Keeping Australian Stingless Bees in a Log or Box

Third Edition — PDF eBook

Anne Dollin & Tim Heard

Keeping Australian Stingless Bees in a Log or Box

3rd Edition (PDF ebook) 2017

by Dr Anne Dollin —
Australian Native Bee Research Centre
&
Dr Tim Heard —
Sugarbag Bees

Native Bees of Australia Series
Booklet 5

An Australian Native Bee Research Centre Publication

All photographs and drawings are by the authors, except where otherwise acknowledged in the text.

FRONT COVER
Left: a log nest of Australian *Tetragonula* Stingless Bees. Photograph by Anne Dollin.
Right: a boxed hive of Australian *Tetragonula* Stingless Bees. Photograph by Tim Heard.

Published by:
AUSTRALIAN NATIVE BEE RESEARCH CENTRE
PO Box 74, North Richmond NSW 2754
Visit our website: https://www.aussiebee.com.au
First edition, 1997 (paperback).
Second edition, 2010 (paperback).
Third edition, 2017 (paperback)
This revised third edition (ebook) published in 2017.

ISBN (2017 ebook edition) 978-1-876307-28-8

Contents

Continued on next page...

Contents

...CONTINUED

Why Keep Australian Stingless Bees?

A nest or box of Australian stingless bees makes a wonderful addition to your backyard — whether you are a gardener, a small-crop grower or simply a lover of Australian wildlife.

— They will help to pollinate your treasured plants.

— They will supply you with a taste of their unique honey.

— They have a fascinating social behaviour similar to the introduced commercial honeybees (*Apis mellifera*) but they are stingless and safe to handle.

— Many of the nests currently kept in boxes by major stingless bee keepers have actually been saved from destruction by being removed from subdivision landclearing operations.

— Best of all, they are 'true-blue' Australian native bees.

Your observations of their behaviour could help unravel some of the remaining mysteries of their secret lives within the nest.

Les Dollin with a nest of stingless bees in a log at the Australian Native Bee Research Centre

History of Stingless Beekeeping

Hundreds of species of stingless bees are found worldwide in tropical and subtropical areas of Central and South America, Africa, India, Southeast Asia and Australia.

Stingless beekeeping is an ancient art. In Mexico beekeepers began keeping stingless bees in managed hives over 2000 years ago. Worldwide, stingless bee honey has been harvested for centuries. It has been used as a food, as a medicine, to make mead and even to pay taxes to Inca and Aztec overlords.

In Australia, there are eleven species of stingless bees in the genera *Tetragonula* and *Austroplebeia*. For details about how to recognise the species of Australian stingless bees and which species occur in which areas, read our ebook, *How to Recognise the Different Types of Australian Stingless Bees* — see page 18.

For Australian Aboriginal people, stingless bee nests have been a prized resource for centuries. The honey provided a rare sweet food and a medicine, and the nest resins were widely used in toolmaking and art.

Right: Pots of precious 'Sugarbag' honey, from a native stingless bee nest, were placed in this bark coolamon by an Australian Aboriginal person before being taken back to camp in Cape York, Queensland. Photograph by Viv Sinnamon, former Land and Natural Resources Manager, Kowanyama, Queensland.

Some early Australian settlers kept nests of stingless bees on their farms in logs. Then in the 1960s, pioneer beekeepers such as Bill Milne began to transfer nests of Australian stingless bees into boxes. Boxed hives were much easier to handle and transport than nests in heavy logs.

Techniques were developed to multiply the hives and to harvest some of the tangy stingless bee honey. Some of the key people who did pioneering work in developing box designs and husbandry methods for the stingless bee industry in Australia from the 1960s to the 1980s are shown below:

Some Australian Pioneers of Stingless Bee Hive Design

Clockwise from below: Tom Carter, Rockhampton; Les Felhaber, Rockhampton; Russell Zabel, Hatton Vale; Bill Milne, Maryborough; and Peter Davenport, Gold Coast with Tim Heard, Brisbane.

In the European commercial honeybees, colonies multiply by sending out a swarm of bees that contains a mature queen bee and thousands of worker bees. The bees move into an empty hollow and build a new nest. Beekeepers can produce a new hive of honeybees by capturing such a swarm and placing it into an empty box.

Colonies of our native stingless bees do not (with rare exceptions) multiply by swarming into an empty hollow. Instead stingless bees spend weeks preparing a new nest site and stocking it with provisions. Then they send out a group of worker bees and a new queen to populate it. Pioneer beekeepers in Australia discovered that the best way to produce a new hive of our stingless bees was to physically divide a hive into two halves. This process is called 'splitting'.

Today interest in keeping Australian stingless bees in a log or hive box is growing rapidly. Some beekeepers have hundreds of hives that they use for commercial pollination services; schools and museums keep nests for their educational value; and gardeners and nature-lovers enjoy the pleasure of keeping these safe and fascinating native bees.

How to Obtain Australian Stingless Bees

Nests of stingless bees in logs can sometimes be obtained from local timbercutters or firewood agents, who may find nests in the timber they are cutting for sale. Alternatively you may be fortunate enough to locate a nest yourself on private land. Remember that it is illegal to remove native bee nests from National Parks and reserves. No permit is currently required to keep native bees.

