ARTICLE TWENTY TWO

AUSTROPLEBEIA CINCTA:
A SPECTACULAR NEW SPECIES OF STINGLESS BEE FOR AUSTRALIA

Aussie Bee Online
Article 22
January 2013

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TINY bees with vivid yellow stripes on their faces peep out of their long resinous nest entrance near a rainforest in far north Queensland. After a five week safari researching their nests and behaviour, *Aussie Bee* presents for you now the fascinating story of the pretty *Austroplebeia cincta* stingless bees.

How This Study Came About

Visiting Brazilian scientist, Rute Brito was collecting stingless bees in Queensland for a DNA study when Charlie Roberts showed her a nest of unusual stripy stingless bees. Rute emailed us about these amazing bees, asking what they were. It took us four years to gather enough information to accurately answer her question.

Lewis Roberts, at our request, found five more nests on his property then kindly sent us some worker bee samples for our research. We studied the bees' colouring, hair patterns, wing veins and DNA in collaboration with Megan Halcroft of the University of Western Sydney and Tiago Francoy of Universidade de San Paulo, Brazil. The bees did not match any species that had previously been documented in Australia. However, they were similar to a New Guinea species called *Austroplebeia cincta*.

Professor Charles Michener had described the nests of this New Guinea species in 1961[(1)], pointing out several distinctive features. If our Queensland bees shared these distinctive nest features, then they too would be called *Austroplebeia cincta*. Otherwise they might be a new Australian species.

Taking a look at the nest structure of these bees involved making a 3000 km journey, laden with an extensive array of specialised field equipment, cameras and microscopes! However, finally we managed to arrange this major safari to far north Queensland to do the research. The Queensland bees' nest structures did indeed match those of the New Guinea species!

Based on all the information we have gathered and analysed to date, we have finally established that the correct name of these beautiful Australian stingless bees is *Austroplebeia cincta*. Now we would like to present to you the first detailed report of the nests and behaviour of these spectacular stingless bees in Australia.

Right: Austoplebeia cincta worker bees guarding the long resin entrance tunnel on their nest in far north Queensland

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Our 2012 safari would not have been possible without the fabulous support of the following people:
-- **Lewis, Edith and Charlie Roberts** kindly showed us these bees, shared their in-depth natural history knowledge and provided invaluable assistance for our research.
-- **Juel and Ross Craig** most generously loaned us a Toyota Landcruiser 4x4, an off-road campertrailer and a wide range of equipment and tools for our safari. Their practical help and friendship was greatly appreciated.

Left: Lewis Roberts shows Anne Dollin the entrance tunnel of an A. cincta nest on his property.

Below: a long tunnel on an A. cincta nest.

The Entrance Tunnel

The entrance tunnels built by the *A. cincta* bees are quite remarkable. Most tunnels built by other *Austroplebeia* species are less than three cm long. In contrast, most of the *A. cincta* tunnels that we recorded were up to 17 cm long, and one exceptional tunnel (shown on page 3) was 43 cm long! The ends of the tunnels are made from a fine mesh of translucent resin that looks orange in colour from a distance. Some longer tunnels also have gentle zig zag shapes.

As we observed these *A. cincta* nests over successive days we began to see some of the reasons for their unusual tunnels:

— Voracious green ants also live in some of the trees. These ants wait near tunnel entrances, attempting to catch returning foragers that might miss the entrance hole. They also try to snatch bees that are inside the tunnel. If any bee is unfortunate enough to be caught, several more ants immediately latch onto it. They tug and pull at the bee as it is carried away. A sticky resin edging on the tunnel entrance helps to keep the green ants at bay. However, the stickiness reduces over time. So the bees continually extend the length of their tunnel by adding fresh sticky orange meshwork to the tip.

— Tunnels may be damaged or even completely knocked off by falling debris or by animals. So short tunnels are sometimes seen. However, the bees can lengthen their entrance tunnels remarkably quickly if they feel threatened.

— The tunnels are initially horizontal. On very hot days, long tunnels may partially melt and sag slowly downwards in the heat. The bees may then extend the

Two of the long A. cincta nest tunnels that had a gentle zig zag shape. The tunnel on the left was 17 cm long and the exceptional tunnel on the right was 43 cm long.

tunnel tip again horizontally - so that the tunnel progressively takes on a gentle zig zag shape.

