door-shaped shield
Trichocolletes	trick-oh-KOLL-eteez	hairy *Colletes*
Trigona	try-GOH-na	triangular
venustus	ven-UST-us	charming
urbanus	er-BAH-nus	refined
Xylocopa	zile-oh-KOH-pa	woodcutter
Zonamegilla	zone-ameg-ILL-a	belted *Amegilla*

Further Reading

Key books of interest to the keen bee-watcher are as follows:

Australian Native Bees, *AgGuide,* by Anne Dollin, Katja Hogendoorn, Tim Heard, Saul Cunningham, Romina Rader, Manu Saunders, Tanya Latty, Caragh Threlfall, Tobias Smith, Megan Halcroft and Danielle Lloyd-Prichard (2016). NSW Department of Primary Industries, Paterson.
www.tocal.nsw.edu.au/publications/bees/australian-native-bees

The Australian Native Bee Book: *keeping stingless bee hives for pets, pollination and sugarbag honey* by Tim Heard (2016). Sugarbag Bees, West End.
nativebeebook.com.au

Ebooks in the *Native Bees of Australia Series* by Anne Dollin, Tim Heard and Russell Zabel (2016-2017). Australian Native Bee Research Centre, North Richmond, NSW:

- *Introduction to Australian Native Bees.*
- *Nests of Australian Stingless Bees.*
- *Behaviour of Australian Stingless Bees.*
- *How to Recognise the Different Types of Australian Stingless Bees.*
- *Keeping Australian Stingless Bees in a Log or Box.*
- *Boxing and Splitting Hives*

www.aussiebee.com.au

The Bees of the World, Second edition, by Charles D Michener (2007). Johns Hopkins University Press, Baltimore and London.

Bees of the World by Christopher O'Toole and Anthony Raw (1999). Blandford Press, London.

The Social Behaviour of the Bees by Charles D Michener (1974). Belknap Press of Harvard University Press, Cambridge.

A Cluster of Bees by Tarlton Rayment (1935). Endeavour Press, Sydney.

Overview of Feral and Managed Honeybees in Australia by David C Paton (1996). Australian Nature Conservation Agency, Canberra.

The Insects of Australia, 2nd ed, by CSIRO Division of Entomology (1991). Melbourne University Press, Carlton.

Zoological Catalogue of Australia, Volume 10, *Hymenoptera: Apoidea* by JC Cardale (1993). Edited by WWK Houston and GV Maynard, AGPS, Canberra.

For new books published after 2017, see page 82

Internet Resources

The following websites also offer great resources for the bee-watcher:

Aussie Bee
View close-up photos and videos of Australian native bees and read how to support native bees in your garden. Downloadable ebooks and free articles on native bees:
www.aussiebee.com.au

Bees Business
Megan Halcroft's website provides a wide range of step-by-step guides on how to make nests for native bees and encourage them to come into your garden:
www.beesbusiness.com.au

Brisbane Insects
Browse a huge gallery of photos of native bees (and other insects):
www.brisbaneinsects.com/brisbane_bees

Valley Bees
Download the *Attract Bees* factsheet for tips on supporting native bees in your garden:
mrccc.org.au/valley-bees

Sugarbag Bees
Find resources and tips on keeping the stingless native bees in hive boxes:
sugarbag.net

Bowerbird Website – see update on page 82
Upload photos of your native bee sightings and browse the postings by other bee-watchers. Your observations will be passed on to the *Atlas of Living Australia*:
www.bowerbird.org.au/projects/2/sightings

Atlas of Living Australia
View photos of most Australian species and see where they have been recorded in Australia. You can also upload your own observations and photos:
www.ala.org.au

Padil
Compare the different species of Australian native bees with detailed macro photos showing the bees' body shape, colouring and hair patterns:
www.padil.gov.au/pollinators/search

Facebook Pages and Groups:
There are now many pages and groups about native bees on Facebook. e.g. *Bee Aware of Your Native Bees, Bees Business, Bee Aware Brisbane, Sugarbag Bees, Bees in the Burbs in a Biodiversity Hotspot* and *Australian Native Bees on Aussie Bee Website*.