Many beekeepers across Australia now sell log nests or boxed hives of stingless bees. Hives of these tropical bees can be produced much more quickly and economically in warm climates such as in Queensland, than in cooler areas such as in New South Wales. However, there is a strong demand for stingless bees – so the prices are relatively high.

A current list of beekeepers selling stingless bees is available on the *Aussie Bee* website:
www.aussiebee.com.au/buy–stingless–bees.html

Where You Can Keep Stingless Bees

There are many areas of Australia where it is too cold to keep the stingless bees. Excessively cold and hot temperatures can kill a nest. Also stingless bees cannot fly below 18° C. So in cold areas where they are unable to fly for some months of the year, they may not be able to collect enough food to survive the winter.

Different species of stingless bees occur in different areas of Australia. Queensland beekeepers produce the majority of stingless bee hives that are for sale. However, local species of stingless bees should be obtained in areas where the Queensland species do not occur naturally.

Check the following state by state guide for more details:

Areas of Australia where stingless bees occur naturally

QLD

The following species of stingless bees may be purchased from beekeepers in QLD:

— *Tetragonula carbonaria* (suitable for southern areas of QLD and warm coastal areas of NSW),
— *T. hockingsi* (suitable for coastal areas of QLD, particularly north of Bundaberg)
— *Austroplebeia australis* (suitable for most inland areas of QLD) and
— *A. cassiae* (suitable for northeastern areas of QLD).

A few other stingless bee species that build much smaller nests occur in far north QLD. These include *T. sapiens* and *T. clypearis*. It is uncommon for these species to be kept by beekeepers.

NSW

Tetragonula carbonaria occurs naturally in warm coastal areas of NSW as far south as Bega.

However:

— The climate of the NSW south coast is marginal for *T. carbonaria*.
— *T. carbonaria* can be kept successfully in eastern areas of Sydney but the climate becomes marginal for it in western Sydney.
— It is too cold for the stingless bees in areas of the Blue Mountains west of about Bilpin and Woodford.

Austroplebeia australis occurs in northern and coastal areas of NSW. However, it does not occur naturally in areas south of about Dungog.

In marginal areas, nests in logs will generally survive better than those in boxed hives.

Few beekeepers produce hives for sale in NSW at present because the climate in most areas does not allow rapid breeding of colonies. However, QLD breeders can post hives of *T. carbonaria* into suitable areas of NSW by overnight courier.

ACT, VIC, SA & TAS

No stingless bee species occur naturally in these areas because the climate is too cold. We recommend that stingless bees are not brought into these areas because they are unlikely to survive there.

WA & NT

The stingless bees do not occur naturally in southern areas of WA. The beautiful wildflowers of that region are pollinated by a completely different array of solitary and semi-social WA native bees. Stingless bees should not be brought into these areas because they would disrupt the delicate pollination balance of the WA wildflowers.

Similarly, in the northern areas of WA and in the NT it is preferable to find sources of stingless bees locally. The stingless bees species in these areas, such as *Tetragonula mellipes*, are different from those in the eastern states.

Setting Up a Nest in its Original Log

If you cut a log nest out of a fallen tree, the nest should be immediately sealed up against ants, honeybees, flies and other predators. Stingless bees defend their nest against predators by sealing up all openings to their nest, other than the nest entrance, with wax and resin. Cuts and cracks in the log may break these important defences.

Stuff plastic bags or newspaper into the ends of the log and seal these areas securely with masking tape. Any cuts or cracks in the log should also be sealed with materials such as masking tape or a filler such as *No More Gaps*.

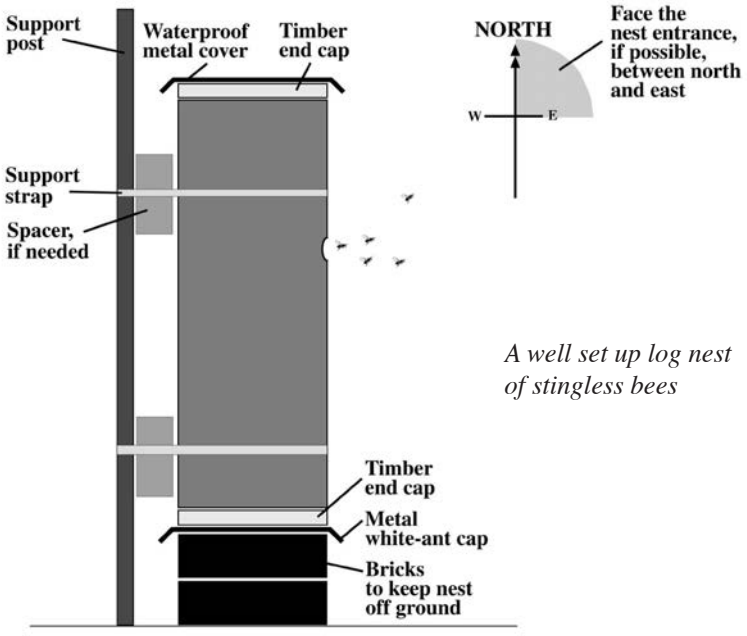
Try to encourage as many flying bees as possible to return to the nest by propping up the log as close as possible to where the nest was originally located. Wait until the bees have stopped flying at dusk; then tape some gauze cloth over the entrance hole before moving your log nest to its new location.