We also noticed some fascinating differences in the way that *A. cincta* bees defend their nest at night. In other *Austroplebeia* species, the bees usually build a fine mesh of soft brown resin droplets across the tunnel entrance at night to keep predators out. In contrast, on the nights we studied them in November 2012, most of the *A. cincta* colonies did not close their entrances at all. Perhaps their need for evening ventilation exceeded their need for nest defence.

The only exception to this was when a nest was threatened by predators such as green ants. In this case the bees would build a full or partial closure over their tunnel entrance. However, the type of closure that they build is quite different from the soft resin curtains built by other *Austroplebeia* species. It is composed of small cream-coloured waxy flakes of material interlocked into a quite dense mesh. Further studies of this behaviour are in progress.

Photographs of nest tunnels taken with a flash at about 11 pm at night:
Left - a soft curtain of brown resin droplets built by an A. symei colony;
Centre - an A. cincta tunnel that was left completely open;
Right - an A. cincta tunnel that was partially closed with a dense mesh of cream waxy flakes.

Left: the hard black batumen shell that enclosed an A. cincta nest in this tree cavity.
Below: detail of the thin batumen shell enclosing a group of honeypots.
Lower left: a cluster of translucent honeypots
Lower right: a cluster of pollenpots

The Nest

The *A. cincta* tunnel leads into the tree cavity where the nest is hidden. The whole nest is snuggly enclosed inside a black resin shell called a *batumen*. This batumen is hard and smooth but quite thin - only 1-2 mm thick. This is quite an unusual nest design for an *Austroplebeia* species.

Inside the batumen shell are several inter-connected batumen compartments. Perhaps the nest is originally built in an inner compartment and as the nest grows, the bees extend their home by adding new batumen 'rooms' adjacent to the first one!

The brood (where the eggs are laid), and the honeypots and pollenpots are all built in different areas inside the batumen shell.

Honeypots and Pollenpots

The honeypots and pollenpots are made from a paper-thin waxy material that is quite translucent and extremely fragile. The colour of the honey and pollen can be easily seen through the pot walls.

The pots are built one on top of the other, into clusters. The pollen and honey are stored in separate clusters in the nest. Sometimes groups of pale-coloured newly hatched adult bees can be seen resting in some of the empty pollenpots, as seen in the photograph above.

Left: the A. cincta queen bee, abdomen swollen with eggs, clings to the side of her brood. The individual brood cells are waxed into small hexagonal combs that interconnect to form the curved surface of the brood.

Below: a close up photograph of some newly constructed brood cells. The cells are built in concentric layers separated by small spaces where the bees can walk. The queen bee can just be seen patrolling the brood, on the lower right.

The Brood

The brood is where the queen lays her eggs. Each egg is laid into an individual spherical waxy cell stocked with nectar and pollen provisions. The young larvae inside the wax cells develop into pupae inside cocoons, then they finally hatch as young adult bees. (See ANBRC Booklet 3: Behaviour of Australian Stingless Bees for a full explanation of this process.)

In all the other *Austroplebeia* species, the individual brood cells are only loosely connected to one another, forming an irregular network. This type of brood structure is called a *cluster*.

In these Queensland nests, however, the brood structure is quite different. The newest brood cells are closely connected together into small hexagonal combs, one cell thick. The whole brood has a rounded shape so the cells interconnnect to form an irregular hemispherical layer over the surface of the brood. There are several concentric layers of these cells.

This nest structure is one of the crucial features of the New Guinea *A. cincta* species that was described by Professor Michener[1]. His diagram, showing a cross section of a New Guinea *A. cincta* brood with its concentric hemispherical layers of cells, is reproduced on page 6. The fact that we found this same structure in these Queensland nests convinced us that the bees' name should be *A. cincta*.

