

The Australian bee genera

An annotated, user-friendly key

Tobias J. Smith



The Australian bee genera

An annotated, user-friendly key

by Tobias J. Smith

2018



Published by The Rader Community Ecology Lab, School of Environmental and Rural Science,
University of New England, Armidale, Australia.

Annotated key composed by © Tobias James Smith, 2018

Contact toby@beeawarekids.com.au

Photography and drawing copyright © All photographs and drawings are copyright of the owner as stated on the page on which each appear. PaDIL images are reproduced here under the Creative Commons Attribution 3.0 Australian License (<http://www.padil.gov.au/imageuse>), and individual photographers are listed with each photo on each page they occur.

This is a not-for-profit publication, produced for education and research only

ISBN 978-1-9215797-77-0

Printed by Fuji Xerox Australia Pty Limited, University of New England, Armidale, Australia

Printing of this book was funded by a grant awarded to Romina Rader as part of an AgriFutures Australia supported project, “*Securing Pollination for More Productive Agriculture: Guidelines for effective pollinator management and stakeholder adoption*”. The project is funded through the Australia Government Department of Agriculture and Water Resources as part of its Rural R&D for Profit Program, as well as Hort Innovation.



AgriFutures™
Securing
Pollination



Australian Government
Department of Agriculture
and Water Resources

Front cover photo *Homalictus* females gathering pollen from *Hibbertia scandens*, K’Gari/Fraser Island – Photo by Verônica Gama, 2016

Back cover photos Top - *Homalictus* female gathering pollen from *Brachyscome* sp., Brisbane – Photo by Tobias Smith, 2015. Bottom - *Hylaeus (Prosopistemon) aralis* female, Palm Beach, QLD – Photo by Tobias Smith, 2018

How to cite this book Smith, T. J. (2018) *The Australian Bee Genera: An Annotated, User-Friendly Key*. The Rader Community Ecology Lab, University of New England, Armidale, Australia.

Acknowledgements

First and foremost, I greatly thank Michael Batley (Australian Museum) for his unrelenting patience and generosity in reviewing multiple drafts of this annotated key and providing extensive feedback. Without Michael's expertise and detailed feedback, this key would not have achieved the quality and precision that it has. In addition, I thank Laurence Packer (York University, Canada) for reviewing one of the final drafts and providing detailed feedback.

I thank Romina Rader for helping me realise that this key was worthy of publication, and for her support during the entire process. I also thank Terry Houston (Western Australia Museum), Ken Walker (Museum Victoria), Manu Saunders, and Karen Retra for providing valuable feedback on drafts, and thank members of the Rader Community Ecology Lab at the University of New England who tested parts of this key and provided feedback. I thank Michael Engel for valuable advice and encouragement, and Anne Dollin for useful comments and feedback.

This annotated key is based, in part, on couplets from a number of keys written by the following authors: Charles Michener, Terry Houston, Glynn Maynard, Victor Gonzalez, Michael Engel, and Terry Griswold (publications listed on page 108). Some of the couplets from these authors appear here as they were first written, others have been modified to varying degrees.

In numerous places throughout this annotated key I support descriptions of characters with line drawings. Some of these are my own original drawings. Others are by myself, but are based on original illustrations by others, including: illustrations in Charles Michener's books *The Bees of the World* (2007) and *A Classification of the Bees of the Australian and South Pacific Regions* (1965), and illustrations by Elaine R. S. Hodges that appear in *The Bee Genera of North and Central America* (Michener, McGinley & Danforth, 1994). Likewise, a small number of other drawings within are by myself, but are based on originals by Terry Houston in his publications *A revision of the Australian Hylaeine bees (Hymenoptera: Colletidae)* (1975) and *Revision of the bee genus Ctenocolletes (Hymenoptera: Stenotritidae)* (1983).

Numerous photos presented here are sourced from the PaDIL pollinators website (padil.gov.au/pollinators), and are identified as such throughout, along with the photographer's name for each. I also thank the following photographers for the use of their photographs: Verônica Gama, Michael Batley, Ken Walker, Steve Smith, and Samantha Gray. I thank Rowena McDonald (my mum) for the laborious task of editing this book.

Lastly, I thank my family, Verônica and Rafaela, for being themselves and for being happy and supportive with me going through the long process of putting together this key. This key was largely produced in my own personal time and, as such, many long nights have gone into it.



Contents

Acknowledgements	i
Preface	1
Identification equipment and bee collecting	2
Using this annotated key	3
Overview of Australia's bees	4
Bee anatomy and terminology	6
Mouthparts can be tricky	9
Bee or wasp?	12
Male or female?	13
THE KEYS	15
Families/subfamilies – Females	16
– Females and males	27
Apidae	33
Colletidae	47
– Colletinae	48
– Euryglossinae	57
– Hylaeinae	73
Halictidae	87
Megachilidae	99
Stenotritidae	105
Resources and References	108



Preface

"Taxonomic keys are made by people who don't need them, for people who don't know how to use them" – Laurence Packer

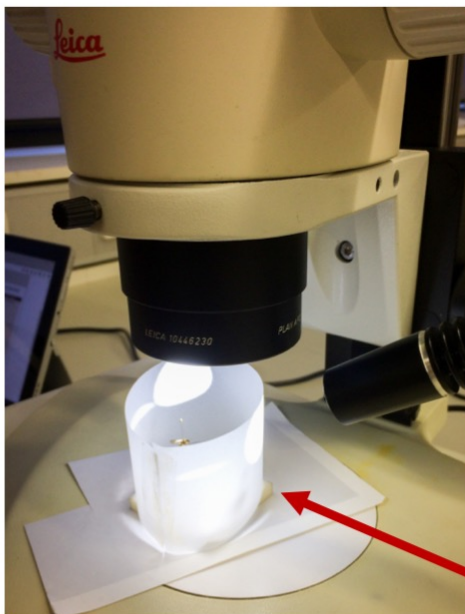
Researchers from multiple fields, as well as citizen scientists and enthusiasts, work on projects that involve Australian bees. There are a number of keys available for identifying bee specimens to family and genus. A common thread throughout these keys, and indeed in taxonomic keys more widely, is that they are often tricky to use when one is new to using them. Many researchers now working on Australian bees are new to bees, and/or do not have formal insect taxonomy experience or training, and thus find formal bee identification keys difficult without guidance. A seemingly increasingly common approach to bee identifications instead, are quick, potentially superficial identifications of bee specimens by matching with online pictorial resources. Australia has some great online tools such as formal photo libraries and groups that are useful in learning about and identifying Australian bees. Because of the difficulty of most existing formal Australian bee keys, these online tools are sometimes over-relied on for identifications by those new to bee identification. This can lead to errors, and does little to help increase the taxonomic skill sets of the next generations of bee workers.

It is with all of this in mind that I have put together this annotated key to the Australian bee genera. I believe that the way to get more widespread use of keys is to make them more user-friendly and simple, without losing taxonomic integrity. Here I provide a simplified, user-friendly key to all of the Australian bee genera, in which all couplets are supported by photos and diagrams to support the descriptions. This book is designed to be as practical and easy as possible, while maintaining the integrity of this complex task. This book is not designed to be a comprehensive summary of the bee families and genera and, as such, gives little detail on the biology or ecology of groups. Once a genus-level identification has been made using this annotated key, it is then up to the user to look further afield for more information. A collection of sources for further information is listed at the end of this book. To get the most from this book, use this annotated key in parallel with the comprehensive taxonomic information in *The Bees of the World*, by Charles Michener (2007).

Tobias J. Smith

Identification equipment

Using this key requires pinned bee specimens and a dissecting microscope and light source. Identification is much easier with a microscope with a high-powered zoom, and with high-powered LED-style light sources. If using a microscope with low-powered zoom, and low-powered lights, you may be frustrated by the difficulty of seeing some characters clearly. However, many such characters are immediately clearer when using a better quality microscope and/or higher powered lights. In some cases, such as body sculpturing and foveae, diffused light can help too. A simple method for diffusing light is to construct a tube of tracing paper, or baking paper, and place this around your specimen while shining the lights onto it.



A simply constructed tube of tracing paper, used to diffuse light from the light sources

Bee collecting

Pinned, dried specimens are the easiest to identify under a microscope. There are many tips online for drying and pinning bees that have been collected using wet techniques. This key relies heavily on mouthparts for family-level identifications. Mouthparts are often hidden under the head when the bee dies. In fresh specimens, immediately after pinning, carefully manipulate the mouthparts so that they become visible (do not try this with dry specimens, however, as they are brittle and parts can break). Some bee researchers choose to kill netted specimens in ethyl acetate killing tubes, as this chemical causes bees to extend their mouthparts as they die.

Photos by Tobias Smith

Using this annotated key

To identify the genus of your Australian bee specimen proceed through the following steps:

1. Determine the sex of your specimen – **Page 13**
2. For female specimens, start on **page 16** for a key to the families/subfamilies. A small number of genera will key out to completion within the families/subfamilies key. Only female specimens will key out with this key.
3. For male specimens, start on **page 27** for a key to the families/subfamilies. This key will also work for female specimens. Male bees do not collect pollen to provision offspring like most female bees, and so lack pollen-carrying structures (scopa). The females key relies on the presence/absence of scopa, and scopal characteristics in the early couplets, and therefore will not work for males.
4. Once the family or subfamily has been determined, proceed to the key to that family/subfamily further in the book to key your specimen to genus.
5. Refer to other resources or reference collections to confirm your generic determination. Some useful resources for helping with this are listed on page 108.
6. Detailed distribution maps can be found at Atlas of Living Australia (ala.org.au), by entering your genus or species. Species numbers presented within this annotated key are from the Australian Faunal Directory (biodiversity.org.au/afd/mainchecklist).
7. This key identifies specimens only to genus level. Most bee genera also have subgenera, however this level of determination is beyond the present scope of this annotated key. For subgenus and species-level identification resources, proceed to the keys listed throughout this annotated key.
8. It is strongly recommended that users of this annotated key have access to a copy of Charles Michener's 2007 *Bees of the World* (citation listed in full on page 108) for detailed explanations of technical terms, detailed information on each group, and for additional keys that may be useful to your identifications.

Overview of Australian bees

Australia is home to about 1630 described bee species (Australian Faunal Directory, 2018), although the true number is higher, as new species are regularly being discovered and numerous recent discoveries remain undescribed. Like bees in many parts of the world, Australia's bees remain understudied. Even for many widespread, common species, little is known about nesting biology, floral diet, responses to landscape change or contributions to agricultural pollination.

Of the seven global bee families, Australia has five, including the endemic Stenotritidae. Within these families, 63 bee genera* occur in Australia (Australian Faunal Directory, 2018). Not only is Australia unique in that we have an endemic bee family, but we are also distinct from the rest of the world in that we have an unusually high proportion of species in the family Colletidae (over half of Australia's described bees are in this family), including an endemic subfamily, the Euryglossinae. Australia's greatest bee diversity areas are found in Mediterranean-like climate regions, while regions like our tropical rainforest areas are relatively less diverse. All broad levels of bee sociality can be found in Australia, from truly solitary species, to communal species, semi-social species, and highly eusocial species. We also have a great diversity of nesting strategies within our species.

Terry Houston's soon to be published book (2018), *A Guide to Native Bees of Australia*, will provide a detailed description of the Australian bee genera, including many subgenera, and will become one of the go-to resources for Australian bees. Existing works covering Australian bee diversity include Michener 1965; 2007, and Batley and Hogendoorn 2009.



Lipotriches

Photo: Tobias Smith

* There is one record of another genus in Australia, *Pseudoapis*, but that record has been identified as a mislabelled specimen, and is believed to have been collected elsewhere (Michener, 2007).

Overview of Australian bees

Bee families, subfamilies, and genera found in Australia

Apidae

Apinae

- *Amegilla*
- *Apis* (I)
- *Austroplebeia*
- *Bombus* (I)
- *Ctenoplectra*
- *Tetragonula*
- *Thyreus*

Nomadinae

- *Nomada*

Xylocopinae

- *Braunsapis*
- *Ceratina*
- *Exoneura*
- *Exoneurella*
- *Xylocopa*

Megachilidae

Lithurginae

- *Austrothurgus*
- *Lithurgus*

Megachilinae

- *Afranthidium* (I)
- *Anthidiellum*
- *Coelioxys*
- *Megachile*

Halictidae

Halictinae

- *Homalictus*
- *Lasioglossum*
- *Patellapis*
- *Seladonia* (I)
- *Sphecodes*

Nomiinae

- *Lipotriches*
- *Mellitidia*
- *Nomia*
- *Reepenia*

Nomioidinae

- *Ceylalictus*

Colletidae

Colletinae

- *Callomelitta*
- *Chrysocolletes*
- *Glossurocolletes*
- *Goniocolletes*
- *Hesperocolletes*
- *Leioproctus*
- *Neopasiphae*
- *Paracolletes*
- *Phenacolletes*
- *Trichocolletes*

Euryglossinae

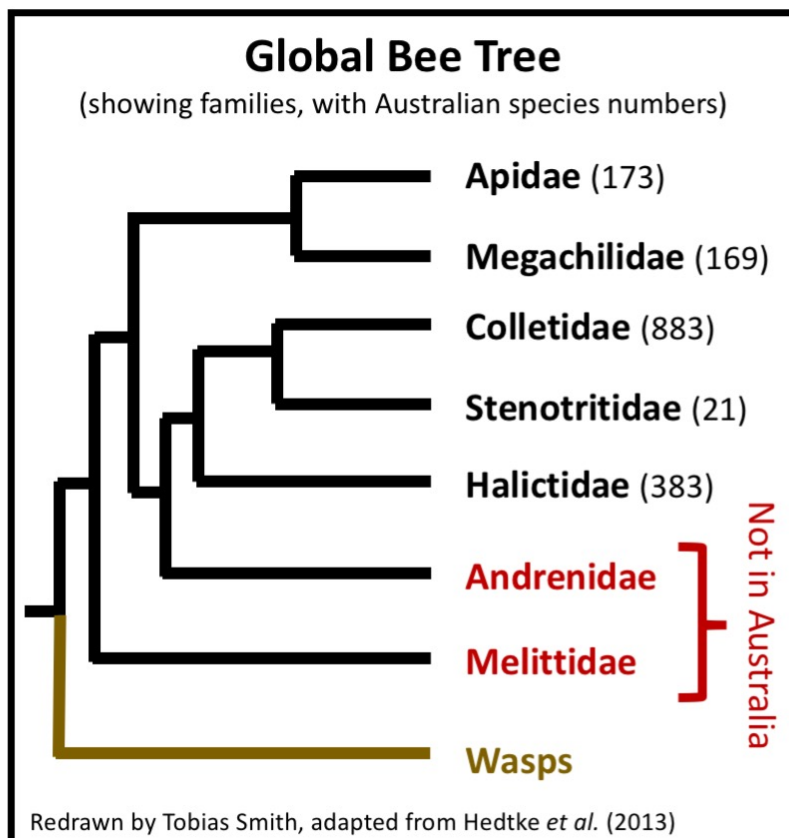
- *Brachyhesma*
- *Callohesma*
- *Dasyhesma*
- *Euhesma*
- *Euryglossa*
- *Euryglossina*
- *Euryglossula*
- *Heterohesma*
- *Hyphesma*
- *Melittosmithia*
- *Pachyprosopis*
- *Sericogaster*
- *Stenohesma*
- *Tumidihesma*
- *Xanthesma*

Hylaeinae

- *Amphylaeus*
- *Hemirhiza*
- *Hylaeus*
- *Hyleoides*
- *Meroglossa*
- *Palaeorhiza*
- *Pharohylaeus*

Stenotritidae

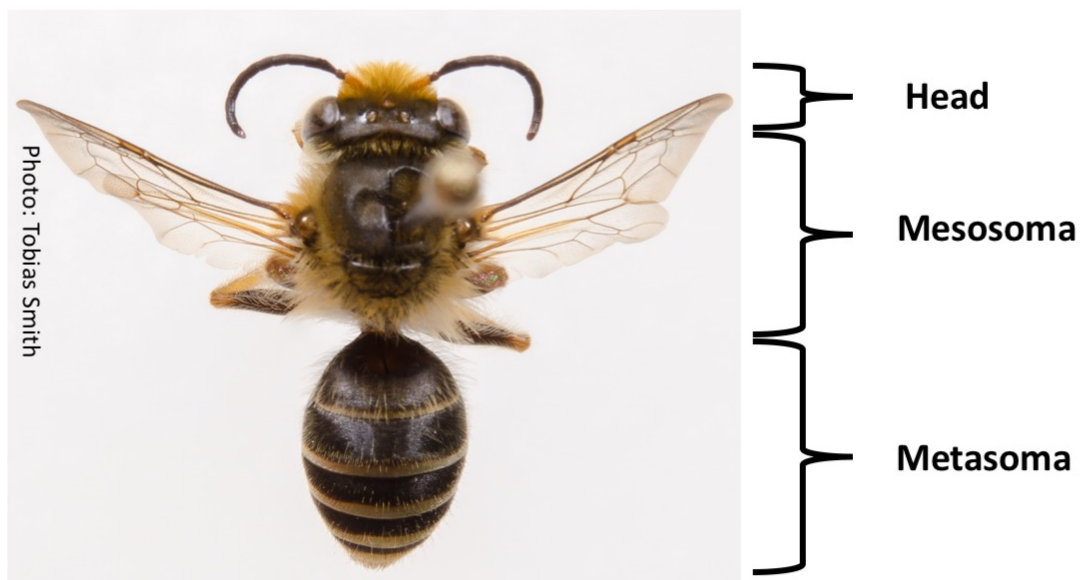
- *Ctenocolletes*
- *Stenotritus*



(I) = Introduced

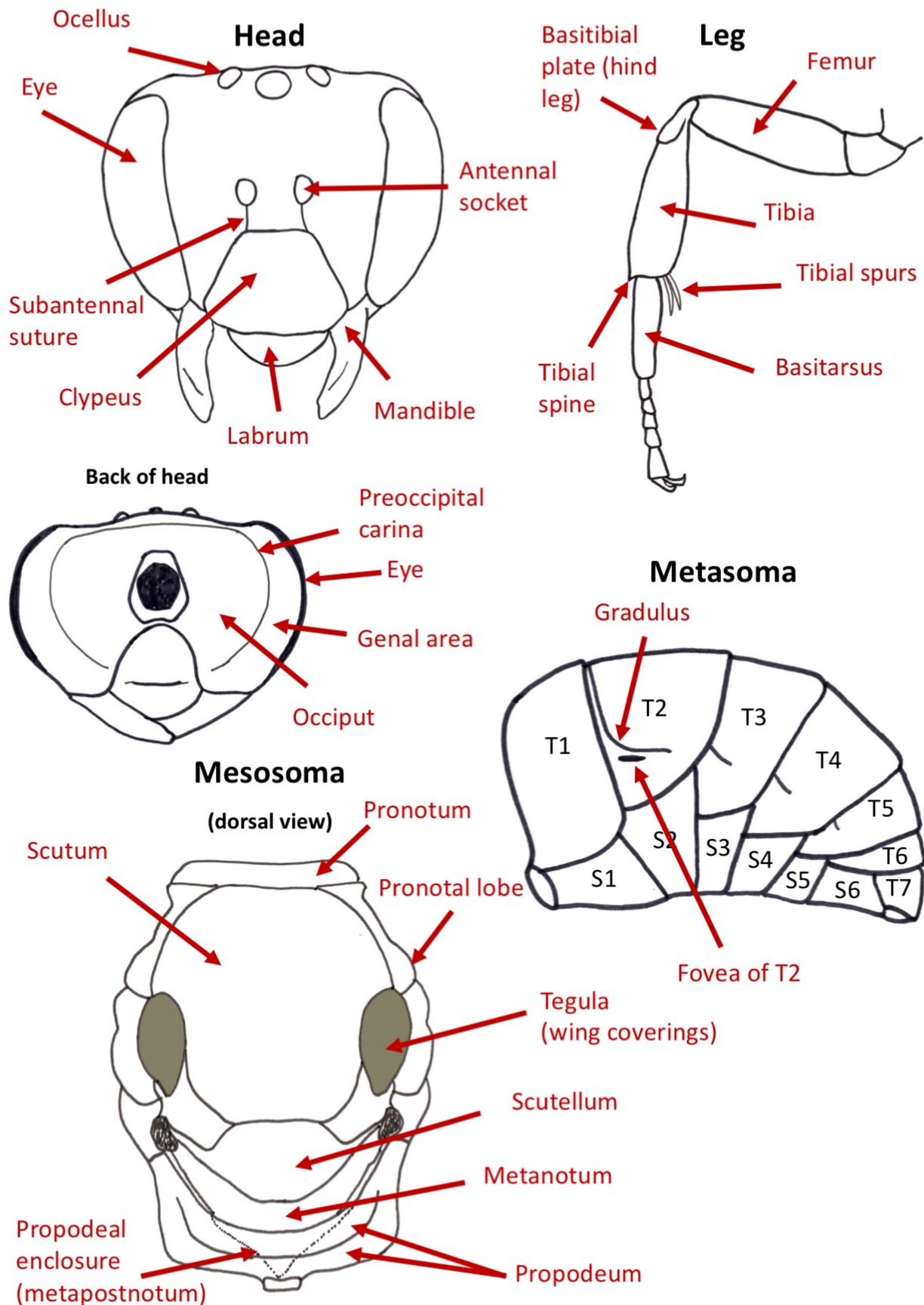
Bee Anatomy and Terminology

This annotated key should not need much reference to anatomical images outside of those presented on the page of each couplet. However, being familiar with bee anatomy and the specialist terms associated with it is important, particularly as you move on to other non-annotated keys beyond this one. To get the most out of this annotated key, it should be used in conjunction with the full anatomical descriptions in Michener 2007. Below are the basics of bee anatomy that are needed before embarking on this key. On the following pages are anatomical diagrams that are presented repeatedly, in part, throughout this annotated key.



With bees (and wasps and ants) we use the terms **mesosoma** and **metasoma**, rather than the thorax and abdomen as we do in other insects. This is because the first abdominal segment, the propodeum, is fused with the thorax in bees. Therefore, the thorax plus the fused propodeum becomes the mesosoma, and what is left of the abdomen is referred to as the metasoma. The mesosoma and metasoma are distinct from one another because of a constriction between them. An easy way to remember the order of these terms is that 'S' (in mesosoma) comes before 'T' (in metasoma) in the alphabet.

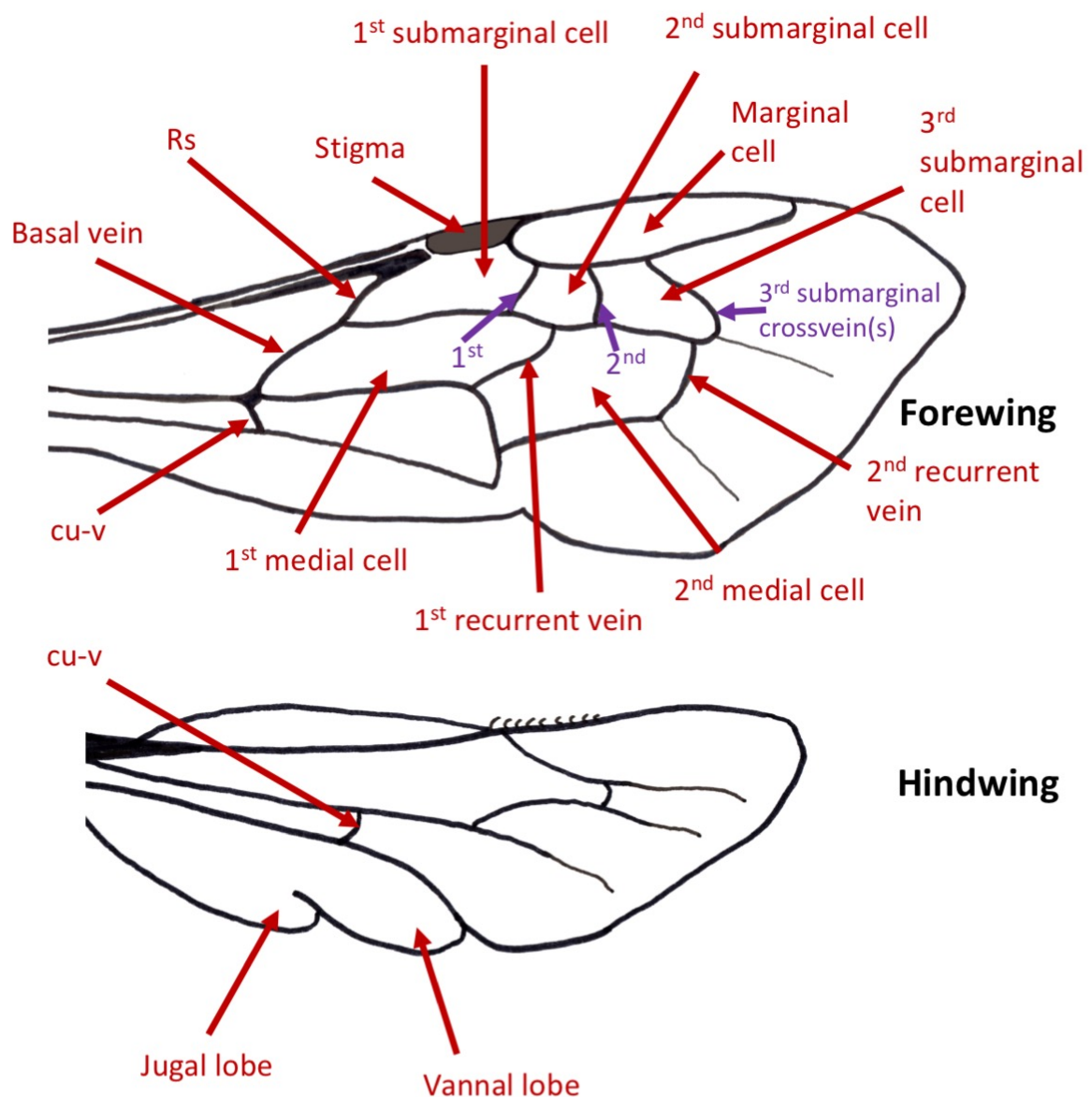
Bee Anatomy and Terminology



Line drawings by Tobias Smith (back of head & mesosoma based on diagrams by E.R.S. Hodges in Michener, McGinley & Danforth, 1994, metasoma based on diagram in Michener 2007)

Bee Anatomy and Terminology

Bees have two pairs of wings, the forewings and the hindwings. The cells and veins in the wings are frequently used as distinguishing characters in bee identification keys. Bee wings are often referred to with unique bee cell and vein names, but they are sometimes also referred to by standard insect wing vein and cell terminology. Highlighted below are some cell and vein terms, and others are highlighted on relevant pages on which terms are mentioned. For simplicity, the wing terminology used in this annotated key follows Michener 2007. There is, however, a movement in bee taxonomy to revert to standard insect wing terminology for bees.



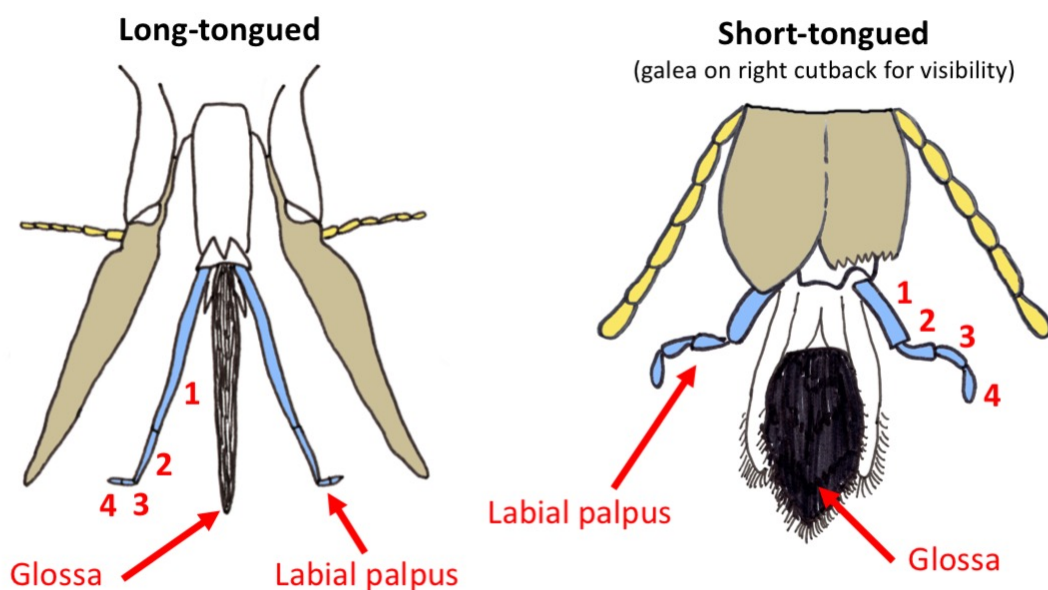
Note: For illustrations and detailed explanations of all anatomical terms see Michener 2007.

Line drawings by Tobias Smith (hind based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994)

Mouthparts can be tricky

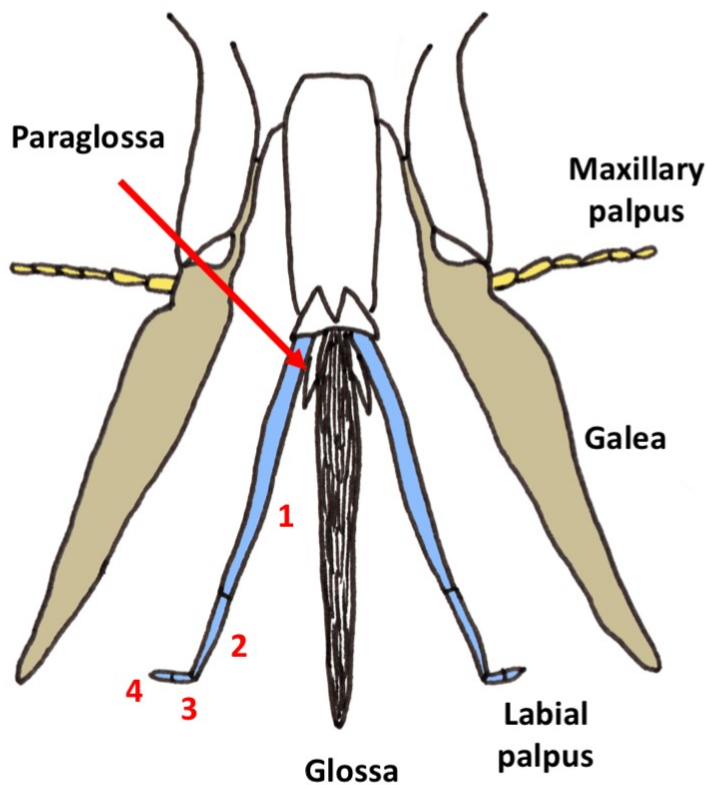
The family keys in this book rely on mouthpart characters in some couplets. Bee families are separated into two broad groups, the **short-tongued bees** and the **long-tongued bees**. These names reflect the relative lengths of the labial palpus, and to a lesser extent also the length of the glossa. In long-tongued bees the first two segments of the labial palpus are elongate, relative to the final two, and in short-tongued bees all segments are relatively similarly short. In the long-tongued bees the glossa is usually (but not always) relatively long, and in the short-tongued bees the glossa is usually (but not always) relatively short. The glossa is like a sponge, and it soaks up nectar when pushed out into the flower. In the long-tongued bees, the elongate labial palpus sit snugly along the sides of the glossa (in living bees), which, with the galea, form a sheath through which the glossa moves in and out like a pipe cleaner emerging from a drinking straw.

Unfortunately mouthparts are one of the more tricky parts to observe when inexperienced. Often when bees die their mouthparts are folded back under the head, and are obstructed from view by the mandibles. Even when mouthparts are visible, recognising key characters can be tricky without experience. Without good mouthpart visibility and high-powered magnification and light, these details are hard to see in most small- and medium-sized bees. With experience you will eventually be able to recognise the family that specimens belong to based on other characters, but to begin with you may be frustrated with some specimens in which mouthparts are hidden. If you have a number of specimens, and have sorted them to morphospecies first, you may be lucky and have some specimens of each morphospecies that have visible mouthparts. For tips on making mouthparts visible in fresh specimens see page 2.

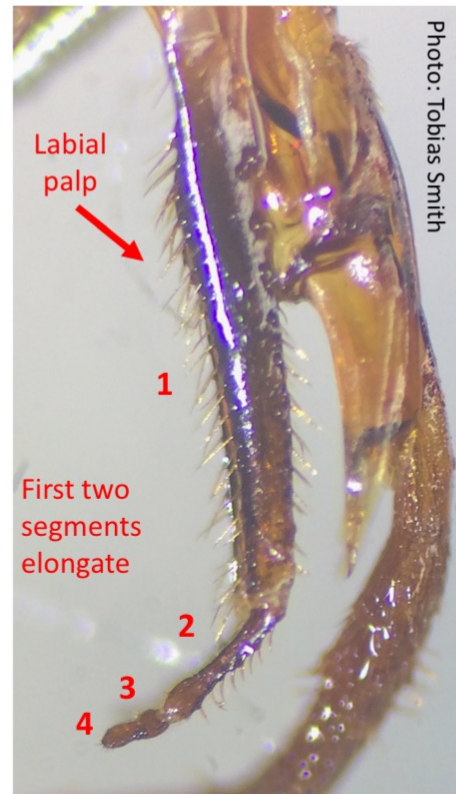


Line drawings by Tobias Smith (based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994 (left) and diagram in Michener 2007 (right))

Long-tongued



Note: This is a large bee. In many specimens, the labial palpus will be much smaller, appearing less robust.



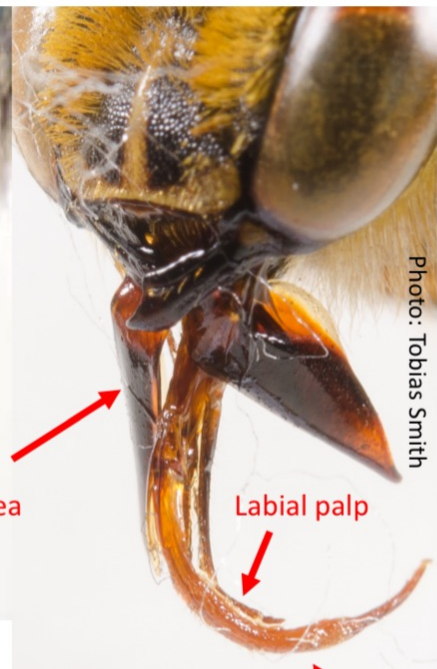
Note: In long-tongued bee specimens the galea are often close together and sheathed down over the labial palpus and glossa, making it tricky to see the segmentation of the labial palpus. In both long- and short-tongued bee specimens, dried nectar can stick the mouthparts to one another too, making it harder to identify each part clearly.



Photo: PaDIL - Caroline Harding



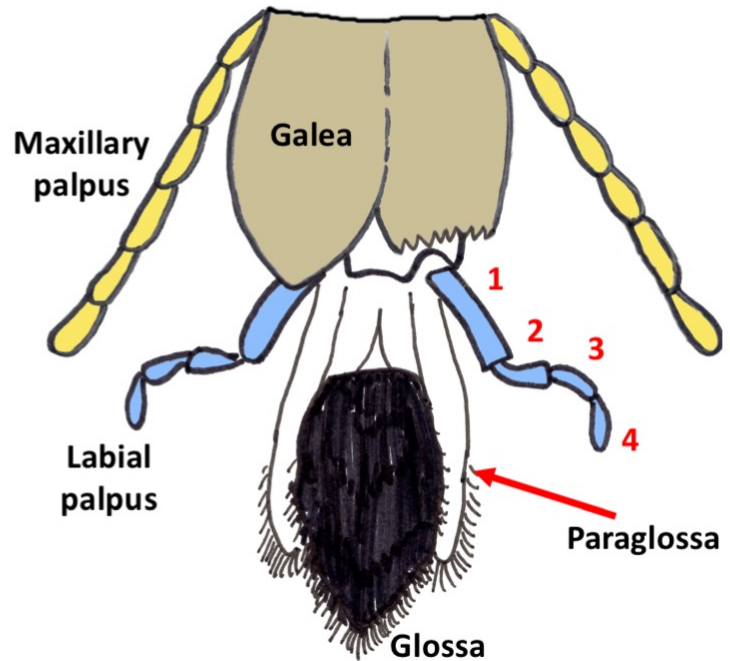
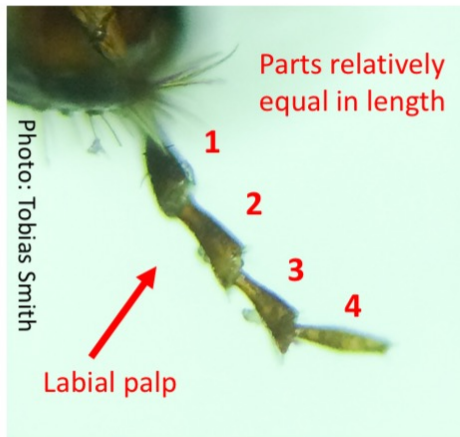
Glossa sheathed by labial palpus



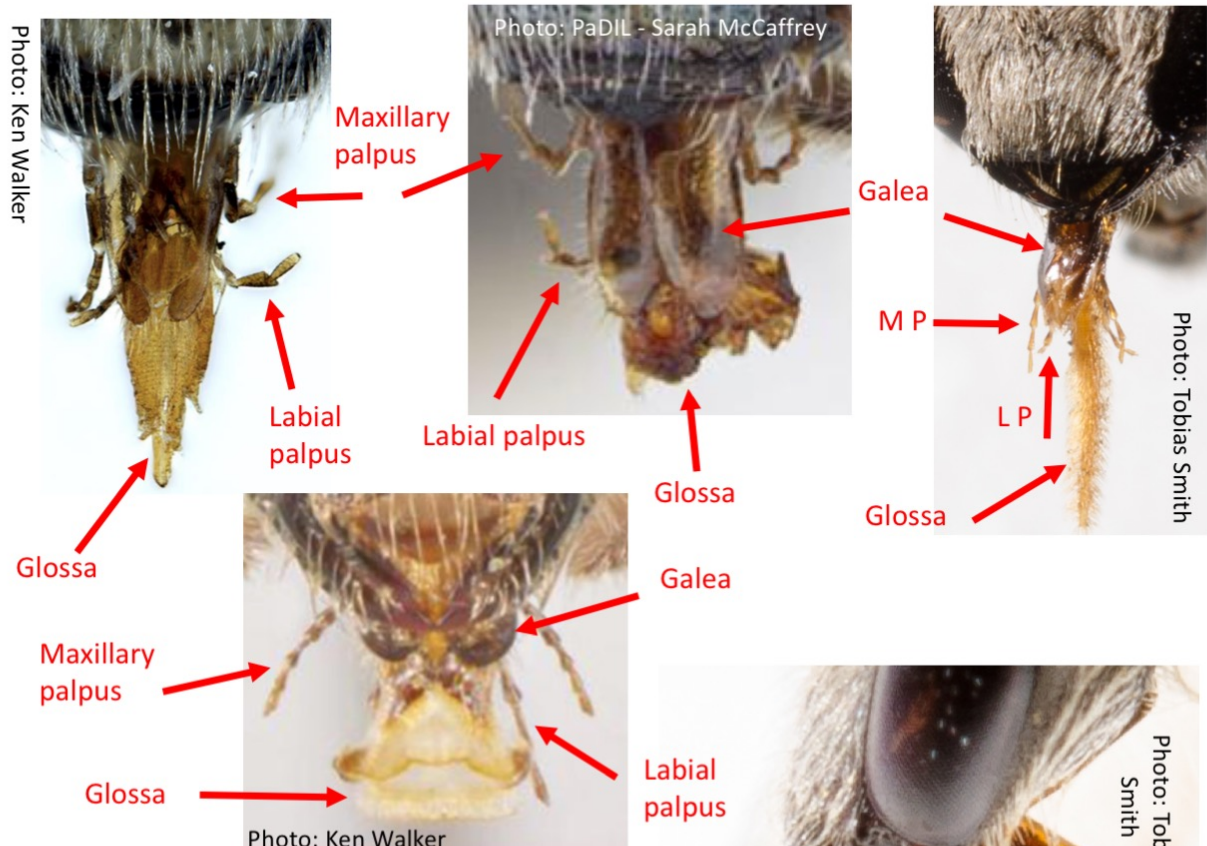
Glossa

Line drawing by Tobias Smith (based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994)

Short-tongued

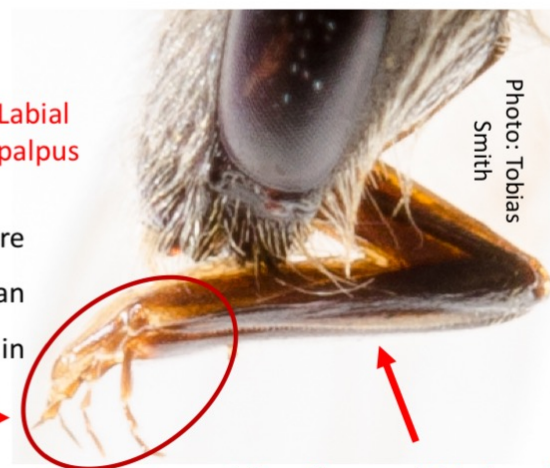


Note: Find at least one of the labial palps, being careful not to mistake one of the maxillary palps with it, and check the relative lengths of each of the four parts. If they are all fairly similar (although the first is sometimes a little longer than the rest), it is a short-tongued bee.



Note: Short-tongued bees have mouthparts that are hinged basally, and fold back under the head and can extend out (this is most commonly observed in Halictidae).

Glossa, labial palpus, galea, maxillary palpus



Hinged, extendable 'arm'

Line drawing by Tobias Smith (based on diagram in Michener 2007)

Bee or wasp?

It can sometimes be tricky to know if a specimen is a bee or in fact a wasp. Many bees, such as the hylaeine and euryglossine bees, can look similar to wasps, and so can easily be mistaken for wasps, or vice versa. There is, however, one character that separates all bees from all wasps: the presence of branched or plumose hairs in bees, which are absent in wasps. Wasps have only simple hairs on their bodies. In many bees it can be very easy to find some branched hairs (such as scopal hairs), however, in some relatively hairless species it can be difficult. In relatively hairless bees, the best place to look for branched hairs is on the pronotal lobes, or the propodeum. Keep in mind that on some relatively hairless bees, hairs may be tiny, and their branches may be even more tiny, so it is not always easy to determine a branched hair from a simple hair. You will need a microscope with a high-powered zoom in such cases.

Examples of branched or plumose hairs



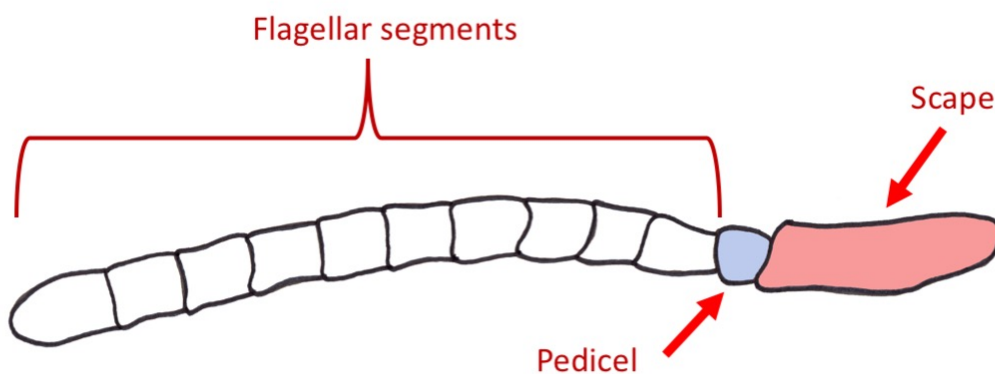
Unfortunately, apart from the presence of branched hairs, there are no easy, generalisable rules for identifying all bees from all wasps. Some wasps have an obviously sharp, pointy end of the metasoma, but so too do a few bees. Some wasps have strong indentation on the inner margin of the eyes, adjacent to the antennal socket, but a small number of bees also have such indentation (although this is much less pronounced in such bees). In one group of wasps, the vespids, the forewing is folded along its entire length. Such a trait is not seen in any bees.