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10. T Rayment (1939). *Aust Zool*, 9, 263–294. [The species described as *Meroglossa hardcastlei* is now known as *Amphylaeus morosus*.]
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12. see ref 5. [The species described as *Euprosopis elegans* is now known as *Hylaeus (Euprosopis) elegans*.]
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17. KL Walker (1986). *Mem Mus Vict*, 47, 105–200.
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25. K Hogendoorn and R Leijs, personal communication.
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A Selection of Other Scientific Papers on Native Bees

M Batley and TF Houston (2012). *Records of the Aust Mus*, 64, 1–50. [Taxonomy of *Trichocolletes*]

AL Cronin and MP Schwarz (1999). *Ann Entomol Soc Am*, 92, 705–716 and references therein. [*Exoneura* nesting and social behaviour]

EM Exley (1974). *Aust J Zool*, Suppl Ser, 26, 1–58. [Taxonomy of *Euryglossa (Callohesma)*]

EM Exley (1976). *Aust J Zool*, Suppl Ser, 41, 1–72. [Taxonomy of *Euryglossa (Euryglossa)*]

J King (1994). *Invert Taxonomy*, 8, 1373–1419. [Taxonomy of *Chalicodoma (Hackeriapis)*]

R Leijs, M Batley and K Hogendoorn (2017). *ZooKeys*, 653, 79–140. [Taxonomy of the blue-banded bees in *Amegilla*]

R Leys (2000). *Invert Taxonomy*, 14, 115–136. [Taxonomy of *Xylocopa*]

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Reed Bee, male

47. *Xylocopa (Lestis) bombylans*
Peacock Carpenter Bee, female

48. *Xylocopa (Lestis) bombylans*
Peacock Carpenter Bee, male

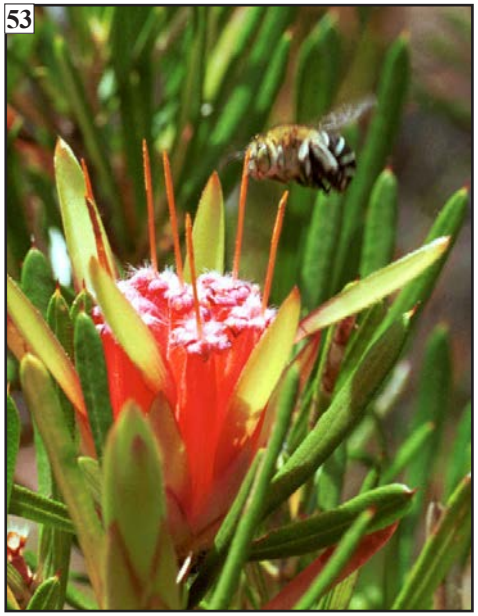
49. Hover Fly

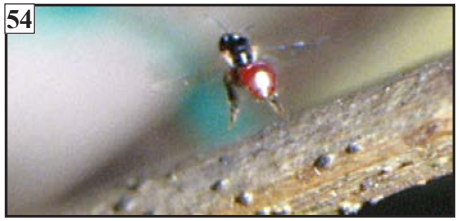
50. Introduced European Wasp

51. Introduced Honeybee

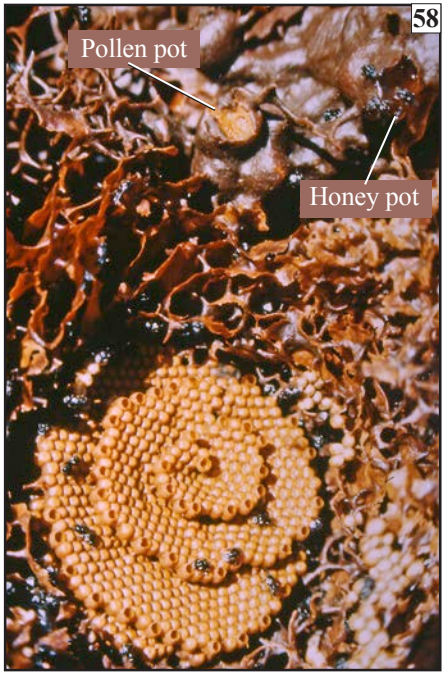
52. Introduced Bumblebee

53. A blue-banded bee (*Amegilla*) hovering over a mountain devil flower (*Lambertia*) (*M Batley*); **54.** A reed bee (*Exoneura*) flying over a *Lantana* cane (*M Robinson*); **55.** A banksia bee (*Hylaeus alcyoneus*) staking out its territory on a *Banksia* flower (*M Batley*).