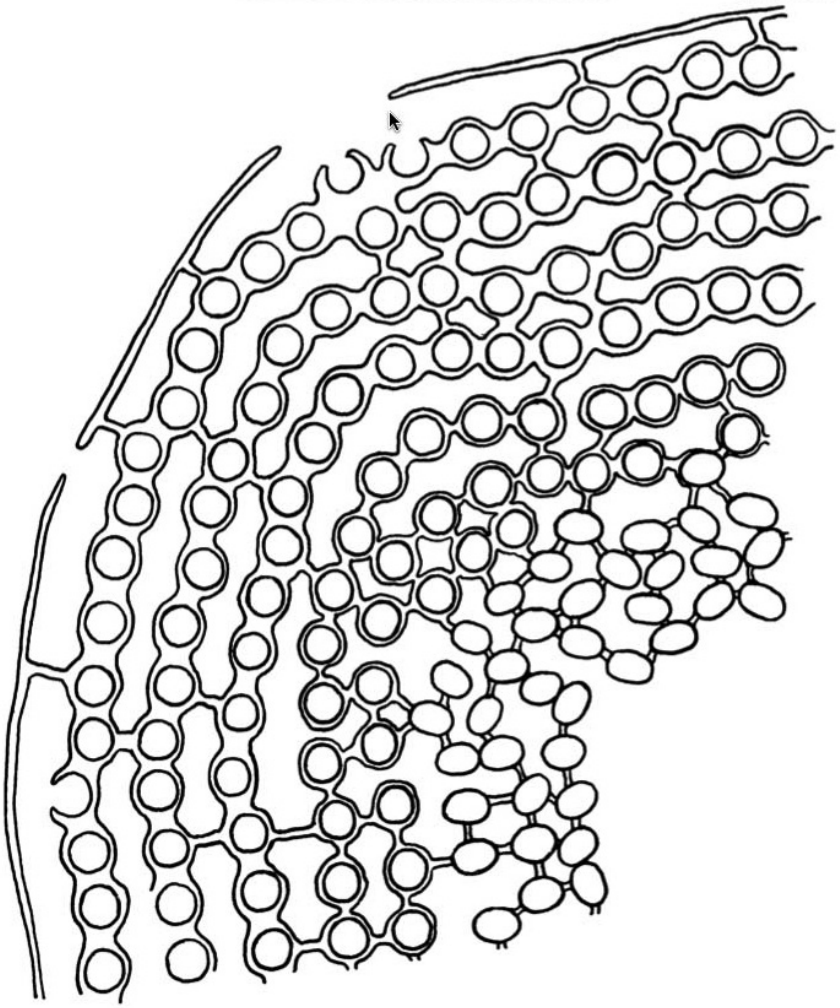


Diagram by Professor Michener of a New Guinea A. cincta brood. (See discussion on page 5.)

Vertical section through the upperpart of the brood in an Austroplebeia cincta nest in New Guinea, showing the covering involucrum sheath (left and above), multiple layers of cells, then the cocoons, and finally an empty central space (lower right). Reproduced from Michener, CD (1961) Observations on the nests and behavior of Trigona in Australia and New Guinea (Hymenoptera, Apidae). American Museum Novitates 2026: 1-46

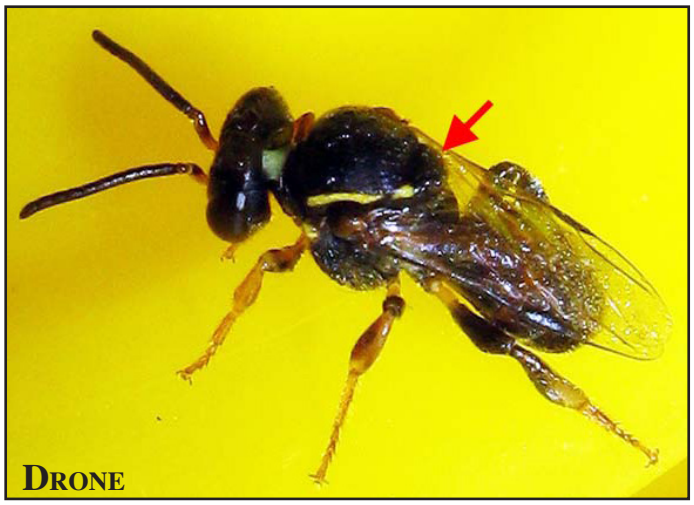
Cocoons, loosely connected in an irregular pattern, in the brood of an A. cincta nest

As the larvae grow inside their spherical brood cells, they need more room. So the worker bees gradually remove the wax between the cells and the comb structure becomes more irregular.