Place the log nest in a warm spot in the garden, preferably with morning sun. The site should be protected from direct afternoon sun and from cold winds. If possible face the nest entrance between north and east.

The bees require flowers for pollen and nectar within about 500 metres of the nest.(1) They will happily use a wide variety of native and introduced flowers.(2) In hot dry inland areas, a supply of water near the nest is also desirable.

Set up the log so that it matches the original orientation of the nest if possible. For instance, if the nest was originally in a standing tree, set up the log in a vertical position. If really necessary, the bees can adapt to a change in nest orientation. However, it would disrupt the structure of the bees' brood for many weeks. In particular, placing a nest upside down will cause great chaos! To avoid mistakes, clearly mark the top of the nest when it is first collected.

Cover the ends of the log with caps of timber and metal to keep out rain and invading insects. If ants are in the area, the nest should be placed on a brick standing in a shallow container of water and detergent until the bees have fully repaired all damage to their nest structure.



A well set up log nest of stingless bees

Which is Better: Log Nest or Boxed Hive?

There are different advantages for keeping stingless bees in a log or a box:

The Log Nest	The Boxed Hive
Leaving the nest in the log is the safest option, as long as the timber is thick and sound. Even in experienced hands, some nests which are boxed will die. A log which has thick solid timber walls would provide the best insulation against heat and cold. In areas with marginal climate, stingless bees survive much better in a log of this type than in a box. A natural log nest has an attractive appearance and makes a great feature in a native garden.	Boxed hives are light weight and regular in shape. They are easy to handle and transport. Boxed hives are essential for large scale crop pollination. Hives can be readily multiplied by splitting. This reduces the need to remove nests from natural bushland. With experience and good conditions, almost all split hives survive. In warm areas, delicious honey can be harvested for your gourmet pleasure.

Hive Box Designs

Many different hive box designs are being used in Australia for keeping stingless bees. These designs vary because four major species of Australian stingless bees are currently kept in hives: *Tetragonula carbonaria, Tetragonula hockingsi, Austroplebeia australis* and *Austroplebeia cassiae*. The nests of these species differ substantially in size and structure and therefore they suit boxes of different shapes and sizes. Also many individual beekeepers have independently created these designs to suit their own methods of hive splitting and honey harvesting.

Most hive boxes in use today fit into one of three basic styles:

(A) Basic Horizontal Split Design
(B) Vertical Split Design
(C) Two Storey Horizontal Split Design

These three basic styles and the splitting methods used with each one are described on the following pages.

All these boxes are constructed from timber between 15 and 45 mm thick. Various timber types are used including hoop pine, cypress pine, oregon pine, western red cedar, silky oak, craftwood and exterior plywood. Surprisingly, it is probably better to choose a light timber than a heavy timber. Light timber is less dense, so it contains more trapped air and is a better insulator.

The above designs all work well in the warm climate of Queensland. For cooler climates, such as in Sydney, boxes constructed from the thicker timbers are recommended to provide better insulation. Many designers also make box covers from polystyrene foam to protect the bees against extremes of temperature.

The joints of the boxes should be secured with galvanised nails or screws plus some waterproof glue. The use of rebated joints will make the boxes more durable. Every care should be taken to avoid gaps between the wooden panels of the boxes; otherwise the hive may be invaded by ants or other predators (see pages 12–15). The boxes should be painted on the outside. A roof made from a bent sheet of metal may also be added.

A landing board for the bees may be constructed by extending the base of the box. Alternatively, a small block of timber or a bent piece of metal may be fitted just below the nest entrance.

Some Australian hive designs: Top to bottom: Peter Davenport's hive with a foam cover; John Klumpp's cylindrical design made from insulated PVC pipe; Tom Carter's hive with a metal lid and shade cloth sides.

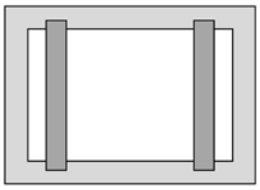
(A) Basic Horizontal Split Design or 'OATH'

This is a very commonly-used box design in Australia. Most stingless beekeepers in Australia use variations on this simple but successful design.

Tim Heard (Sugarbag Bees, Queensland) uses the hive illustrated below for his *T. carbonaria* and *T. hockingsi* stingless bees. This hive design is called the OATH (Original Australian *Trigona* Hive).

The base of this hive is 280 x 200 mm and its height is 230 mm. The timber thickness is 25 mm. The hive is cut horizontally into two halves, to allow splitting. A 13 mm entrance hole is drilled into the lower half. This hole is positioned 25 mm above the base board to help prevent the entrance becoming blocked if any soft resin in the hive melts during hot weather. A 7 mm ventilation hole is drilled near the top of the back wall of the top box.