As you gain more experience you will become more familiar with bee body forms, and the telltale signs of various wasp groups, and become more adept at sorting a bee from a wasp at first glance.

Female or male?

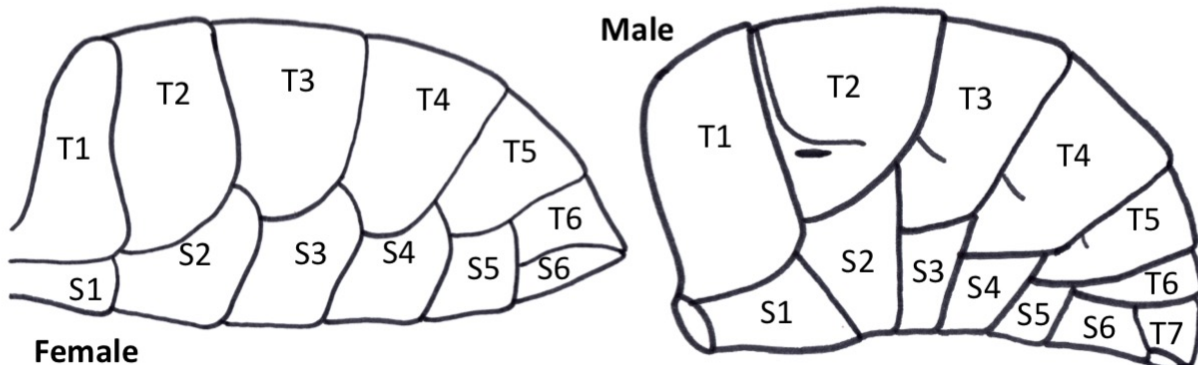
Determining the sex of your specimen is the first step to identifying the genus using this key, as females and males of the same species are often dissimilar in a number of characteristics, and are therefore dealt with separately in parts of this key. The quickest way to determine sex is to look to see if your specimen has a protruding sting. If you see a sting, it is a female, as male bees do not possess a sting. However, many female specimens die with their stings not protruding from the metasoma. So, in addition to the presence of a sting, there are two easy methods of determining the sex of bee specimens: **1)** the number of antennal segments, and **2)** the number of metasomal segments.

Antennal segments. Count the total number of antennal segments, including the scape and pedicel. Female bees have **12** segments, and males have **13** segments.



Note: One Australian bee subgenus, *Euryglossina* (*Quasihesma*) (the smallest bees in the world, see page 60), Colletidae, has some species with one less antennal segment than the usual number. These *Euryglossina* (*Quasihesma*) females have 11 antennal segments, and males have 12.

Metasomal segments. Count the total number of metasomal segments. These are pairs of terga (top) and sterna (bottom). Female bees have **6** segments, and males have **7** visible terga, and two extra sterna (S7 and S8) that are hidden internally.



Line drawings by Tobias Smith (metasomas based on diagrams in Michener 2007)



The Keys

This book is divided into a series of individual annotated keys: the first two for family-level identifications, and then the subsequent keys for genus-level identifications. These are binary keys, in which each couplet gives two possible outcomes, and the user chooses one path based on the character states listed in the descriptions for each. As each key is a process of elimination, characters are not necessarily unique to the groups for which they are useful in individual couplets. For example, a character that separates two genera from one another in couplet 7 is not necessarily useful for separating out the same genus from all the previous genera. Rather it is useful in couplet 7 because any other genera that may share the character have already been eliminated in earlier couplets using other characters.

Each couplet in the keys appears in the following format:

The diagram illustrates the format of a key couplet. It features a yellow rectangular box containing the text of a couplet. Above the box, three red arrows point to specific parts of the header: 'Which key' points to 'Halictidae', 'Couplet number' points to 'Couplet 3', and 'Number of the couplet that leads to the present couplet' points to '(2)'. Inside the yellow box, there are two bullet points. The first bullet point describes a 'Metanotum with protrusion in the middle' and lists '... *Mellitidia*' as an example. The second bullet point describes a 'Metanotum without protrusion in the middle' and lists '... 4' as an example. Red circles highlight the text '... *Mellitidia*' and '... 4'. A red arrow points from the text 'Proceed on to this couplet' to the '... 4' example. Another red arrow points from the text 'A determination has been reached. See the associated box on the page for more information. Also search this genus in the other resources listed on page 108.' to the '... *Mellitidia*' example.

Which key Couplet number Number of the couplet that leads to the present couplet

Halictidae – Couplet 3 (2)

- ❖ Metanotum with protrusion in the middle; black hairless patches resembling a goat footprint on mesosoma; patches of orange hair on head, mesosoma, and metasoma
... *Mellitidia*
- ❖ Metanotum without protrusion in the middle; no black hairless patches resembling a goat footprint on mesosoma; orange hair patches not present on all body parts
... 4

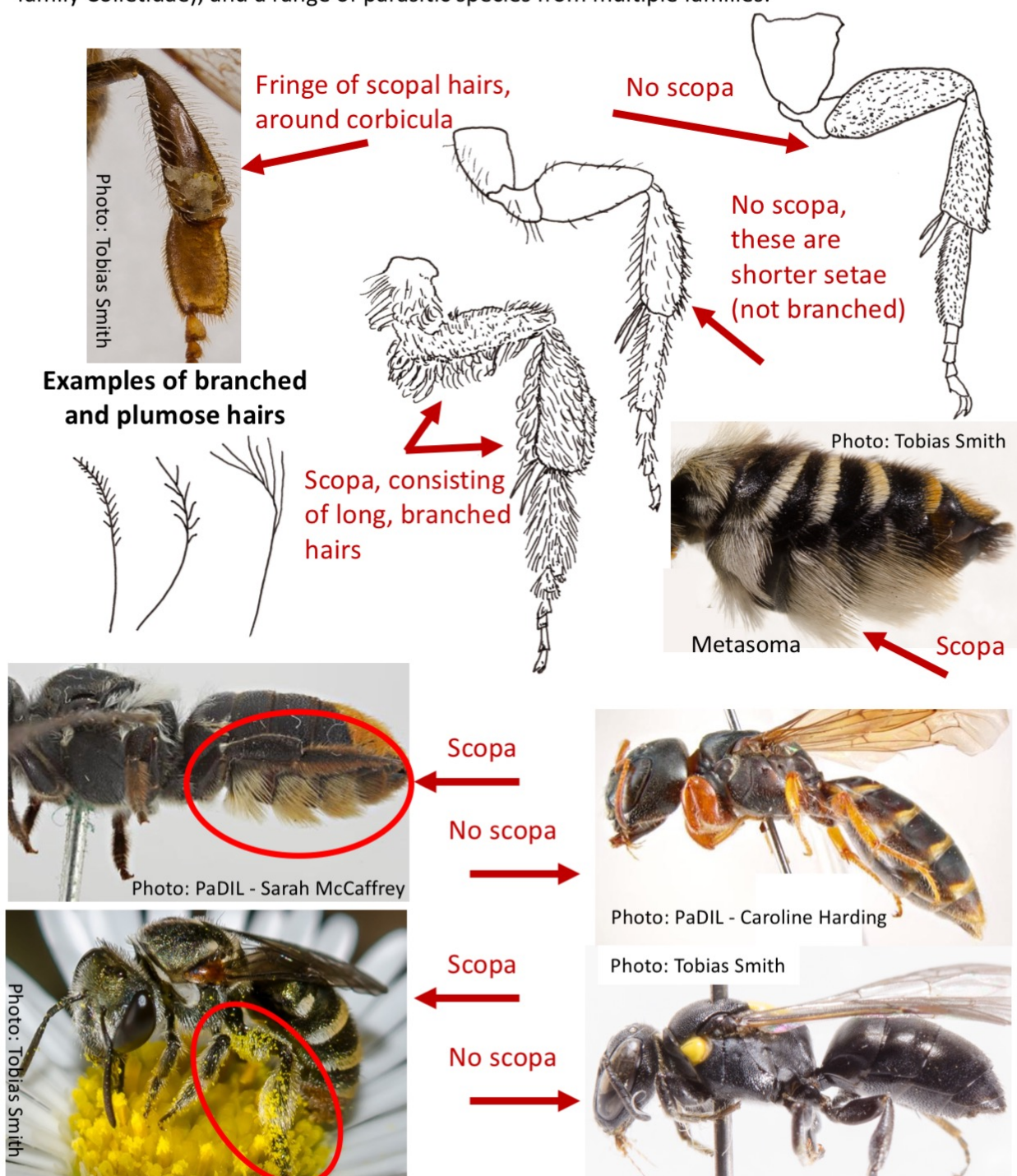
Proceed on to this couplet

A determination has been reached. See the associated box on the page for more information. Also search this genus in the other resources listed on **page 108**.

Family/Subfamily (Females) – Couplet 1

- ❖ Scopa, consisting of hairs for carrying pollen, present on female ... 2
- ❖ Scopa absent on female ... 6

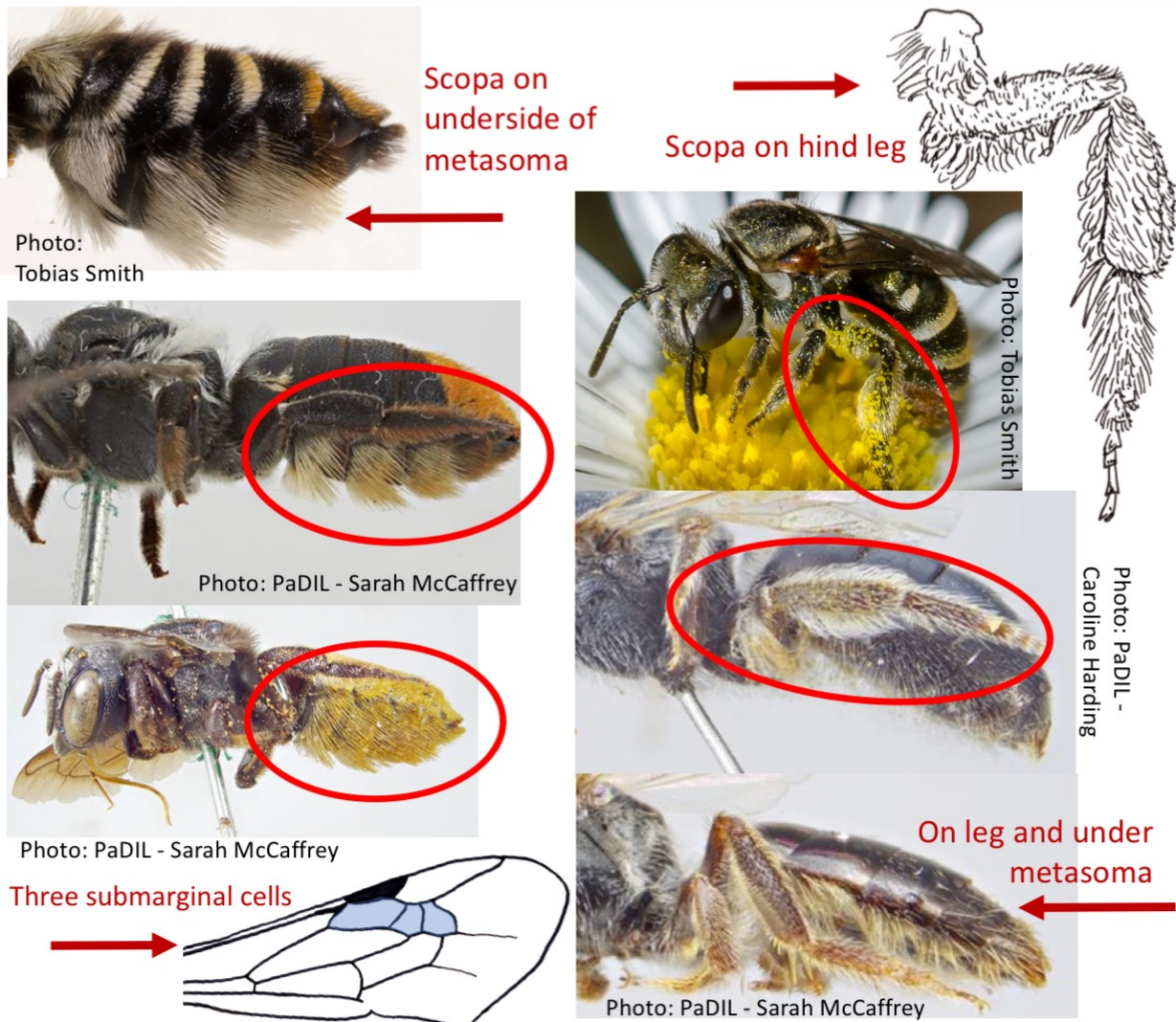
Scopa (plural scopae) are dense clusters of branched or plumose (or sometimes simple) hairs on the bodies of some female bees that are used for carrying pollen back to the nest. Scopa are found on various parts of the hind leg, and/or the underside of the metasoma. In some genera, scopal hairs are seen only as a fringe around the corbicula (modified, flattened hind tibia). Female bees in our region that do not have scopa are the Hyleainae and Euryglossinae (both family Colletidae), and a range of parasitic species from multiple families.



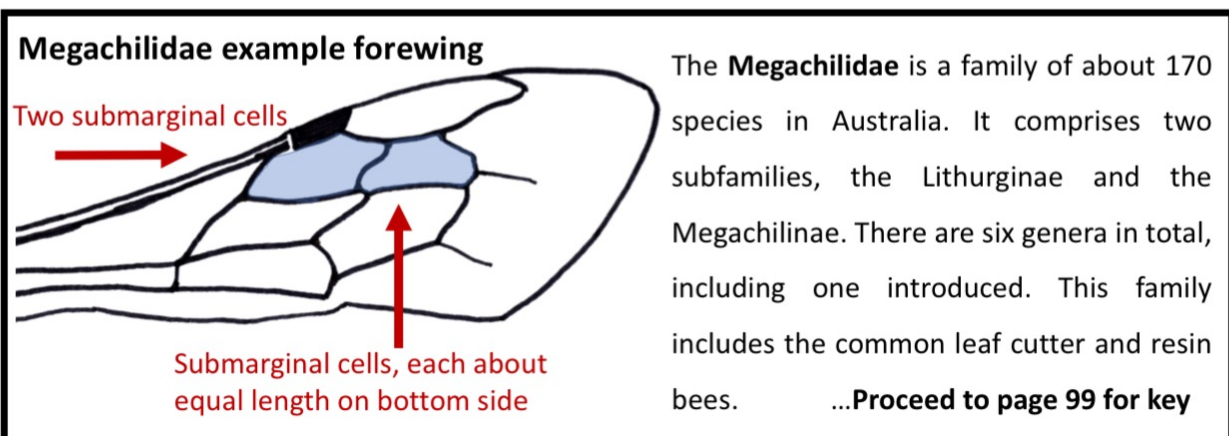
Line drawings by Tobias Smith (based on diagrams in Michener 2007)

Family/Subfamily (Females) – Couplet 2 (1)

- ❖ Scopa well developed on underside of metasoma, consisting of rows of simple, stiff hairs (two submarginal cells in forewing, usually about equal in length)
... **Megachilidae** (page 99)
- ❖ Scopa on hind legs, sometimes also on underside of metasoma (if with scopa also on underside of metasoma, then also with forewing with three submarginal cells, except in *Ctenoplectra* – page 39)
... **3**



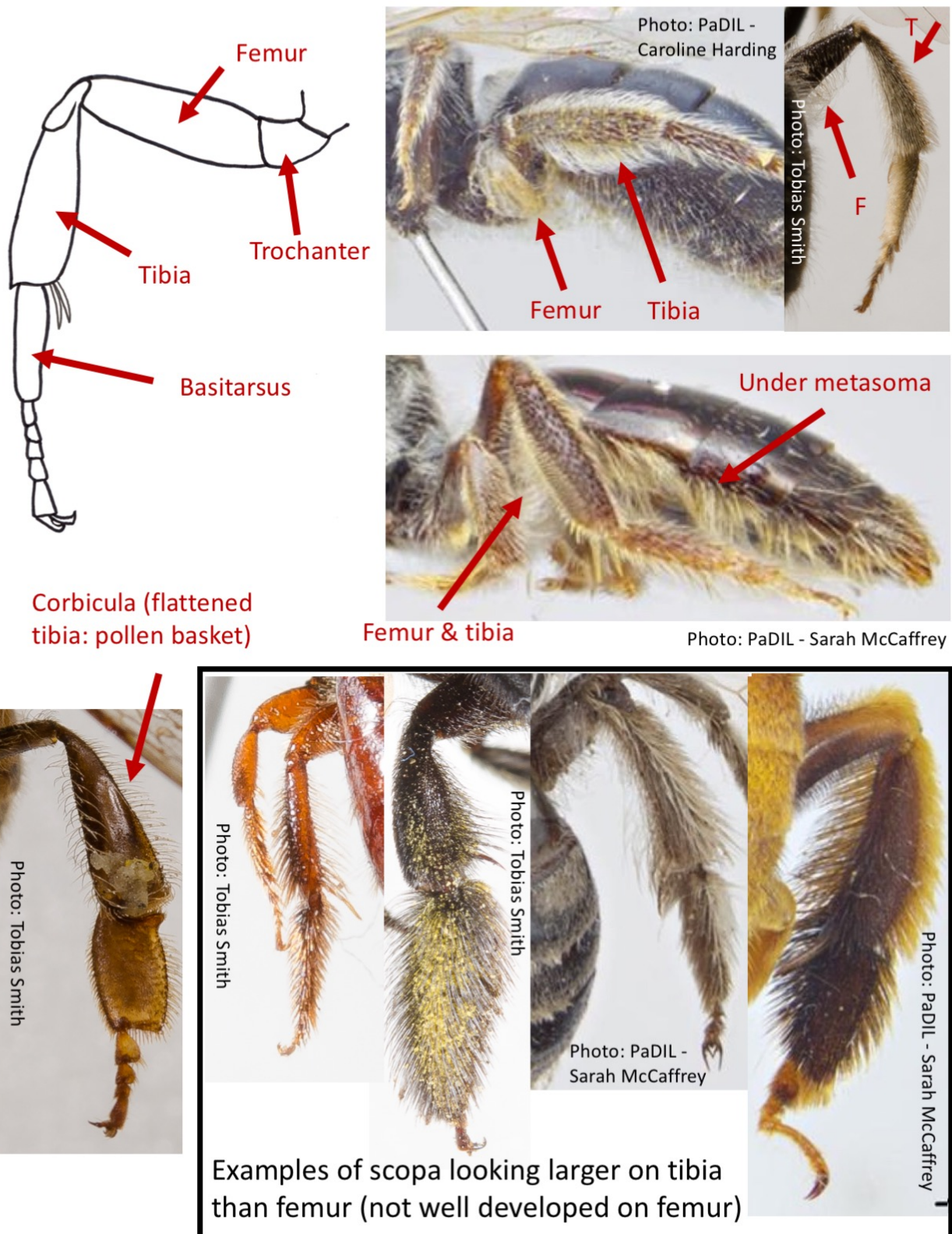
Note: While two submarginal cells is a character of the Megachilidae, it is not unique to this group and is seen in a range of other bee groups.



Line drawings by Tobias Smith (based on diagrams in Michener (2007 scopa and 1965 wings))

Family/Subfamily (Females) – Couplet 3 (2)

- ❖ Scopa (sometimes as tibial corbicula) on hind tibia & usually basitarsus, elsewhere not well developed, tibial scopa thus looking considerably larger than that of femur ... 4
- ❖ Scopa on hind femur, scopal hairs usually also present on trochanter, tibia, and basitarsus and sometimes on metasomal sterna ... 5



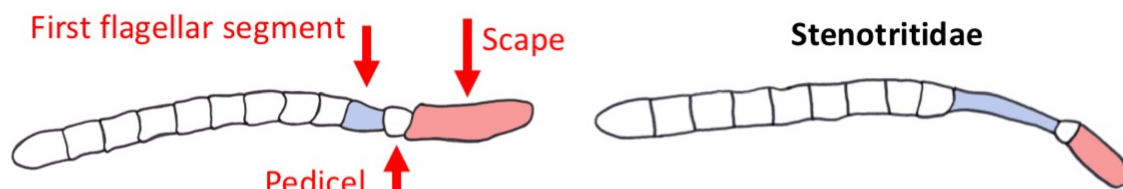
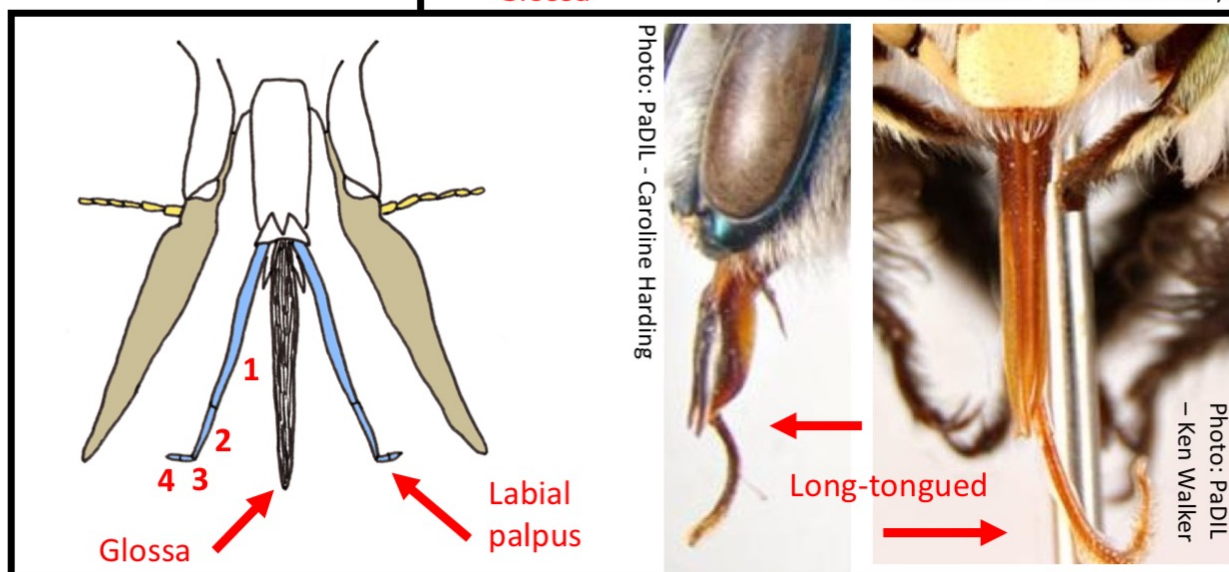
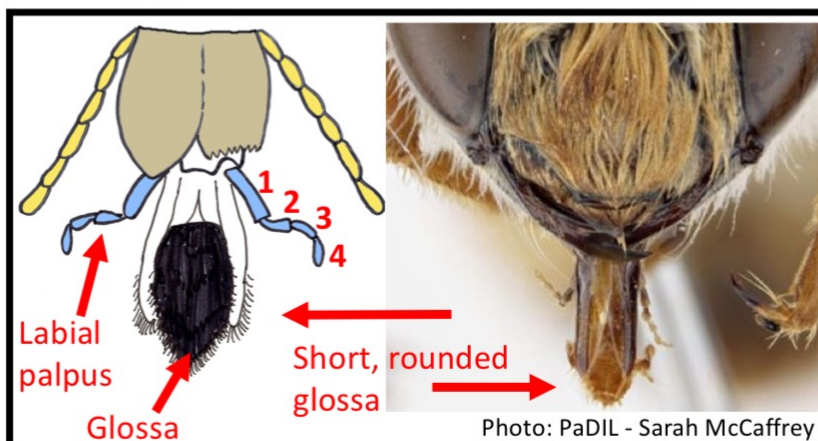
Line drawing by Tobias Smith

Family/Subfamily (Females) – Couplet 4 (3)

- ❖ Glossa short, apex broadly rounded, first two segments of labial palpus not elongate; first flagellar segment longer than scape on antennae ... **Stenotritidae** (page 105)
- ❖ Long-tongued bees, first two segments of labial palpus elongate, flattened (except labial palpus not elongate in *Ctenoplectra*. Large blue bees, see page 39); first flagellar segment not longer than scape on antennae ... **Apidae** (page 33)

The **glossa** and **labial palpus** are mouth parts. These are sometimes difficult to see in dried specimens as they may be folded backwards, under the head. In these cases, try looking at your specimen upside down.

See pages 9–11 for more information on mouthparts



The **Stenotritidae** is a small family of about 21 species, endemic to Australia. The family consists of two genera: *Ctenocolletes* and *Stenotritus*. All species in this family are ground nesting bees.
...Proceed to page 105 for key

The **Apidae** is a family of about 173 species in Australia. Australia has three subfamilies, and 13 genera. The family includes both above- and below-ground nesting species.

...Proceed to page 33 for key

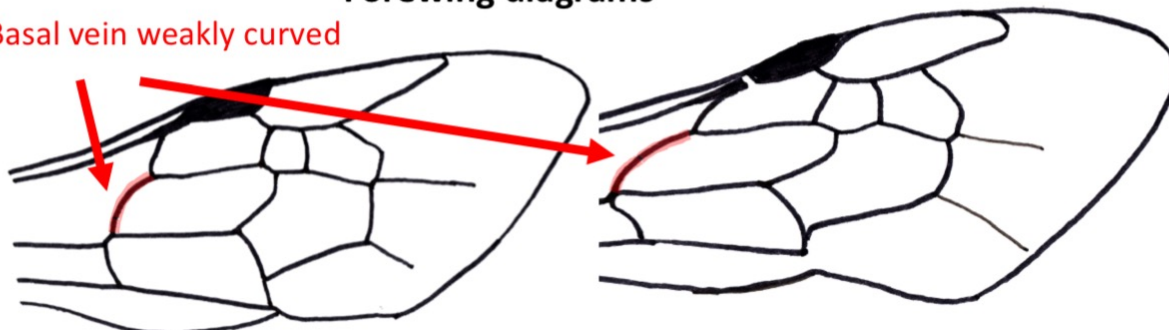
Line drawings by Tobias Smith (mouthparts based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994 (long tongue) and diagram in Michener 2007 (short tongue))

Family/Subfamily (Females) – Couplet 5 (3)

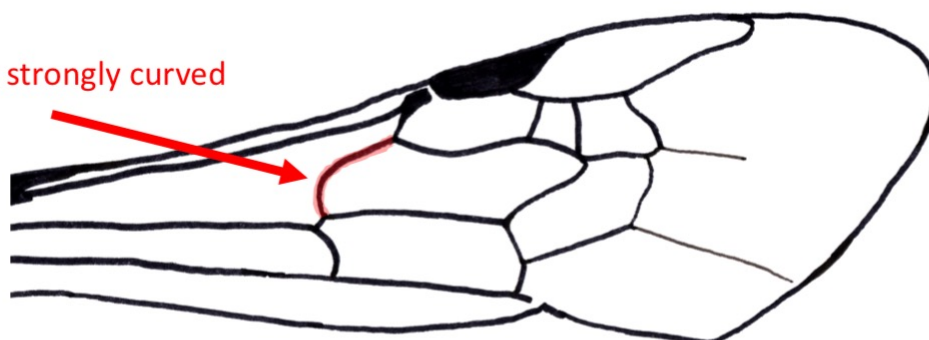
- ❖ Basal vein only weakly curved; glossa bilobed ... **Colletinae (Colletidae)** (page 48)
- ❖ Basal vein strongly curved; glossa acutely pointed ... **Halictidae** (page 87)

Forewing diagrams

Basal vein weakly curved

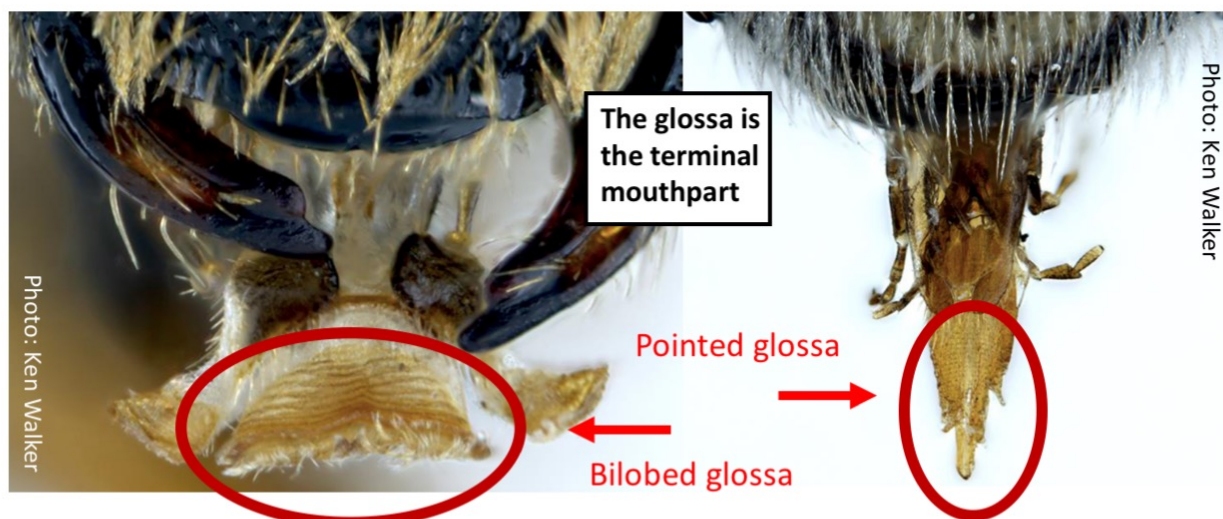


Basal vein strongly curved



*A strongly curved basal vein is characteristic of the family Halictidae

See pages 9–11 for more information on mouthparts



*A bilobed glossa is characteristic of the family Colletidae

The **Colletinae** is a subfamily within the family Colletidae. The subfamily has 10 genera, with about 277 species. The Colletinae are ground nesting bees. ...**Proceed to page 48 for key**

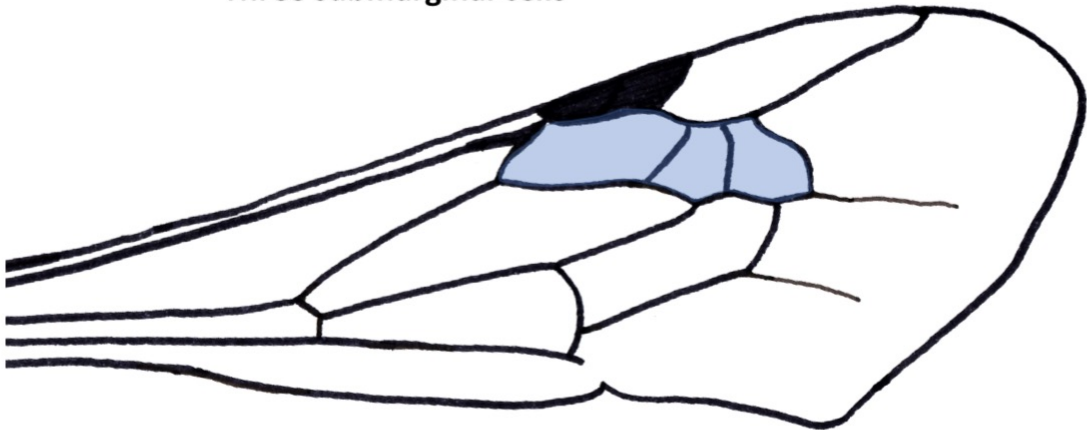
The family **Halictidae** is the second largest of the Australian bee families, with approximately 383 described species. ...**Proceed to page 87 for key**

Line drawings by Tobias Smith (based on diagrams in Michener 1965)

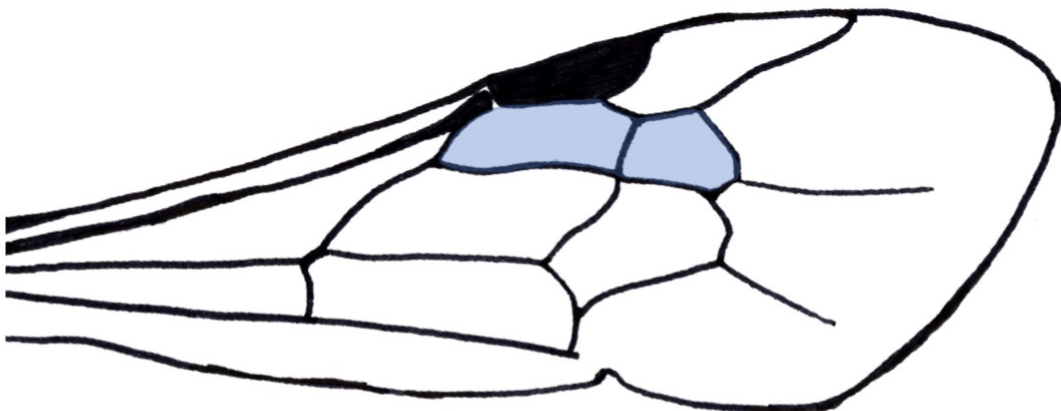
Family/Subfamily (Females) – Couplet 6 (1)

- ❖ Forewings with three submarginal cells ...7
- ❖ Forewings with two submarginal cells ...9

Three submarginal cells



Two submarginal cells



Family/Subfamily (Females) – Couplet 7 (6)

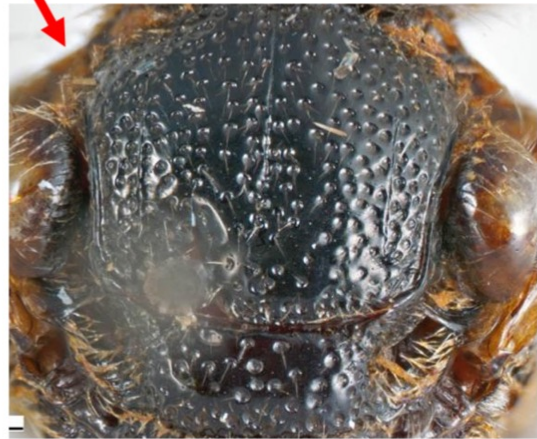
- ❖ Black bees with white or iridescent blue patches of hair on all body parts;
mesosoma not coarsely pitted ... ***Thyreus*** (page 37)
- ❖ Not as above; mesosoma coarsely pitted ... **8**

Coarsely pitted mesosoma

Photo: PaDL - Sarah McCaffrey



Photo: PaDL - Ken Walker



Thyreus nitidulus nitidulus



Photo: PaDL - Caroline Harding

Thyreus lugubris



Photo: PaDL - Caroline Harding

Thyreus waroonensis



Photo: PaDL - Caroline Harding

Thyreus caeruleopunctatus



Photo: PaDL - Caroline Harding

The genus ***Thyreus***, family Apidae, is represented in Australia by 5–10 species.
Thyreus species are nest parasites of *Amegilla*.

Family/Subfamily (Females) – Couplet 8 (7)

❖ Basal vein strongly curved

...*Sphecodes* (page 96)

❖ Basal vein almost straight

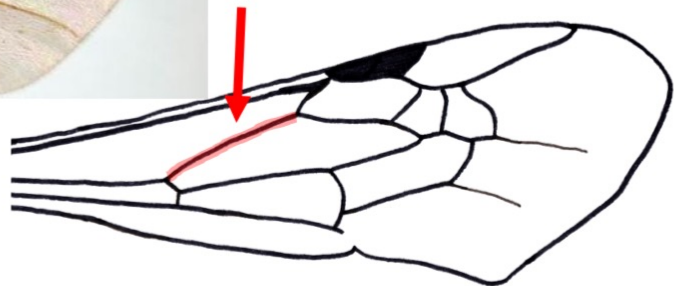
...*Nomada* (page 36)

Basal vein strongly curved



Photo: PaDIL – Ken Walker

Basal vein almost straight



The genus *Sphecodes*, family Halictidae (subfamily Halictinae), is represented in Australia by two species. These bees are nest parasites of other Halictine bees. *Sphecodes* is only known from Queensland in our region.

Sphecodes (Sphecodes) profugus



Photo: PaDIL – Ken Walker

Sphecodes (Callosphecodes) manskii



Photo: PaDIL -
Claus Rasmussen &
Charles Michener



Photo: PaDIL - Sarah McCaffrey

♀

The genus *Nomada*, family Apidae, is represented in Australia by two species. The example here is *Nomada australensis*. *Nomada* is known only from QLD, and are thought to be nest parasites of *Lasioglossum* or some other small bees.



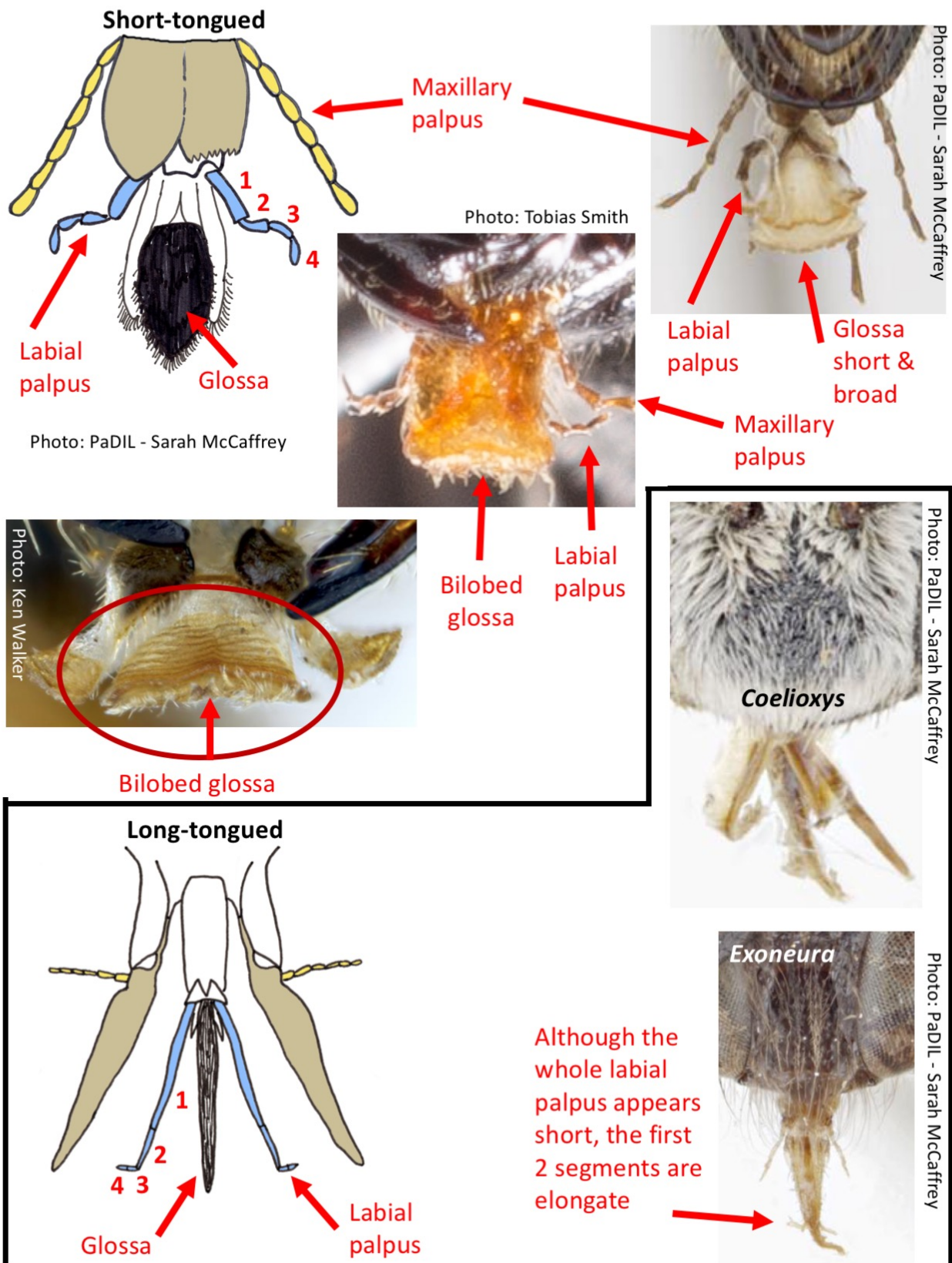
Photo: PaDIL - Sarah McCaffrey

Line drawing by Tobias Smith (based on diagram in Michener 1965)

Family/Subfamily (Females) – Couplet 9 (6)

- ❖ Short-tongued bees, glossa bilobed or short and broad, labial palpus with the four segments similar to one another ...10
- ❖ Long-tongued bees, first two segments of labial palpus elongate, flattened ...11

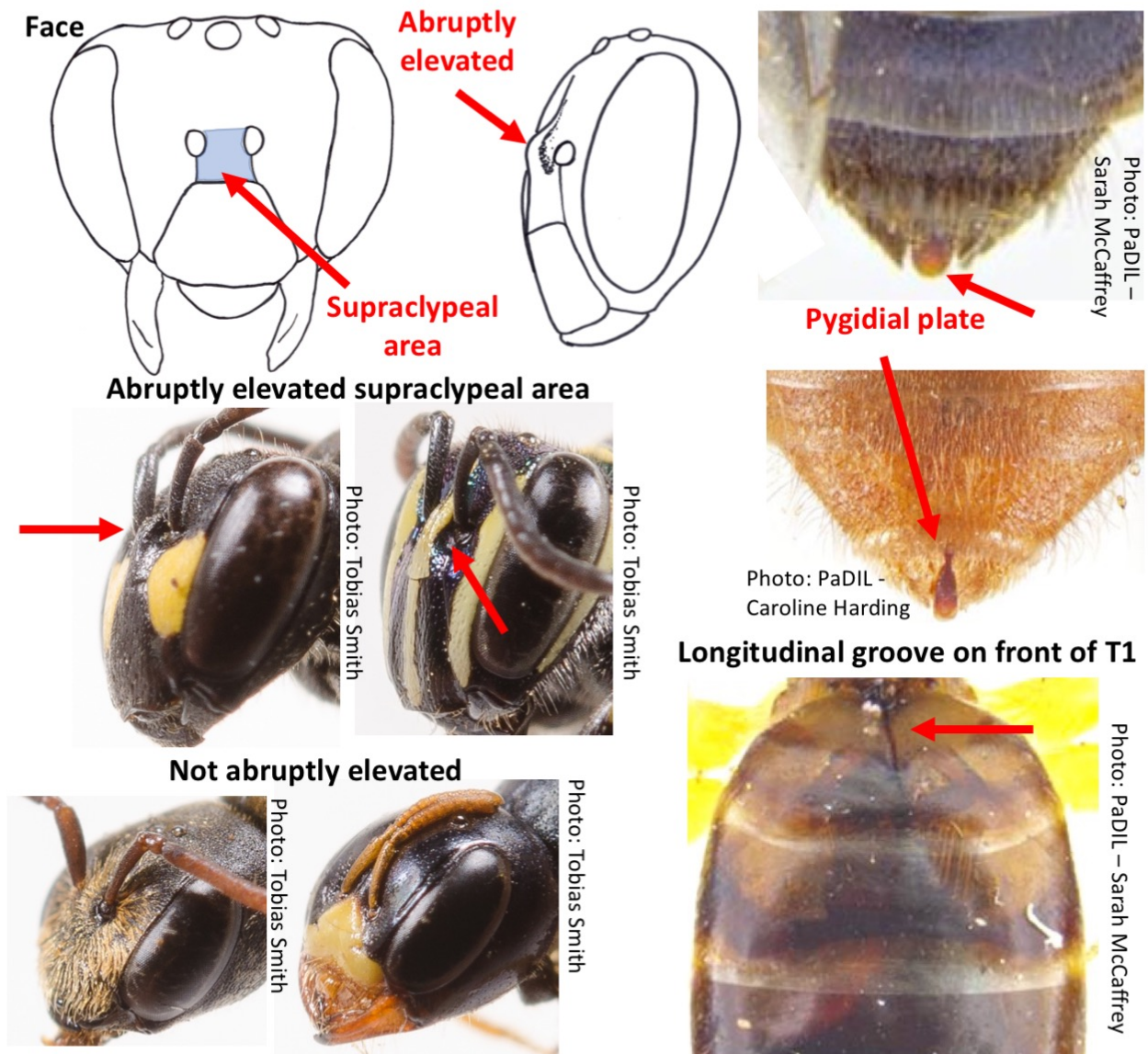
See pages 9–11 for more information on mouthparts



Line drawings by Tobias Smith (based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994 (long tongue) and diagram in Michener 2007 (short tongue))

Family/Subfamily (Females) – Couplet 10 (9)

- ❖ Supraclypeal area elevated abruptly above level of antennal sockets; pygidial plate usually absent, but *if* present, then broad, its margins converging posteriorly (except in some *Hyleoides*, page 74); front surface of T1 usually lacking longitudinal median groove or ridge
...Hylaeinae (Colletidae) (page 73)
- ❖ Supraclypeal area sloping up from level of antennal sockets; pygidial plate present, the apical part slender, parallel-sided or spatulate; front surface of T1 with longitudinal median groove or ridge
...Euryglossinae (Colletidae) (page 57)



The subfamily **Hylaeinae**, family Colletidae, consists of seven genera. These bees carry their pollen internally, in the crop. Most species are above-ground nesting bees.