Egg Laying

The fascinating way in which *A. cincta* workers build these brood cells and the queen lays her eggs is described in *Aussie Bee Online* — Article 23.

Below: differences between the worker and the drone in Austroplebeia cincta. See full explanations on page 7. The arrows indicate a plate on the top of the thorax that is yellow in the worker but black in the drone.



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An A. cincta worker bee foraging for pollen

Identifying *A. cincta* bees

It can be quite difficult to accurately identify an Australian stingless bee species just by looking at a single worker bee. Happily this is not the case with *A. cincta*! However, you do need to take a close look with a good hand lens or a small microscope.

Workers

We have examined *A. cincta* worker bees from both Queensland and Papua New Guinea.

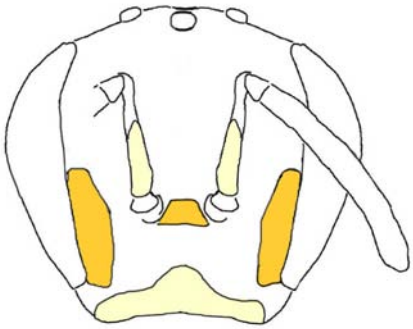
A. cincta worker bees are small. Workers from Queensland are about 3.4 mm in body length. Workers from Papua New Guinea are fractionally longer, about 3.8 mm in body length.

A. cincta workers have bold markings on the face and thorax as shown in the diagrams on this page. Please note, though, that some *A. essingtoni* and *A. percincta* workers have colour bands on the top of the thorax that can look quite similar to these.

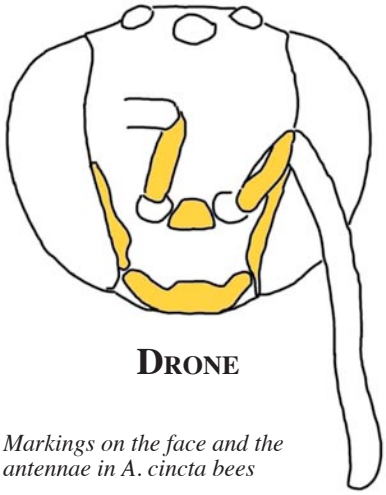
However, *A. cincta* workers have an additional distinguishing feature that is not seen in any other Australian stingless bee species: a coloured marking on the side of the thorax. See arrow in the diagram of a worker on page 8. If you can clearly see this coloured marking, then you have an *A. cincta* worker.

In some *A. cincta* workers, all these markings are a vivid yellow. However, sometimes the markings are duller, ranging from yellow to reddish brown. Nevertheless the pattern of the markings on the face, and on the top and side of the thorax is similar in most colonies.

A. cincta workers also differ from those of other *Austroplebeia* species in their hair patterns. The hair on the *A. cincta* face and on parts of the thorax is much finer than that seen in the other species. However, you need a microscope to be able to see these differences.



WORKER



DRONE

Markings on the face and the antennae in A. cincta bees

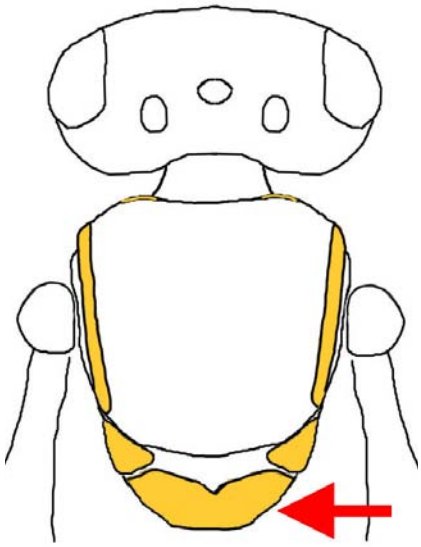
Drones (or male bees)

We have only examined *A. cincta* drones from Queensland so far.