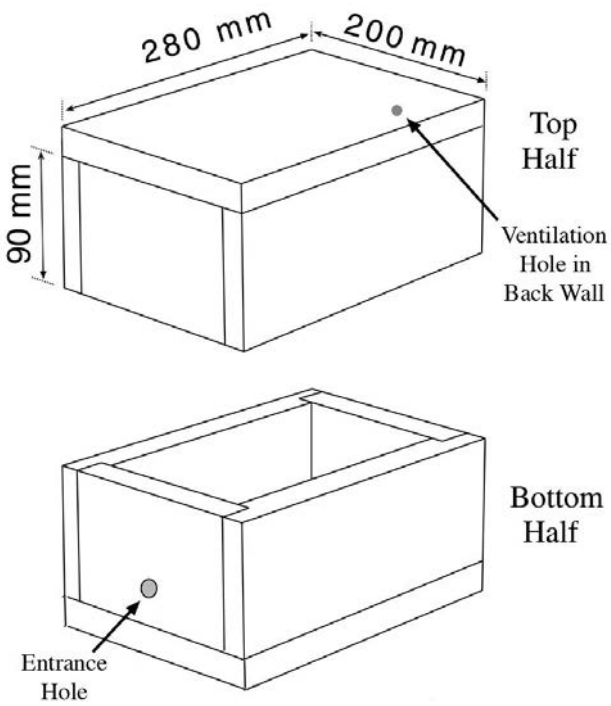
Tim Heard adds two 'split bars' to the top half of his hive design to prevent the nest contents of the top half collapsing into the bottom half following a split. These bars are about 25 mm wide and made from wood, plastic or metal. They are rebated into the timber of the hive and positioned as shown below:



View looking up into the top half of Tim's hive showing the position of the two split bars

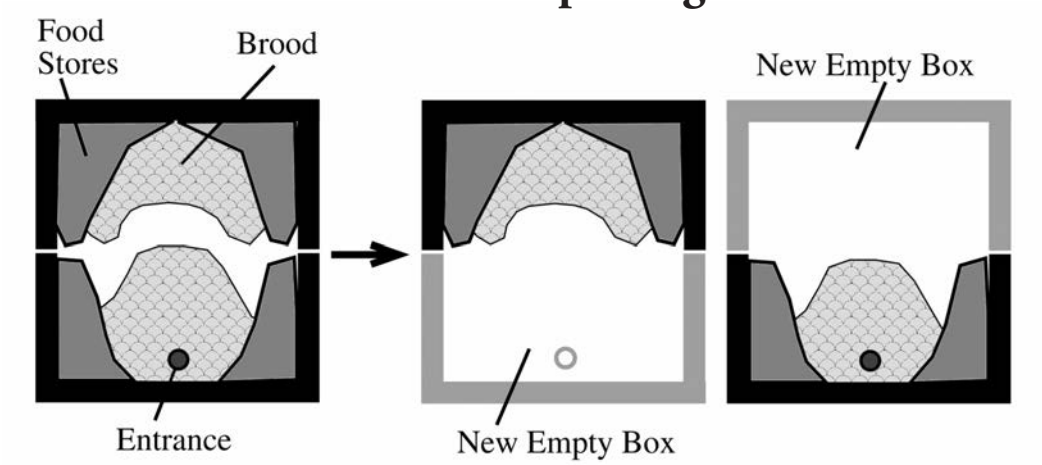
Rebated joints are used in this design. The sections of the hive need to be tightly bound together to keep out pest insects. Plastic packaging tape that is secured with a buckle works well. Alternatively, metal *Emlock* fasteners can be used.

The volume of Tim's hive is 6 litres. An additional compartment can be added to this design for honey harvesting (see page 17).



The OATH box used by Tim Heard — a two part design with the entrance in the lower half. The entrance and ventilation holes are drilled at an angle, sloping upwards towards the inside of the hive to keep out the rain.

Tim Heard's Hive Splitting Method



The brood and food stores in the original hive box are divided by separating the box into its two halves. New empty boxes are then added to each half to produce two new hives.