56. The spectacular colours of a neon cuckoo bee (*Thyreus nitidulus*) (*A Dollin*);
57. A female (left) and a male (right) carpenter bee (*Xylocopa*) on *Kunzea* (*M Batley*);
58. The spiral brood comb and storage pots in a *Tetragonula carbonaria* nest (*A Dollin*);
59. A stingless bee (*Tetragonula carbonaria*) on *Euphorbia* (*B Faulkner*).



Appendix 1

Updated Scientific Names in Ebook Edition of *Native Bees of the Sydney Region*

New information is constantly being published in science. Names of species are also sometimes changed as scientists learn more about the relationships between the different species.

Just after *Native Bees of the Sydney Region* was published in 2000, an important new book called *The Bees of the World,* by Professor Charles Michener of the University of Kansas, arrived in Australia. A second edition of this book was published in 2007. In this massive book Professor Michener revised the family groupings of all the bees in the world. This has changed the genus names of some of the bees covered in the field guide as shown in the table below.

Old Name Given in Original Field Guide & Page Reference in Field Guide	New Name Selected by Charles Michener & Page Reference in *The Bees of the World*	New Names of 'Similar Local Species' Listed in Field Guide & Page Reference in Field Guide
Euryglossa (Euryglossa) ephippiata - p30	*Euryglossa ephippiata - p227*	*Euryglossa adelaidae, E. capitata, E. depressa, E. nigrocaerulea, E. subsericea - p30*
Euryglossa (Callohesma) calliopsiformis - p31	*Callohesma calliopsiformis - p225*	*Callohesma quadrimaculata, C. calliopsella - p31*
Heterapoides delicata - p32	*Hylaeus (Heterapoides) delicatus - pp194, 206*	*Hylaeus (Heterapoides) bacillarius, H. extensus - p32*
Nomia (Austronomia) australica - p42	*Lipotriches (Austronomia) australica - p336*	*Lipotriches (Austronomia) flavoviridis, L. moerens, L. ferricauda - p42*
Nomia (Curvinomia) swainsoniae - p43	*Nomia (Paulynomia) swainsoniae - p341*	*Nomia (Paulynomia) aurantifer - p43*

Table continued on page 79

Old Name Given in Original Field Guide & Page Reference in Field Guide	New Name Selected by Charles Michener & Page Reference in *The Bees of the World*	New Names of 'Similar Local Species' Listed in Field Guide & Page Reference in Field Guide
Chalicodoma aurifrons - p45	*Megachile aurifrons - p576*	*Megachile erythropyga - p45*
Chalicodoma leucopyga - p46	*Megachile leucopyga - p576*	*Megachile heliophila, M. tasmanica, M. tosticauda - p46*
Chalicodoma punctata - p47	*Megachile punctata - p576*	*Megachile lucidiventris - p47*
Chalicodoma (Callomegachile) mystaceana - p48	*Megachile (Callomegachile) mystaceana - p567*	—
Inquilina - p56	*Exoneura (Inquilina) - p631*	—

Reference: *The Bees of the World,* Second edition, by Charles D Michener (2007). Johns Hopkins University Press, Baltimore.

Leafcutter, Blue-banded Bee & Stingless Bee Name Changes
See Next Page

Appendix 1 Continued

Updated Scientific Names in Ebook Edition of Native Bees of the Sydney Region

We have also updated the scientific names of three other bees listed in *Native Bees of the Sydney Region* due to new information that has become available since the original edition was printed.

Gold-tipped Leafcutter Bee - Page 49

In the original edition of *Native Bees of the Sydney Region,* we listed this larger Sydney leafcutter species as *Megachile (Eutricharaea) chrysopyga*.

However, Dr Judy King has found that *Megachile chrysopyga* is actually a Western Australian species and that the correct name of the east coast species is *Megachile maculariformis*. So we now list this name for the larger Sydney leafcutter species.

Common Blue-banded Bee - Page 52

In the original edition of *Native Bees of the Sydney Region,* we listed this Sydney blue-banded bee species as *Amegilla (Zonamegilla) cingulata.*

However, Australia's species of blue-banded bees were revised in 2017 by Drs Remko Leijs, Michael Batley and Katja Hogendoorn using DNA and morphological techniques (*ZooKeys*, 653, 79–140).