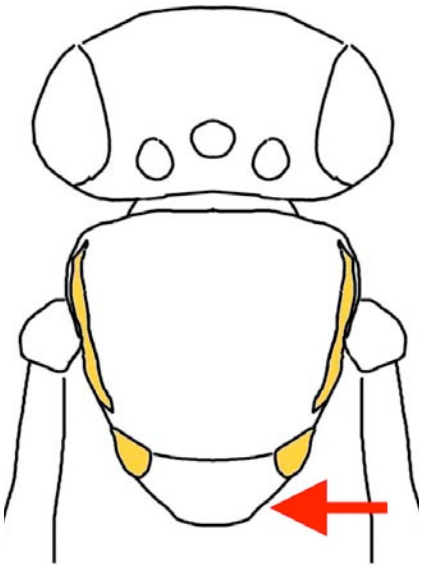
The drones are slightly longer than the worker bees: about 3.8 to 4.0 mm in body length.

They have similar face markings to the workers. However, the markings on the top of their thorax are quite different and they lack the marking on the side of the thorax. (See the diagrams on the right and on page 8.)

A. cincta drones can be distinguished from the workers fairly easily, using a good magnifying glass, by looking for the difference in the markings of the top of the thorax.



WORKER



DRONE

Markings on the top of the thorax in A. cincta bees. The arrows point out a major difference in the colour patterns between the worker and the drone.

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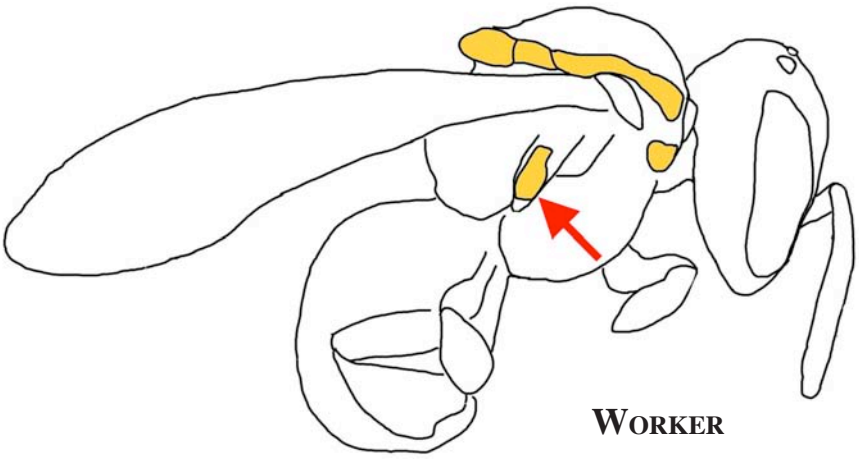
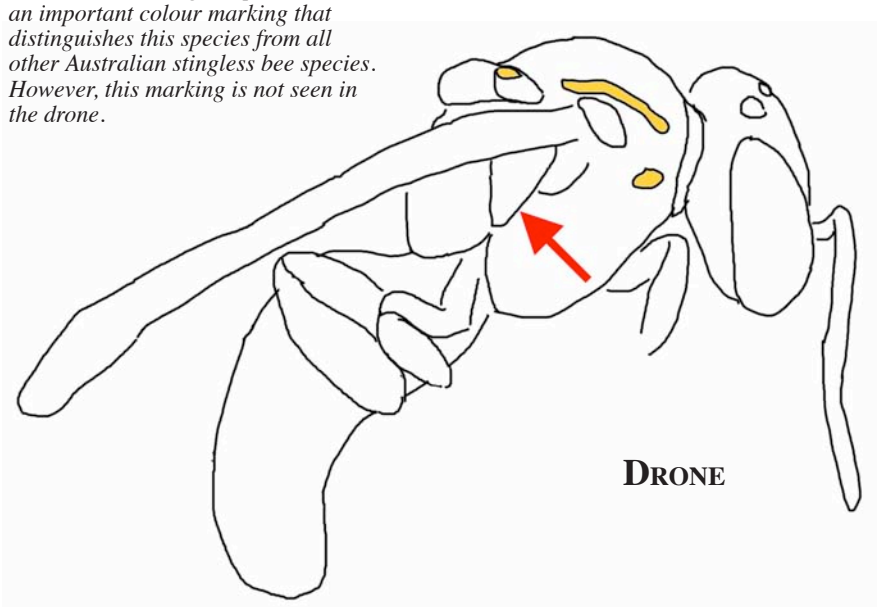


Markings on the side of the thorax in A. cincta bees. The arrow on the worker bee diagram points out an important colour marking that distinguishes this species from all other Australian stingless bee species. However, this marking is not seen in the drone.