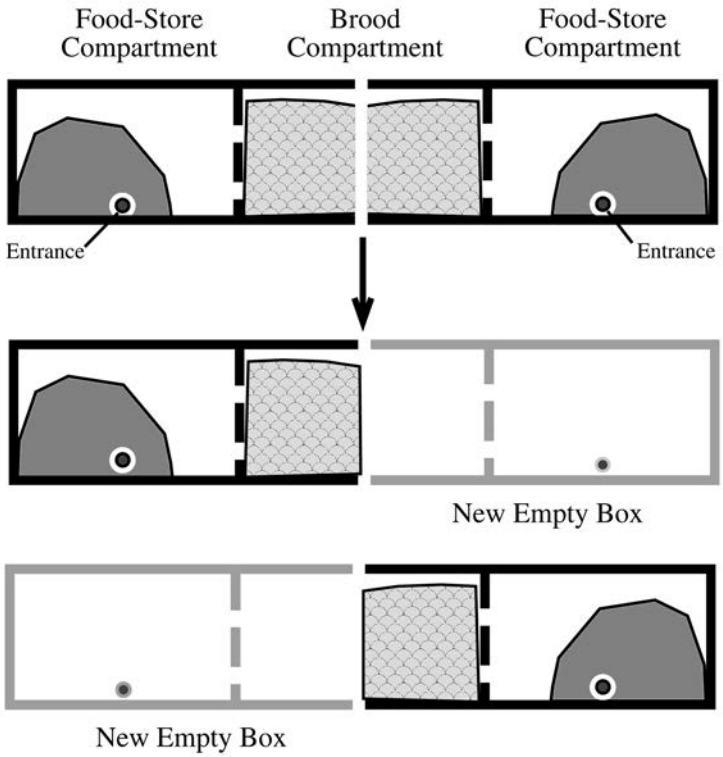
(B) Vertical Split Design

Les Felhaber (Rockhampton, Queensland) designed a long, horizontal hive design for his *T. hockingsi* bees.

His hive is 600 mm long and 120 mm wide. Its height is 120 mm. The hive is divided into three compartments with pieces of perforated board, the centre compartment being for the brood and the two outer compartments being for the honey and pollen supplies. The hive is cut vertically down the centre for splitting purposes. One entrance hole (width 6 mm) is drilled into each of the food-store compartments. The volume of Les' hive is 8 litres.

One of Les Felhaber's horizontal hive boxes with the the lids removed from the central brood compartment, revealing the T. hockingsi brood comb inside.

Les Felhaber's Hive Splitting Method



Les cuts vertically through the brood in the central compartment of his design with a hot wire. Each new hive receives half of the original hive's brood and half of its food stores.

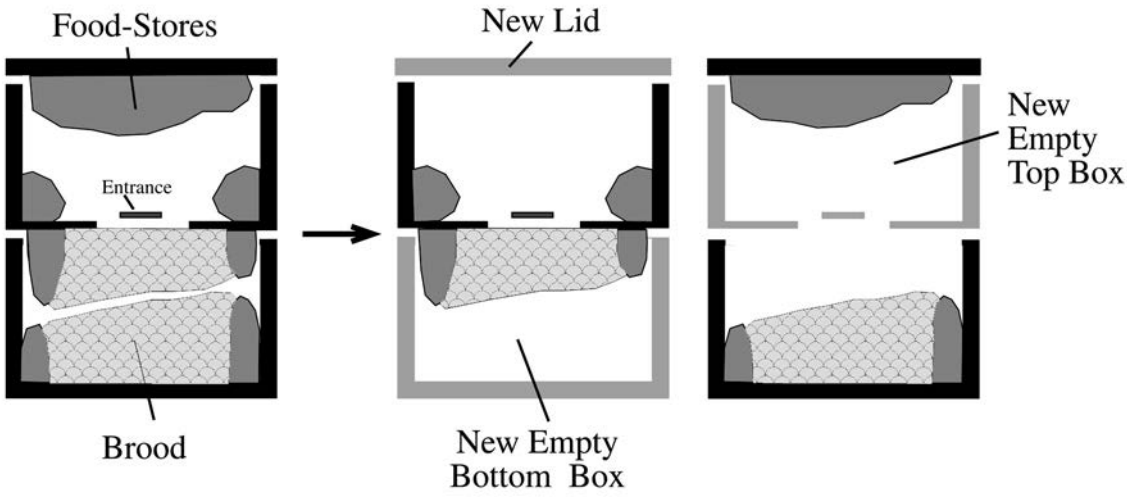
(C) Two Storey Horizontal Split Design

Tom Carter (Rockhampton, Queensland) designed a two-storey hive for his *T. hockingsi* bees.

The lower storey of the hive is for the brood while the upper storey is for honey and pollen. Unlike the other designs, Tom's brood compartment is not divided into two sections. Instead, Tom splits his hives by separating off the brood which is attached to the top surface of his brood box. The base of his hive is 325 x 250 mm and its complete height is 325 mm. The entrance hole is 4 x 50 mm. The volume of Tom's hive is 14.5 litres.

A bank of pots containing delicous honey in the top storey of a 'Carter Built' native bee hive. One advantage of Tom's design is that most of the honey pots are well separated from the brood, so honey harvesting is easy and safe.

Tom Carter's Hive Splitting Method



Tom Carter's design separates into three pieces: the bottom box, the top box, and the lid. Tom separates the brood in the base of the bottom box from the brood which is attached to the under surface of the top box. He also divides the major food stores by separating the stores in the base of the top box from the stores attached to the under surface of the lid.

How to Box a Nest

A complete step-by-step guide to boxing a nest of stingless bees is presented in another ebook in this series, *Boxing and Splitting Hives* — see page 18. It is recommended that you obtain a copy of this ebook before attempting to box a nest.

The basic steps in boxing a nest are as follows:

1. Split the original log open as gently as possible.

2. Carefully remove the brood and place it in the hive box. Peter Davenport recommends the use of a garden trowel to pick up the brood.