Their results show that the species, *Amegilla cingulata*, does not occur in Sydney but is limited to more northern areas of Australia. The study also found that this Sydney species is *Amegilla (Zonamegilla) asserta* and a similar Sydney species is *A. pulchra*

Carbonaria Stingless Bee - Page 60

In the original edition of *Native Bees of the Sydney Region,* we listed the Sydney stingless bee species as *Trigona (Heterotrigona) carbonaria*.

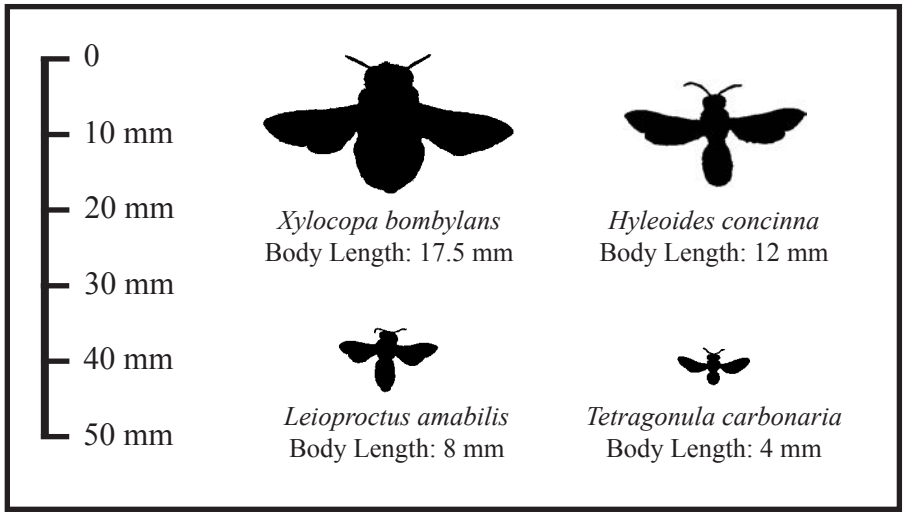
However, the genus name of the *Trigona* bees from Australia through to India has been changed to *Tetragonula,* because DNA studies have shown that these species are different from those in other parts of the world. So the Sydney stingless bee species is now called *Tetragonula carbonaria*.

Appendix 2

How to Check the Size of Your 'Actual Size' Bee Silhouettes

Depending on the type of printer you have and the printer settings you choose, the pages of this field guide may be slightly enlarged or reduced when you print them out. This will not cause problems with anything other than the 'Actual Size' bee silhouettes shown for each bee species.

Print out a copy of this page to see if the field guide's bee silhouettes are changed in size by your printer. If your printout of the diagram below is slightly larger or smaller than it should be, keep this adjustment in mind when you refer to the 'Actual Size' silhouettes on the other pages.



Note: The Body Length measurements in this diagram do not include the bee's antennae.

Appendix 3
Updates on Native Bee Resources Available in 2019

New Books Published in 2018

Two new books of interest to the keen bee-watcher are as follows:

Bees of Australia – a Photographic Exploration, by James Dorey (2018). CSIRO Publishing, Clayton South.
www.publish.csiro.au/book/7786

A Guide to Native Bees of Australia by Terry Houston (2018). CSIRO Publishing, Clayton South.
www.publish.csiro.au/book/7388

Upcoming Changes to BowerBird Website

It is likely that the popular citizen science website, BowerBird, will be discontinued in 2019 or 2020 due to funding issues. This would be a great loss as over 4000 native bee images had been contributed to the Australian Native Bees project on BowerBird by mid 2019 and this resource has been providing an excellent tool for identifying native bees and discovering new species for many years.
www.bowerbird.org.au/projects/2/sightings

Contributors are now being encouraged to move their citizen data to the **iNaturalist** citizen science website and to continue to share their Australian native bee observations to the BowerBird project there. As was done for BowerBird, observations will be passed on to the Atlas of Living Australia, to contribute to Australia's knowledge of our native bees.

To sign up with iNaturalist, visit:
www.inaturalist.org

...and for step-by-step instructions on how to transfer your BowerBird observations to iNaturalist, visit:
www.inaturalist.org/projects/bowerbird/journal/25054