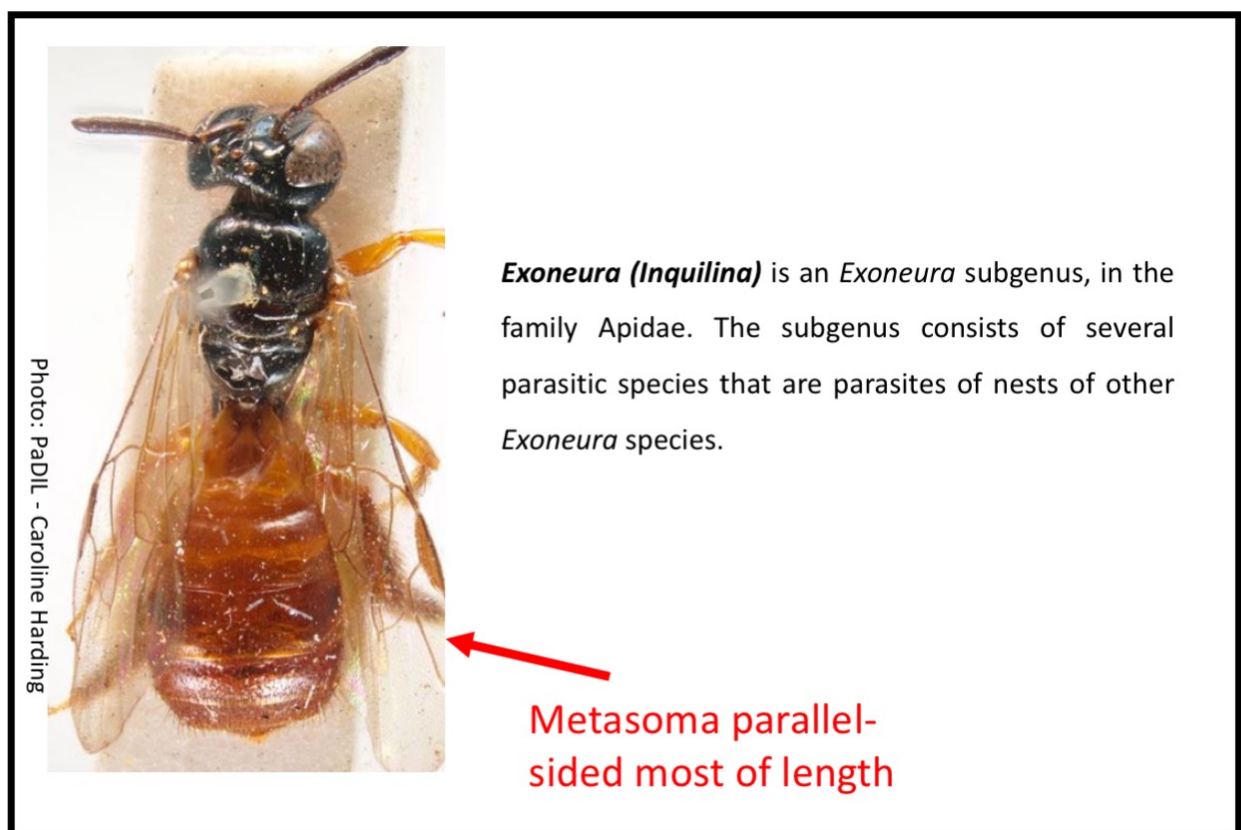
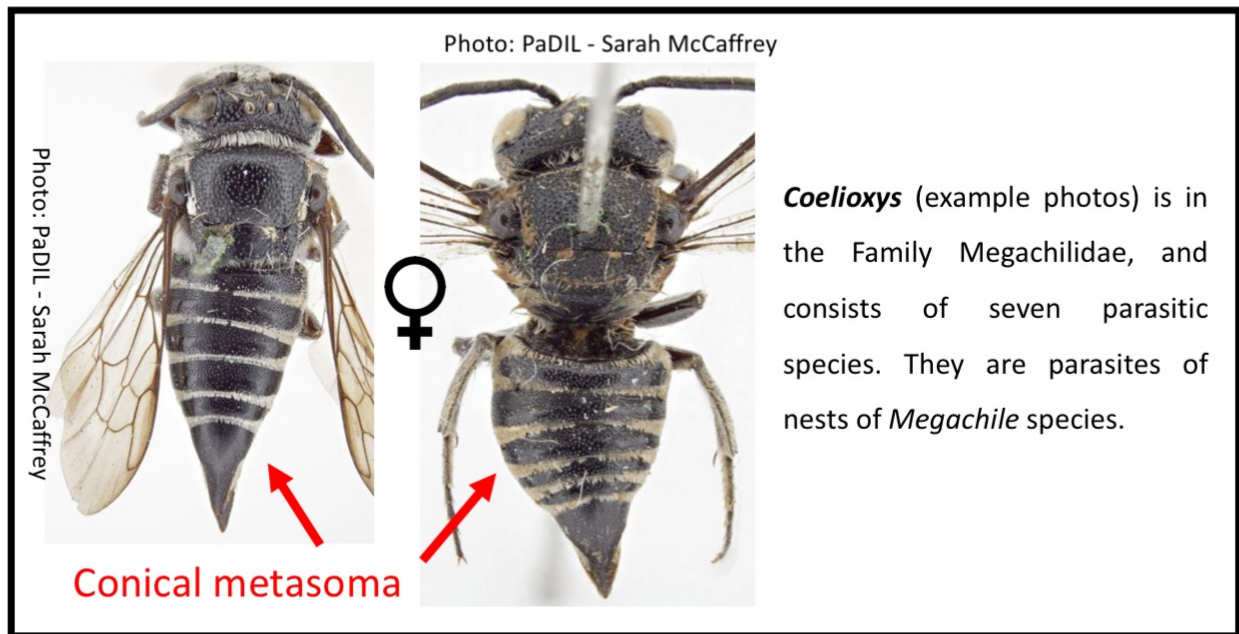
...Proceed to page 73 for key

The subfamily **Euryglossinae**, family Colletidae, consists of 15 genera. These bees carry their pollen internally, in the crop. There are ground nesting species and above-ground nesting species.

...Proceed to page 57 for key

Family/Subfamily (Females) – Couplet 11 (9)

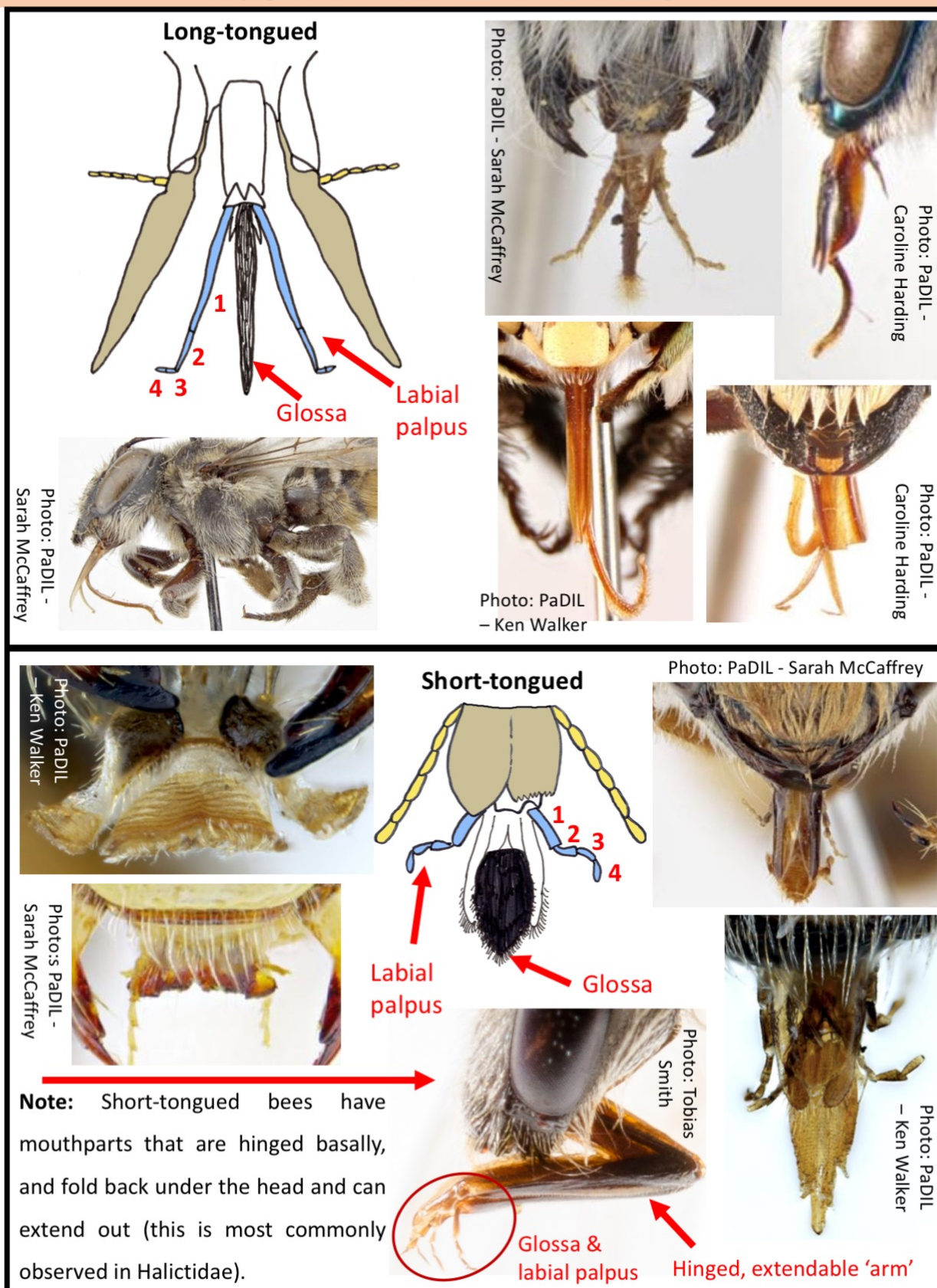
- ❖ Metasoma conical, widest in first segment, tapering from near base to narrow, acutely pointed apex; eyes hairy ...***Coelioxys*** (page 100)
- ❖ Metasoma parallel-sided for most of length, last three metasomal terga somewhat flattened; eyes not hairy ...***Exoneura (Inquilina)*** (page 45)



Family (Females and Males) – Couplet 1

- ❖ Long-tongued bees, first two segments of labial palpus elongate, flattened ...2
- ❖ Short-tongued bees, labial palpus with the four segments similar to one another, glossa short, apex broadly rounded ...3

See pages 9–11 for more information on mouthparts

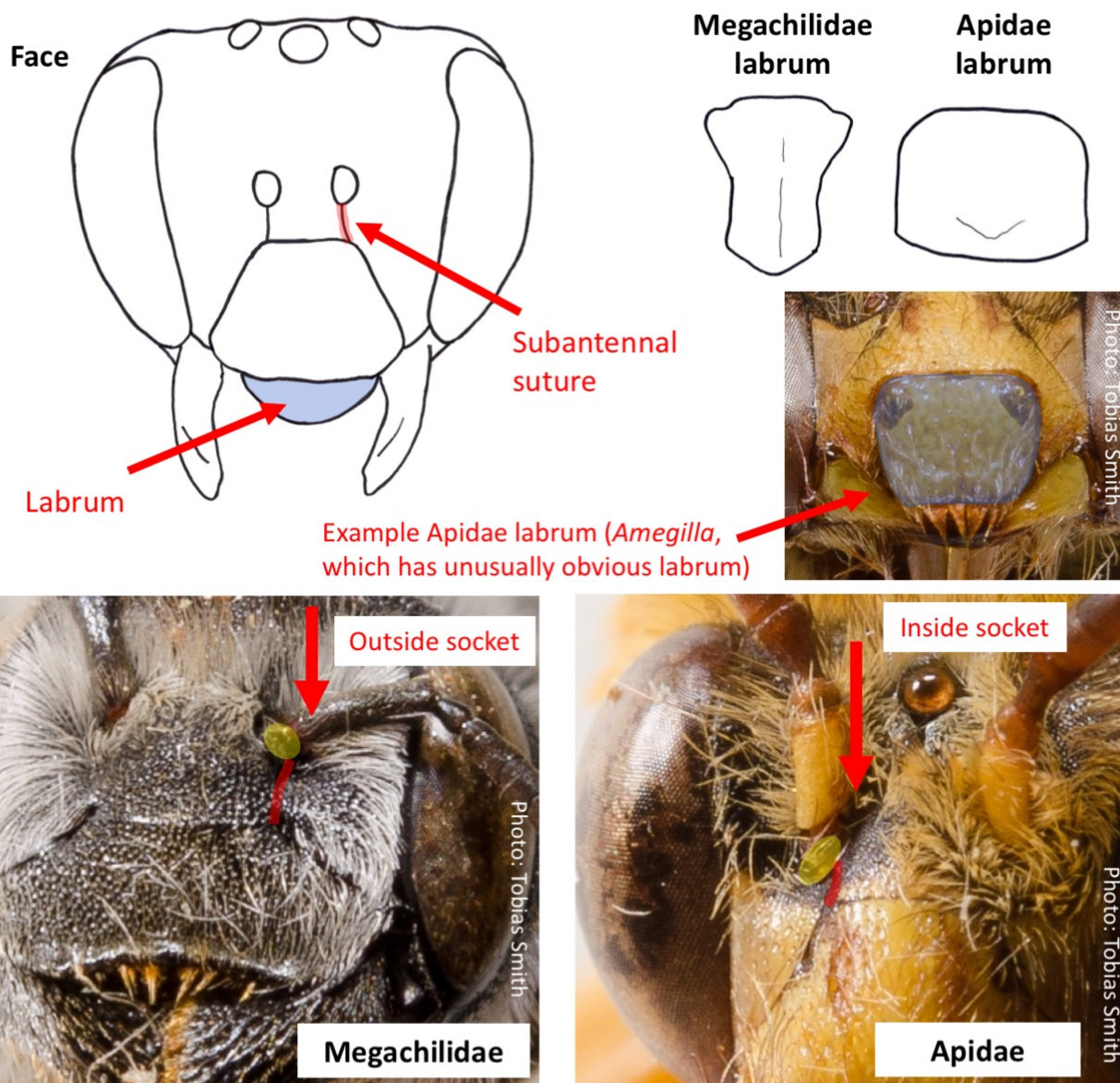


Line drawings by Tobias Smith (based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994 (long tongue) and diagram in Michener 2007 (short tongue))

Family (Females and Males) – Couplet 2 (1)

- ❖ Labrum longer than broad; subantennal suture directed towards outer margin of antennal socket
...**Megachilidae** (page 99)
- ❖ Labrum broader than long; subantennal suture directed towards inner margin of antennal socket
...**Apidae** (page 33)

Note: The labrum can often be tricky to see as it is often tucked backwards below the clypeus and blocked from view by the mandibles. This is particularly so in many species of the Megachilidae. In fresh specimens you can manipulate this, but in dry specimens you will likely break parts if you try. Look from underneath.



Note: The subantennal sutures and the labrum are often covered in hairs in these two families. You will have to scratch the hairs away to see properly. Use the pointy end of an entomology pin to carefully scrape the hairs away. In dried specimens they scrape off easily. To see the subantennal sutures use bright light, and shadow, to your advantage.

Line drawings by Tobias Smith

Family (Females and Males) – Couplet 3 (1)

❖ Basal vein strongly curved

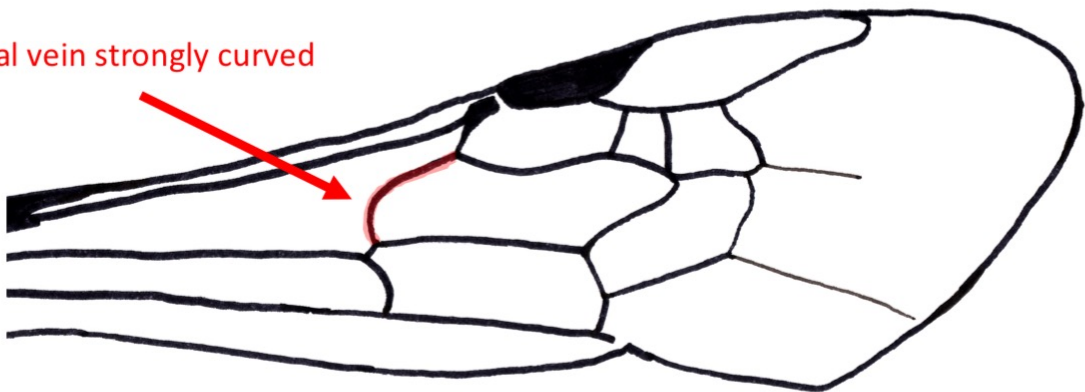
...Halictidae (page 87)

❖ Basal vein straight or only weakly curved

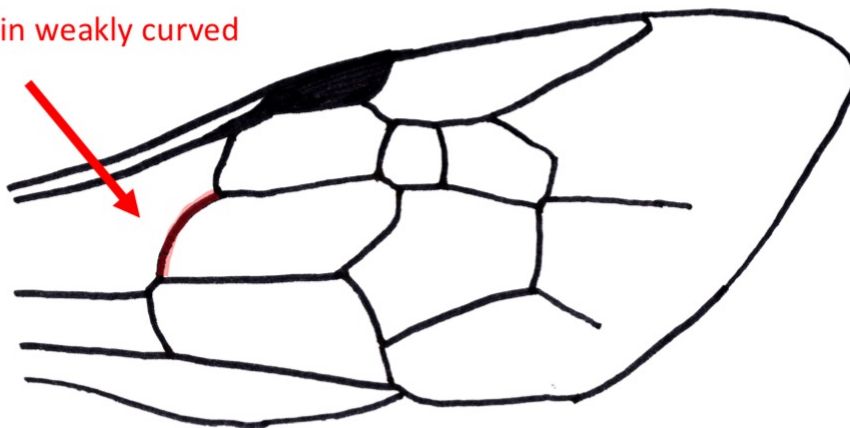
...4

Forewing diagrams

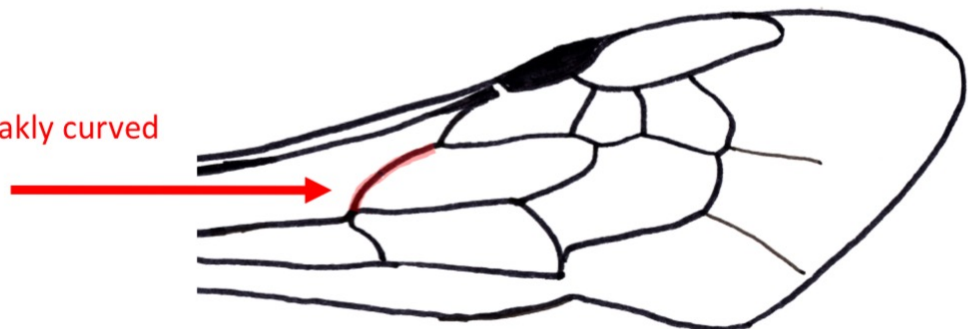
Basal vein strongly curved



Basal vein weakly curved

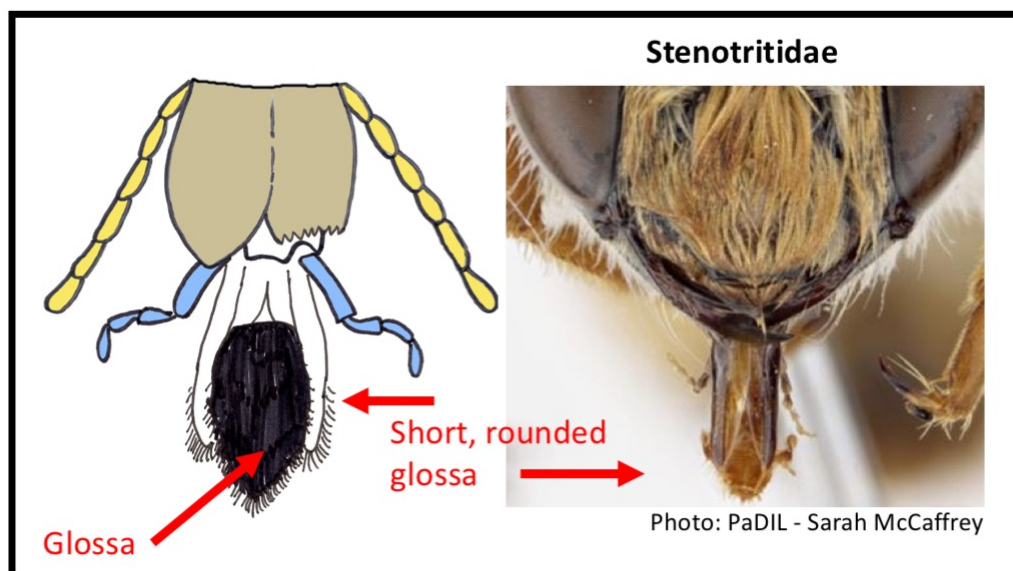
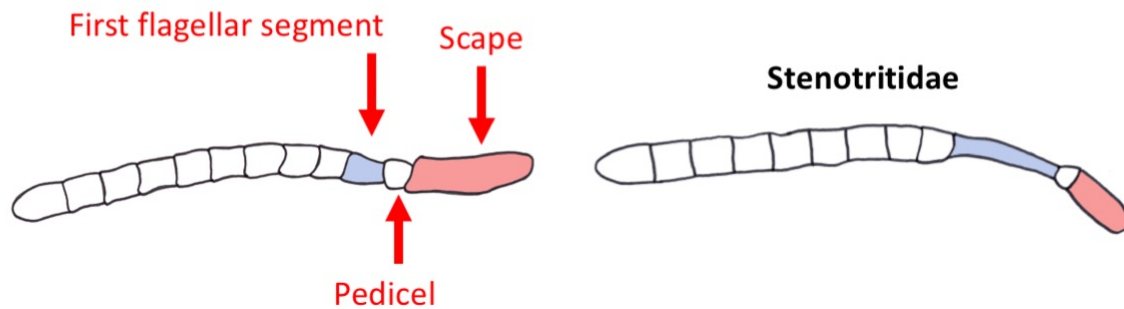


Basal vein weakly curved



Family (Females and Males) – Couplet 4 (3)

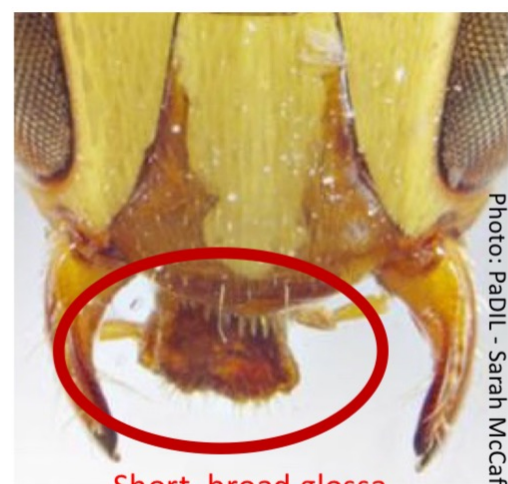
- ❖ First flagellar segment longer than scape on antennae; apex of glossa bluntly rounded
...**Stenotritidae** (page 105)
- ❖ First flagellar segment not longer than scape on antennae; apex of glossa broad to bilobed (except pointed in males of three genera)
...**5 (Colletidae)**



See pages 9–11 for more information on mouthparts



Bilobed glossa



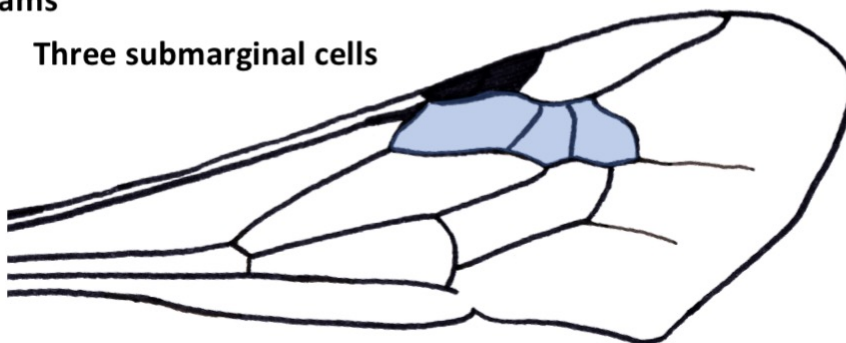
Short, broad glossa

Family (Females and Males) – Couplet 5 (4) – Colletidae subfamilies

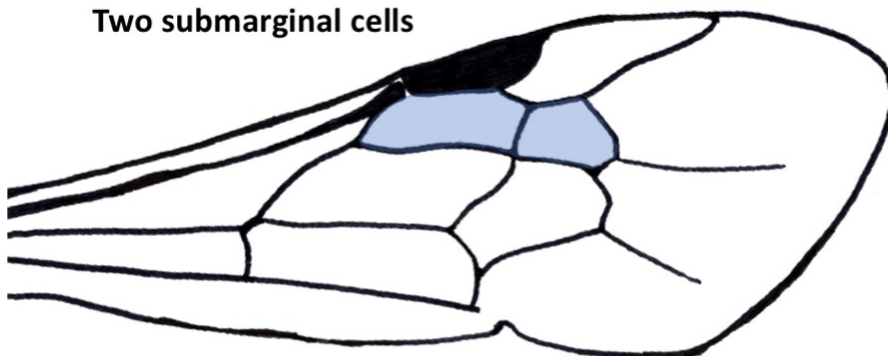
- ❖ With three submarginal cells or, if with two, second about as long as first; relatively hairy bees
...**Colletinae** (page 48)
- ❖ With one or two submarginal cells, second usually much shorter than first (except equal lengths in *Hyleoides*, page 74, and a few uncommon species of *Palaeorhiza*, page 82); relatively bare or short-haired bees
...6

Forewing diagrams

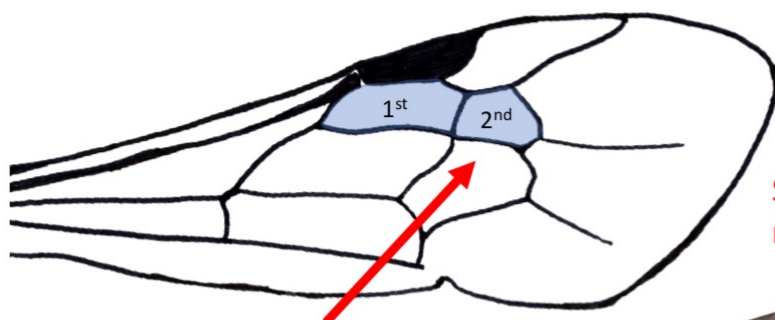
Three submarginal cells



Two submarginal cells

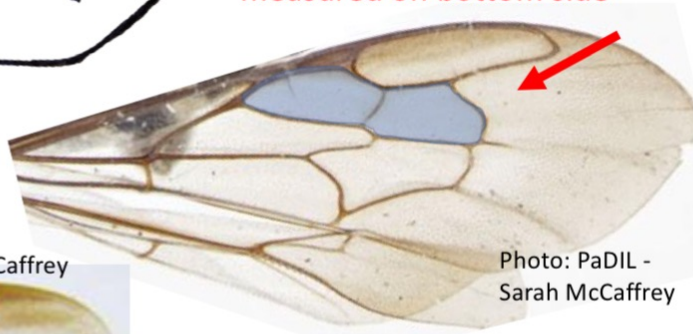


If two submarginal cells, check relative lengths



Second submarginal cell
obviously smaller than first

Submarginal cells similar length,
measured on bottom side



Hyleoides

Photo: PaDIL - Sarah McCaffrey

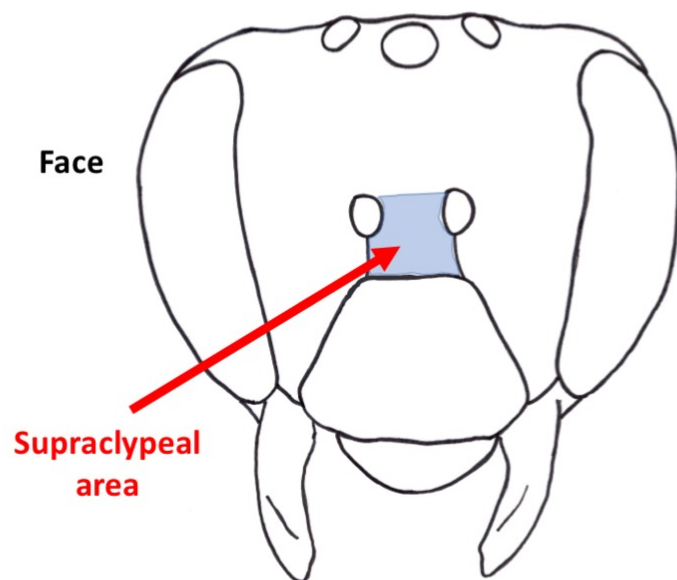


Hyleoides forewing usually
dark/shaded in cells close to
the upper margin, compared
with clear lower cells

Line drawings by Tobias Smith (based on diagrams in Michener 1965)

Family (Females and Males) – Couplet 6 (5) – Colletidae subfamilies

- ❖ Supraclypeal area elevated abruptly above level of antennal sockets; front surface of T1 of metasoma usually lacking longitudinal median groove or ridge
...**Hylaeinae** (page 73)
- ❖ Supraclypeal area sloping up from level of antennal sockets; front surface of T1 of metasoma with longitudinal median groove or ridge ...**Euryglossinae** (page 57)



Abruptly elevated supraclypeal area

No longitudinal groove on front of T1

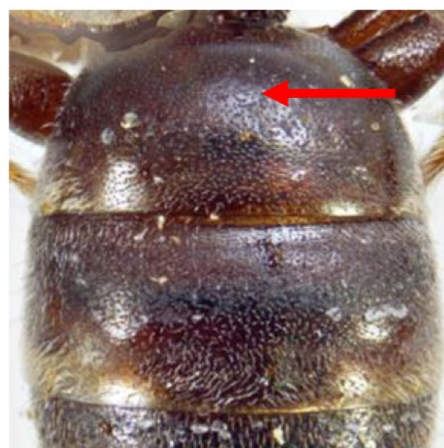


Photo: PADIL – Sarah McCaffrey



Photo: Tobias Smith

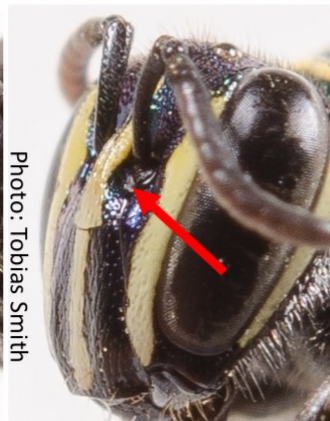


Photo: Tobias Smith

Longitudinal groove on front of T1



Photo: PADIL – Sarah McCaffrey

Not abruptly elevated



Photo: Tobias Smith



Photo: Tobias Smith

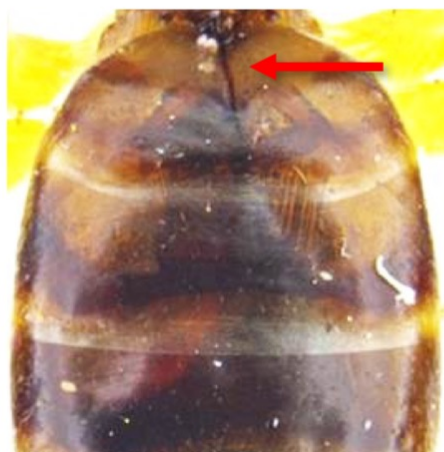
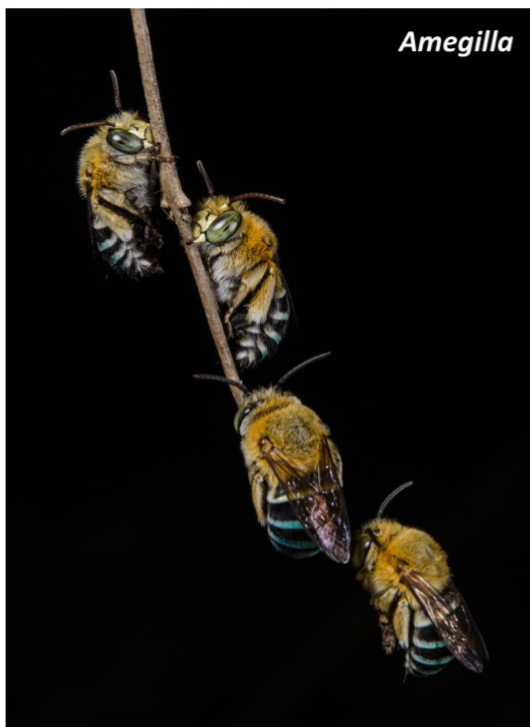


Photo: PADIL – Sarah McCaffrey

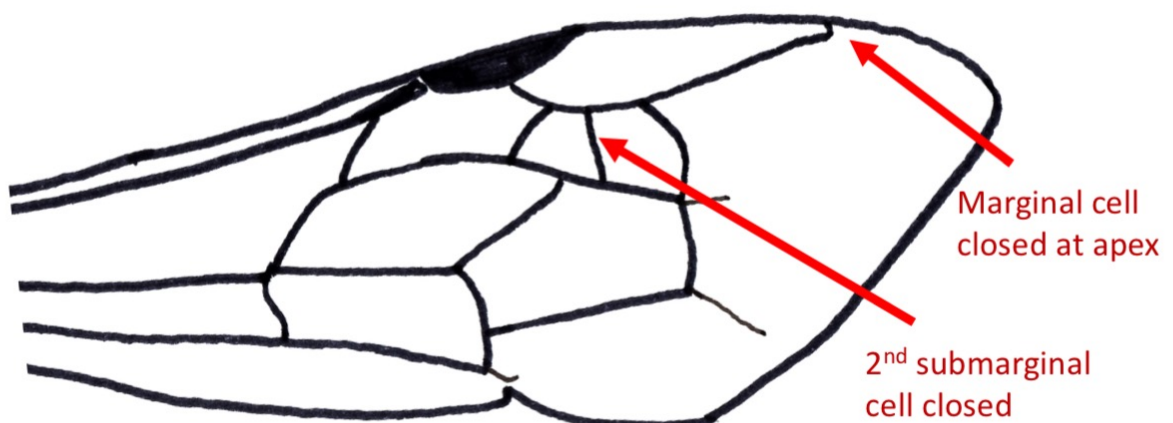
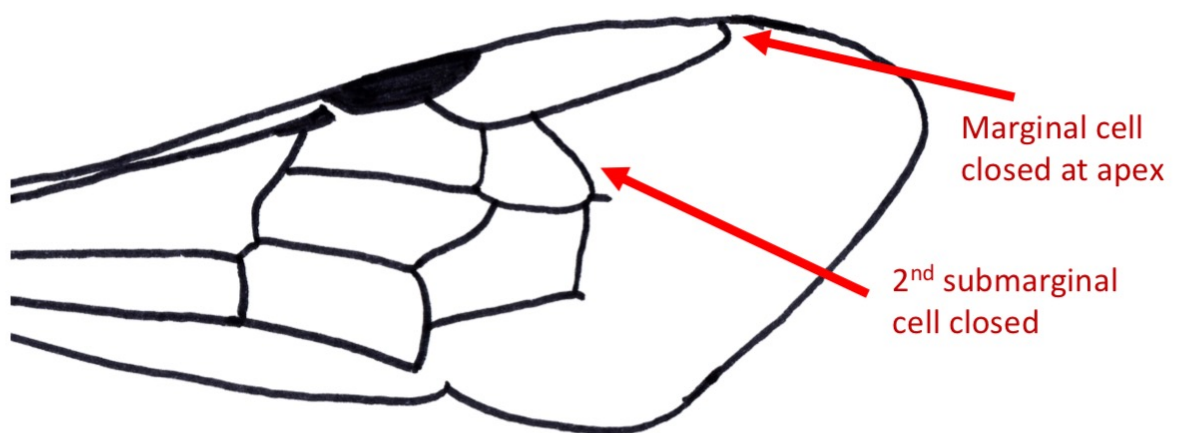
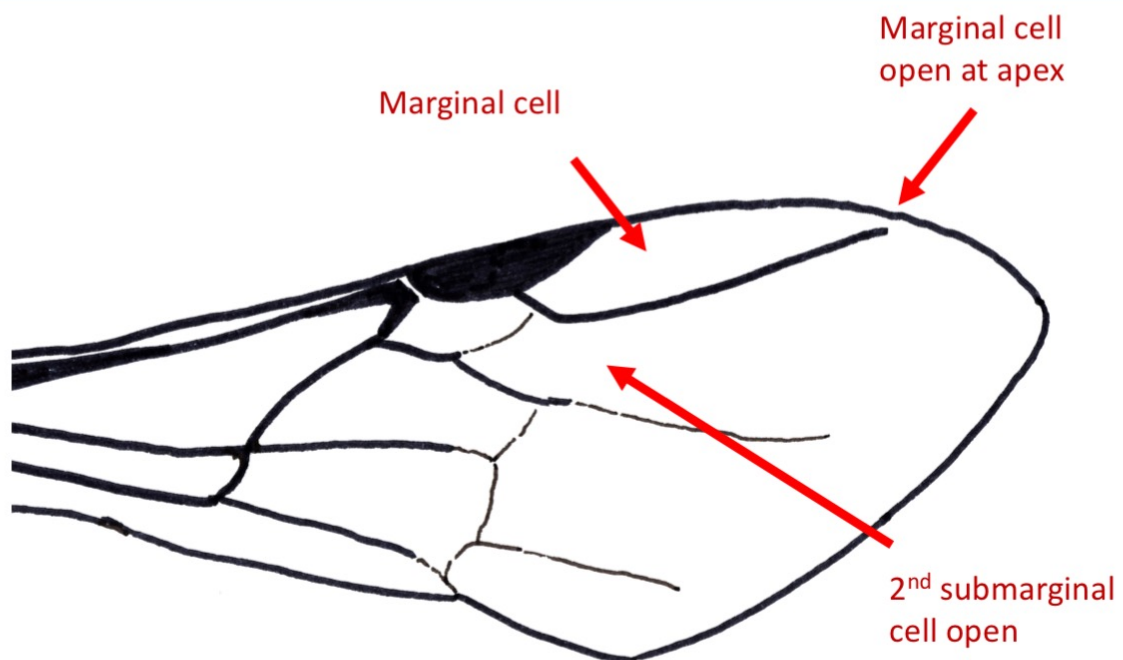
Family Apidae

The family Apidae in Australia is made up of 13 genera, within which there are approximately 173 described species. There are three subfamilies in Australia: the Apinae, Nomadinae, and Xylocopinae. Species in the Apidae vary widely in their nesting strategies and levels of sociality. Nesting strategies include both above- and below-ground nesters, and all levels of sociality from truly solitary to highly eusocial are represented among the species. The following couplets are based, in part, on keys by Michener (1965; 2007).



Apidae – Couplet 1

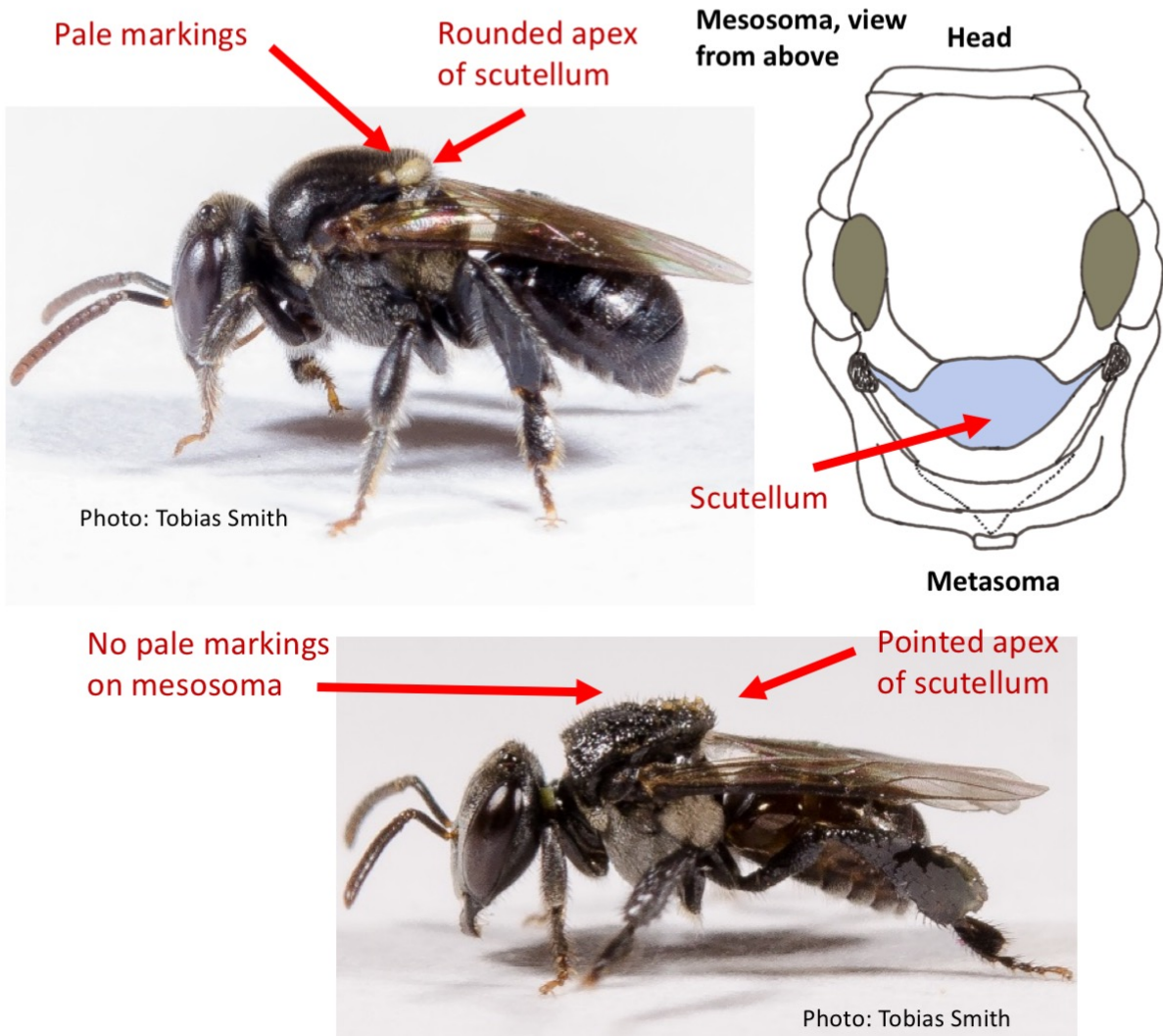
- ❖ Marginal cell open at apex, and second submarginal cell open ... 2
- ❖ Marginal cell closed at apex, and second submarginal cell closed ... 3



Line drawings by Tobias Smith (based on diagrams in Michener 1965)

Apidae – Couplet 2 (1)

- ❖ Usually with pale integumental markings on mesosoma, rounded apex of scutellum when viewed from side ... ***Austroplebeia***
- ❖ No pale integumental markings on mesosoma, pointed apex of scutellum when viewed from side ... ***Tetragonula***



***Austroplebeia*, 5 species**

Subtropical and tropical only

Dollin, A.E., Dollin, L.J., & Rasmussen, C. (2015) Australian and New Guinean stingless bees of the genus *Austroplebeia* Moure (Hymenoptera: Apidae)—a revision. *Zootaxa*, 4047: 1–73.