Peter Davenport of the Gold Coast, wearing a bee-veil and protective clothing, begins the process of boxing a nest of Tetragonula stingless bees by cutting open the log

3. Do not transfer any groups of honey or pollen pots into the hive box unless they are completely intact. Stingless bees easily drown in spilt honey and broken honeypots also attract predators such as Phorid and Syrphid flies (see page 14).

4. Securely fasten all sections of the box together with plastic strapping or tape.

5. Transfer as many bees as possible into the new nest box. Place the box in the same position as the original log. Elevate the box on a platform or mount it on a star picket so that the hive entrance is at about the same height as the old nest entrance was. Stick some resinous material from the original nest entrance onto the new box entrance to encourage any flying bees to enter the new box.

Caring for a Boxed Hive

Once established, a boxed hive of stingless bees requires little maintenance. The bees should be protected against hazards such as insect predators, spiders and insecticides (as described on pages 10–15). However, beyond that, little needs to be done other than keeping the box painted.

The main dangers to avoid with a boxed hive are overheating and chilling. The thin walls of a hive box do not provide as much insulation as a natural log with thick solid walls would do. Adding a closely fitting polystyrene foam cover to a hive box may help it resist temperature extremes.

— Afternoon temperatures above 40° C can cause nest structures to melt in a boxed hive and a temperature of 44° C can kill the bees in a hive. Adding a ventilation hole near the top of a hive (see page 6) will help. Hives should be shaded from hot afternoon sun. On an extremely hot day, you can cool a hive by draping it with wet towels. Alternatively, if practical, close the entrance of a hive with some gauze, on the evening before, and move the hive into a cool location.

— Similarly, frosts and extremely cold temperatures can endanger stingless bees. These bees are tropical and the developing bees in their brood may die if the nest becomes chilled. Hives should be shielded from cold prevailing winds. In marginal areas, siting a hive under the shelter of a verandah or inside a shed (with an entrance tube passing through the shed wall) can help the bees cope with cold weather.

It is not necessary for the health of the bees to split the hive. The bees can happily occupy the same box for decades without interference and should give their owner many years of pleasure.

How to Move Your Stingless Bees

Care must be taken if you wish to move a nest or hive of stingless bees. The bees recognise the position of their nest by landmarks and chemical markers. If they are moved to a new position within the bees' original flight range, many forager bees will return to the original nest site and may be lost.

Two possible ways to safely move a nest to another nearby site within a garden are as follows:

— The nest can be moved gradually, about a metre every second day, so the bees can still find their nest.

— Alternatively, the nest can be moved away to a temporary site at least one kilometre* away, so that the bees do not encounter any of their old position markers and become lost. Then, after at least three weeks, you can bring the nest back to the garden and set it up in its new position. The new generation of foragers that emerges from the nest will safely orient to their new position.

** Russell Zabel recommends a minimum of two kilometres.*

Swarming

If the queen bee in a nest becomes old, a new queen bee raised by the colony may replace her. A swarm of males may be seen near the nest in this situation waiting for the young queen to emerge for her mating flight.

Once a colony becomes very strong, the bees may begin to build a daughter nest elsewhere. If this is happening you will notice bees coming *out* of your nest or hive carrying balls of building materials on their hind legs. Finally a virgin queen bee and some workers fly over to the new nest site. However, there is no reason to be concerned about this because most of the bees will stay in their original nest. In this situation the mating swarm of males will form near the new nest.

Occasionally a large swarm of worker bees may form outside a nest. This is usually caused by stingless bees from one nest trying to enter another nest and being attacked by the guard bees. A major battle can result with large numbers of bees wresting one another to the death on the ground. Although this looks alarming, nests usually recover successfully after such events. A detailed description of this behaviour can be found in a free article on our website:
Aussie Bee Online Article 13 — The Mysterious Fighting Swarms.
www.aussiebee.com.au/abol–current.html

Eric Smith standing in a huge swarm of stingless bees near his hive in the lower Blue Mountains, NSW.

Hazards to Avoid

Pesticides

Many household and garden pesticides can kill stingless bees. These may include fly sprays, surface insecticides, agricultural and garden insecticides as well as chemicals used to treat houses for white ants and other insects.

The bees may die immediately from direct contact with the spray. Alternatively the bees may bring pesticide-contaminated pollen or nectar back into the nest, and developing brood and young bees in the nest may die from eating these toxic materials.

A search for the product name and 'bee toxicity' on Google will usually give you information about whether a particular pesticide is toxic to commercial European honeybees.

A pesticide may be harmful for our stingless bees, even if it is considered safe for commercial honeybees. Our 3 to 4 mm long Australian stingless bees are much smaller than the 12 mm long commercial honeybees. Smaller bees are usually more vulnerable to poisons because of their relatively small weight compared with their surface area.

In 2009 a study in Mexico[3] examined the toxic effects of three agricultural pesticides, permethrin (pyrethroid), diazinon (organophosphorous) and methomyl (carbamate), on a stingless bee species. This stingless bee is about 5 mm long so it is a fraction larger than our *T. hockingsi* and *T. carbonaria* bees.

— The researchers found that all three pesticides were much more toxic to this Mexican stingless bee than they were to the commercial honeybee. It took between 1.5x and 8.6x more of the three pesticides to kill a sample of commercial honeybees than it took to kill a sample of the stingless bees.