Were There Any Earlier Records of *A. cincta* in Australia?

Before the discovery of the north Queensland populations of this species described in this article, to our knowledge there were no confirmed records of *A. cincta* in Australia.

The earliest record of *A. cincta* is from New Guinea. The species was first described (in Latin!) in a scientific paper written in 1898[2]. The description was based on a worker bee from Madang, Papua New Guinea.

The online *Australian Faunal Directory* and the *Zoological Catalogue of Australia*[3] list *A. cincta* as an Australian species, found in 'N Australia (no locality specified)'. However, new information that we have obtained suggests that this listing is incorrect.

This listing was based on a brief comment about this species in a book written by Professor Charles Michener in 1974[4]. He referred to the species as '... cincta of northern Australia and New Guinea'. As part of my ongoing research on the *Austroplebeia* in 2008, I asked Professor Michener for further details about this comment.

It was understandably difficult for him to retrieve the details three decades after the publication of his book. However, he replied, 'I now believe that *Austroplebeia* cincta of New Guinea probably does *not* also occur in Australia.' He thought that the comment in his book was based on a museum specimen collected from Western Australia, which had been incorrectly identified. (See full statement, kindly supplied by Professor Michener, in Box on right.)

Statement by Professor Charles Michener about his reference to *cincta* in *The Social Behaviour of the Bees*: written on 28 August 2008

I now believe that *Austroplebeia cincta* of New Guinea probably does not also occur in Australia. In 1974 in *The Social Behavior of the Bees*, p. 341, I wrote about *Trigona cincta* "of northern Australia and New Guinea." This statement resulted in the inclusion of *A. cincta* by J. C. Cardale in the 1993 *Zoological Catalogue of Australia* (vol. 10, Hymenoptera: Apoidea, p. 319). My mention of northern Australia was presumably based on one worker specimen (metasoma largely missing) in the collection of the Entomology Division, Natural History Museum, University of Kansas. Its machine printed labels are "Kimberley district / N V Austr. Mjoberg." [The N V may be an error for NW, northwest.] There is also a typical identification label from H. Friese: "*Trigona cincta* Mocs. 1911 Friese det" and in Friese's hand, written across the lower margin, what looks like im aus gefärbt. No doubt this refers to the less strong coloration than in New Guinea *cincta*; the first word in uncertain because of the probable symbol for a worker at the first of the line.

In spite of Friese's identification, the specimen is not *A. cincta*. As would be expected from the locality label, it agrees with Australian *Austroplebeia* specimens. Thus it almost lacks yellow on the metepisternum, which is largely yellow in *A. cincta*. Also it has more abundant and more conspicuous, white, seemingly plumose hairs. In particular on the clypeus many of the hairs are conspicuously white and broadened, while in *A. cincta* from New Guinea, on the middle and upper parts of the clypeus, the hairs are slender, inconspicuous, and not noticeably white.

Tarlton Rayment mentioned *A. cincta* briefly in a list of Australian stingless bee species [5] that he published in 1932. However, he described this species as 'Doubtful for Australia'.

Now, however, we do have a confirmed population of *A. cincta* in far north Queensland. It was somewhat surprising that these spectacular stingless bees had gone unreported in the scientific record until this time! This made us wonder how long this species had been in Australia. Could they have arrived here quite recently, perhaps accidentally enclosed in a ship's cargo from New Guinea, or deliberately introduced in a boxed hive?

How Long has *A. cincta* been in Australia?

To answer this question, we have begun searching for very old specimens of *A. cincta* in museum collections in Australia and overseas. This involves either visiting individual museums or arranging to borrow their collections. Already this search has yielded some results.

We visited the British Museum of Natural History in London earlier in 2012 and searched their Australian stingless bee collection for *A. cincta* specimens. We found six *A. cincta* specimens amongst the unidentified bees. Unfortunately the only labelling on these bees read 'Australia N Queensl' with no details of the collector or date.