***Tetragonula*, 6 species**

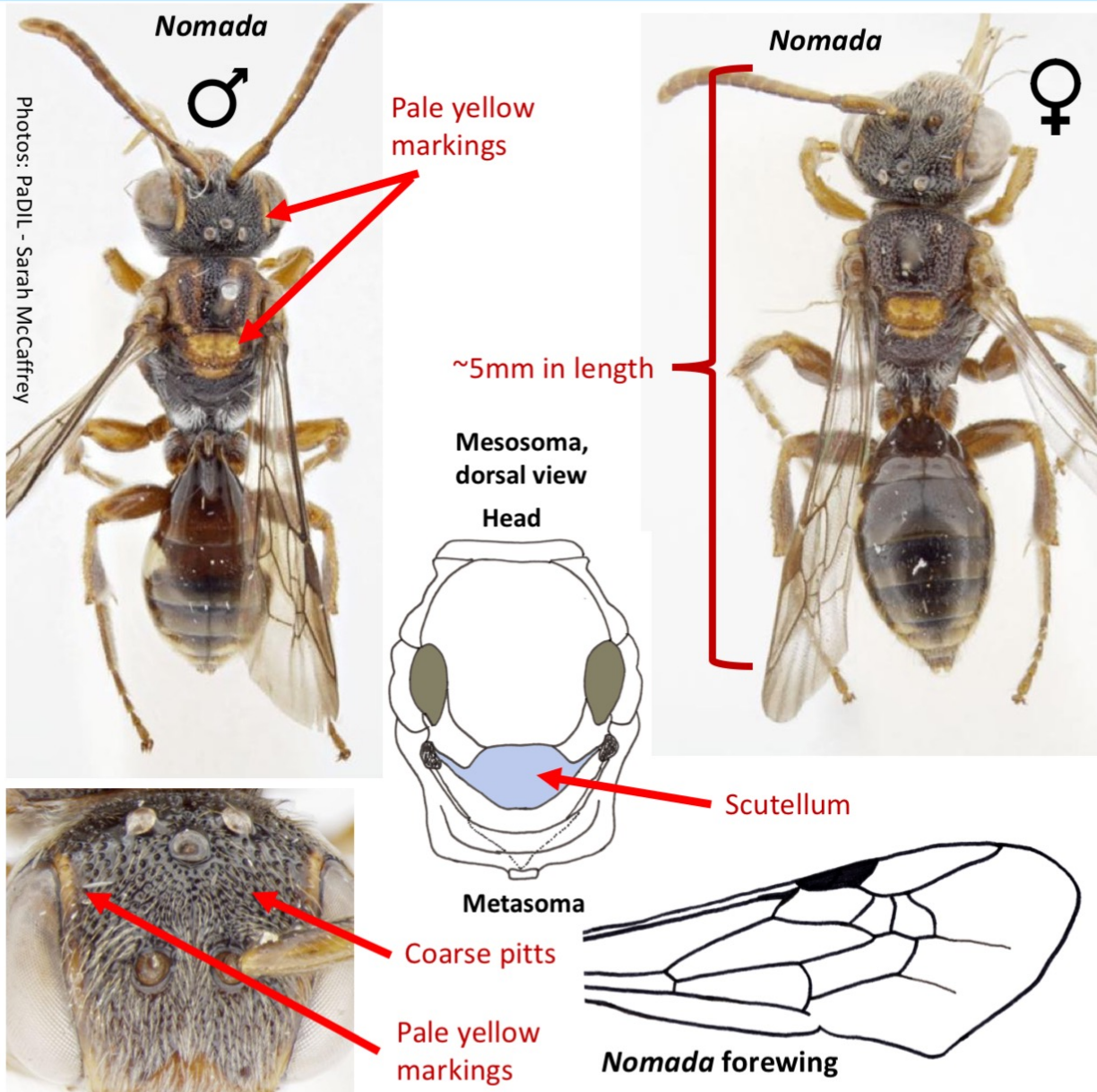
Subtropical and tropical only

Dollin, A.E., Dollin, L.J., & Sakagami, S.F. (1997) Australian stingless bees of the genus *Trigona* (Hymenoptera: Apidae). *Invertebrate Taxonomy*, 11: 861-896.

Note: This paper uses the old genus name, *Trigona*. Australian *Trigona* are now *Tetragonula*.

Apidae – Couplet 3 (1)

- ❖ Small, wasp-like bees, with strong constriction between mesosoma and metasoma; pale yellow integumental markings on inner margins of eyes (particularly pronounced towards the top) and on scutellum (head and mesosoma coarsely pitted) ... *Nomada*
- ❖ Constriction between mesosoma and metasoma normal; no pale yellow integumental markings on inner margins of eyes and scutellum (but may have pale markings elsewhere on face) ... 4



Nomada

1 species, *N. australensis*

Only known from QLD

Nomada are thought to be nest parasites of *Lasioglossum* or some other small bees.

Line drawings by Tobias Smith (based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994 (mesosoma) and diagram in Michener 1965 (wing))

Apidae – Couplet 4 (3)

- ❖ Black bees with white or iridescent blue patches of hair on all body parts (darkened wings) ... *Thyreus*

- ❖ Not black with white or iridescent blue patches of hair on all body parts

... 5

Thyreus nitidulus nitidulus



Thyreus lugubris



White or blue hair patches

Thyreus waroonensis



Thyreus caeruleopunctatus



Photos: PaDL - Caroline Harding

Note: Colour may fade, particularly in specimens that have been stored in ethanol, but otherwise the appearance of *Thyreus* is obvious, so if it doesn't look like one of these, then it is not *Thyreus*.

Thyreus

5–10 species, widespread
on mainland

Thyreus species are nest parasites of *Amegilla*.

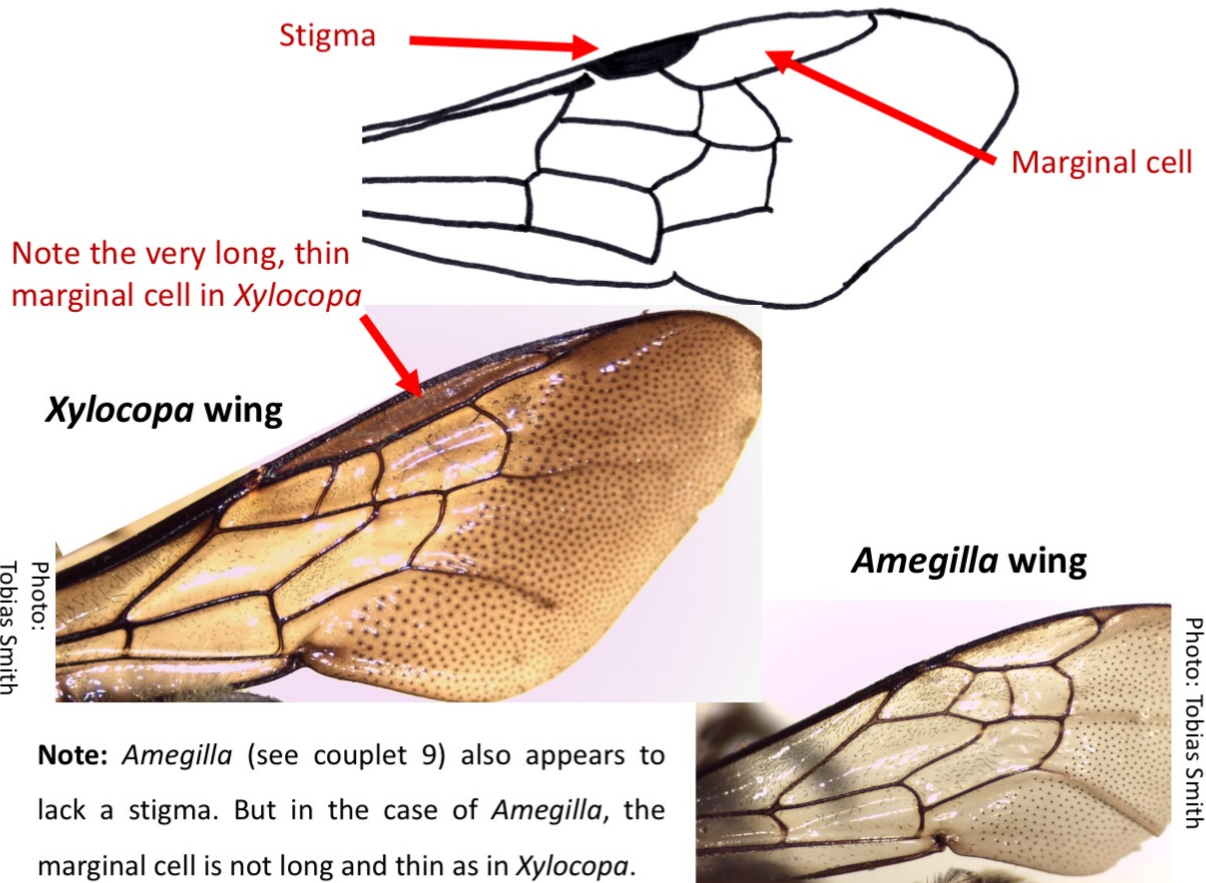
Apidae – Couplet 5 (4)

- ❖ Marginal cell long and thin, almost parallel-sided; stigma always almost absent (large, robust bees that lack any obvious banding/stripes on metasoma)

... *Xylocopa*

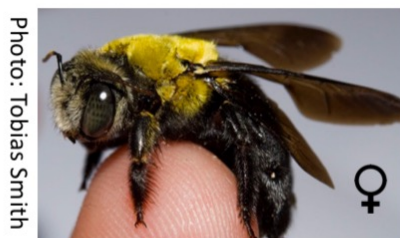
- ❖ Marginal cell not long and thin, not parallel-sided; stigma usually distinct, longer than broad

... 6



Xylocopa (Koptortosoma)

Subtropical and tropical only



Xylocopa (Lestis)

Eastern Australia



Leys, R. (2000) A revision of the Australian carpenter bees, genus *Xylocopa* Latreille, subgenus *Koptortosoma* Gribdo and *Lestis* Lepeletier & Serville (Hymenoptera: Apidae). *Invertebrate Taxonomy*, 14: 115-136.

Line drawing by Tobias Smith (based on diagram in Michener 1965)

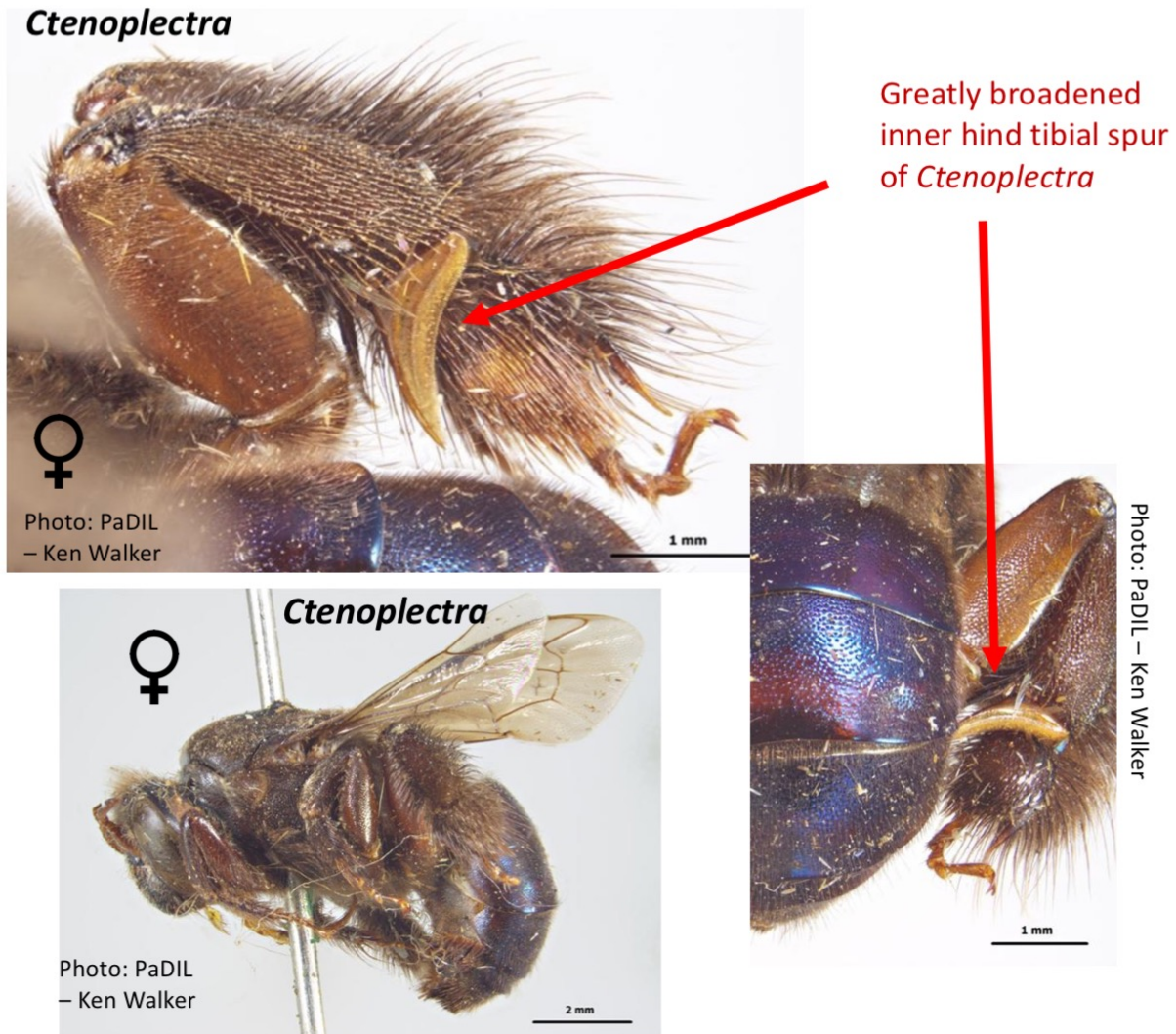
Apidae – Couplet 6 (5)

- ❖ Inner hind tibial spur in female greatly broadened; large, metallic blue bees

... *Ctenoplectra*

- ❖ Inner hind tibial spur not greatly broadened; not large and metallic blue

... 7



Note: This broadened spur is for collecting oil, and is only present in the female. Males of *Ctenoplectra* will not be recognised in this key. So, if you are working in the Iron Range region, Far North Queensland, and you have a male bee with blue metasoma from the family Apidae it could be it, if it is nothing else.

Ctenoplectra

Ctenoplectra is represented in Australia by a single species,
C. australica, and is only known from Iron Range, Far North QLD.

Apidae – Couplet 7 (6)

- ❖ Corbicula (flattened tibia, fringed with scopal hairs) in female; eyes hairy or large, densely hairy bees with yellow/orange hair bands on both mesosoma and metasoma (pictured below, on right) ... 8
- ❖ No corbicula in female; eyes not hairy, body hair and size not fitting the above description ... 9

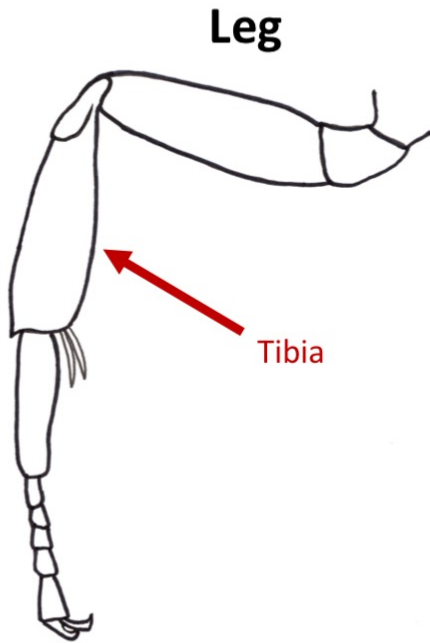


Photo: Tobias Smith

Densely hairy, with yellow/orange bands on mesosoma and metasoma



Line drawing by Tobias Smith

Apidae – Couplet 8 (7)

- ❖ Large, densely hairy bees; first two metasomal terga with yellow hairs, third and fourth black, fifth and sixth tergum pale/white; eyes not hairy ... ***Bombus***
- ❖ Medium sized bees; hairy mesosoma, but no dense hairs on metasoma; eyes hairy ... ***Apis***



Photo: Tobias Smith

Bombus

Introduced

Only known from Tasmania

1 species, *B. terrestris*



Photo: Tobias Smith



Photo: Tobias Smith

Hairy eye

Apis

Introduced

2 species

Apis mellifera - widespread



Photo: Tobias Smith

Apis cerana – QLD wet tropics only



Photo: Tobias Smith

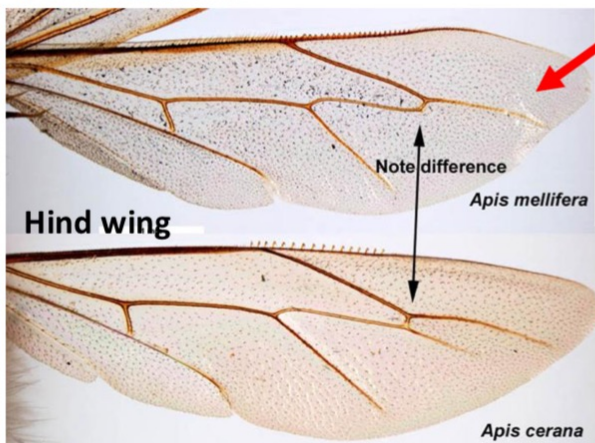


Photo: PaDIL – Ken Walker

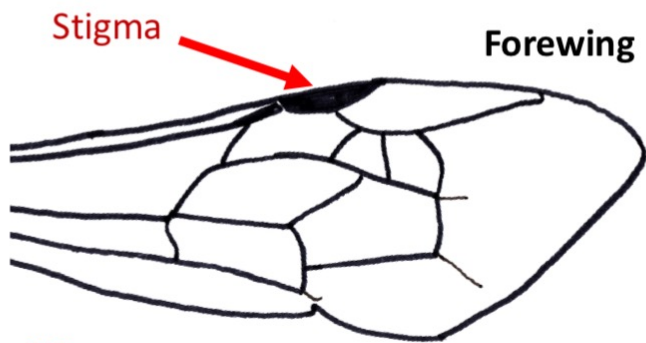
Apidae – Couplet 9 (7)

- ❖ Pygidial plate present in female; robust bees, usually with dense, coarse hair present on top surface of metasoma (often in obvious bands); stigma of forewing appearing absent ... ***Amegilla***
- ❖ No pygidial plate in female; largely hairless top surface of metasoma; stigma of forewing distinct ... **10**



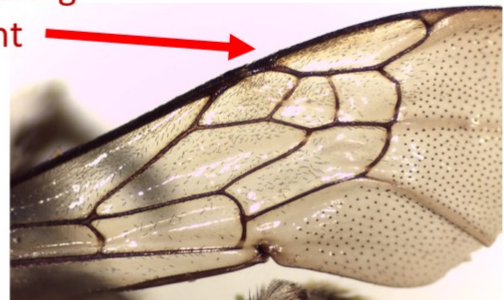
Dense hair on metasoma (in this case with obvious bands)

Pygidial plate



Stigma appearing absent

***Amegilla* wing**



Amegilla

~40 species

Widespread



Leijs, R., Batley, M., & Hogendoorn, K. (2017) The genus *Amegilla* (Hymenoptera: Apidae: Anthophorini) in Australia: A revision of the subgenera *Notomegilla* and *Zonamegilla*. *ZooKeys*, 2017: 79-140.

Line drawing by Tobias Smith (based on diagram in Michener 1965)

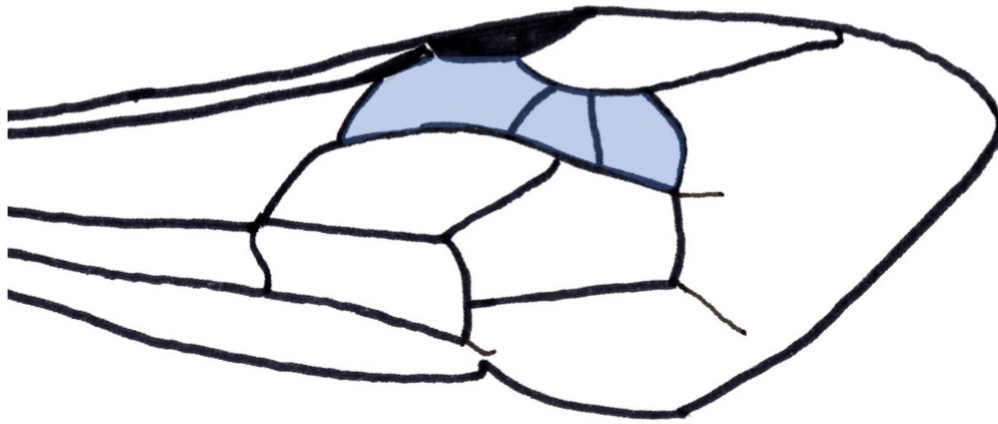
Apidae – Couplet 10 (9)

- ❖ Three submarginal cells
- ❖ Two submarginal cells

... *Ceratina*

... 11

Three submarginal cells



Two submarginal cells

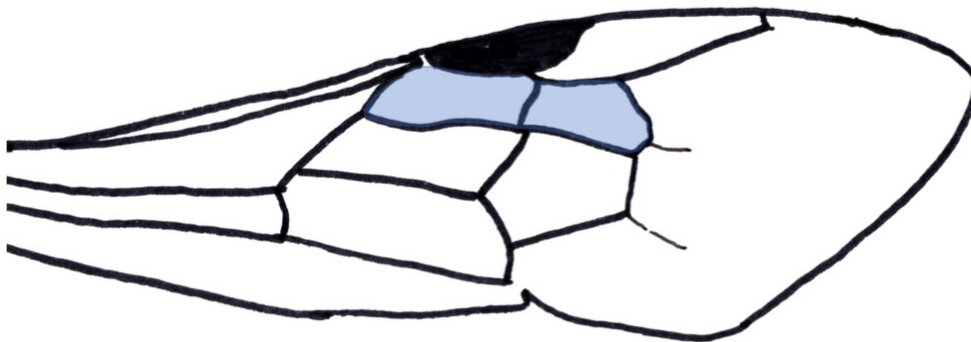


Photo: PaDIL - Sarah McCaffrey



Photo: PaDIL – Marc Newman

Ceratina

1 species, *C. australensis*

Eastern Australia



Photo: Tobias Smith

Apidae – Couplet 11 (10)

- ❖ Second recurrent vein of forewing present
- ❖ Second recurrent vein of forewing absent

... *Braunsapis*

... 12

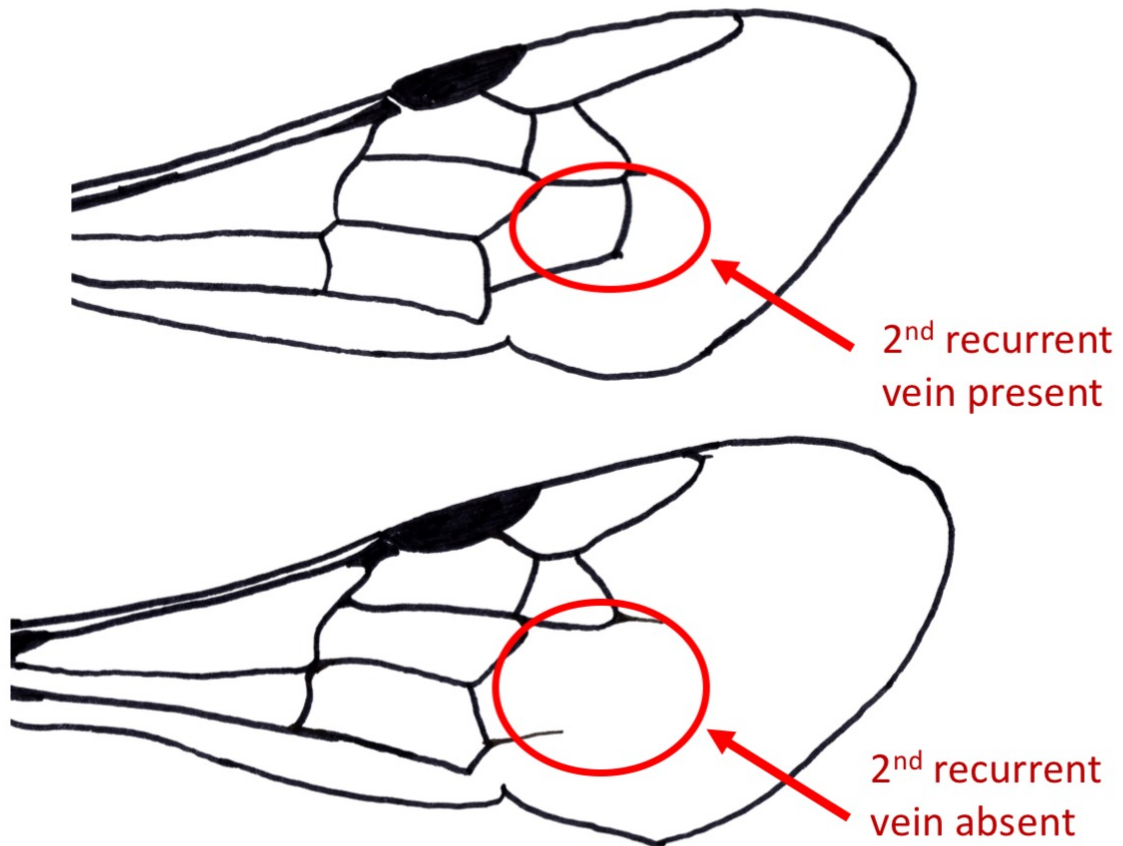


Photo: PaDIL - Sarah McCaffrey

Braunsapis

22 species

Widespread

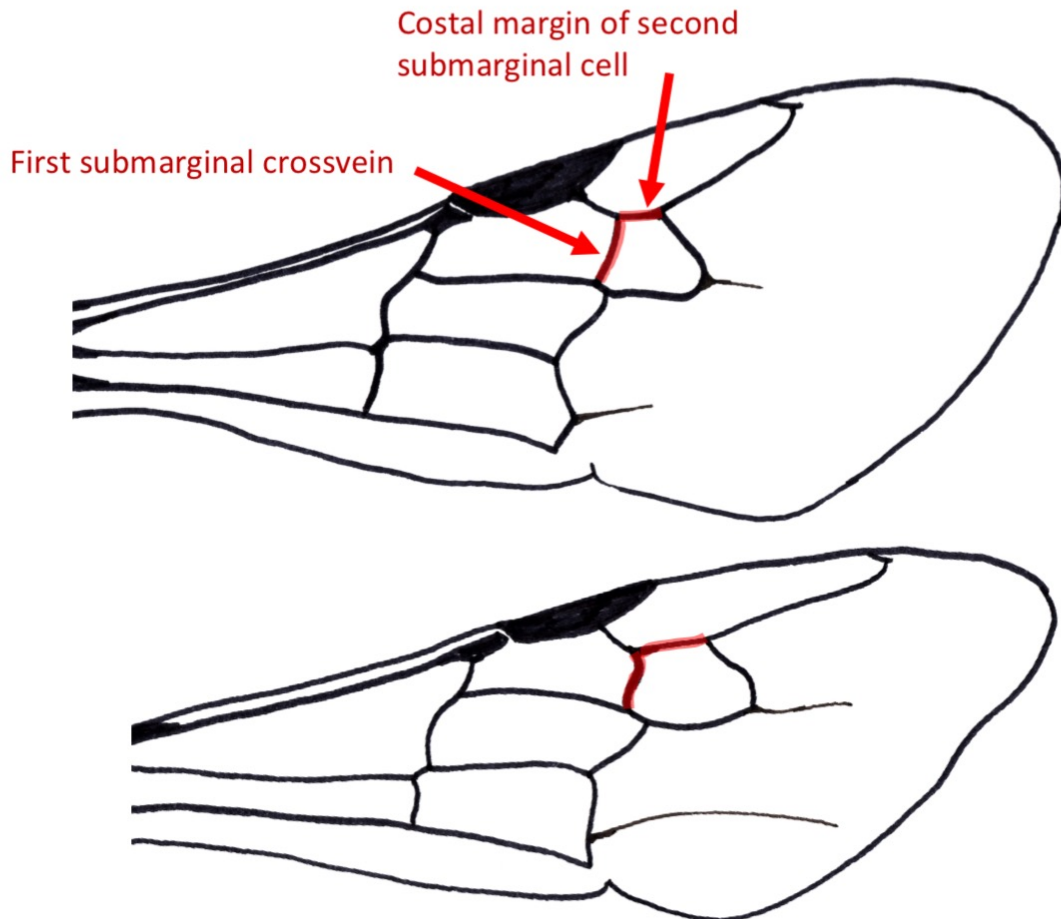


Photo: PaDIL - Sarah McCaffrey

Reyes, S. (1993) Revision of the bee genus *Braunsapis* in the Australian region (Hymenoptera: Xylocopinae: Allodapini). *The University of Kansas science bulletin*, 55: 97-121.

Apidae – Couplet 12 (11)

- ❖ Costal margin of second submarginal cell short, often less than half as long as first submarginal crossvein ... ***Exoneurella***
- ❖ Costal margin of second submarginal cell usually as long as first submarginal crossvein ... ***Exoneura***



Exoneurella, 4 species, widespread

Photo: PaDIL -
Caroline Harding



Dew, R.M., Stevens, M.I., & Schwarz, M.P. (2018) Taxonomy of the Australian Allodapine bee genus *Exoneurella* (Apidae: Xylcopinae: Allodapini) and description of a new *Exoneurella* species. *Insect Systematics and Diversity*, 2: ixx013-ixx013.

Exoneura, ~68 species, widespread



Photo: PaDIL - Sarah McCaffrey

Houston T.F. (1976) New Australian allodapine bees (subgenus *Exoneurella* Michener) and their immatures (Hymenoptera: Anthophoridae). *Trans. R. Soc. S. Aust.* 100: 15-28.



Family Colletidae

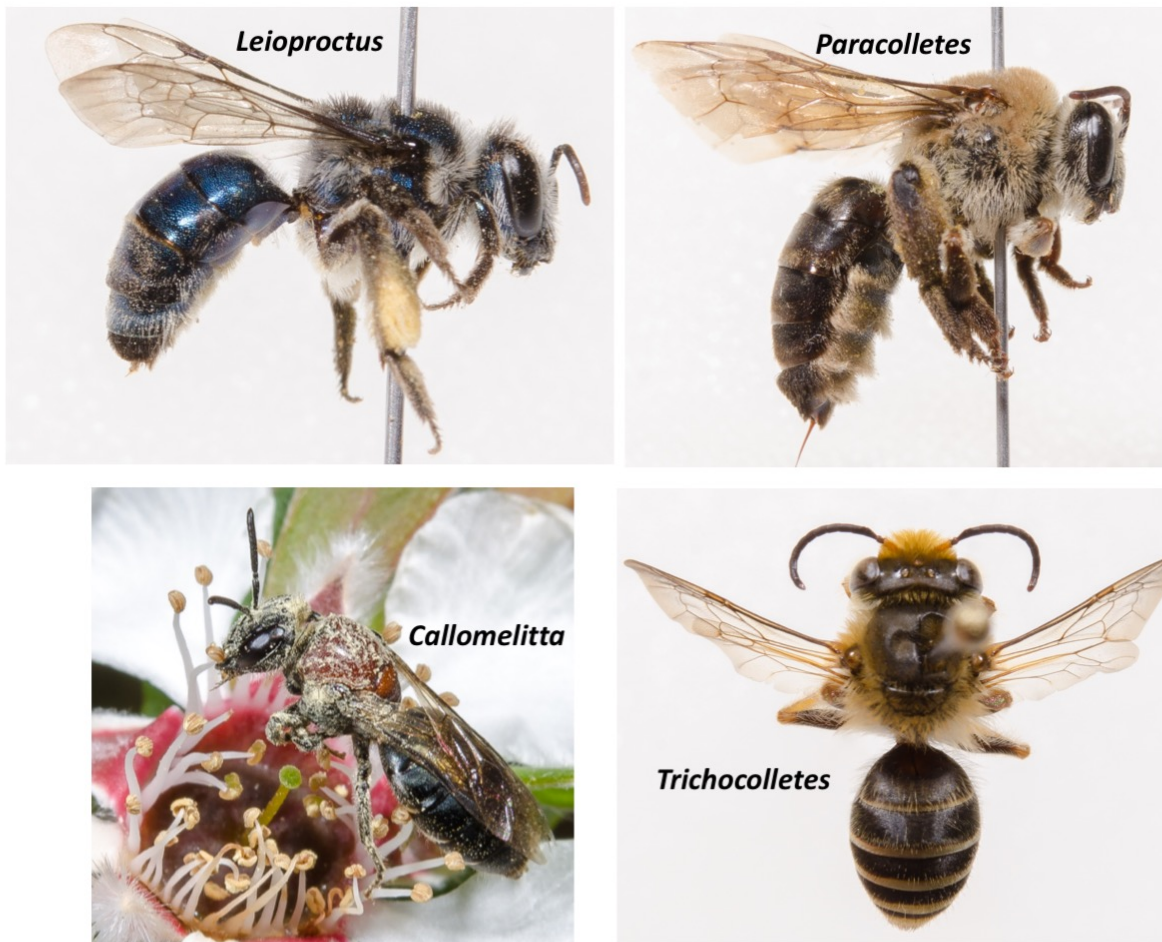
The family Colletidae is the largest of the Australian bee families, with approximately 883 described species. There are three subfamilies in Australia: the Colletinae, Euryglossinae, and Hylaeinae.



Colletidae: Subfamily Colletinae

The subfamily Colletinae includes 10 genera*, with approximately 277 described species. Most of these species are ground nesting bees. The genus *Leioproctus* is the largest, with 177 species. The following couplets are an adaptation of keys by Michener (2007) and Maynard (2013).

Colletinae examples



* Two genera are omitted from the following couplets, Firstly, *Hesperocolletes*, which is known only from a single male specimen of a single species, collected in 1938. This specimen is labelled as being collected at Rottnest Island, WA, but doubt remains as to whether that was the true locality, although it is thought to be likely that it did come from WA. *Hesperocolletes* has unusual tarsal claws, as described by Michener (1965). The second omitted genus is *Glossurocolletes*, which will key out here as *Leioproctus*, but can be identified as the true genus using the *Leioproctus* subgenera key of Maynard (2013), as it was previously treated as a *Leioproctus* subgenus. *Glossurocolletes* is known only from Western Australia.

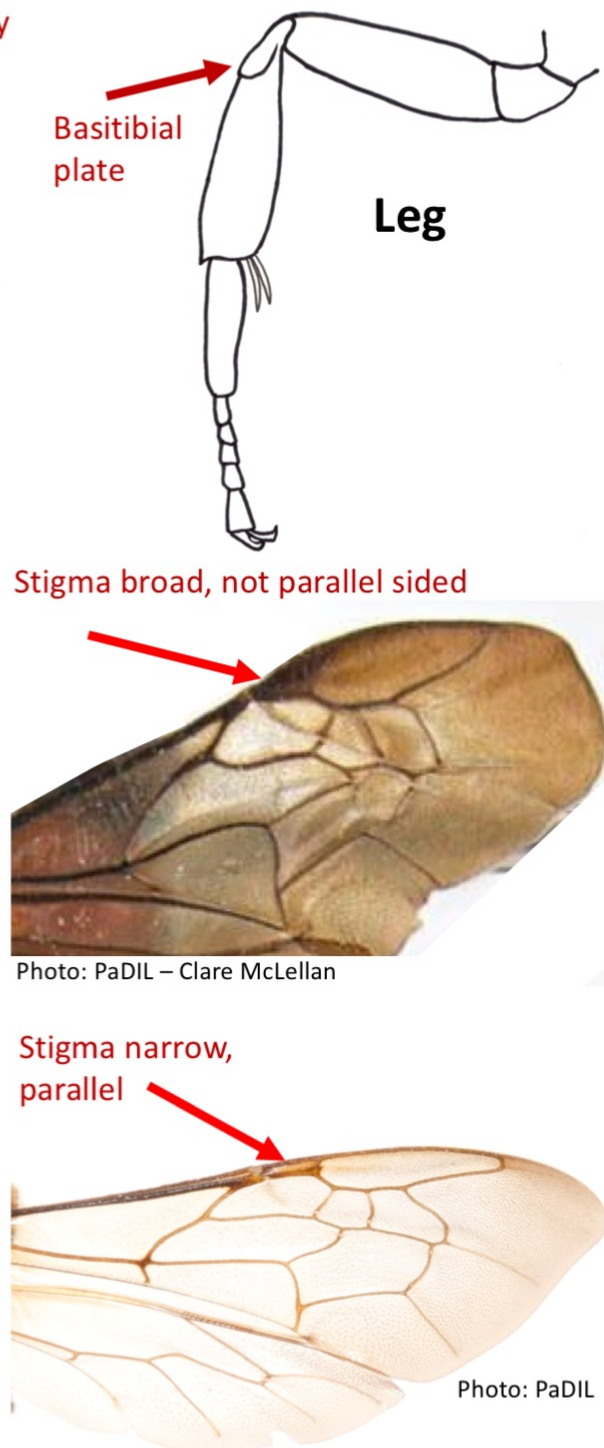
Photos by Tobias Smith

Colletinae – Couplet 1

- ❖ Hind basitibial plate clearly defined, forming ridge laterally and/or stigma broad ... 2
- ❖ Hind basitibial plate ill-defined or hidden by dense hairs, not forming a clear ridge laterally; stigma narrow, parallel sided ... 7



Line drawing by Tobias Smith



Colletinae – Couplet 2 (1)

- ❖ Metasoma with yellow integumental bands, broken or narrowed sublaterally;
clypeus yellow; males with enlarged scape (on antenna) ... ***Neopasiphae***
- ❖ Metasoma without coloured integumental that are broken or narrowed sublaterally ... **3**

Note: Males of *Leioproctus* (*Andrenopsis*) (5 species) also have yellow integumental bands, although they are not broken or narrowed sublaterally as in *Neopasiphae*, and they do not have the enlarged scape. If unsure here, check *Leioproctus* (*Andrenopsis*) images.