— Furthermore all three pesticides were even more toxic to stingless bee callows (young pale coloured bees normally found in the brood) than they were to the mature foragers.

However, factors other than body size can affect the toxicity of a pesticide. For instance, the presence of certain detoxifying enzymes in a bee or the amount of fat in its body can also make a difference. In two earlier studies, some stingless bee species overseas were more resistant than commercial honeybees were to particular pesticides.

Nevertheless it is best to be very cautious when using any pesticides near our tiny Australian stingless bees, even if the product is stated to be safe for commercial honeybees. Make sure that your neighbours know that you are keeping bees and ask them to notify you if they intend spraying pesticides on their property.

If spraying is going to be done nearby, you should either:

— move the hive at least one kilometre away from the spraying for two to three days; or

— prevent the bees from flying for two to three days by taping some light gauze over the nest entrance and covering the log or hive with a hessian sack. If the weather is hot, keep the bees cool by wetting the hessian.

Other actions that can be taken to protect all types of bees, small or large, wild or domesticated, from pesticide poisoning are:

— Avoid spraying pesticides on the blossoms of the target plants or those of nearby weeds.

— Apply pesticides in the late evening after all bees have stopped flying.

— Choose the least toxic formulation available.

Cadaghi Tree Resin

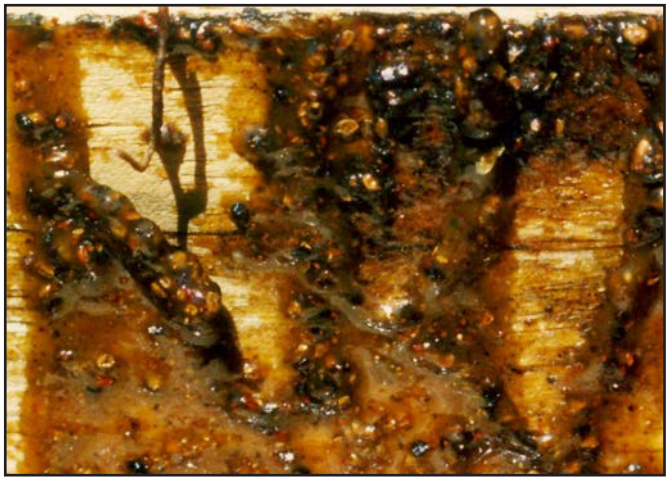
The cadaghi tree, *Corymbia torelliana*, is a north Queensland rainforest tree that grows up to 30 m high. It has been planted as a fast-growing garden and street tree in many east coast areas, down to Newcastle, but it is now considered a weed in much of its introduced range. The resin from this tree may be a hazard to stingless bees.

The cadaghi tree produces a soft resin in its seed pods. Stingless bees are so attracted to this resin, that they may fly up to one kilometre to collect it. The bees may carry huge amounts of the resin, along with many cadaghi seeds, into their nest. In this situation you may see cadaghi seeds, that look similar to large tomato seeds, glued around the nest entrance.

Problems could occur if the cadaghi resin melts in hot weather, Stockpiled resin in the nest may slump and block off the nest entrance. Furthermore nest structures that have been built using the resin may collapse.

The resin rich fruit of the cadaghi tree, Corymbia torelliana, may be hazard to stingless bee nests

Views about cadaghi resin differ. Tom Carter in Rockhampton, Queensland, had to periodically clean out the excess resin and seed from his hives. Some beekeepers move their hives to other areas at times when the cadaghi seed pods are producing this resin (about December to January). Other beekeepers, including Tim Heard, do not consider cadaghi to be a serious threat to stingless bee hives.



Left: seeds and soft melted resin from the cadaghi tree inside a T. carbonaria hive

Ants

Various species of ants may attack a nest or hive of stingless bees that is damaged or weak. Ants can be a particular problem when:

— a nest or hive is first set up in a new location;
— a nest is transferred into a box; or
— a hive of bees is split.

Ants can usually be dealt with using physical barriers. A log nest can be set up on a brick placed in a dish of soapy water. A boxed hive mounted on a star picket can be protected by daubing a ring of sump oil or grease on the star picket. John Klumpp makes the great suggestion that a long pipe cleaner, soaked in oil and wrapped around the support post of a hive, makes an effective and long lasting ant barrier.

Ants will find it more difficult to invade a hive box if the joints between the box sections are neat and closely fitting. When building a hive box, all touching surfaces should be planed and sanded so that they are flat and will meet with little or no gap. The bees can quickly seal up small gaps with resin, keeping out ants and other predators.

Spiders

Spiders looking for an easy feed may capture many stingless bee foragers. Regular inspections should be done to make sure spiders do not build their webs too close to a nest or hive of stingless bees. Overhanging roof structures on a hive and foam covers can make ideal places for web building and need particular monitoring.

Bembix Wasps

Another insect predator that can trouble a nest or hive of stingless bees is the *Bembix* sand wasp, so called because it nests in loose sand. These wasps may hover persistently in front of a stingless bee nest entrance, trying to capture the flying bees. The wasps sting the bees to paralyse them then they store them in their nest burrows as food for their young.