Then in the South Australian Museum collection, with the help of Dr Mark Stevens, we found a more conclusive result. In Kuranda, Queensland there was once a famous insect collector called Frederick Parkhurst Dodd (1861-1937). Known as 'The Butterfly Man of Kuranda', FP Dodd created spectacular insect collections that he took on tour around eastern Australia to inspire others with an interest in insects.

Three stingless bees collected by FP Dodd ended up in a tray of unidentified bees in the South Australian Museum collection. Close examination revealed that they were all *A. cincta* specimens. One of the specimens was simply labelled 'Cairns dist'. However, the labels on the other two bees showed that they were collected in Kuranda, Queensland, in February 1921.

FP Dodd's two *A. cincta* bees were collected in Kuranda 92 years ago. Furthermore Lewis Roberts told us that he recalls seeing nests of this species 50 years ago on his Queensland property. Clearly the species did not arrive in very recent years in Australia. The search continues!

A Search for other Populations

As a final goal in our safari we wanted to find out how widely distributed *A. cincta* might be in Queensland. Lewis Roberts told us that he had looked for this species in other areas near his property but that he had not had any success. So we decided to try our luck 150 km further south, at Kuranda.

Right: Les Dollin visits the grave of the famous 'Butterfly Man of Kuranda', Frederick Parkhurst Dodd, in Kuranda.

Below: one of the A. cincta specimens caught by FP Dodd in 1921 in Kuranda and now part of the South Australian Museum collection. The arrow indicates the important colour marking on the side of the thorax, that shows that this bee belongs to A. cincta. Photograph by Michael Batley.

Kuranda is a pretty village set in the rainforest on the edge of the Atherton Tablelands. FP Dodd had caught his two *A. cincta* bees there in 1921. However, there was also another more recent clue to this species' presence there. Expert photographer, Paul Zborowski, had captured a beautiful photograph of a brightly striped stingless bee there in 2008 and it had been posted on the ANBees website. The bee looked like *A. cincta*, although only the markings on the top of the thorax were clearly visible.

Paul kindly agreed to show us where he saw the stripy bee. This spot was right in the rainforest but nearby on the road were several houses with flowers in their front gardens. There, collecting pollen from a palm tree, were some tiny *A. cincta* bees. Thanks to Paul Zborowski's help, we were able to confirm a second population of *A. cincta* in far north Queensland.

Right: Les Dollin and Paul Zborowski look for bees in Kuranda.
Below: the pretty A. cincta bees.

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Ongoing Studies

With the assistance of Lewis, Edith and Charlie Roberts we will continue monitoring and researching the *A. cincta* nests that we studied during our 2012 safari. These colonies face threats such as bushfire, flooding rain and green ant attack. However, they also benefit greatly from the care and husbandry work of all the Roberts family.

We look forward to returning to this beautiful region of far north Queensland for another *Aussie Bee* safari, to learn more these spectacular new Australian stingless bees.

References

(1) Michener, C.D. 1961. Observations on the nests and behavior of *Trigona* in Australia and New Guinea (Hymenoptera, Apidae). *American Museum Novitates* **2026**: 1-46

(2) Friese, H. 1898. Die *Trigona*-Arten Australiens. *Természetrajzi Füzetek* **21**: 427-431

(3) Cardale, J.C. 1993. Hymenoptera: Apoidea. In Houston, WWK and Maynard GV (eds). *Zoological Catalogue of Australia*. Canberra. AGPS. Volume 10

(4) Michener, C.D. 1974. *The Social Behaviour of the Bees. A comparative study*. Cambridge : Belknap Press of Harvard University Press

(5) Rayment, T. 1932. The stingless bees of Australia. 6. The finding of a new species. *Victorian Naturalist* **49**: 104-107

See spectacular photographs of the *Austroplebeia cincta* queen laying eggs in: *Aussie Bee Online* Article 23

Can You Help?

Do you know of other locations in Australia where *Austroplebeia cincta* is found?

Or could you help us obtain some *Austroplebeia cincta* bees from New Guinea?

Please send us an email: anbrc@zeta.org.au