Yellow bands, broken or narrowed sublaterally (just in from the sides)



Photo: PaDIL -
Sarah McCaffrey



Photo: PaDIL –
Clare McLellan



Photo: PaDIL -
Sarah McCaffrey

Neopasiphae

3 species

Only known from Western Australia &
north-western NSW & south-western QLD



Photo: PaDIL – Clare McLellan

Enlarged scape in male



Photo: PaDIL – Clare McLellan

Integumental bands
unbroken, not narrowed

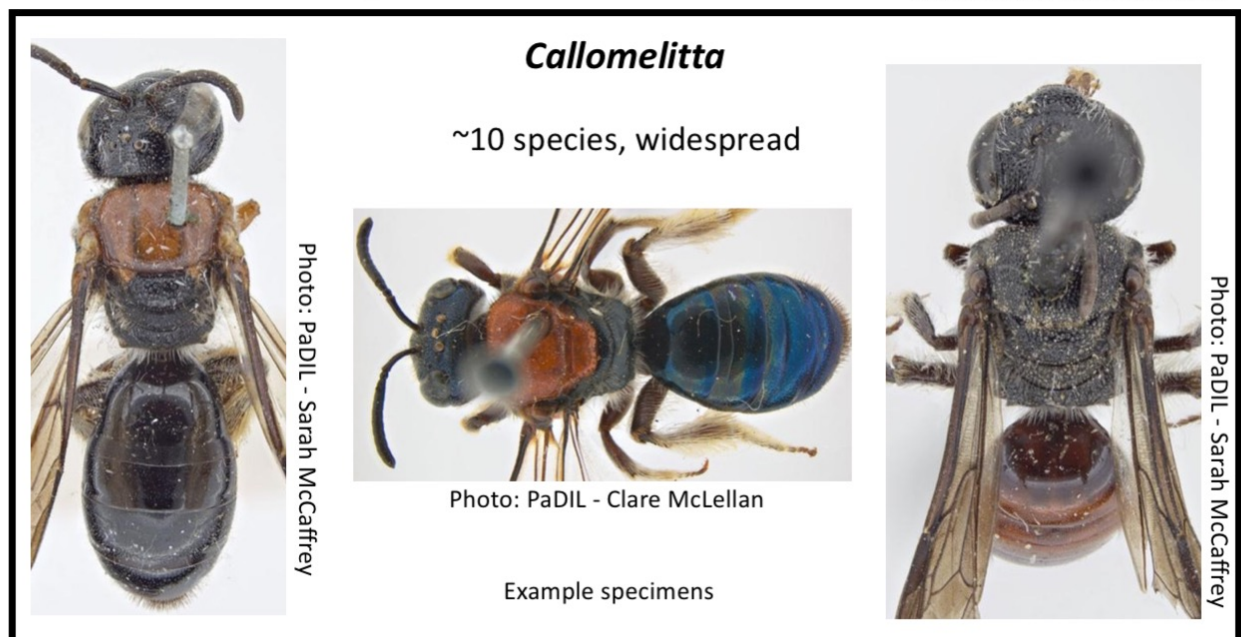
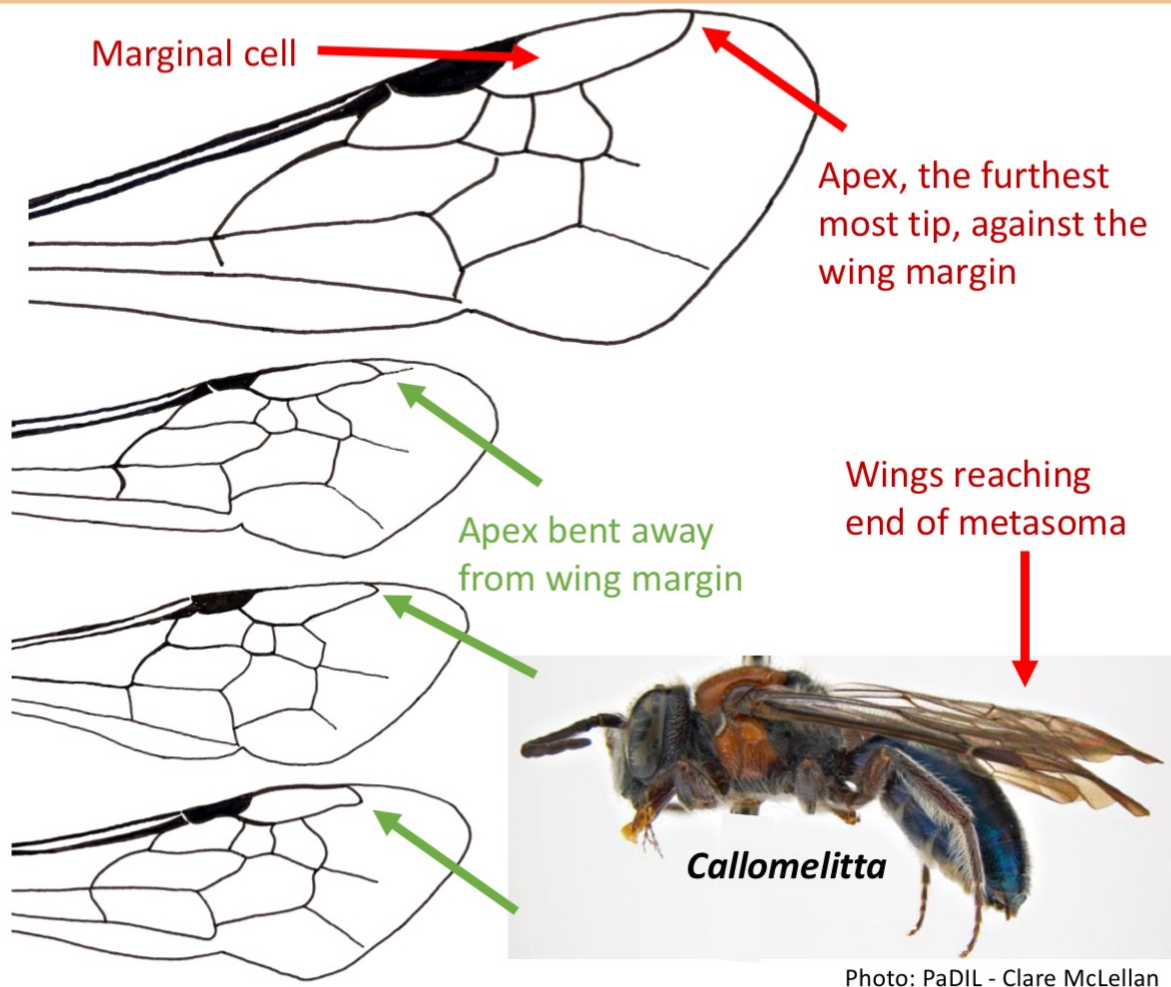


Photo: PaDIL – Michael Batley

Leioproctus (*Andrenopsis*)
example

Colletinae – Couplet 3 (2)

- ❖ Apex of the marginal cell of forewing on wing margin; wings reaching end of metasoma ... ***Callomelitta***
- ❖ Apex of the marginal cell of forewing divergent from wing margin; wings reaching middle of metasoma ... **4**



Line drawings by Tobias Smith (based on diagrams in Michener 1965)

Colletinae – Couplet 4 (3)


- ❖ Female hind basitibial plates covered in dense fine, branched hairs; median process of S8 of males confluent with the rest of segment (this trait in the males is a difficult one, and not shown here. See below) ...*Goniocolletes**
- ❖ Female hind basitibial plates not covered in dense, fine, branched hairs; median process of S8 of males distinctly narrower than the rest of segment ... 5




Note: If you have a male bee, then this is a tricky trait. It requires an internal characteristic of the male (S8), and you need to extract the body part while the specimen is fresh. Unless you are experienced, I suggest you have a look through the PaDIL images of *Goniocolletes* to see if your specimen looks like it might belong to the genus. There are <10 species, although there are not PaDIL images for all of them. For more on S8 in males, see Michener 2007.

Goniocolletes*


<10 species, widespread



Photos: PaDIL - Sarah McCaffrey



Example specimens (but note, appearance varies quite a lot)



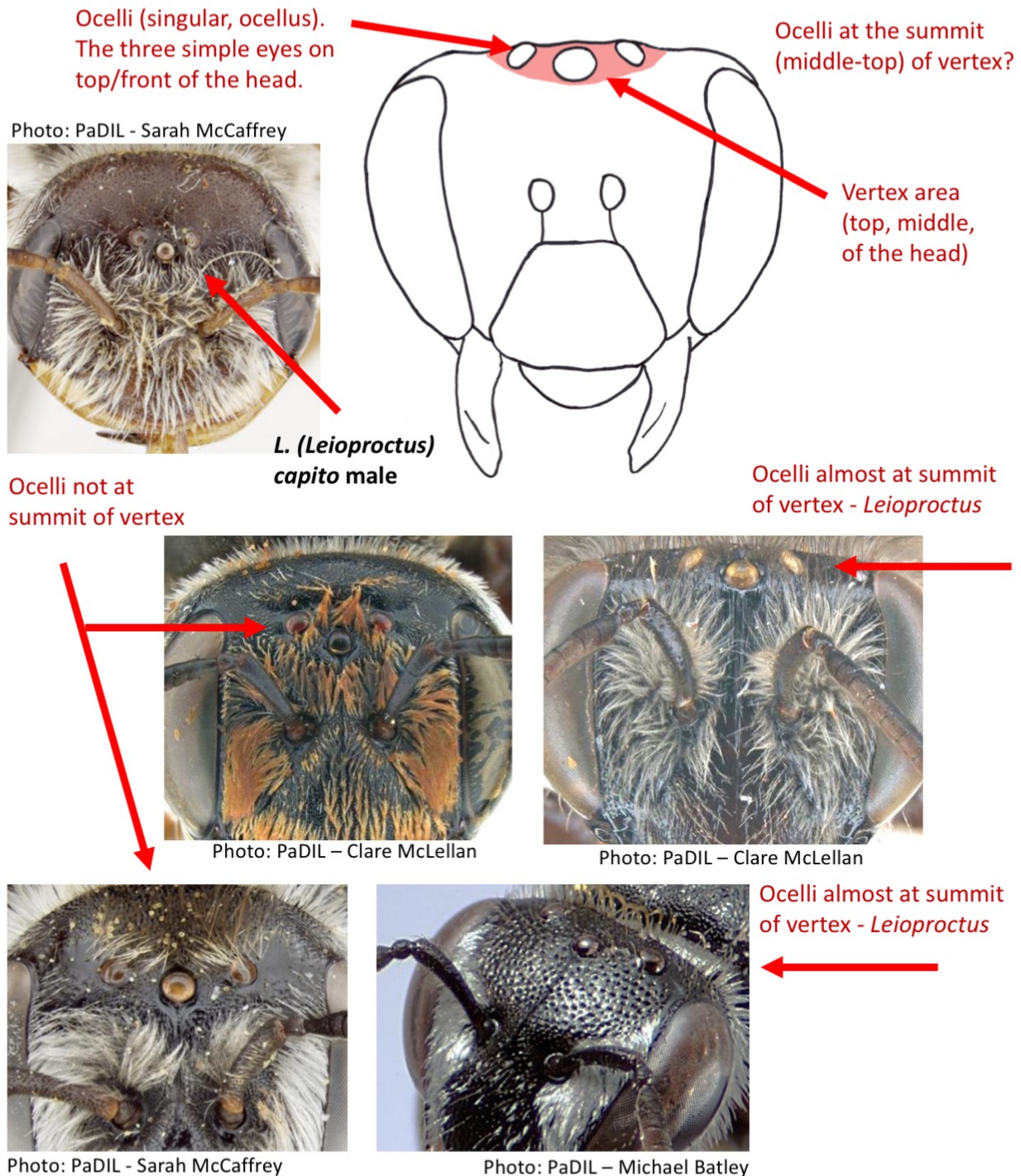
*In his new book (page 4), Houston (2018) retains *Goniocolletes* as a subgenus of *Leioproctus*

Maynard, G. (2013) Revision of the *Goniocolletes* and seven Australian subgenera of *Leioproctus* (Hymenoptera: Apoidea: Colletidae), and descriptions of new taxa. *Zootaxa*, 3715 (1): 1–114.

Line drawing by Tobias Smith

Colletinae – Couplet 5 (4)

- ❖ Ocelli almost at summit of vertex (except for males of *Leioproctus* (*Leioproctus*) *capito* species-group – WA only) ... ***Leioproctus***
- ❖ Ocelli not at summit of vertex ... **6**



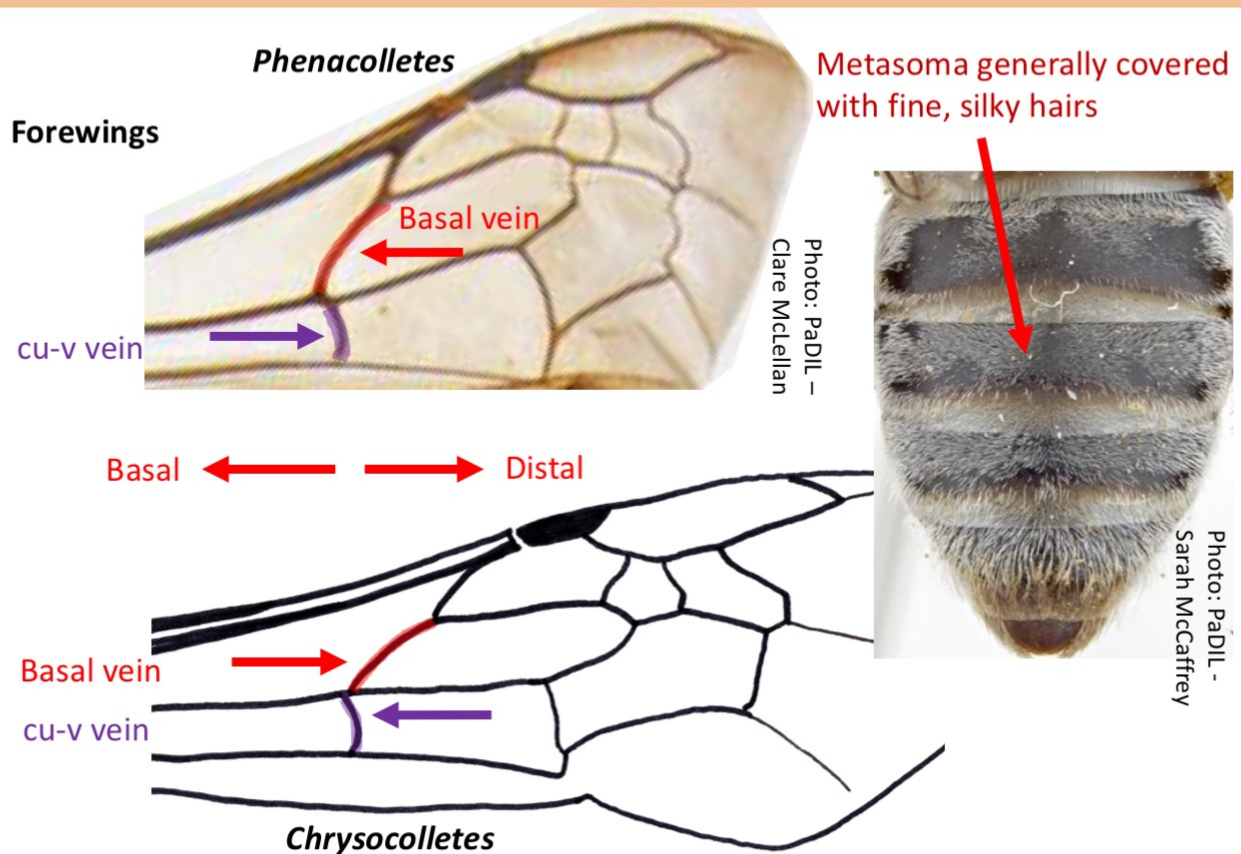
***Leioproctus*, ~177 species, widespread**

Maynard, G. (2013) Revision of the *Goniocolletes* and seven Australian subgenera of *Leioproctus* (Hymenoptera: Apoidea: Colletidae), and descriptions of new taxa. *Zootaxa*, 3715 (1): 1–114.

Line drawing by Tobias Smith

Colletinae – Couplet 6 (5)

- ❖ Basal vein meeting or distal to cu-v vein of forewing; surface of metasoma covered with fine silky hair ... ***Chrysocolletes***
- ❖ Basal vein basal to cu-v vein of forewing; surface of metasoma not covered with fine silky hair ... ***Phenacolletes***



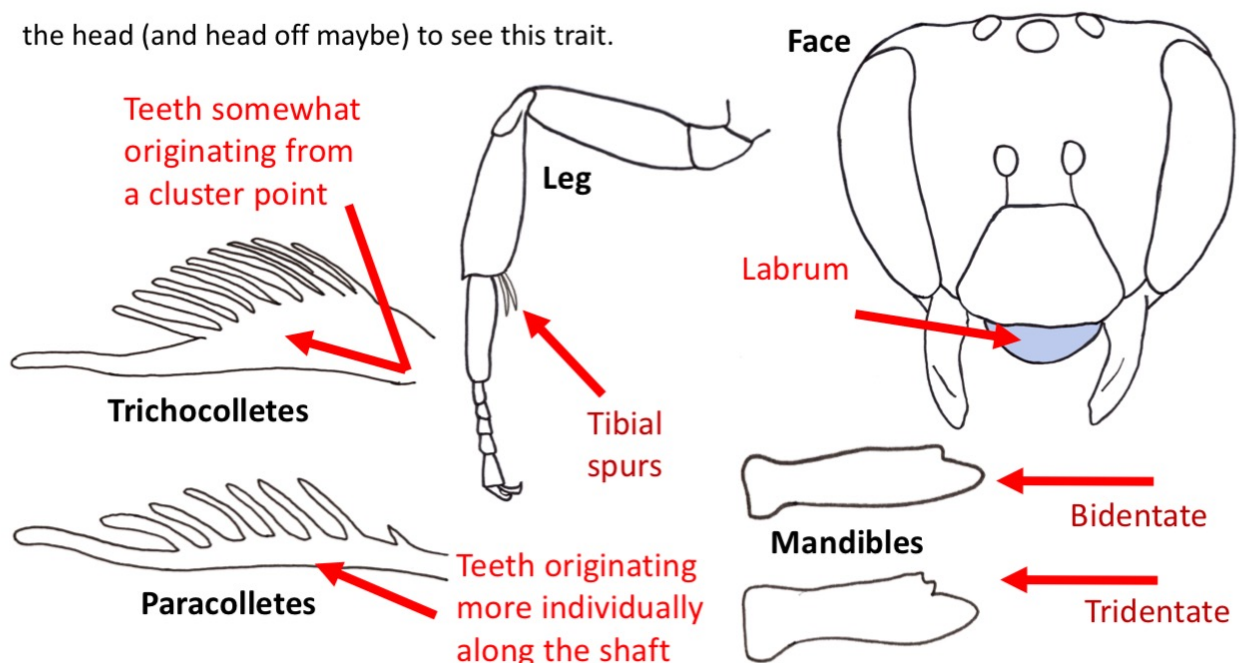
<p>Photos: PaDIL – Sarah McCaffrey</p>	<p><i>Chrysocolletes</i></p> <p>~5 species</p> <p>Widespread</p> <p>Example specimens</p>	
<p>♀</p>	<p><i>Phenacolletes mimus</i></p> <p>This is the only <i>Phenacolletes</i> species.</p> <p>Only known from Western Australia</p> <p>Photos: PaDIL – Clare McLellan</p>	<p>♂</p>

Line drawing by Tobias Smith (based on diagram in Michener 2007)

Colletinae – Couplet 7 (1)

- ❖ Labrum as long as or longer than width; female inner hind tibial spur with several long, fine teeth originating from more or less the one point (almost palmate); female mandibles bidentate; some species with hairy eyes; may have golden or silver bands on metasoma ... ***Trichocolletes***
- ❖ Labrum shorter than width; female inner hind tibial spur ciliate, teeth originating individually along the length of the shaft (serial); female mandibles tridentate; males without hairy eyes; without golden or silver bands on metasoma ... ***Paracolletes***

Note: The labrum can often be tricky to see as it is often tucked backwards below the clypeus and blocked from view by the mandibles. In fresh specimens you can manipulate this, but in dry specimens you will likely break bits. Look from underneath, or be willing to break parts of the head (and head off maybe) to see this trait.



Trichocolletes

~40 species, widespread

Batley, M. & Houston, T. (2012) Revision of the Australian bee genus *Trichocolletes* Cockerell (Hymenoptera: Colletidae: Paracolletini). Records of the Australian Museum, 64: 1–50.



Photo: Tobias Smith

Paracolletes

~17 species, widespread



Photo: Tobias Smith

Line drawings by Tobias Smith (spurs & mandibles based on diagrams in Michener 1965)



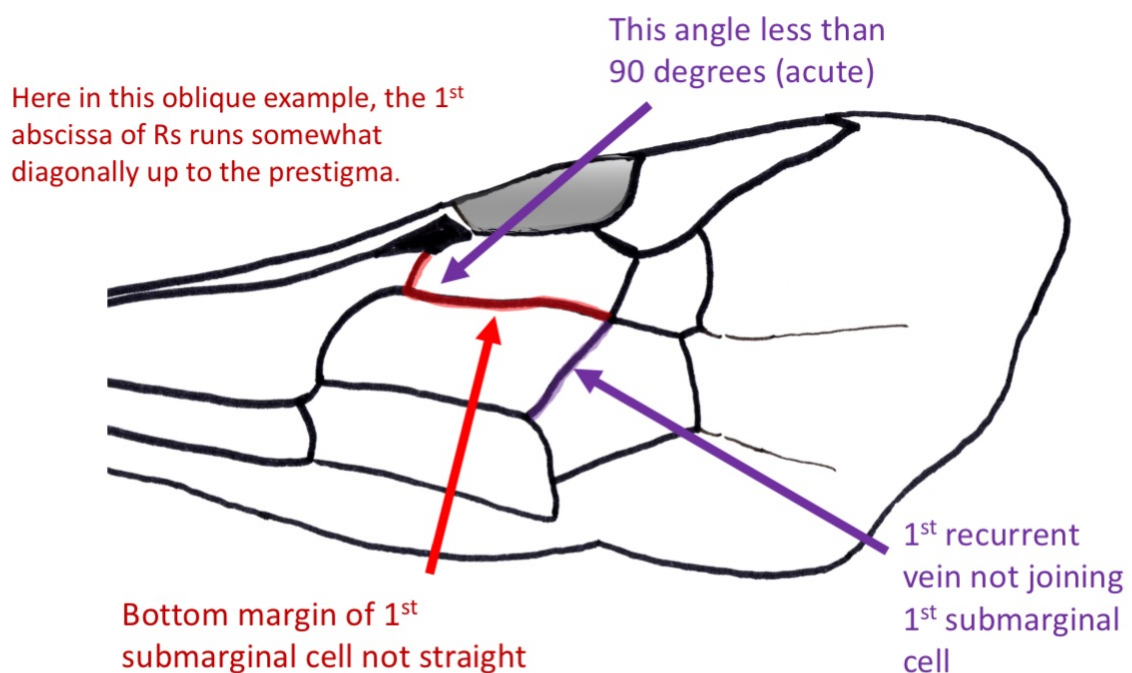
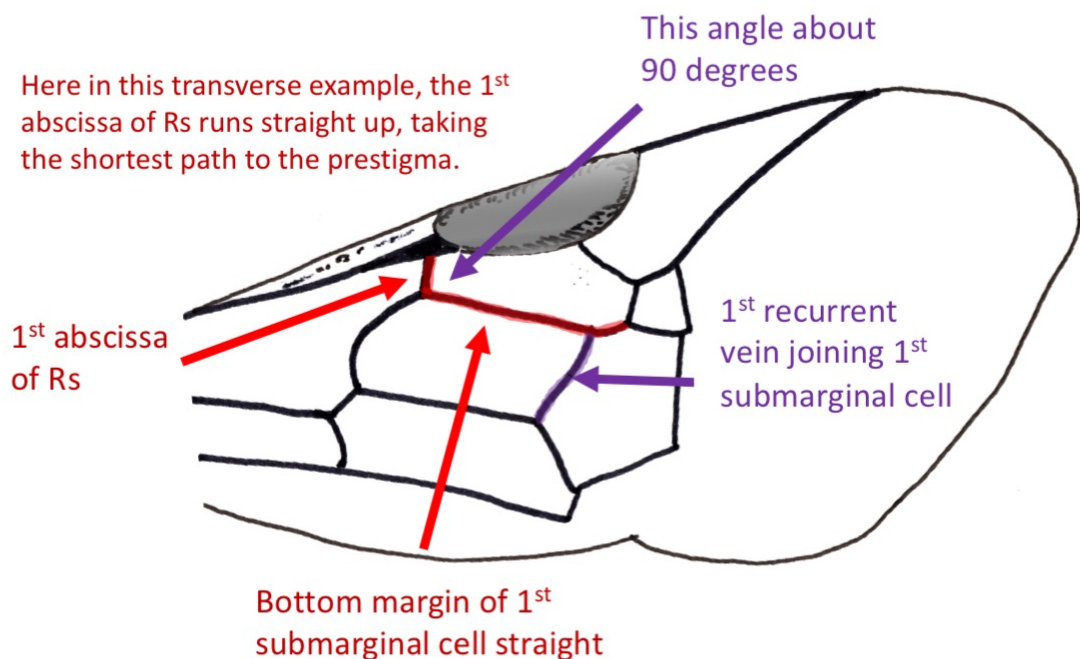
Colletidae: Subfamily Euryglossinae

The Euryglossinae is a large subfamily of the family Colletidae. They are mostly small to tiny bees, including the smallest bees in the world, although some species are up to 10mm in length. There are 400+ species. Females of this group carry their pollen internally, in the crop. There are ground nesting species and above-ground nesting species. The following couplets are an adaptation of a key by Michener (2007).



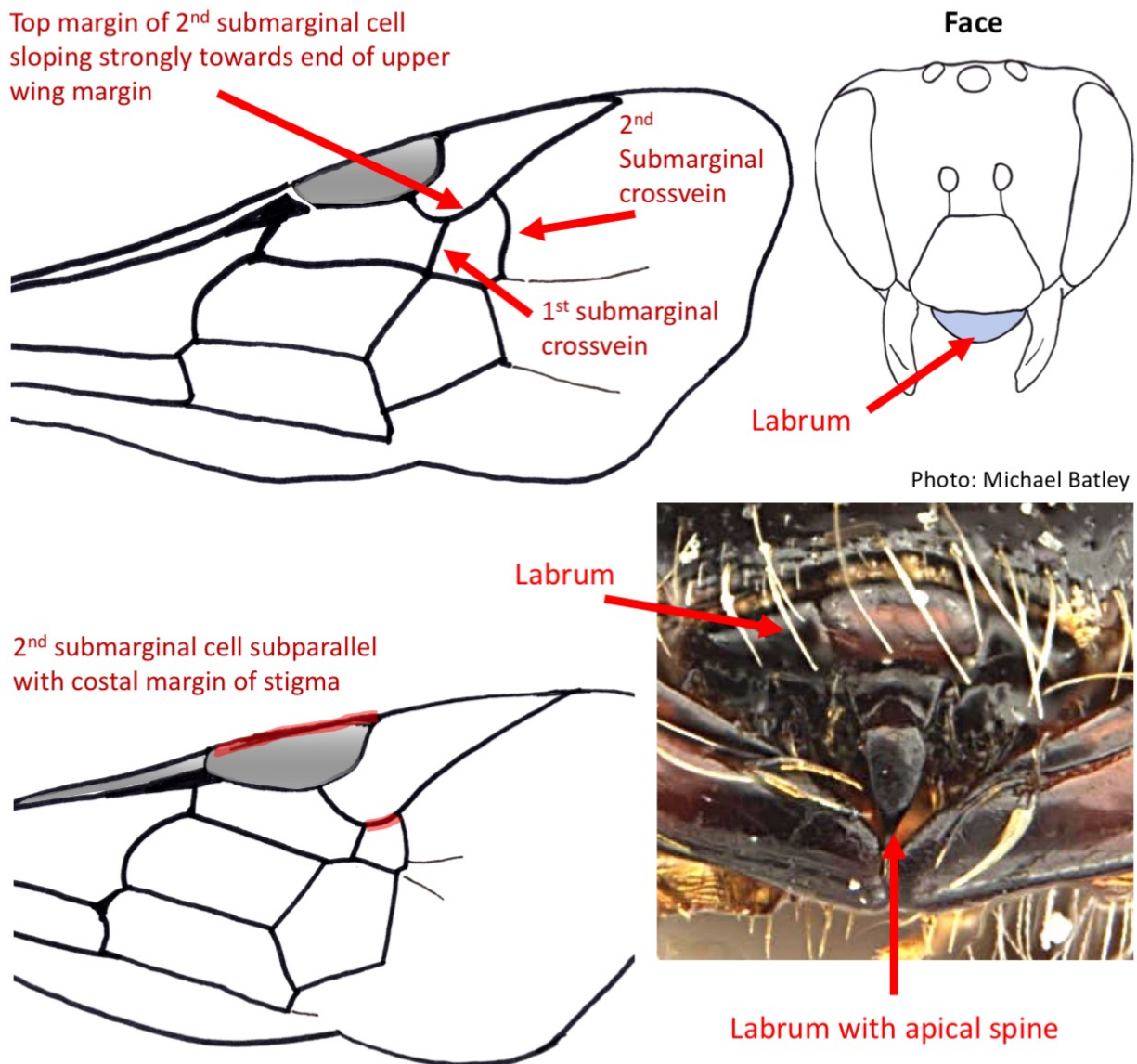
Euryglossinae – Couplet 1

- ❖ First abscissa of vein Rs transverse, so that posterior (bottom) inner corner of first submarginal cell has an angle of about 90 degrees; bottom margin of first submarginal cell straight; first recurrent vein joining first submarginal cell or rarely meeting first submarginal crossvein ... 2
- ❖ First abscissa of vein Rs oblique, so that bottom inner corner of first submarginal cell is nearly always acute; bottom margin of first submarginal cell curved [except in *Brachyhesma* and *Euhesma hemixantha*]; first recurrent vein not joining first submarginal cell ... 4



Euryglossinae – Couplet 2 (1)

- ❖ Second submarginal crossvein about one-third longer than first; costal (top) margin of second submarginal cell sloping strongly towards end of upper wing margin; labrum of female nearly always with strong apical spine ... ***Pachyprosopis***
- ❖ Second submarginal crossvein usually little longer than first or absent; top margin of second submarginal cell subparallel to costal margin of stigma; labrum of female usually without apical spine (minute species) ... **3**



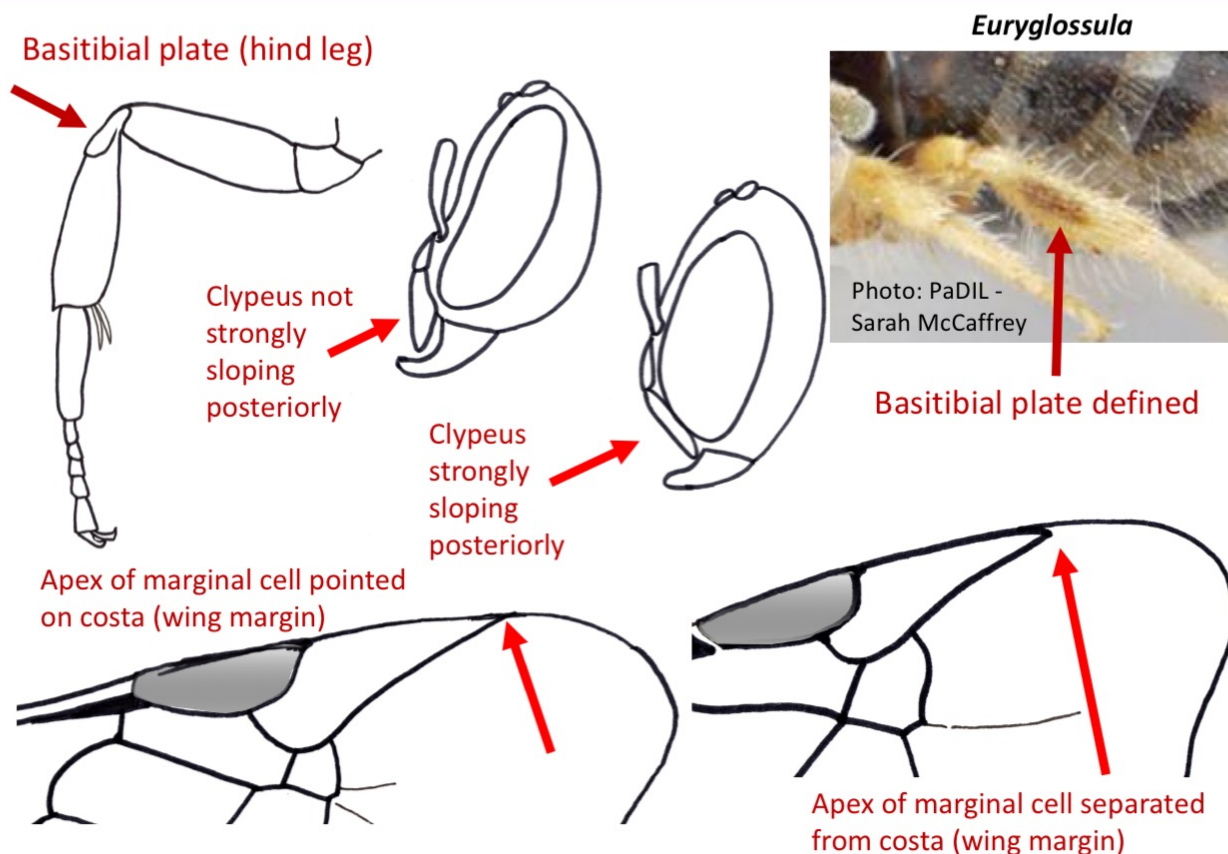
Pachyprosopis

~23 species, widespread

Exley, E. M. (1972) Revision of the genus *Pachyprosopis* Perkins (Apoidea: Colletidae).
Australian Journal of Zoology Supplementary Series 10: 1–43 [15].

Euryglossinae – Couplet 3 (2)

- ❖ Basitibial plate of female defined (though in some cases very indistinctly and incompletely), one-fourth to one sixth of length of tibia; clypeus of female not strongly sloping posteriorly, as seen in profile; apex of marginal cell pointed on costa
... ***Euryglossula***
- ❖ Basitibial plate of female not clearly defined, but margin indicated (often vaguely) by tubercles and ending near middle of tibia; clypeus of female sloping posteriorly, at least below; apex of marginal cell often separated from costa, sometimes by less than width of a vein (except in at least two species)
... ***Euryglossina***



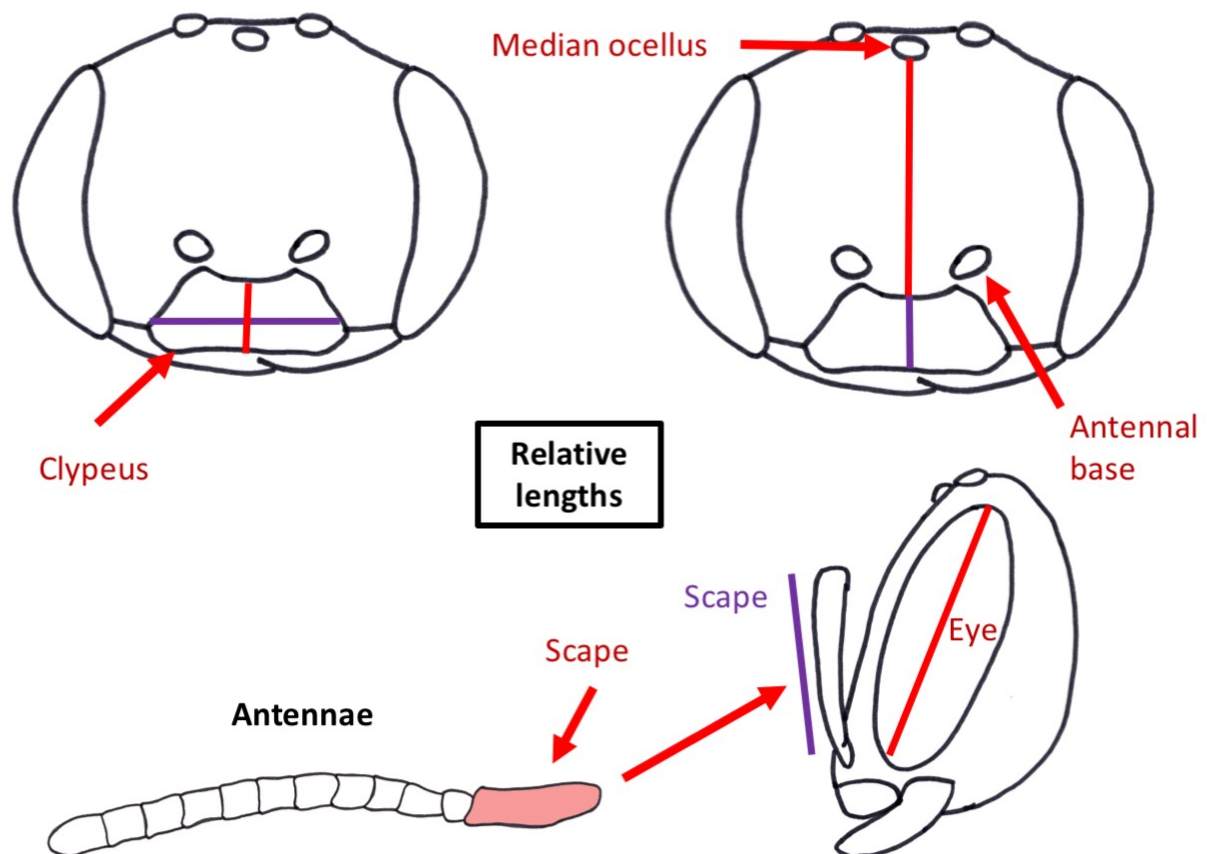
Note: While the apex of marginal cell character is useful to help separate some species in each of these two genera, it is not useful in others. In some species of *Euryglossula* there are also dense hairs in the wing that seem to make the vein appear longer, and thus not fitting the description above.

<i>Euryglossula</i>	<i>Euryglossina</i>
<20 species, widespread	<75 species, widespread
Batley, M. (2016) New species of <i>Euryglossula</i> Michener (Apoidea: Colletidae). <i>Rec. Aust. Mus.</i> 68(6): 245–261.	Exley E.M. (1968) Revision of the genus <i>Euryglossina</i> Cockerell (Apoidea: Colletidae). <i>Australian Journal of Zoology</i> , 16: 915–1020.

Line drawings by Tobias Smith (heads & wings based on diagrams in Michener 2007)

Euryglossinae – Couplet 4 (1)

- ❖ Clypeus more than 3.5 times as broad as long, as seen from front; and folded under the head; scape at least two-thirds as long as eye; antennal bases more than three times as far from median ocellus as from lower edge of clypeus (antennal bases touching the clypeus)
... ***Brachyhesma***
- ❖ Clypeus usually less than 3.5 times as broad as long, not folded under the head; scape usually not much more than one-half as long as eye; antennal bases not much more than twice as far from median ocellus as from lower edge of clypeus
... 5



Brachyhesma

~40 species, widespread



Photo: PaDIL - Sarah McCaffrey

Example specimens



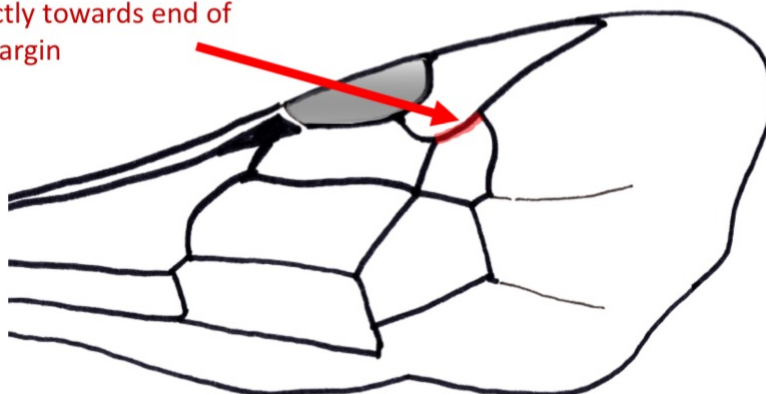
Photo: PaDIL - Sarah McCaffrey

Exley E.M. (1977) The Australian genus *Brachyhesma* (Apoidea: Colletidae) revised and reviewed. *Australian Journal of Zoology Supplementary Series* 25: 1-54.

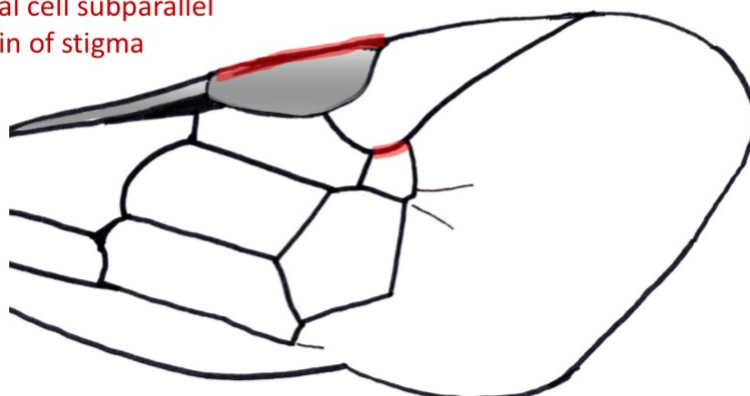
Euryglossinae – Couplet 5 (4)

- ❖ Costal (top) margin of second submarginal cell distinctly sloping apically towards costa (body black, without yellow markings; subantennal sutures absent, see page 71) ... *Hyphesma*
- ❖ Costal (top) margin of second submarginal cell usually sub-parallel to costal margin of stigma ... 6

Top margin of 2nd submarginal cell sloping distinctly towards end of upper wing margin



2nd submarginal cell subparallel with top margin of stigma



Note: What is a 'distinctly' sloped? This can be tricky. For example, *Sericogaster fasciata* (couplet 8) is fairly sloped, but actually keys out here as sub-parallel. If you run into trouble at or beyond this couplet, try coming back and taking the alternate path here.

Hyphesma

<10 species, widespread

Exley, E. (1975) Revision of the genus *Hyphesma* Michener (Apoidea: Colletidae). *Australian Journal of Zoology*, 23: 277–291.

Photo: PaDIL - Caroline Harding



Example specimen

Line drawings by Tobias Smith (based on diagrams in Michener 2007)

Euryglossinae – Couplet 6 (5)

- ❖ T1 about as broad as long, as seen from above (not yellow bodied) ... *Heterohesma*
- ❖ T1 much broader than long or body largely yellow ... 7



Photo: PaDL - Caroline Harding

T1 (highlighted in red here), as broad as long



Photo: PaDL - Clare Mclellan

T1 (highlighted in red here), much broader than long



Photo: PaDL - Caroline Harding

Heterohesma
2 species, east coast



Photo: PaDL - Caroline Harding

Euryglossinae – Couplet 7 (6)

- ❖ Second submarginal cell strongly narrowed towards costa (top), about half as long on anterior side as on posterior side; second submarginal crossvein strongly curved or sinuate and at an angle of about 45 degrees to first; head and mesosoma strongly and closely punctate, metasoma dull with dense, minute punctures
... ***Dasyhesma***
- ❖ Second submarginal cell only a little shorter on anterior side than on posterior side; second submarginal crossvein only gently curved and subparallel to first or at an angle of less than 40 degrees to first; head and mesosoma with punctures fine or well separated, metasoma not dull with minute, dense punctures, although sometimes dulled by other sculpturing
... **8**

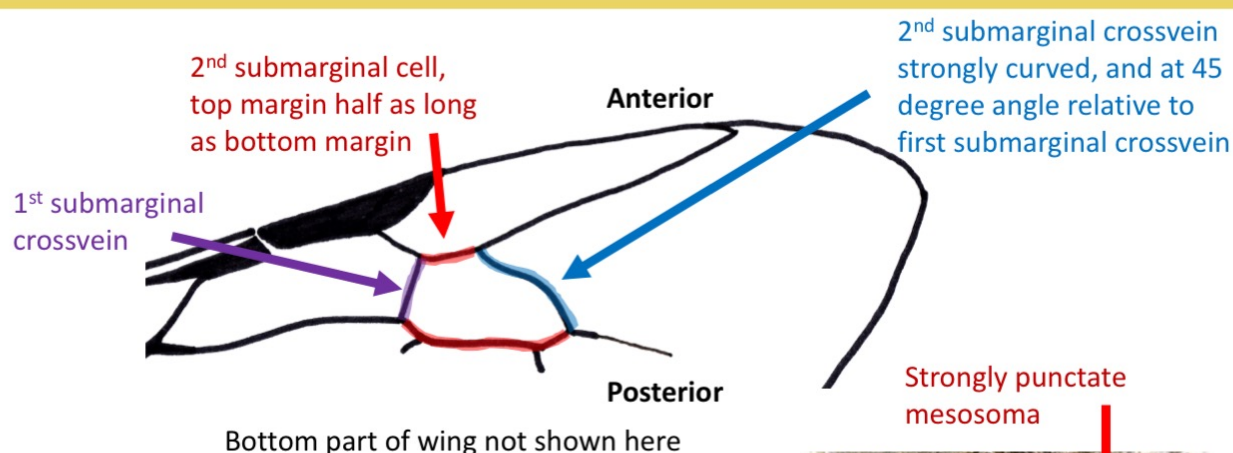


Photo: PaDIL - Caroline Harding

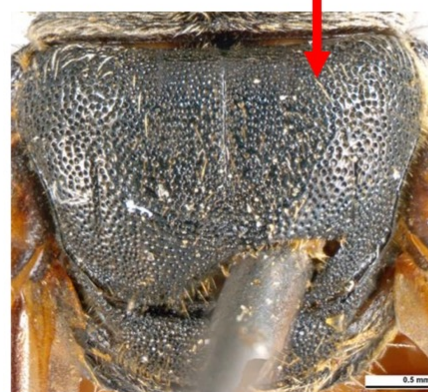
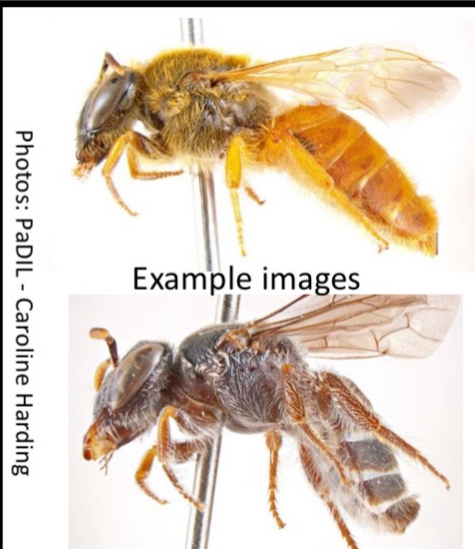


Photo: PaDIL - Caroline Harding



Dasyhesma

~20 species

Only known from WA

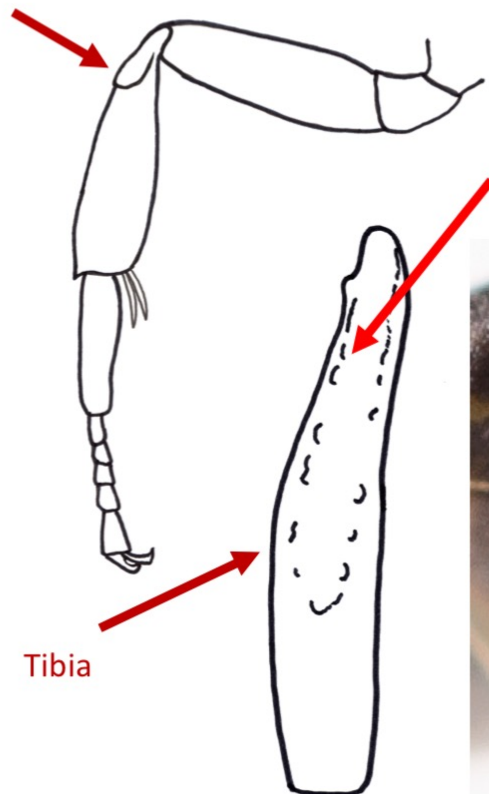
Exley, E. (2004) Revision of the genus *Dasyhesma* Michener (Apoidea: Colletidae: Euryglossinae). Records of the Western Australian Museum, 22 (2): 129–146.

Line drawing by Tobias Smith (based on diagram in Michener 2007)

Euryglossinae – Couplet 8 (7)

- ❖ Basitibial plate in both sexes indicated by two rows of large tubercles, the rows nearly meeting and terminating the “plate” well beyond middle of tibia
... *Sericogaster*
- ❖ Basitibial plate not extending beyond middle of tibia, although a single row of tubercles may extend beyond middle
... 9

Basitibial plate (hind leg)



Two rows of tubercles (spiny protrusions) on hind tibia

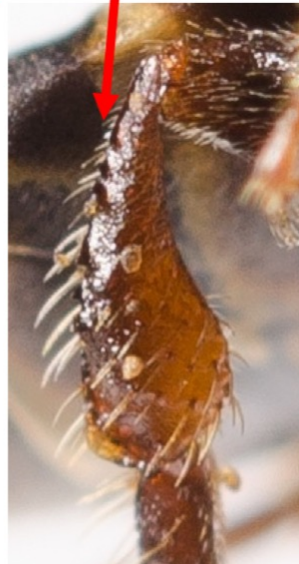
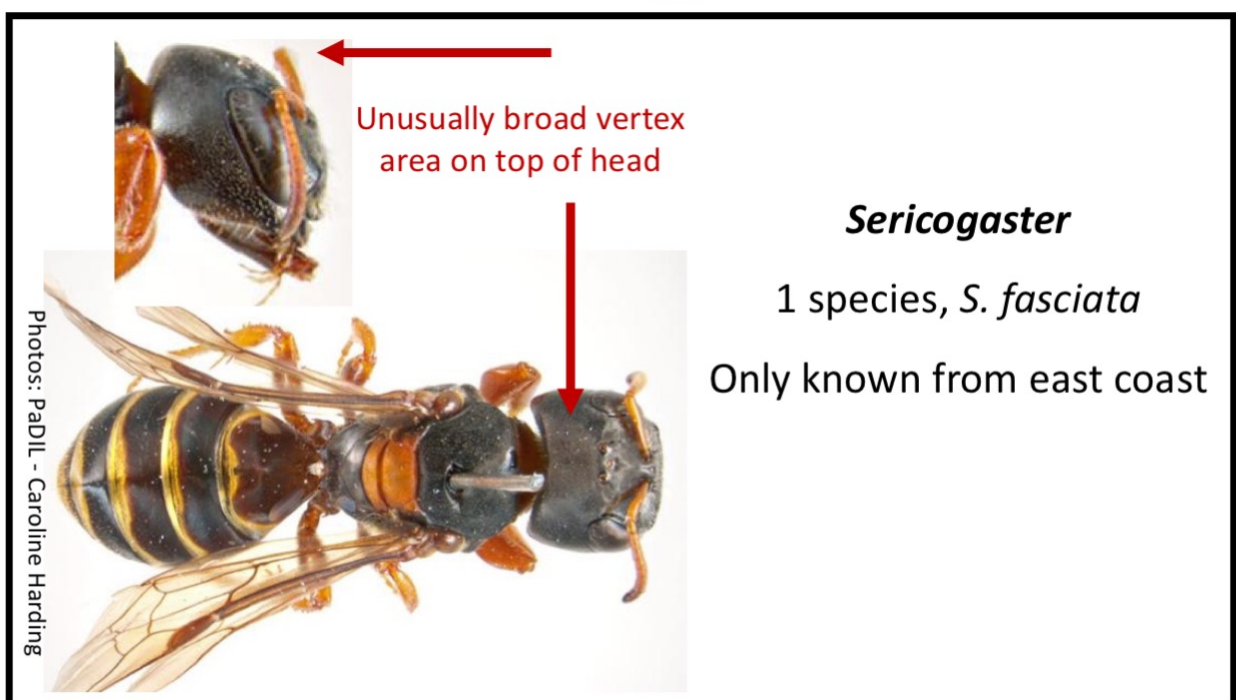


Photo: PADL - Caroline Harding

Photo: Tobias Smith

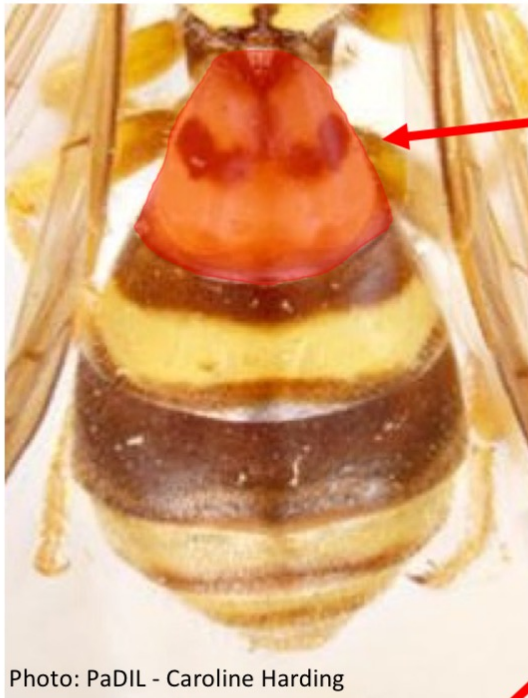


Photos: PADL - Caroline Harding

Line drawings by Tobias Smith (basitibial plate based on diagram in Michener 2007)

Euryglossinae – Couplet 9 (8)

- ❖ Body slender, T1 seen from above little broader than long (extensive yellow pattern on body; mandible simple in both sexes) ... ***Stenohesma***
- ❖ Body of ordinary form, T1 seen from above much broader than long ... **10**



T1 (highlighted in red here),
about as broad as long



T1 (highlighted in red here),
much broader than long



Stenohesma

1 species, *S. nomadiformis*

Only known from
north QLD



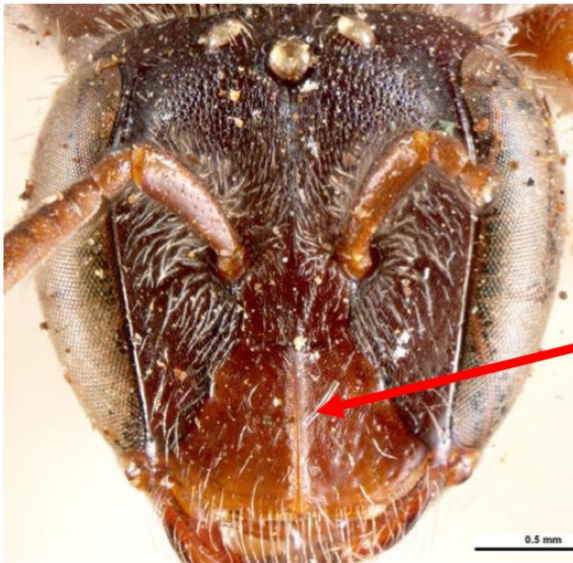
Euryglossinae – Couplet 10 (9)

- ❖ Clypeus with strong longitudinal median carina (ridge); mandible simple
... ***Melittosmithia***
- ❖ Clypeus without longitudinal carina
... 11

Mandible simple



Photo: PaDIL - Caroline Harding



Clypeus with strong carina (ridge)



Photo: PaDIL - Caroline Harding

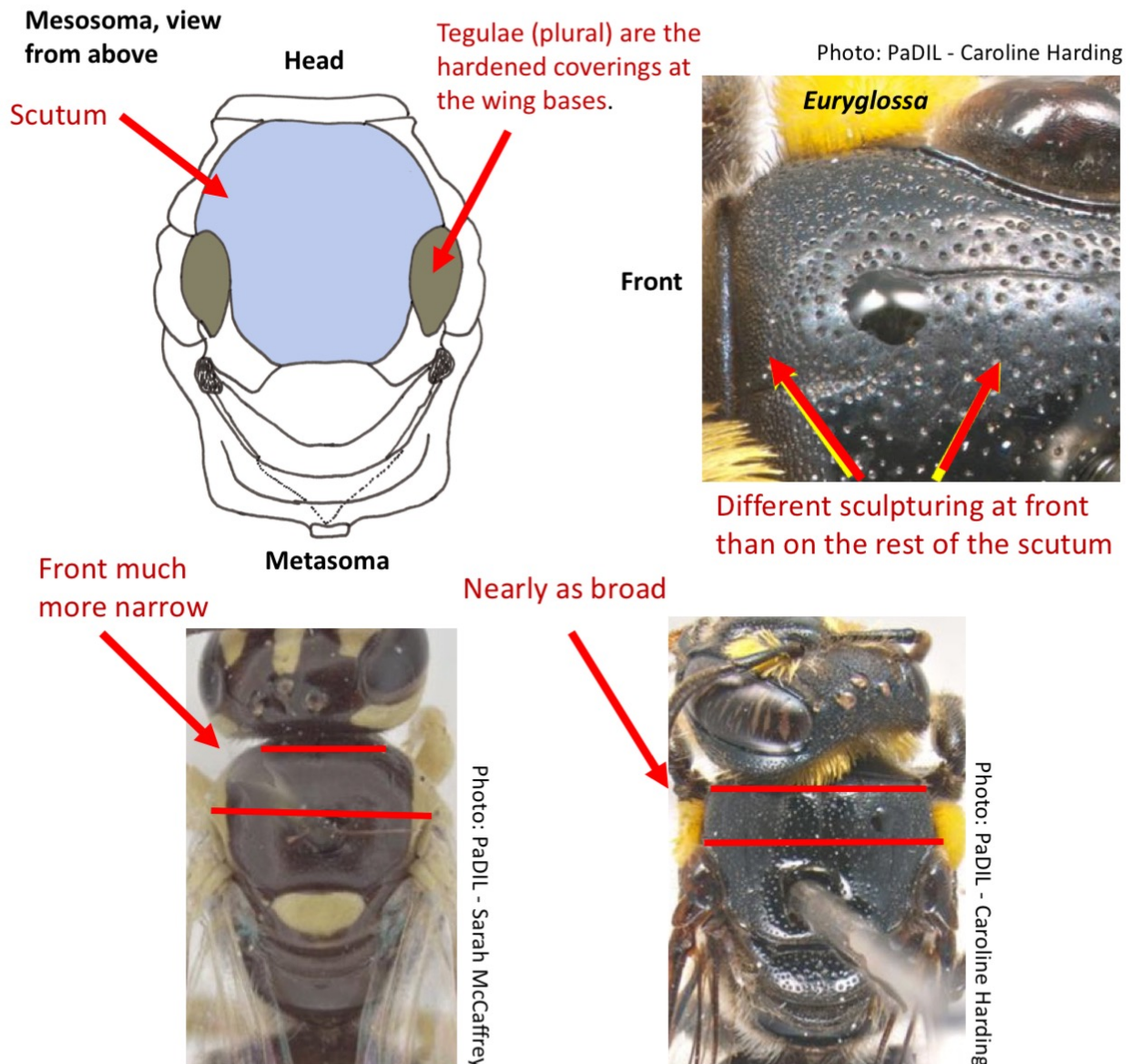
Melittosmithia

4 species

South-eastern Australia

Euryglossinae – Couplet 11 (10)

- ❖ Front end of scutum, especially in female, nearly as broad as scutal width at front ends of tegulae; front of scutum curved down rather sharply and usually differently sculptured than rest of scutum; scutum coarsely punctured, in female; body usually without yellow markings
... **Euryglossa**
- ❖ Front end of scutum much narrower than width at front ends of tegulae; front of scutum curved down rather uniformly and usually not sculptured differently than rest of scutum; scutum shining and almost impunctate, or usually dull, minutely lineate or roughened, its punctation variable
... **12**



Euryglossa

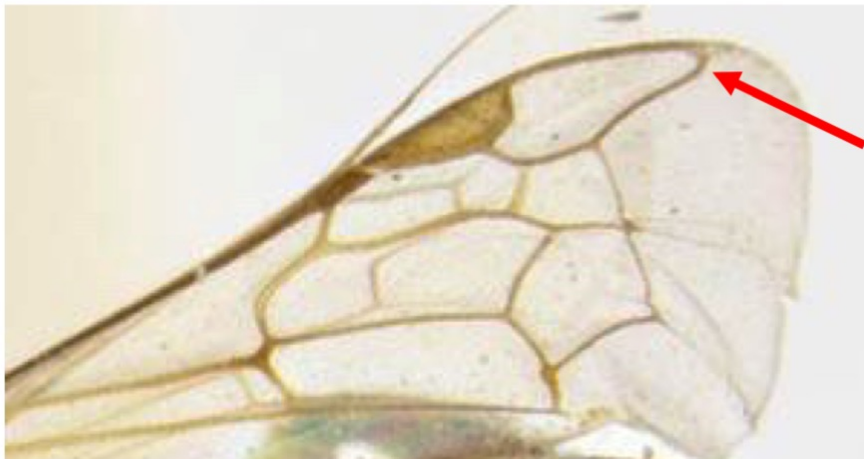
~40 species, widespread

Exley E.M. (1976) Revision of the subgenus Euryglossa Smith (Apoidea: Colletidae: Euryglossinae). *Australian Journal of Zoology Supplementary Series*, 24: 1-72.

Line drawing by Tobias Smith (based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994)

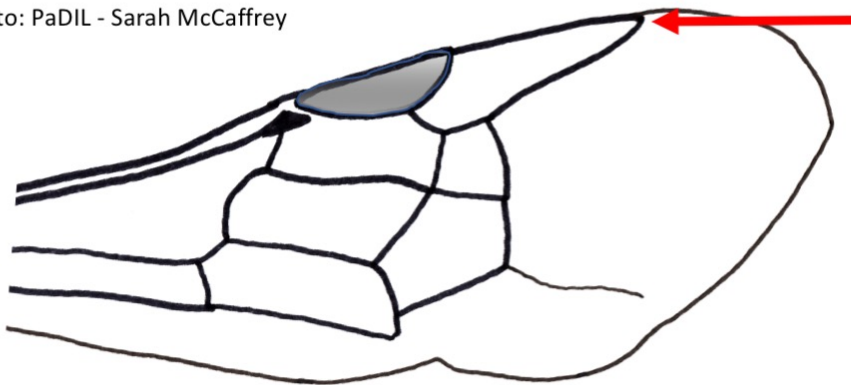
Euryglossinae – Couplet 12 (11)

- ❖ Apex of marginal cell rounded or somewhat pointed, bent well away from wing margin; outer surface of hind tibia of female covered with simple bristles
... ***Callohesma***
- ❖ Apex of marginal cell pointed on or almost on wing margin; outer surface of hind tibia of female usually with some plumose hairs in addition to simple bristles
... **13**



Apex of marginal cell rounded, bent away from wing margin

Photo: PaDIL - Sarah McCaffrey



Pointed apex, and almost on wing margin

Example specimen



Photo: PaDIL - Sarah McCaffrey

Callohesma

~35 species, widespread

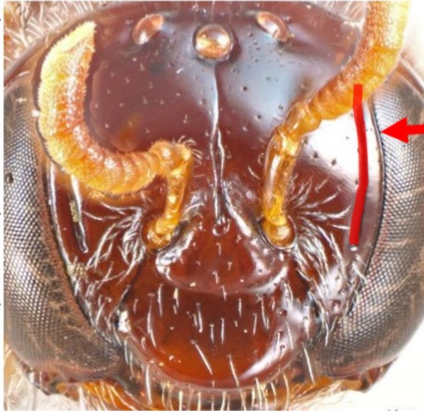
Exley, E. (1974) Revision of the subgenus *Callohesma* Michener (Apoidea: Colletidae). *Australian Journal of Zoology Supplementary Series*, 22: 1-58.

Line drawing by Tobias Smith (based on diagram in Michener 2007)

Euryglossinae – Couplet 13 (12)

- ❖ Mandible of female tridentate (male unknown); facial foveae linear, not bent towards ocelli
... ***Tumidihesma***
- ❖ Mandible simple or bidentate; facial foveae broader, or, *if* narrowly linear, then upper end bent toward ocelli
... **14**

Photo: PaDIL - Caroline Harding



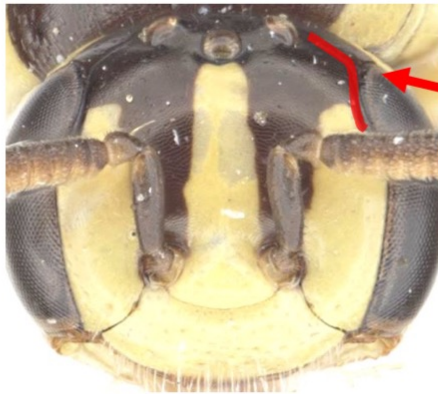
A groove/channel in the cuticle is a fovea (plural foveae). In the face they come in pairs, and are called facial foveae. In this case they are linear and narrow.

Photo: PaDIL - Caroline Harding



In this case, the facial foveae are broad, not thin, and not linear.

Photo: PaDIL - Sarah McCaffrey



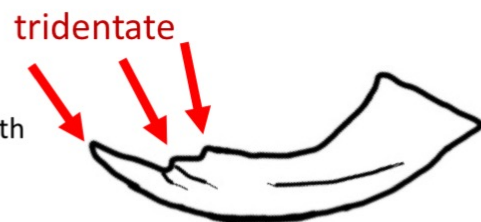
In these two cases, the facial foveae are also narrow and linear, but they bend inwards towards ocelli at the top end.

Photo: PaDIL - Sarah McCaffrey



Note: It can help to use light from one side, and look for the shadow here.

Note: A tridentate mandible is one with three teeth at/near the end. Bidentate is two, simple is none.



Tumidihesma

2 species
~6mm long
Not known from
eastern states



Photos: PaDIL - Caroline Harding

Line drawing by Tobias Smith

Euryglossinae – Couplet 14 (13)

- ❖ Facial foveae of female slender, linear, upper fourth or more bent inwards towards ocelli; mandible of female simple (with small preapical tooth in subgenus *Chaetohesma*); subantennal suture absent, upper lateral part of clypeus usually produced upward to antenna; body commonly with extensive yellow markings
... ***Xanthesma***
- ❖ Facial foveae of female broad or broadly linear, upper end commonly not bent inwards; mandible of female with preapical tooth on upper margin; subantennal suture usually present, but upper lateral angle of clypeus sometimes attaining antennal base, eliminating subantennal suture; body usually without extensive yellow markings
... ***Euhesma***

Photo: PaDIL - Sarah McCaffrey

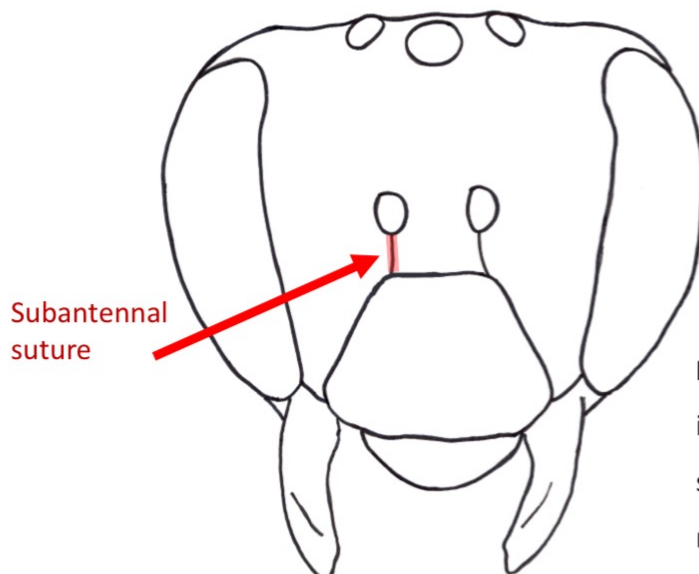


Facial foveae of female slender, linear, and bent towards ocelli

Facial foveae of female broad, not usually bent towards ocelli



Photo: PaDIL - Caroline Harding



Note: The subantennal suture is absent in *Xanthesma* because the antennal sockets touch the clypeus, leaving no room to see a suture in between the two.

Xanthesma

~50 species, widespread

Exley, E. (1974) A contribution to our knowledge of the bee fauna (Colletidae: Euryglossinae) of remote areas of Australia with descriptions of new species. *Proceedings of the Royal Society of Queensland*, 85 (9): 95–110.

Euhesma

~90 species, widespread

PART: Exley, E. (2001) The *walkeriana* species-group of *Euhesma* Michener (Hymenoptera: Colletidae: Euryglossinae). *Austral Entomology*, 40: 102–112.

PART: Hogendoorn, Stevens, & Leijs (2015) DNA barcoding of euryglossine bees and the description of new species of *Euhesma* Michener (Hymenoptera: Colletidae: Euryglossinae). *ZooKeys*, 520: 41–59.



Colletidae:

Subfamily Hylaeinae

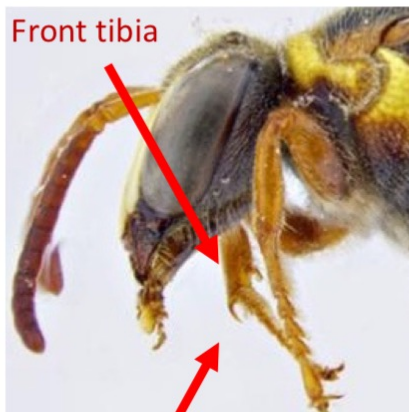
The subfamily Hylaeinae, family Colletidae, has approximately 210 species, and includes seven genera. These bees are sometimes superficially mistaken for wasps. Females carry their pollen internally, in the crop. The majority of species are above-ground nesting bees. Most species use pre-existing holes, while some, such as some *Amphylaeus* and *Palaeorhiza*, excavate their own nest holes. The following couplets are adaptations of keys by Houston (1975) and Michener (2007).



Photos by Tobias Smith, unless otherwise attributed

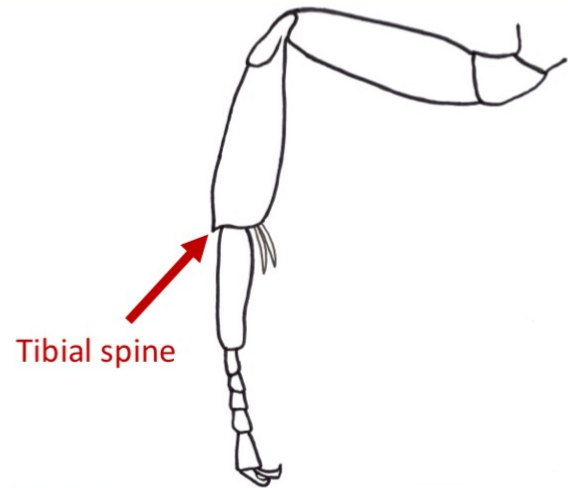
Hylaeinae – Couplet 1

- ❖ Front tibial spine prolonged into long curved process at least as long as basitarsal diameter; strong protrusion on second metasomal sternum (S2); black with yellow, red or orange integumental bands on metasoma ... **Hyleoides**
- ❖ Front tibial spine small and inconspicuous; no strong protrusion on S2; no coloured integumental banding on metasoma ... **2**

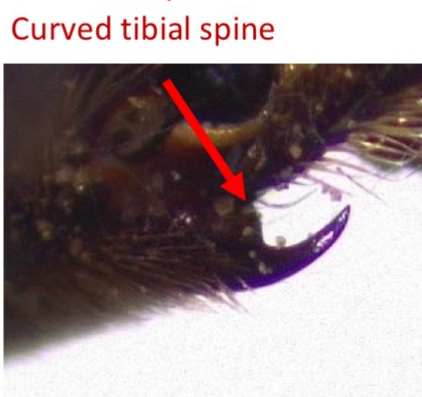


Front tibia

Photo: PaDIL - Sarah McCaffrey



Tibial spine



Curved tibial spine

Photo: Tobias Smith



Photo: PaDIL - Caroline Harding

Strong protrusion on second metasomal sternum

Hyleoides, 8 species, widespread



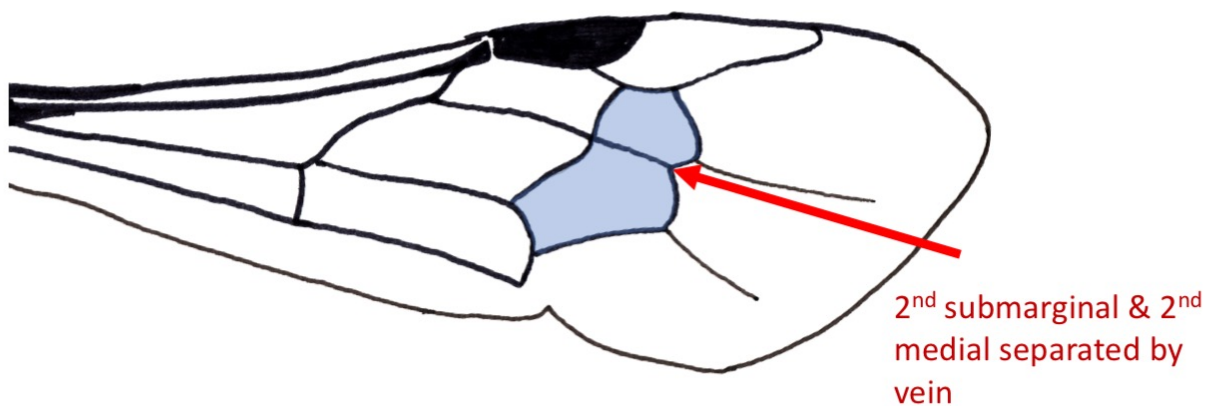
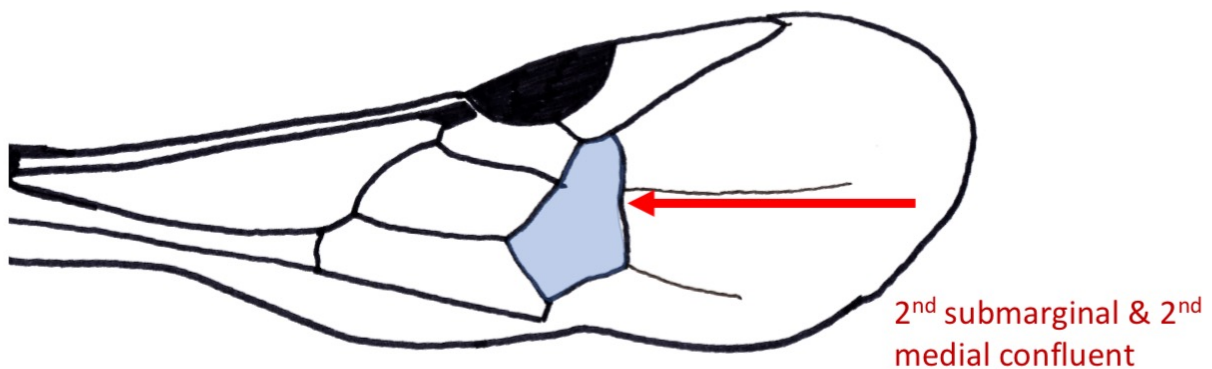
Photos: PaDIL - Caroline Harding

Houston, T. (1975) A revision of the Australian hylaeine bees (Hymenoptera: Colletidae).
Australian Journal of Zoology, Supplementary Series, 36: 1–135.

Hylaeinae – Couplet 2 (1)

- ❖ Second submarginal and second medial cells of forewing confluent (minute slender bees) ... *Hylaeus* (part*)
- ❖ Second submarginal and second medial cells of forewing separated by a vein ... 3

* *Hylaeus* that key out here are in the subgenus *Heterapoides* or *Gephyrohylaeus*



Hylaeus (*Heterapoides*)

8 species
Widespread

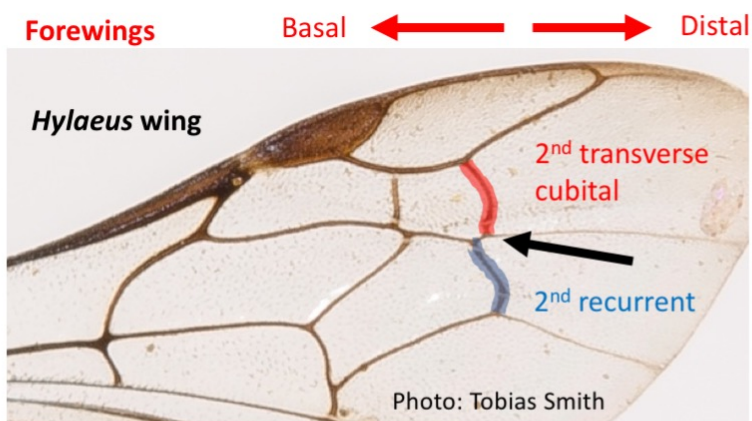
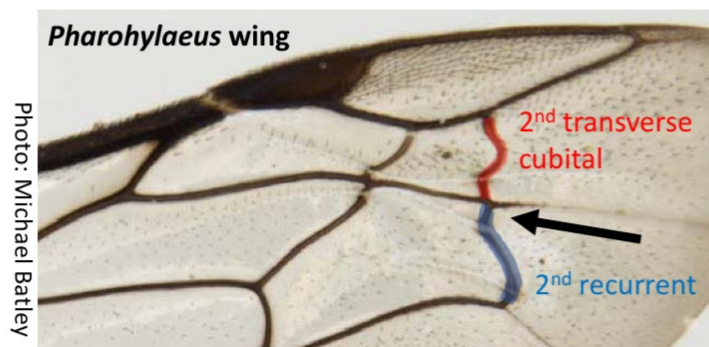
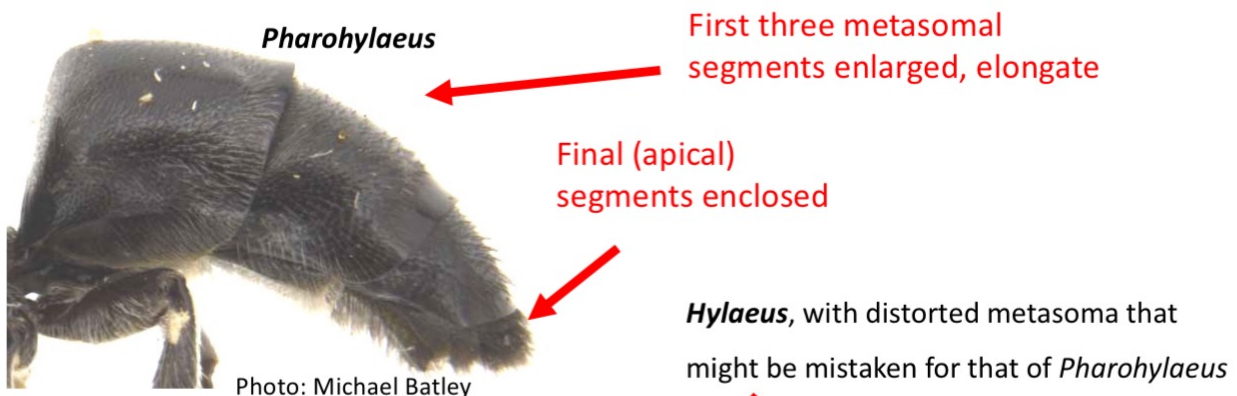
Hylaeus (*Gephyrohylaeus*)

1 species
Widespread

Hylaeinae – Couplet 3 (2)

- ❖ Second recurrent vein distal to second transverse cubital vein; metasomal segments 1–3 enlarged and enclosing more apical ones ... *Pharohylaeus*
- ❖ Second recurrent vein in line with or basal to second transverse cubital vein; metasomal segments 1–3 not enlarged nor enclosing more apical ones ... 4

Note that occasionally the metasoma of some pinned specimens of other genera such as *Hylaeus* can appear to have enlarged metasomal segments 1–3 as an artefact of drying out (see example photo below right).



Pharohylaeus

1 species, *P. lactiferus*
Only known from north
and central QLD



Hylaeinae – Couplet 4 (3)

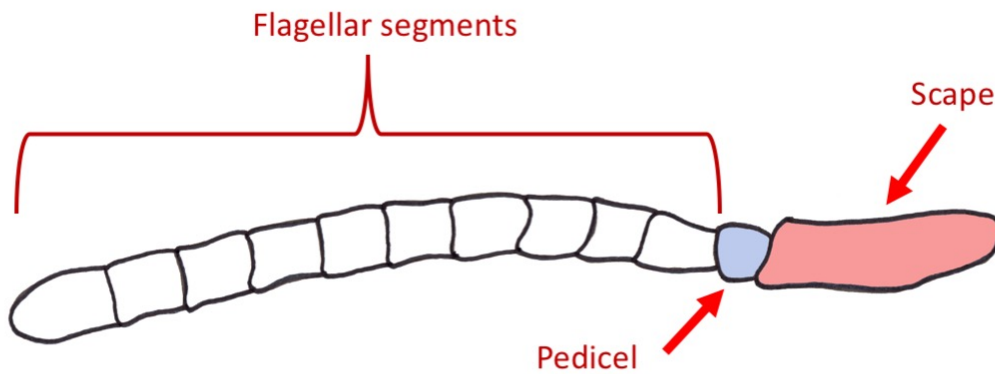
- ❖ Males
- ❖ Females

... 5

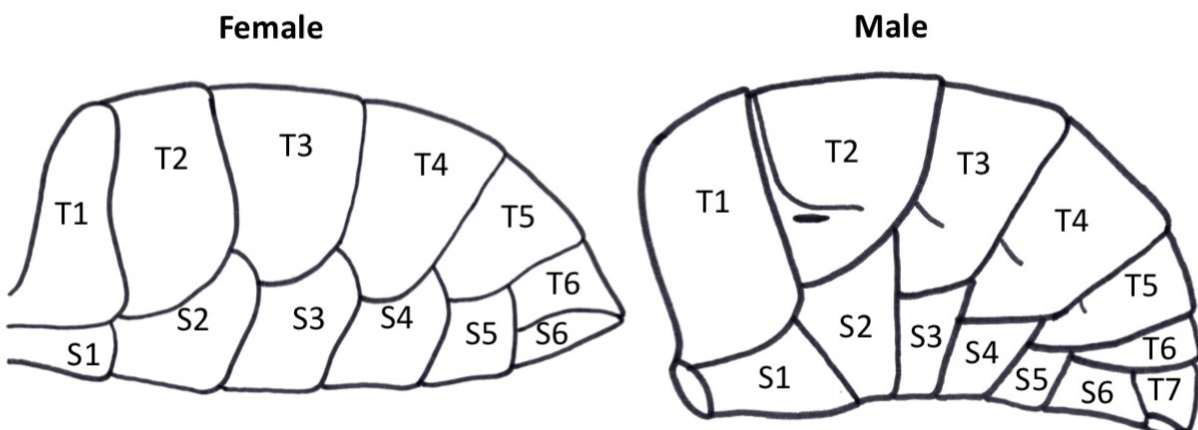
... 9

There are two easy methods of determining the sex of bee specimens: **1)** the number of antennal segments, and **2)** the number of metasomal segments.

Antennal segments. Count the total number of antennal segments, including the scape and pedicel. Female bees have **12** segments, and males have **13** segments.



Metasomal segments. Count the total number of metasomal segments (pairs of terga and sterna). Female bees have **6** segments, and males have **7** segments.



Hylaeinae – Couplet 5 (4)

- ❖ Glossa obtuse or rounded at apex (with a small median point in *Hylaeus nubilosus*)

... *Hylaeus* (part)

- ❖ Glossa pointed at apex

... 6

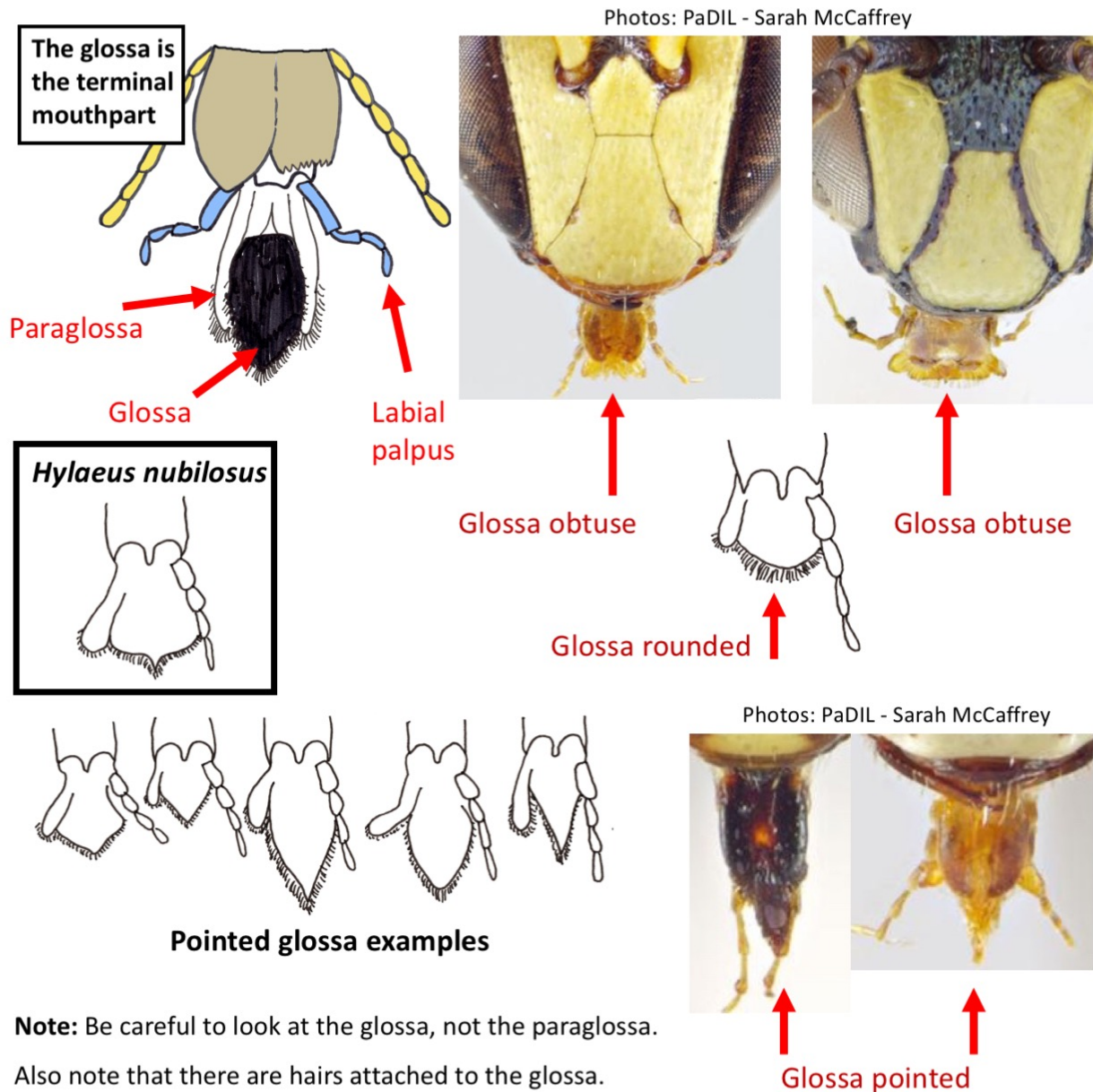


Photo: Tobias Smith

Hylaeus

150+ species (20 subgenera)

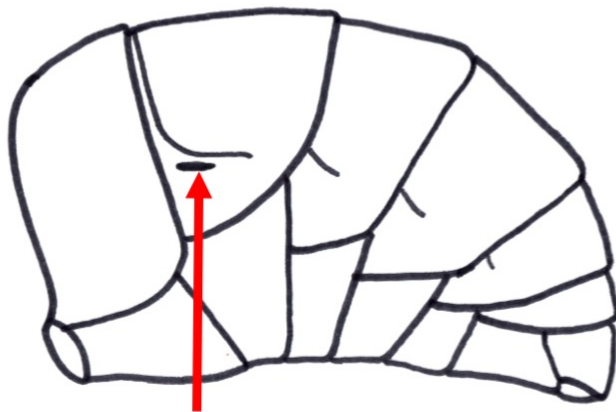
Widespread

Houston, T. (1981) A revision of the Australian hylaeine bees (Hymenoptera: Colletidae). II. *Australian Journal of Zoology, Supplementary Series*, 80: 1–128.

Line drawings by Tobias Smith (based on diagrams in Michener (2007 top left and 1965))

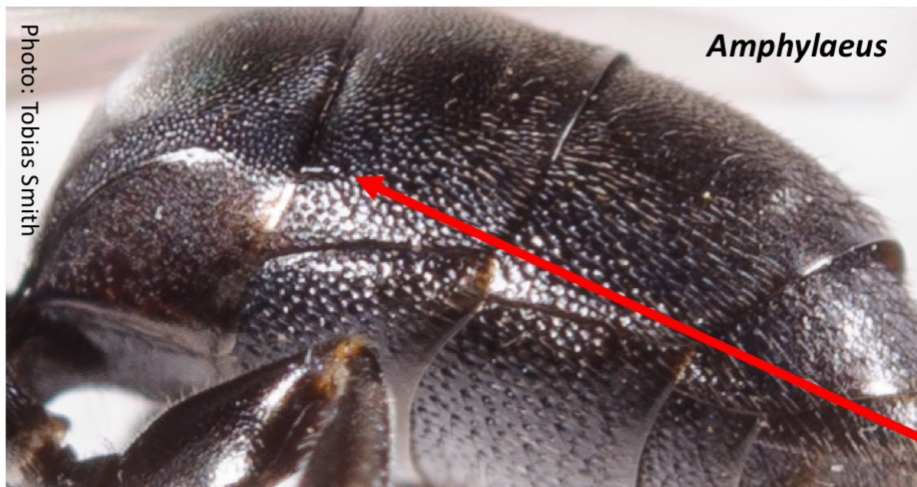
Hylaeinae – Couplet 6 (5)

- ❖ Foveae of second metasomal tergum linear and horizontal ... 7
- ❖ Foveae of second metasomal tergum punctiform (point/dot like) or absent ... 8



Fovea of T2

Note: Foveae (fovea, singular) are depressions in the cuticle. Foveae of the second metasomal tergum are hairless grooves. To see foveae, try looking from various angles to try to see the shadow of the depression. Diffused light can be beneficial too.



T2 fovea, linear and horizontal

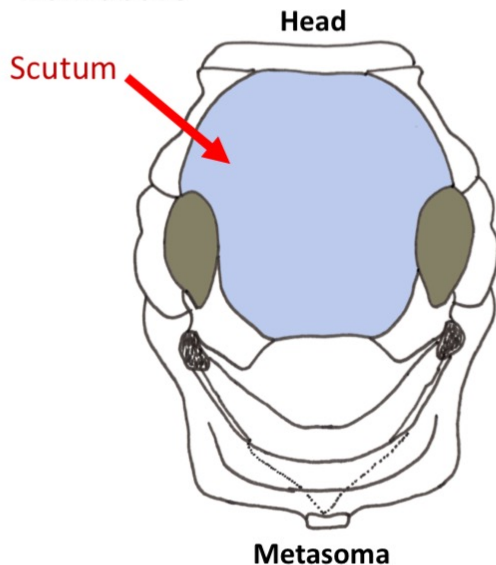


Line drawing by Tobias Smith (based on diagram in Michener 2007)

Hylaeinae – Couplet 7 (6)

- ❖ Genae and scutum with yellow markings; first metasomal segment appearing constricted in side view ...*Hemirhiza*
- ❖ Genae and scutum without pale markings; first metasomal segment not appearing constricted in side view ... *Amphylaeus*

Mesosoma, view from above

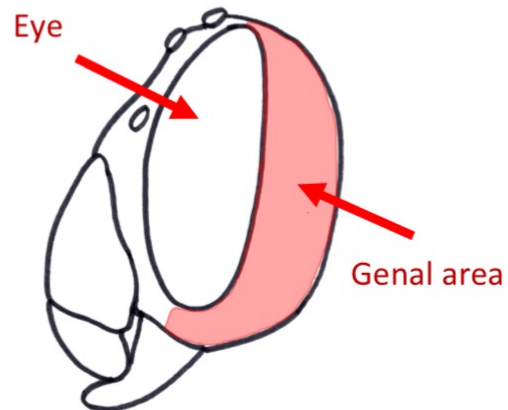


1st metasomal segment appearing constricted

Hemirhiza melliceys



Head, viewed from side



Yellow on genae

Yellow on scutum



Hemirhiza melliceys



Photo: Tobias Smith

Amphylaeus

4 species

Only known from eastern states

Houston, T. (1975) A revision of the Australian hylaeine bees (Hymenoptera: Colletidae). *Australian Journal of Zoology, Supplementary Series*. 36: 1–135.

Hemirhiza

1 species, *H. melliceys*

Only known from east coast

Line drawings by Tobias Smith (based on diagrams by E.R.S. Hodges in Michener, McGinley & Danforth, 1994)

Hylaeinae – Couplet 8 (6)

- ❖ Face with large lateral depressions from sides of clypeus to above antennal sockets; gradulus of second metasomal tergum exposed and curved posteriorly medially; hind tibia with one or two spines on outer apical margin (*see couplet 9 for full description of tibial spines*)
... **Meroglossa** (page 82)
- ❖ Face without large lateral depressions; gradulus of second metasomal tergum normally concealed and transverse; hind tibia without spines on outer apical margin
... **Palaeorhiza** (page 82)

Photo: PaDIL - Sarah McCaffrey



Note: A good way to see the depressions here is to move your specimen around, trying to create shadows using the angle of your lights.

Large lateral depressions

No depressions



Photo: PaDIL – Michael Batley

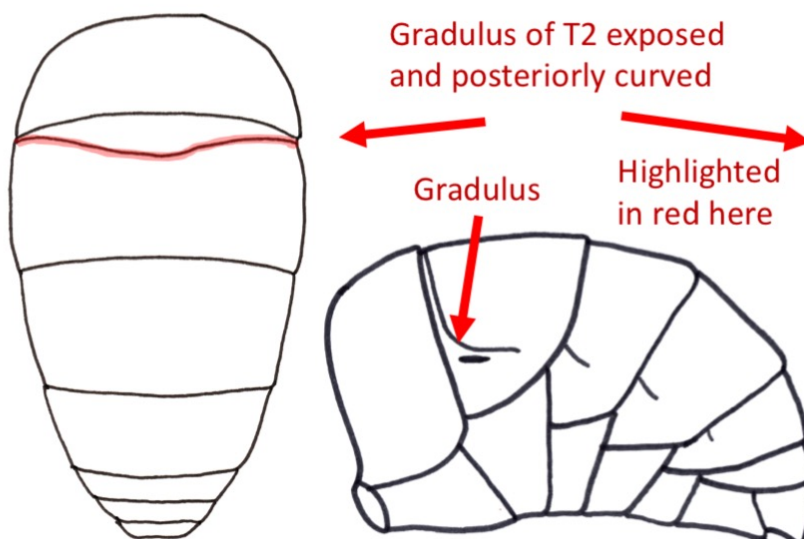
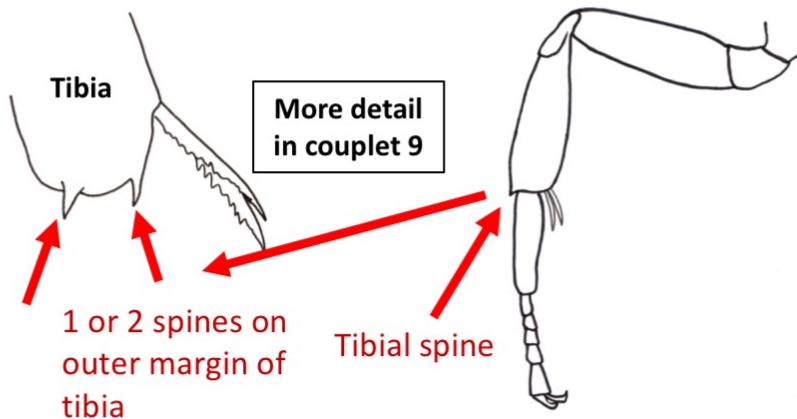


Photo: PaDIL - Caroline Harding

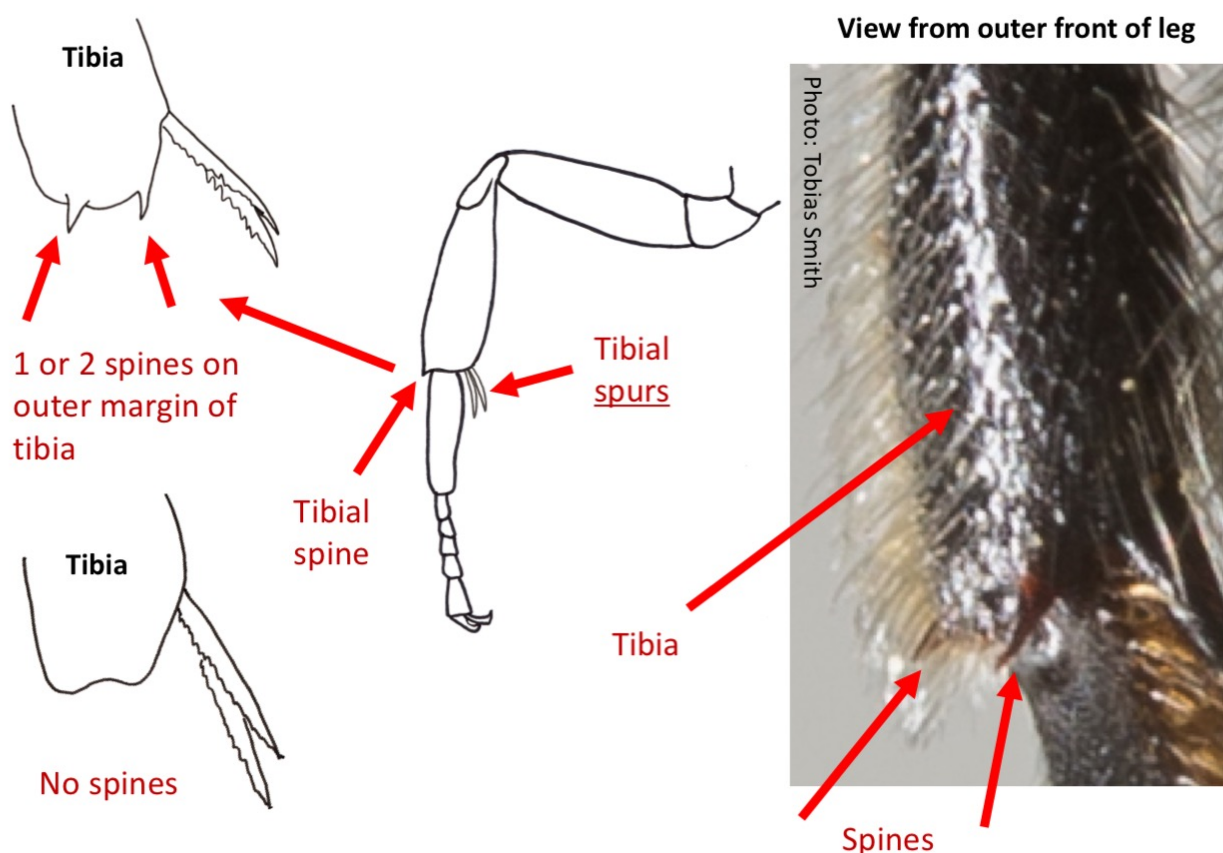


Line drawings by Tobias Smith (based on diagrams in Michener 2007 & Houston 1975 (dorsal view metasoma))

Hylaeinae – Couplet 9 (4)

- ❖ Outer apical margin of hind tibia usually with a pair of spines ... 10
- ❖ Outer apical margin of hind tibia without spines ... 11

Note: Don't get the hind tibial spines confused with the hind tibial spurs. The spines are different, and protrude from the outer/front side of the tibia, whereas the tibial spurs protrude inwards/back towards the body. These tibial spines can be partially hidden by hairs. Use the sharp end of an entomology pin to carefully scrape off some hairs, which will come off easily in dried specimens. You can also use an entomology pin to try and 'feel' the spines.



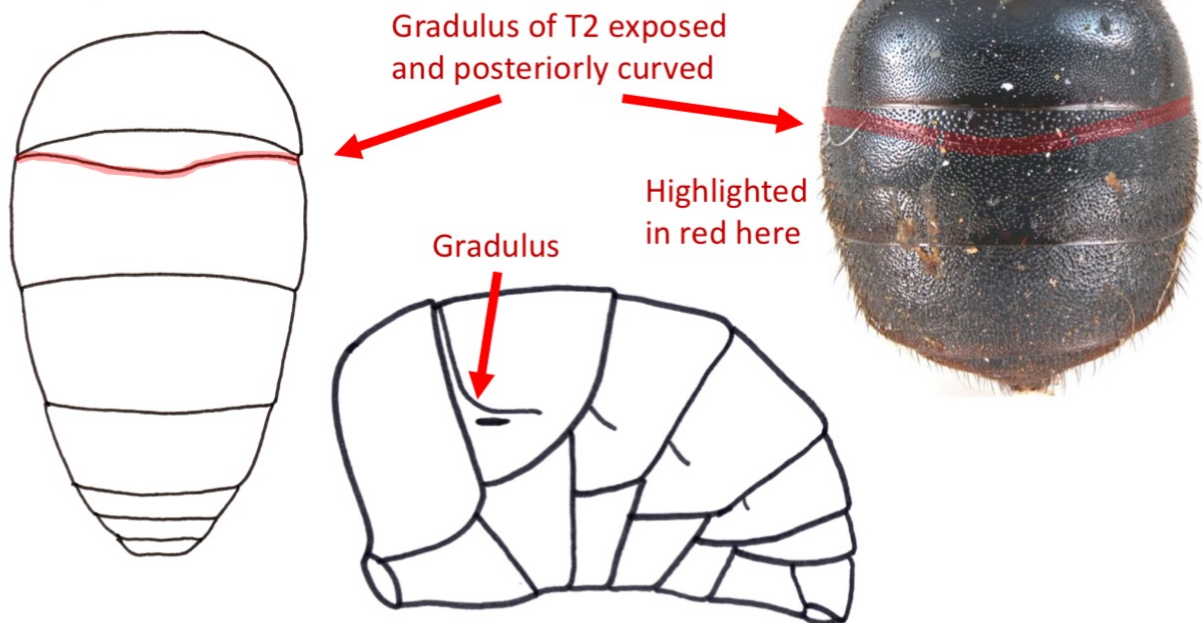
Descriptions below for genera keyed out on other pages of this Hylaeinae key	
<p><i>Meroglossa</i></p> <p>21 species</p> <p>Widespread</p> <p>Houston, T. (1975) A revision of the Australian hylaeine bees (Hymenoptera: Colletidae). <i>Australian Journal of Zoology, Supplementary Series</i>, 36: 1–135.</p>	<p><i>Palaeorhiza</i></p> <p>25 species</p> <p>Coastal QLD and northern NSW</p> <p>Houston, T. (1975) A revision of the Australian hylaeine bees (Hymenoptera: Colletidae). <i>Australian Journal of Zoology, Supplementary Series</i>, 36: 1–135.</p>

Line drawings by Tobias Smith (tibial spines based on diagrams in Michener (2007))

Hylaeinae – Couplet 10 (9)

- ❖ Gradulus of second metasomal tergum usually exposed and posteriorly curved medially; foveae of second metasomal tergum absent or punctiform (see Hylaeinae key couplet 6) ... ***Meroglossa* (page 82)**
- ❖ Gradulus of second metasomal tergum usually hidden and procurved medially; foveae of second metasomal tergum linear ... ***Amphylaeus* (page 80)**

***Meroglossa* metasoma**



***Amphylaeus* metasoma**



Photo: PaDIL - Sarah McCaffrey

Gradulus not exposed when metasoma flat

But, when metasoma is bent forward, gradulus of T2 is exposed, and procurved (highlighted in red here)

***Amphylaeus* metasoma**



Photo: Tobias Smith

Line drawings by Tobias Smith (based on diagrams in Michener 2007 & Houston 1975 (left))

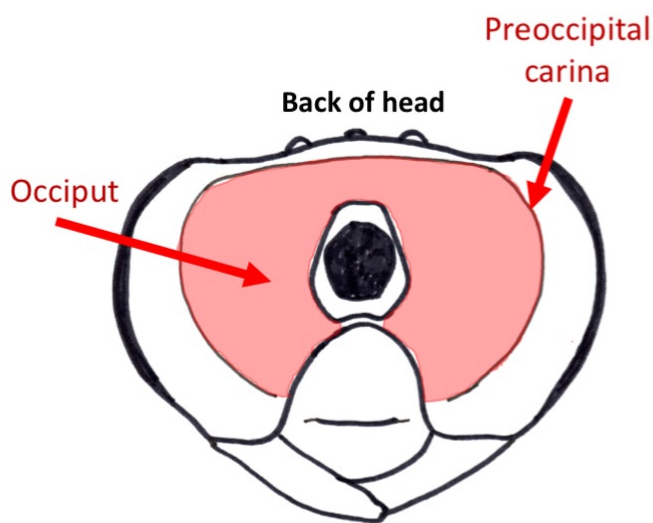
Hylaeinae – Couplet 11 (9)

- ❖ Preoccipital carina present
- ❖ Preoccipital carina absent

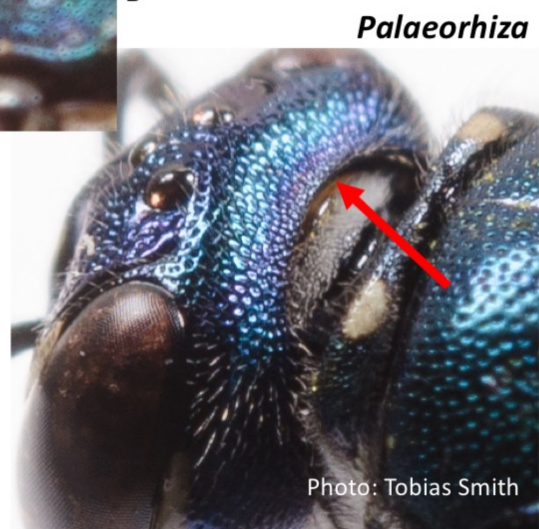
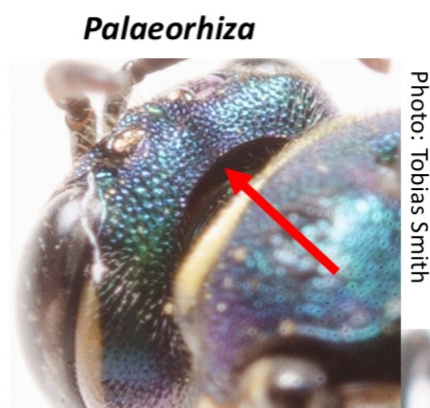
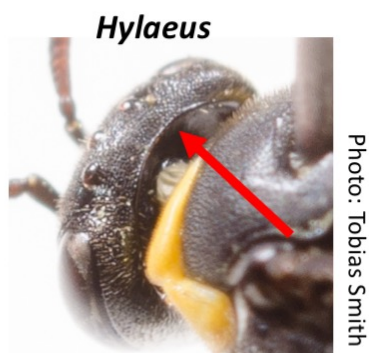
... 12

... 13

Note: A carina is a ridge, or a sharp line in the cuticle. If a specimen has a sharp ridge/line in the preoccipital area (back of the head, edge of the occiput), then it has the carina present. If the preoccipital area is smooth or rounded without a line or ridge, then the carina is absent.



Red arrows below indicate the presence of preoccipital carina



Line drawing by Tobias Smith (based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994)

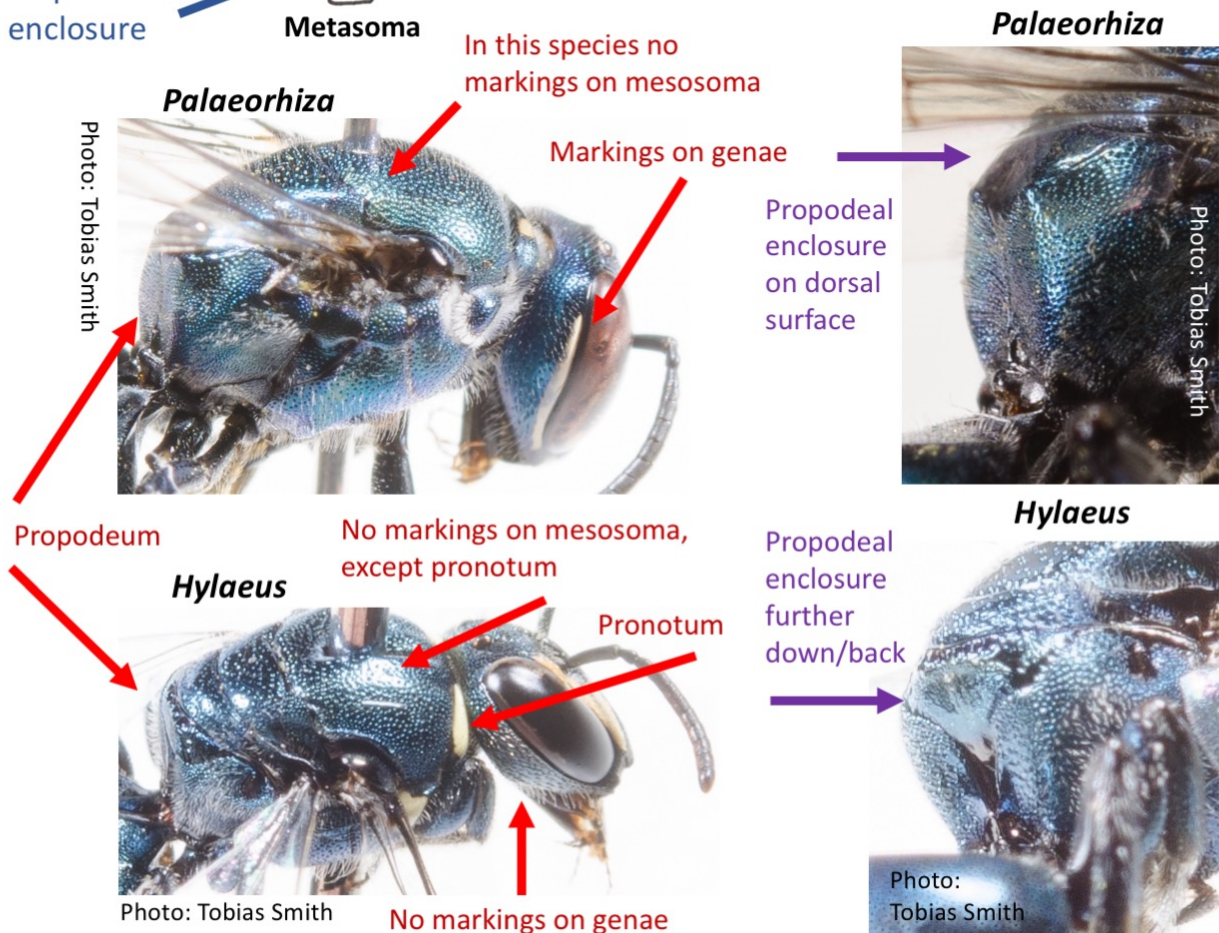
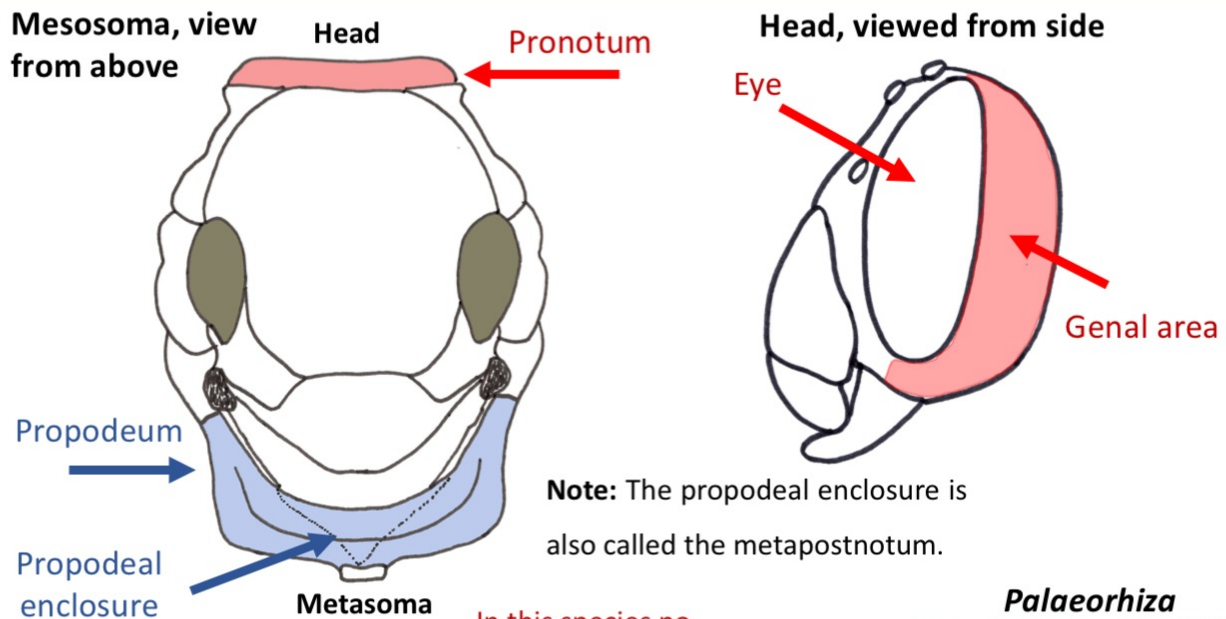
Hylaeinae – Couplet 12 (11)

- ❖ White to yellow markings on genae and mesosoma, body usually of metallic colouration; Propodeal enclosure nearly all on dorsal surface of propodeum

... *Palaeorhiza* (page 82)

- ❖ Genae and thorax (except pronotum) without white to yellow markings; Propodeal enclosure with less than three-quarters of its length on dorsal surface of propodeum

... *Hylaeus* (page 78)



Line drawings by Tobias Smith (based on diagrams by E.R.S. Hodges in Michener, McGinley & Danforth, 1994)

Hylaeinae – Couplet 13 (11)

- ❖ Genae and scutum with yellow markings; propodeal enclosure smooth, shiny and evenly rounded; sixth metasomal tergum with a distinct pygidial plate

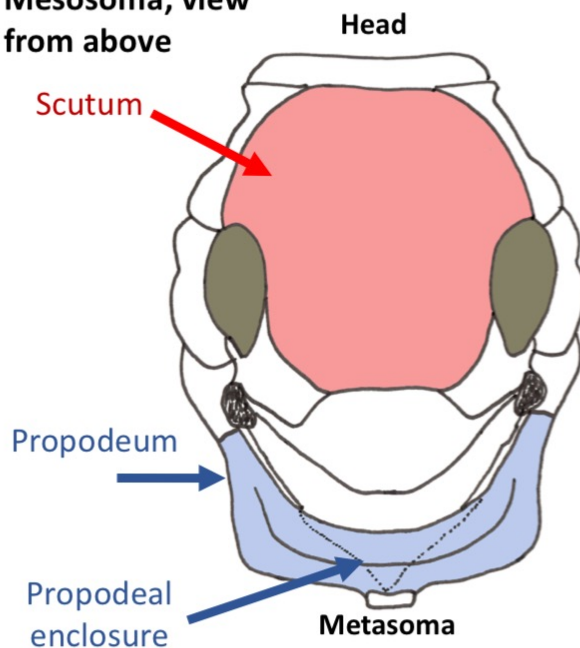
... *Hemirhiza* (1 species)

- ❖ Genae and scutum without yellow markings or, if with them, then propodeal enclosure not smooth, nor shiny, nor evenly rounded, pygidial plate absent

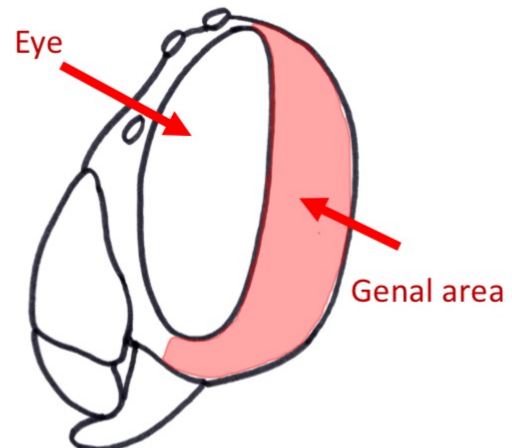
...*Hylaeus* (page 78)

* See *Apidae* Couplet 9 for description of pygidial plate

Mesosoma, view from above



Head, viewed from side



Hemirhiza melliceps

Hemirhiza melliceps

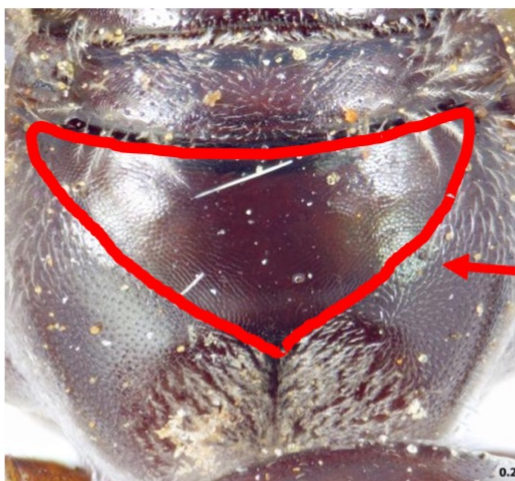


Photo: PaDIL - Sarah McCaffrey

Yellow on genae

Yellow on scutum

Smooth & shiny propodeal enclosure

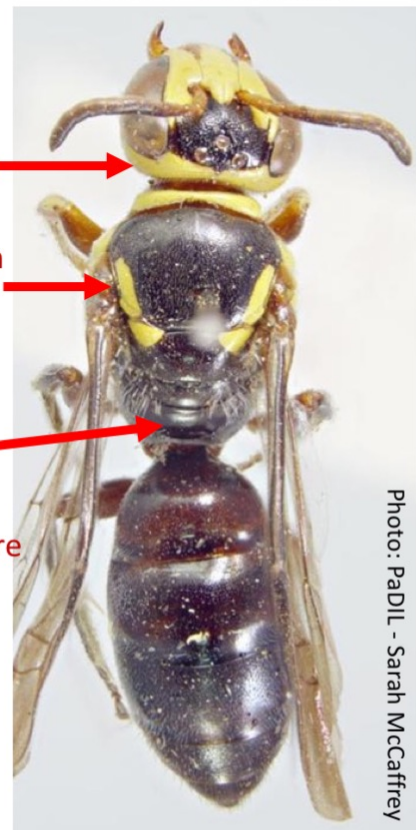


Photo: PaDIL - Sarah McCaffrey

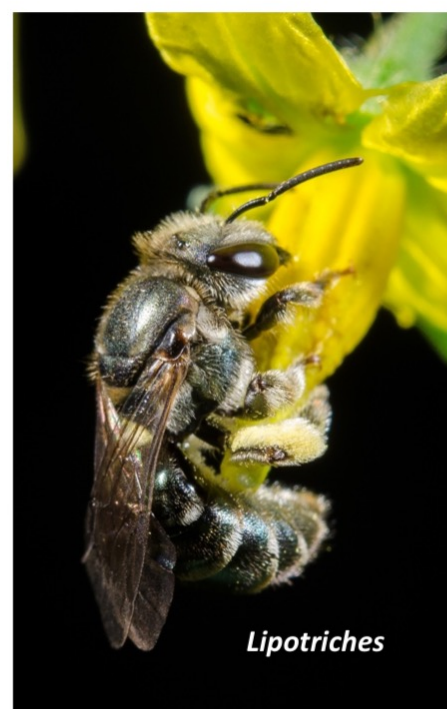
Note: The propodeal enclosure, or propodeal triangle, is more correctly termed the metapostnotum, but you will find all three used.

***Hemirhiza*, see page 80**

Line drawings by Tobias Smith (based on diagrams by E.R.S. Hodges in Michener, McGinley & Danforth, 1994)

Family Halictidae

The family Halictidae is the second largest of the Australian bee families, with approximately 383 described species. There are three subfamilies in Australia: the Halictinae, Nomiinae, and Nomoidinae. There are 10 genera, including one introduced. The majority of the Halictidae are ground nesters, and various levels of sociality are represented among the species. Some of the following couplets are based on Michener (2007).

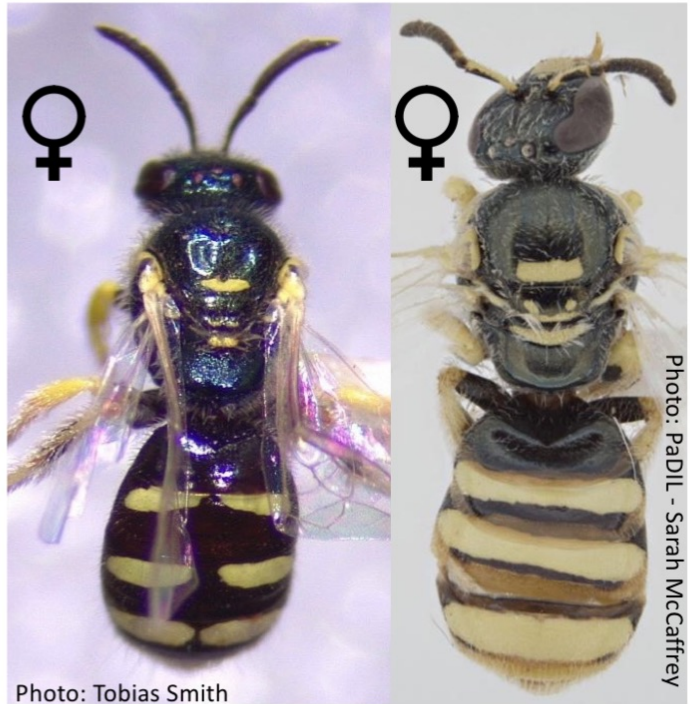
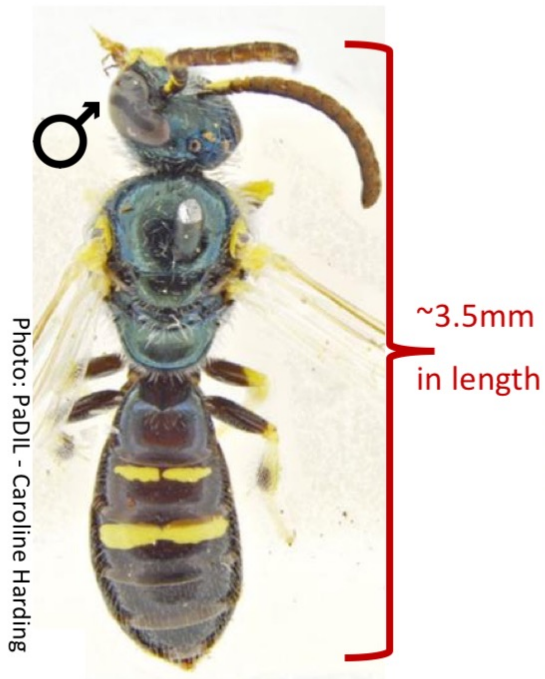


Photos by Tobias Smith



Halictidae – Couplet 1

- ❖ With yellow/pale integumental markings on metasoma (small bees, metallic green/blue mesosoma) ... **Subfamily Nomiodinae**
- ❖ Without yellow/pale integumental markings on metasoma ... **2**



The subfamily **Nomiodinae** is represented in Australian by a single species:

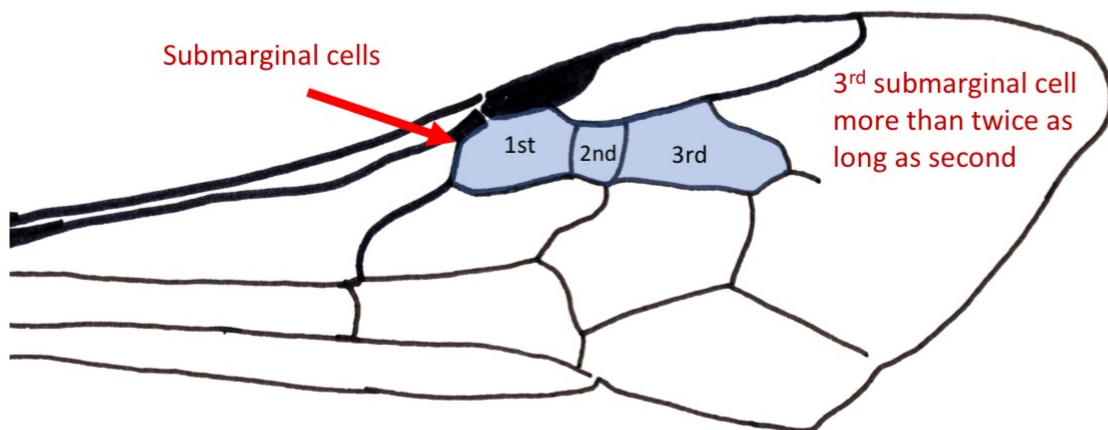
Ceylalictus perditellus

Widespread in tropical and subtropical parts of Australia



Halictidae – Couplet 2 (1)

- ❖ Third submarginal cell at least three-fourths as long as first, and more than twice as long as second ... **3 (Subfamily Nomiinae)**
- ❖ Third submarginal cell usually less than three-fourths of first, and in every case less than twice as long as second ... **6 (Subfamily Halictinae)**



3rd submarginal cell less than twice as long as second, less than three-fourths as long as first

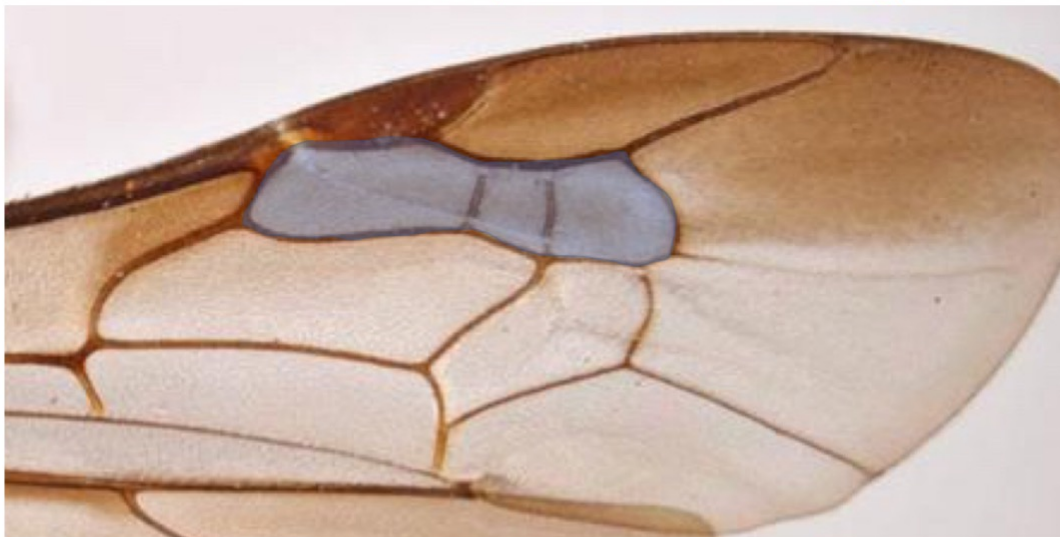


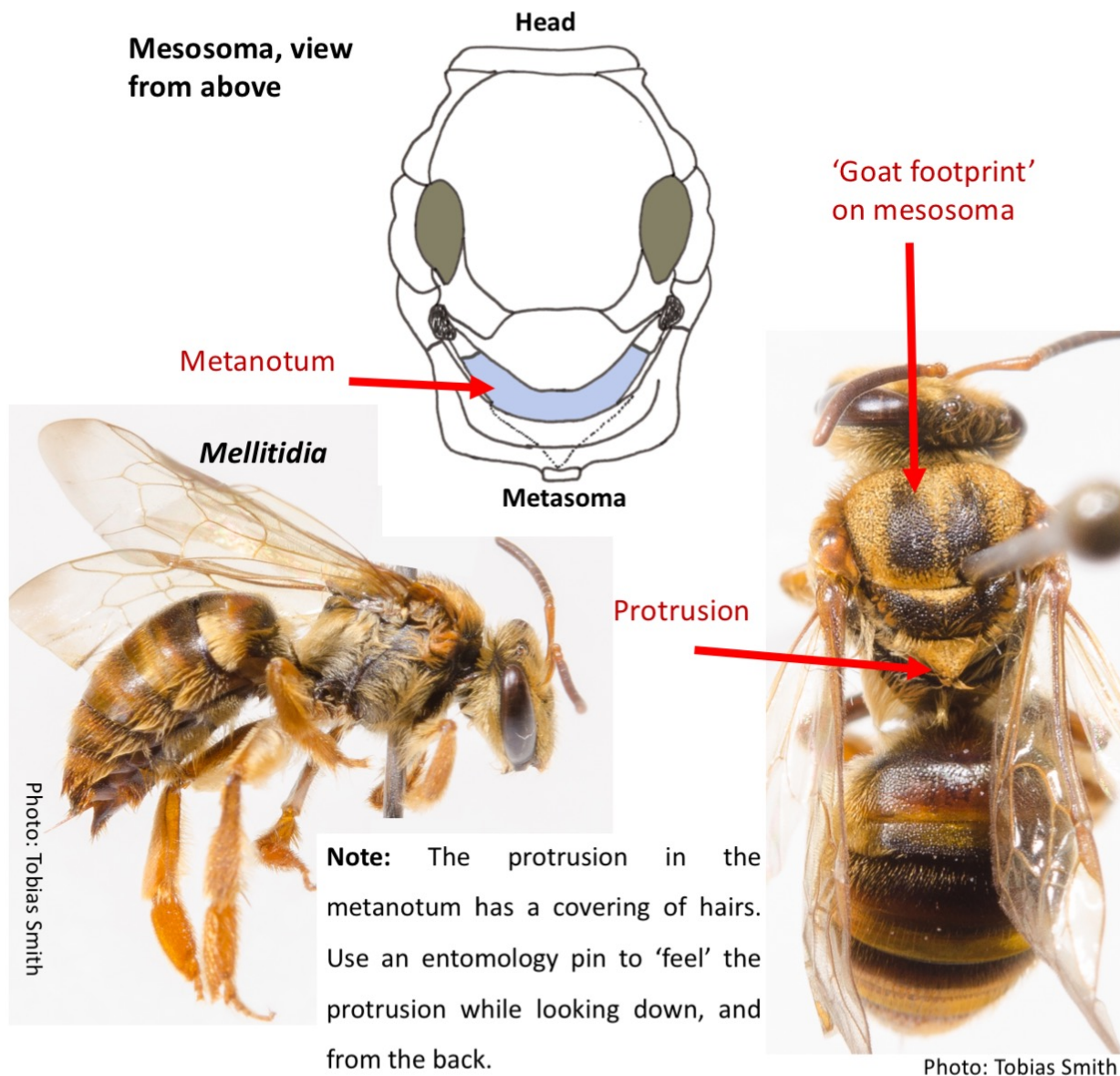
Photo: PaDIL – Ken Walker

Halictidae – Couplet 3 (2)

- ❖ Metanotum with protrusion in the middle; black hairless patches resembling a goat footprint on mesosoma; patches of orange hair on head, mesosoma, and metasoma
... *Mellitidia*

- ❖ Metanotum without protrusion in the middle; no black hairless patches resembling a goat footprint on mesosoma; orange hair patches not present on all body parts

... 4



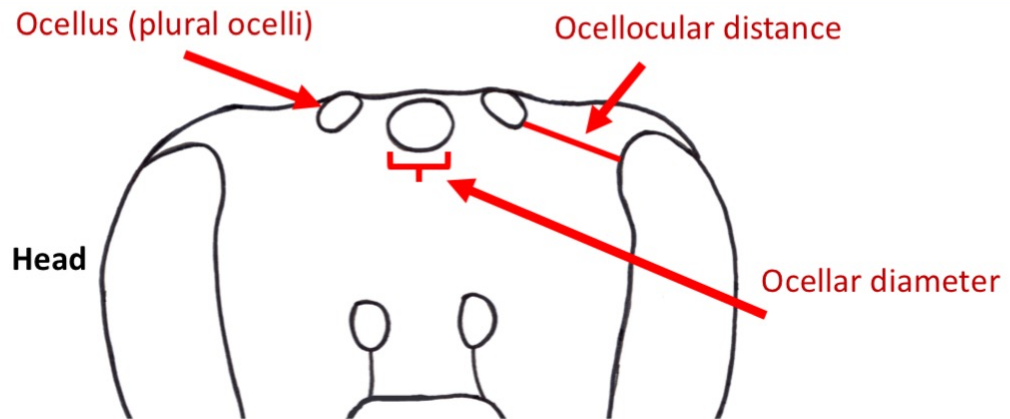
Mellitidia

1 species, *M. tomentifera*

Only known from north QLD

Halictidae – Couplet 4 (3)

- ❖ Ocelli enlarged, ocellocular distance equal to or less than ocellar diameter; no obvious bands (hairs or enamel-like cuticle) on metasoma ... ***Reepenina***
- ❖ Ocelli not enlarged, ocellocular distance greater than ocellar diameter; obvious bands (hairs or enamel-like cuticle) on metasoma ... **5**



All images below are *Reepenina*



Enlarged ocelli



Reepenina

1 species, *R. bituberculata*
Only known from north QLD

Note: Enlarged ocelli like these are associated with low-light flying, and are only seen in night-flying and low-light-flying bees.

Halictidae – Couplet 5 (4)

- ❖ Metasoma terga with apical integumental bands of enamel-like yellow, blue, green, or white
... ***Nomia***
- ❖ Metasoma terga without enamel-like apical integumental bands, rather often with bands of light coloured hairs
... ***Lipotriches***



Nomia
6 species
Widespread

Lipotriches
56 species
Widespread

Halictidae – Couplet 6 (2)

- ❖ Dense bands of apical (towards the back) hairs on each metasomal tergum in females ... ***Seladonia***
- ❖ If present, bands of hair on metasomal terga arising basally (towards the front) in females ... **7**

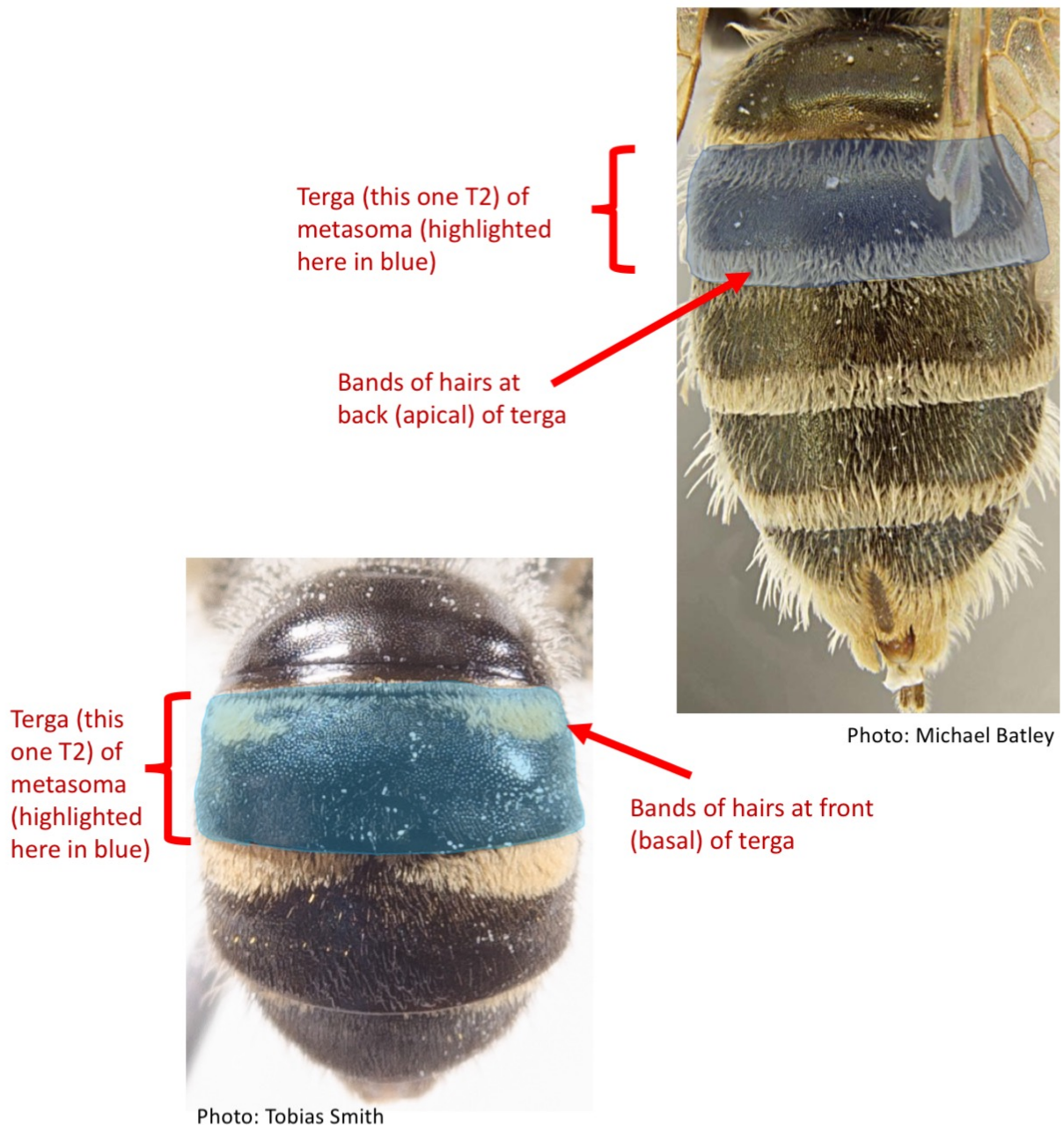


Photo: Batley et al 2016



Seladonia

Introduced (emerald furrow bee)

1 species, *S. hotoni* (previously called *Halictus smaragdulus*)

Only known from the Hunter Valley, NSW

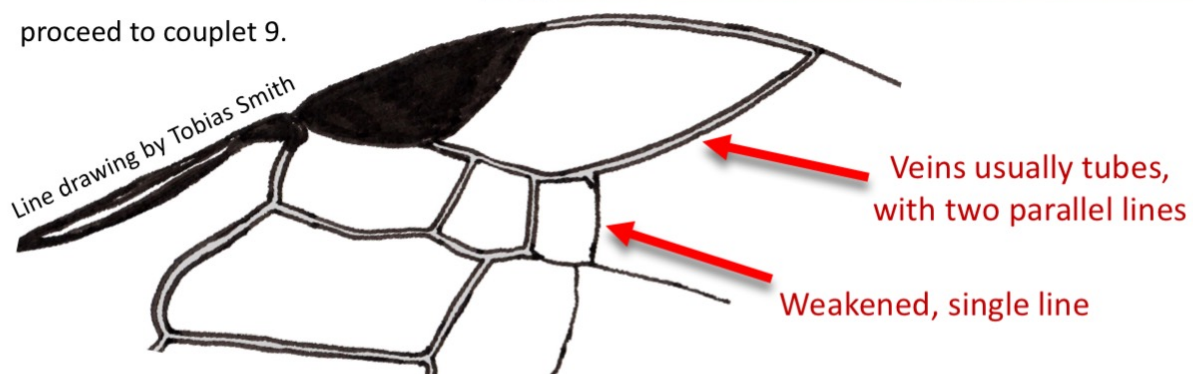
Halictidae – Couplet 7 (6)

- ❖ Third submarginal crossvein of forewing of female as strong as preceding one; males always without pale markings on clypeus* (QLD only) ... 8
- ❖ Third submarginal crossvein of forewing weaker than first and second in female; males sometimes with pale markings on clypeus* ... 9



Pale marking on clypeus (males)

***Note:** This couplet, and therefore the following, does not work well for all males. If you have a male bee from QLD with the third submarginal crossvein as strong as preceding one and without clypeal markings, first try proceeding to couplet 8, and then if there is no clear match, return here & proceed to couplet 9.

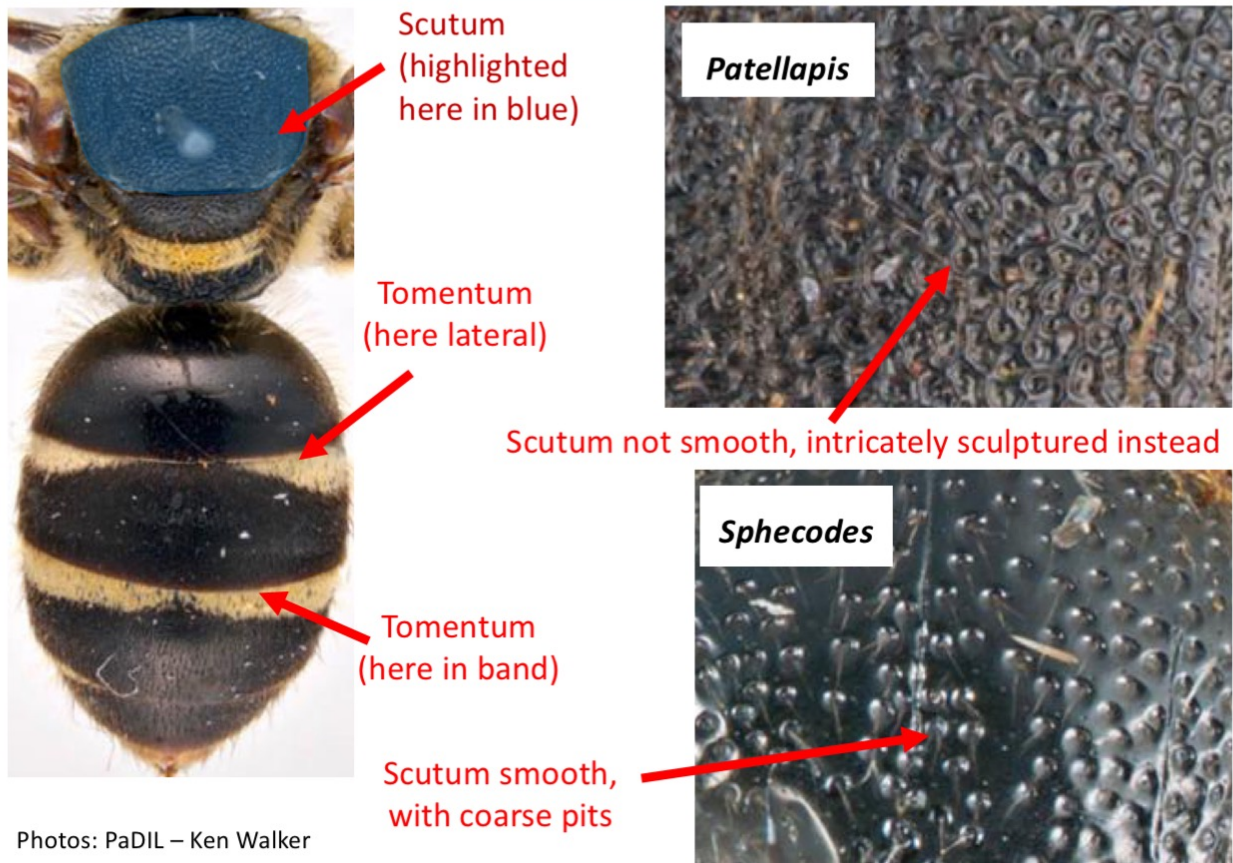


Note: Often the weakened third submarginal crossvein is very obvious, other times it is more subtle. In subtle cases, it is helpful to think of the veins of the wing as tubes that have two sides (two parallel lines next to one another). So veins are usually like tubes with two sides, but in the case of the weakened third submarginal crossvein, instead of a tube with two sides, it is more like a single line rather than two parallel to one another. Zoom in very close with good light to see this.

Halictidae – Couplet 8 (7)

... 1 of 2 pages of descriptions

- ❖ Bands or lateral areas of tomentum (dense, short pale hairs) on metasoma; scutum not smooth, and intricately sculptured; scopa present in female; males with bristles on S4 of metasoma
... ***Patellapis***
- ❖ No bands or lateral areas of tomentum on metasoma; scutum smooth, not sculptured, but with deep, coarse pits; scopa absent in female; males without bristles on S4 of metasoma
... ***Sphecodes***



Sphecodes (Sphecodes) profugus



Sphecodes (Sphecodes) manskii



Photos PaDIL - Claus Rasmussen & Charles Michener

Sphecodes

2 species

Only known from

QLD

Patellapis, 2 species, only known from North QLD (+ 1 species on Christmas Is.)

Walker, K. (1996) A new species of Australian '*Pachyhalictus*' Cockerell (Hymenoptera: Halictidae). *The Australian Entomologist*, 23 (4): 125-131.



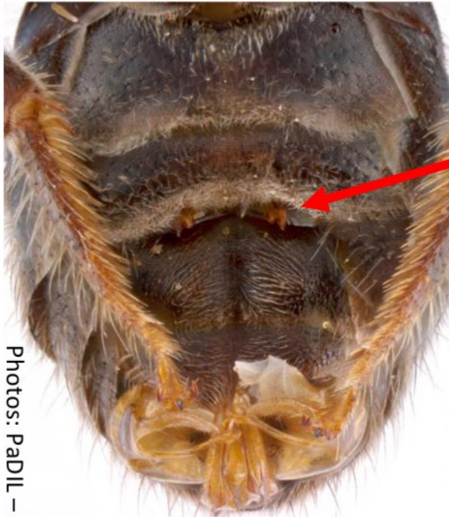
Photo: Michael Batley

Extra descriptions of males

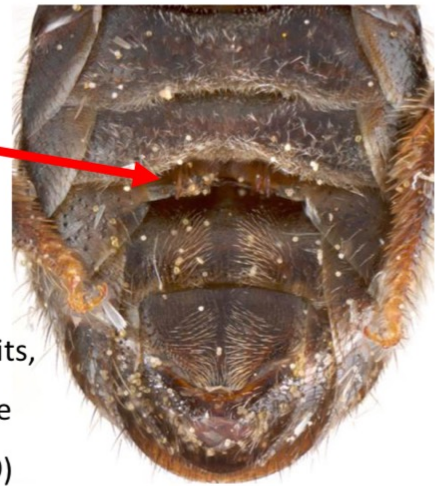
Note: These descriptions are rather cumbersome. But unless you are working in QLD, it is highly unlikely you will have *Patellapis* or *Sphecodes*. Check distributions on ala.org.au

***Patellapis* – Males**

Note: Male *Patellapis* have bristles on S4 of the metasoma.

Patellapis (Pachyhalictus) albopilatus***Patellapis (Pachyhalictus) stirlingi***

Large bristles on S4
of metasoma



T1 of metasoma with pits,
rather than smooth (see
description in couplet 9)



Photos: PaDIL – Ken Walker

***Sphecodes (Sphecodes) profugus* – Male**

Photos: PaDIL – Ken Walker



T1 of metasoma with pits, rather than smooth

Sphecodes (Sphecodes) manskii

Rasmussen, C., & Michener, C. D. (2011) *Callosphecodes*, a little-known bee (Hymenoptera: Halictidae: Sphecodes). *ZooKeys*, (127): 61–68.

Open access, and includes images of the male

Halictidae – Couplet 9 (7)

- ❖ Metasoma of female flattened, terga folded under at sides, with a distinct angle separating ventral parts from dorsal parts; scopa of female consisting of very long plumose hairs arising primarily on underside of metasoma, with some on legs; T1 of metasoma impunctate (smooth)

... *Homalictus*

- ❖ Metasoma of female not strongly flattened, terga curving over sides and not angulate sides; scopa of female primarily on legs and some short branched hairs on the underside of the metasoma; T1 of metasoma punctate (with small pits)

... *Lasioglossum*

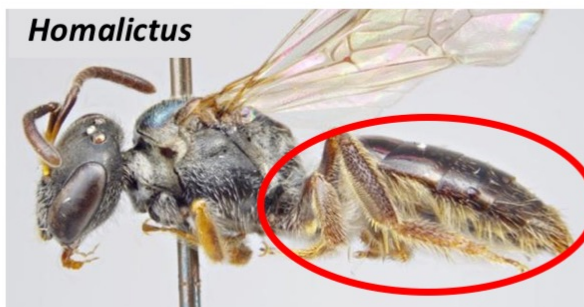


Photo: PaDIL - Sarah McCaffrey



Photo: PaDIL – Ken Walker

Homalictus, T1 smooth



Photo: PaDIL - Caroline Harding

Lasioglossum, T1 with pits

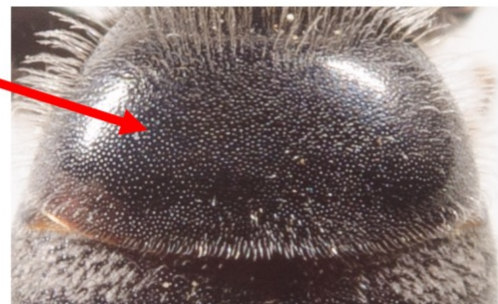


Photo: Tobias Smith

***Homalictus* ~46 species, widespread**

Walker, K. 1986. Revision of the Australian species of the genus *Homalictus* Cockerell (Hymenoptera: Halictidae). *Memoirs of the Museum of Victoria*, 47 (2): 105–200.

***Lasioglossum* ~250 species, widespread**

Walker, K. 1995. Revision of the Australian native bee **subgenus** *Lasioglossum* (*Chilalictus*) (Hymenoptera: Halictidae). *Memoirs of the Museum of Victoria*, 55 (1): 1–423.

If *Lasioglossum*:

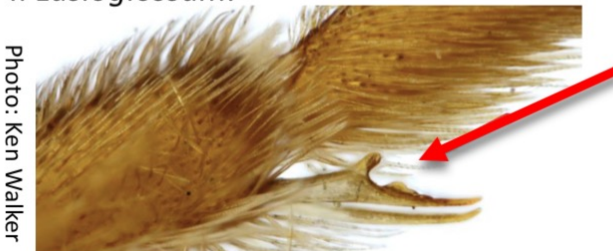


Photo: Ken Walker

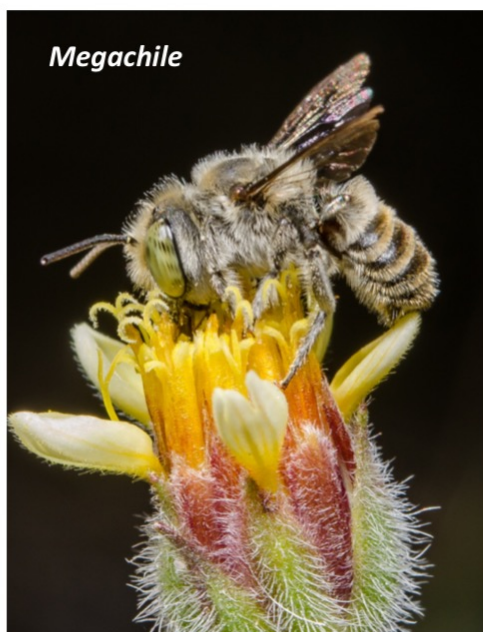
Does it have an inner hind tibial spur that looks like this?

If yes, it is **subgenus** *Chilalictus*

And there is a key for *Chilalictus* (above). Other subgenera there are not, yet.

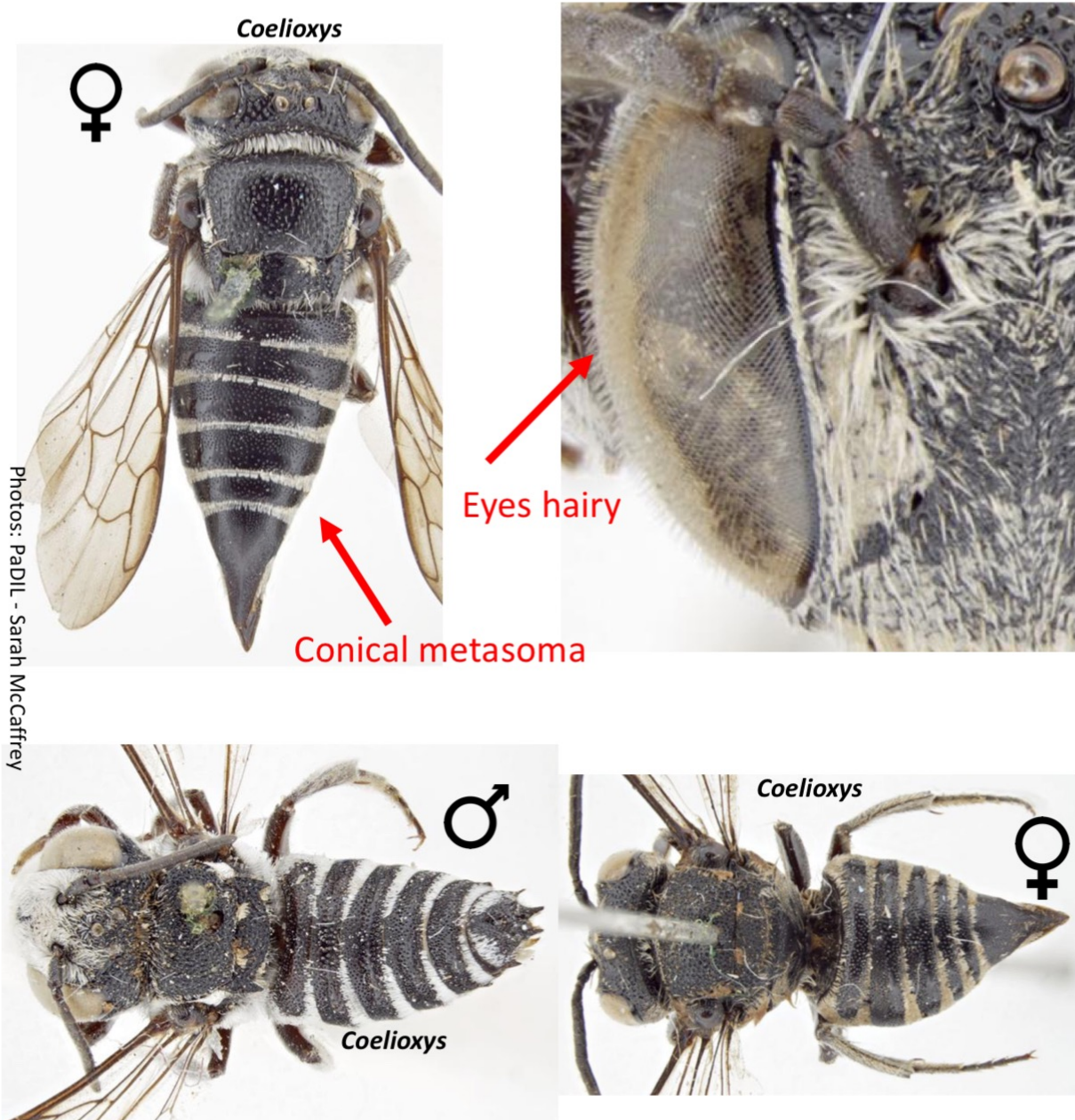
Family Megachilidae

The family Megachilidae is the second smallest of the Australian bee families, with approximately 169 described species. There are two subfamilies in Australia: the Megachilinae and Lithurginae. There are six genera, including one introduced.



Megachilidae – Couplet 1

- ❖ Eyes hairy; metasoma conical, widest in first segment, tapering from near base to narrow, acutely pointed apex ... ***Coelioxys***
- ❖ Eyes not hairy; metasoma not conical ... **2**



Coelioxys

7 species

Widespread

Nest parasites of *Megachile* species

Megachilidae – Couplet 2 (1)

- ❖ Matching the images below
- ❖ Not matching the images below

... *Anthidiellum*

... 3



Photos: PaDIL - Sarah McCaffrey



Photo: Samantha Gray

~5mm



Photo: PaDIL - Sarah McCaffrey

Anthidiellum

1 species, *A. (Pycnanthidium) turneri*

Only known from Queensland

Megachilidae – Couplet 3 (2)

- ❖ Matching the images below
- ❖ Not matching the images below

... *Afranthidium*

... 4

Note: These metasomal bands are integumental markings, not bands of hairs.



Female: Thin white transverse apical bands on metasomal segments

Photo: Tobias Smith



Male: Yellow transverse band in middle of each metasomal segment



Photo: Tobias Smith



Male foreleg



Photo: Tobias Smith



Afranthidium

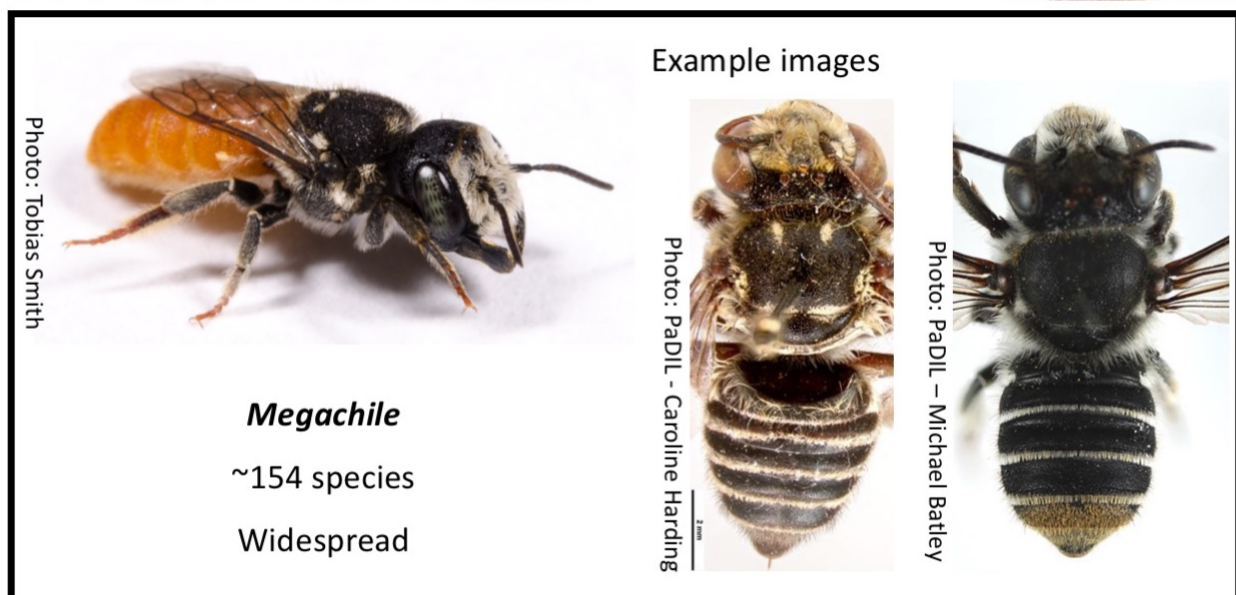
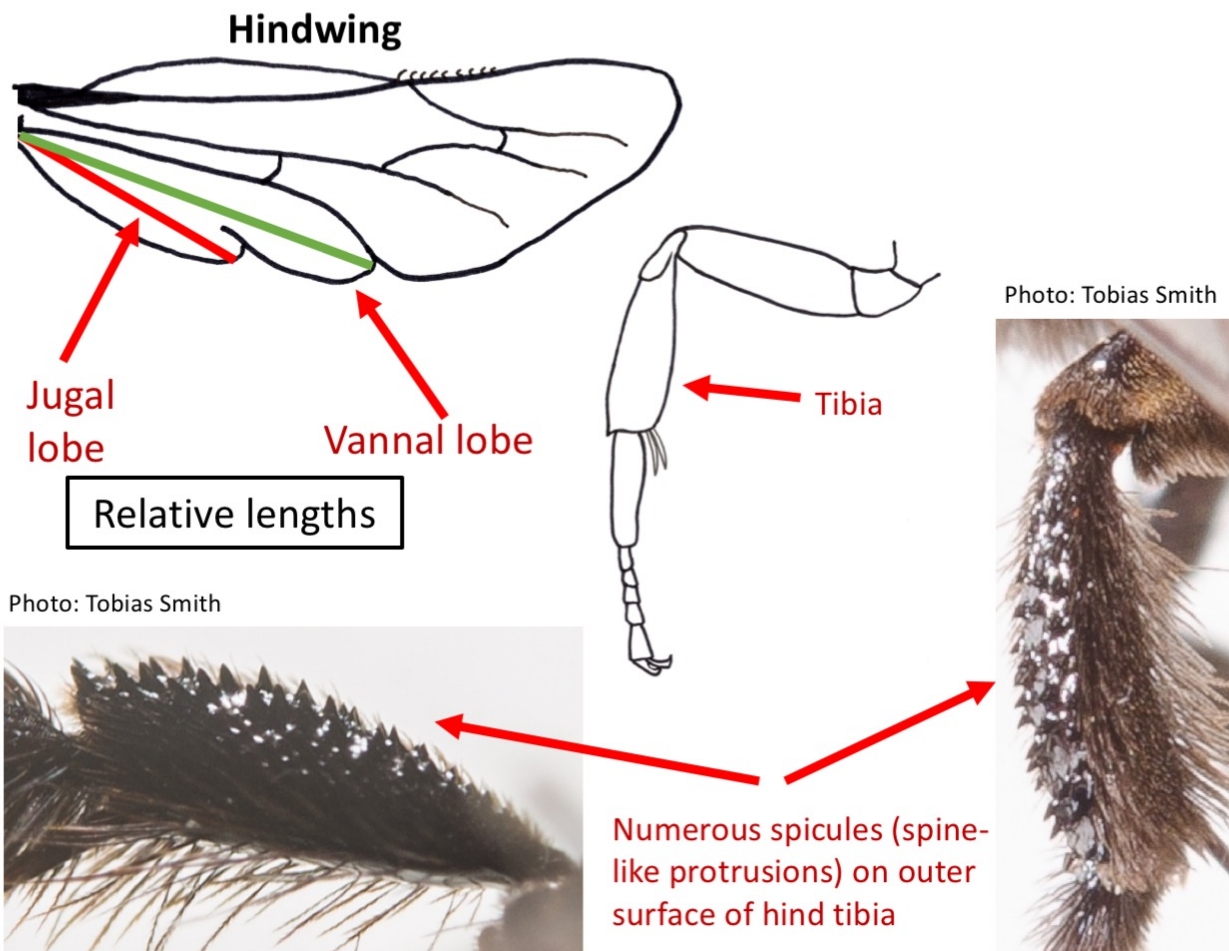
1 species, *A. (Immanthidium) repetitum*

African carder bee

Introduced, widespread east coast

Megachilidae – Couplet 4 (3)

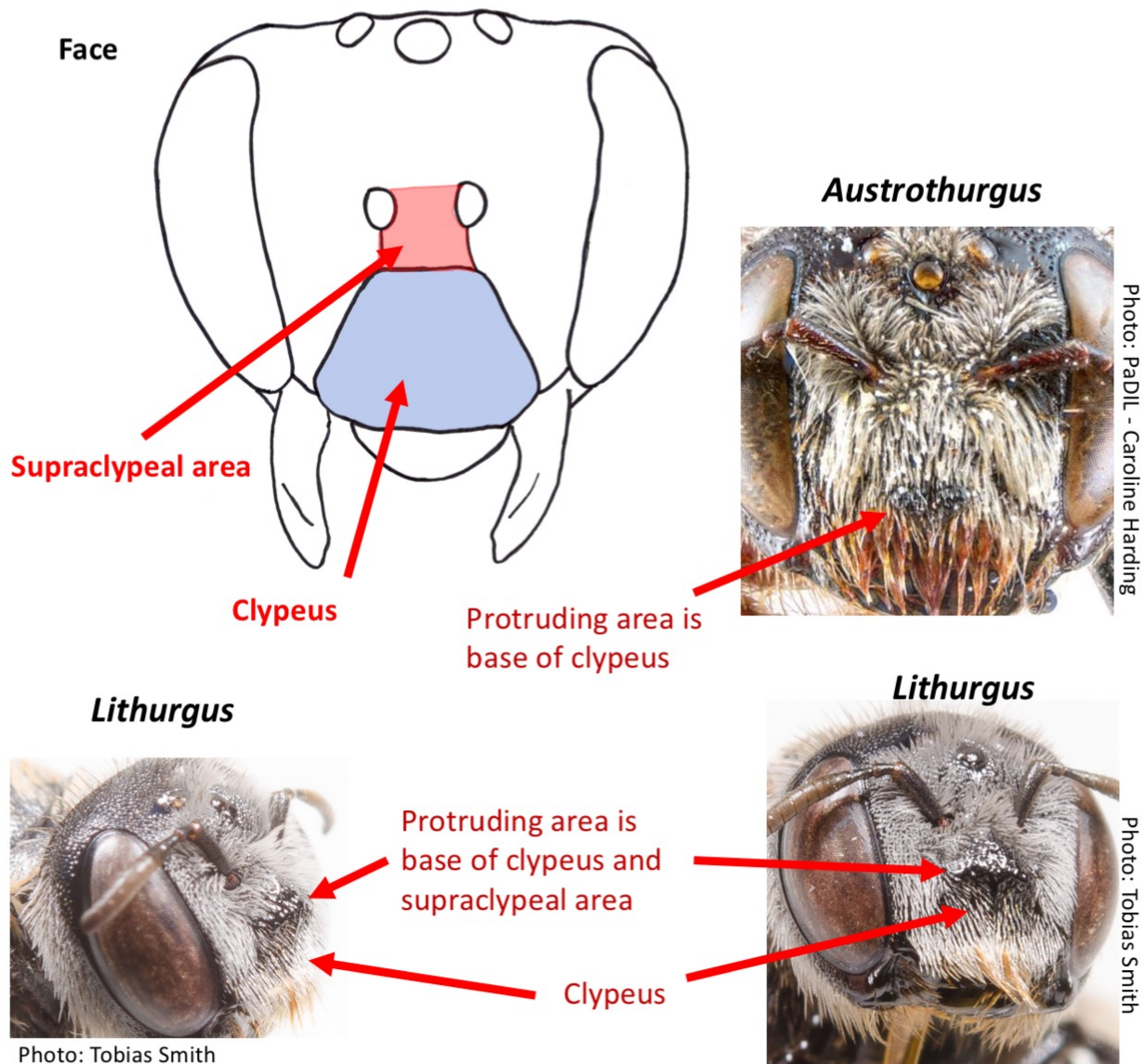
- ❖ Outer surface of hind tibia of female with numerous large, bare spicules; jugal lobe of hindwing about three-fourths as long as vannal lobe ... **5**
- ❖ Outer surface of hind tibia of female without large, bare spicules; jugal lobe of hindwing less than half as long as vannal lobe ... ***Megachile***



Line drawing by Tobias Smith (wing based on diagram by E.R.S. Hodges in Michener, McGinley & Danforth, 1994)

Megachilidae – Couplet 5 (4)

- ❖ Facial prominence involving base (top part) of clypeus and part of supraclypeal area ... *Lithurgus*
- ❖ Facial prominence mostly involving base of clypeus ... *Austrothurgus*



<p>Photo: PadIL - Caroline Harding</p> <p><i>Lithurgus</i> 3 species Widespread</p> <p>♀</p>	<p><i>Austrothurgus</i> 3 species Northern half of continent</p> <p>♀</p> <p>Photo: PadIL - Caroline Harding</p>
---	---

Gonzalez, V. H., Engel, M.S., & Griswold, T. L. (2013) The lithurgine bees of Australia (Hymenoptera: Megachilidae), with a note on *Megachile rotundipennis*. *Journal of Melittology*, 11: 119.

Line drawing by Tobias Smith

Family Stenotritidae

The family Stenotritidae is endemic to Australia, and is the smallest of the Australian bee families, with approximately 21 described species. All species are ground nesting bees. There are two genera: *Ctenocolletes* and *Stenotritus*. The following couplet is adapted from Houston (1983) and Michener (2007).

Photo: PaDIL - Caroline Harding



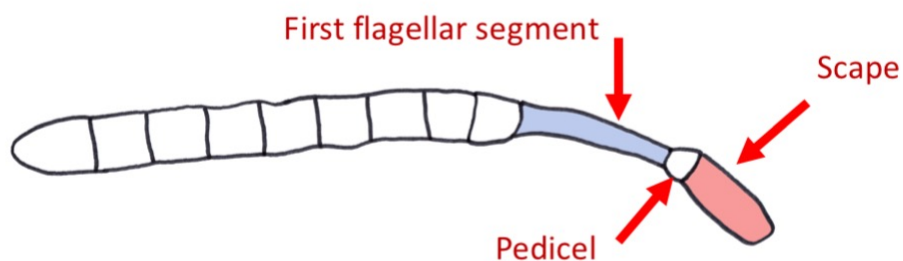
Photo: PaDIL - Sarah McCaffrey



Photo: PaDIL - Sarah McCaffrey



Photo: PaDIL - Lanni Zhang



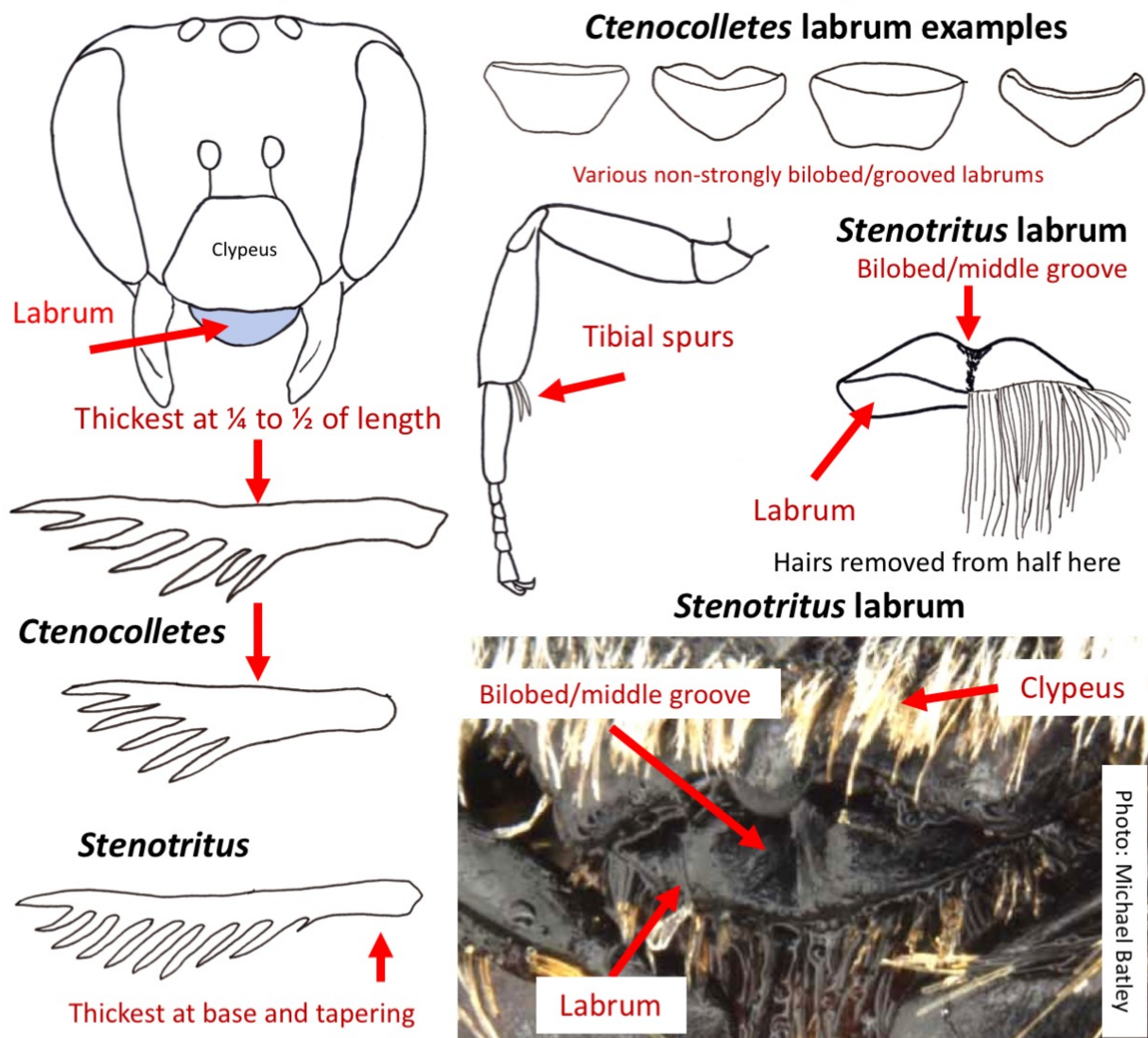
A characteristic of all Stenotritidae species, that separates them from all other bees, is that the first flagellar segment of the antennae is longer than the scape. In bees of all other families the scape is longer than the first flagellar segment.

Line drawing by Tobias Smith

Stenotritidae

- ❖ Labrum of female with an undivided basal elevation; inner hind tibia spur of female thickest at one-fourth to one-half, with long coarse teeth; T7 in male with well developed pygidial plate (see page 42) ... ***Ctenocolletes***
- ❖ Labrum of female with basal elevation strongly bilobed or grooved in the middle; inner hind tibia spur of female tapering from base, with moderate sized to coarse teeth; T7 in male with bare area representing pygidial plate ... ***Stenotritus***

Note: The basal end of the labrum is the top end, closest to the clypeus. The basal elevation is the area above the angular 'corner' of the labrum where there is a ridge.



Ctenocolletes 10 species, WA & NT

Houston, T. F. (1985) Supplement to a Revision of the Bee Genus *Ctenocolletes* (Hymenoptera: Stenotritidae) Records of the Western Australian Museum, 12 (3): 293-305.

Stenotritus 11 species

Widespread

Line drawings by Tobias Smith (spurs & labrums based on diagrams in Houston 1983)



Photo by Tobias Smith

Hylaeus

Resources and references

Sources that parts of this key are based on:

Gonzalez, V. H., Engel, M.S., & Griswold, T. L. (2013) The lithurgine bees of Australia (Hymenoptera: Megachilidae), with a note on *Megachile rotundipennis*. *Journal of Melittology*, 11: 119.

Houston, T. (1975) A revision of the Australian Hylaeine bees (Hymenoptera: Colletidae). *Australian Journal of Zoology, Supplementary Series*, 36: 1–135.

Houston, T. (1983) Revision of the bee genus *Ctenocolletes* (Hymenoptera: Stenotritidae). *Records of the Western Australian Museum*, 10 (3): 269–306.

Maynard, G. (2013) Revision of the *Goniocolletes* and seven Australian subgenera of *Leioproctus* (Hymenoptera: Apoidea: Colletidae), and descriptions of new taxa. *Zootaxa*, 3715 (1): 1–114.

Michener, C.D. (1965) A classification of the bees of the Australian and South Pacific regions. *Bulletin of the American Museum of Natural History*, 130: 1–362.

Michener, C.D. (2007) *The Bees of the World* (2nd ed.). The John Hopkins University Press, USA. (plus unpublished adaptations to Australia, by **Michael Batley**)

Further resources for Australian Bee ID:

- PaDIL pollinators (bee species image library) – www.padil.gov.au/pollinators
- Atlas of Living Australia (useful for distributions) – www.ala.org.au
- Australian Faunal Directory (list of all species) – <https://biodiversity.org.au/afd/home?>
- Bowerbird (user submissions of bee photos. Well used) – www.bowerbird.org.au
- Michael Batley's identification guides for the Sydney region:
 - *Hylaeus*: <https://michaelbatley.github.io/Bee-ID-SH/main.htm>
 - *Megachile*: <https://michaelbatley.github.io/Bee-ID-SM/main.htm>

Other publications cited within this key:

Batley, M. & Hogendoorn, K. (2009) Diversity and conservation status of native Australian bees. *Apidologie*, 40: 347–354.

Batley, M., Pauly, A., Gollan, J. R., Ashcroft, M. B., & Sonet, G. (2016) Re-identification of an exotic bee introduced to the hunter valley region, New South Wales – *Seladonia hotoni* (Vachal, 1903) (Hymenoptera: Halictidae). *Australian Entomologist*, 43 (3): 109–112.

Hedtke, S.M., Patiny, S., & Danforth, B.N. (2013) The bee tree of life: a supermatrix approach to apoid phylogeny and biogeography. *BMC Evolutionary Biology*, 13: 138.

Michener, C. D. McGinley R. J. & Danforth, B. N. (1994) *The Bee Genera of North and Central America*. Smithsonian Institution Press, Washington.

The Australian bee genera
An annotated, user-friendly key
by Tobias Smith



“ As the pre-eminent pollinators the bees bring together flora and fauna, forming an integral component in sustaining natural ecosystems. To understand and protect ecosystems, resources that permit the identification of organisms are vital, particularly those that bridge the gap between professional taxonomists and citizen scientists. Here Tobias Smith has provided a wonderful guide to Australia’s melittological fauna, one that is well illustrated and easy to use. Each couplet is accompanied by photographs or illustrations that guide the user to the proper bee genus. A successful key is one in which any user can reach a proper identification without recourse to the composer of the key. It is fair to say that Tobias Smith has achieved such success with the present work and, as such, this volume is a tremendous resource for amateurs and professionals alike and does justice to the rich and myriad melittofauna of Australia. ”



—**Michael S. Engel**

Senior Curator & University Distinguished Professor
University of Kansas Natural History Museum

ISBN 978-1-9215797-77-0