Bembix wasps are remarkably good diggers in sand. They can use their front legs to rapidly dig a burrow, ejecting a curtain of sand behind them. They can also completely cover over a burrow entrance in a few seconds with a shower of loose sand.

Bembix wasps near one of their nest entrances in a sandy track near Sydney, NSW

Several species of *Bembix* wasp prey on native bees.[4]

— *Bembix tuberculiventris* was reported to have stocked its nests in a sandhill in Queensland with a variety of bee species from the family Colletidae.

— *Bembix flavipes*, studied near Kununurra, Western Australia, had stocked its nests exclusively with male *Austroplebeia* stingless bees. One wasp had burrowed 6 cm deep into moist sand on the edge of a creek, whist another had built a twisty 35 cm long burrow in dry soil, leading to a nest 15 cm below the surface. The latter nest was packed with 25 fresh stingless bees.

— About 50 nests of *Bembix musca* were found at Carnarvon Gorge National Park in Queensland, crowded together in a 2 m^2 site beside a creek. The nests were so close together that they could not be individually excavated but they all were reported to be stocked with *T. carbonaria* bees.

The *Bembix* wasps that harass stingless bees in Sydney are 10 to 12 mm long. They are black with yellow on the lower face and white stripes along the back edge of the eyes. Their abdomens are shiny black with wavy white bands. Their legs are long and fine and they have yellow markings on the front two pairs of legs.

If numerous wasps target a particular nest or hive at the same time, it can become quite difficult for the bees to get in and out of their entrance. Removing individual wasps by catching them with a butterfly net may become necessary.

Braconid Wasps

A sneaky predator that can pick off individual forager bees is the Braconid wasp, *Syntretus trigonaphagus*.[5] This wasp's rather gruesome habits are hinted at by its scientific name, '*trigonaphagus*', which means 'glutton of *Trigona* bees'! (*Trigona* was the former name of our *Tetragonula* bees.)

Ros Gloag and John Klumpp have made some fascinating observations on the behaviour of this wasp. Up to a dozen female wasps may wait on or near a single stingless bee hive. When given the chance, a wasp follows one of the bees, trying to lay an egg on her. The wasp curls her ovipositor underneath her body and stretches it out to deposit an egg on or into the bee's abdomen. This process takes just a fraction of a second.

John notes that the wasps tend to stalk the guard bees or bees that are spreading resin near the hive entrance, rather than the faster moving forager bees. Sometimes a bee will rush towards a wasp, trying to drive it off. The wasp retreats but rarely takes flight. Recently John has also discovered these wasps stalking and attacking stingless bees that were foraging on flowers.

If the attack is successful, the white larva or grub of the wasp develops inside the bee's abdomen, growing to 4 to 5 mm long. A bee carrying a fully developed wasp larva is easy to spot because her abdomen becomes stretched to twice the length of the abdomen of a normal bee. Finally the wasp larva breaks out of the bee's abdomen and drops into the soil outside the hive to complete its development into an adult. Amazingly the bee is still able to walk or even fly immediately after the larva breaks out. However, the bee does not seem to survive very long.

Top: a slender adult Braconid wasp, lying in wait on a hive. Above: a Braconid wasp, on left, stalking two stingless bees that are foraging for pollen on a flower. Both photographs by John Klumpp, Brisbane, Qld.

John Klumpp managed to study the further development of these wasp grubs by keeping them in some relatively dry garden mulch. They spun snow white cocoons around themselves and eventually emerged as adult wasps.

The adult wasp is 3 to 4 mm long with a slender body. Its head and upper thorax are yellowish orange but the back of the thorax is black. It has a long thin black stalk between its thorax and the broader part of its abdomen. Its eyes are silvery grey and its long fine antennae are dark brown.

This species of wasp has only been described so far in Brisbane, Queensland, but it is likely to prey on stingless bees right along the east coast. John Klumpp sees these wasps throughout most of the year on his *T. carbonaria* hives, he has not yet seen them on his *A. australis* hives. If you see this wasp attacking other species of stingless bees, or if you spot them in areas other than Brisbane, we would be interested to hear from you.

Phorid Flies, Syrphid Flies and Small Hive Beetles

These insect pests try to lay their eggs in nests of stingless bees. The grubs of these flies and beetles feed upon the honey and pollen stores of the nest and if sufficiently numerous, they can destroy the nest.

A nest or hive that has a strong population of bees and is well sealed up is normally safe from these pests. However, particular care should be taken to exclude these pests whilst you are transferring a nest into a box or splitting a hive.

Make sure that the joints in your hive box are neat and close fitting. After working on a hive, put strips of tape over the box joints and reduce the size of the entrance to about 10 mm until the bees become established.

Small Hive Beetle grubs in a nest of Tetragonula bees that had died

Phorid Flies (*Dohrniphora*): These hunchbacked flies in the family Phoridae are greyish brown to black. Just 2.5 mm long, the adult flies are slightly smaller than a stingless bee. These troublesome flies are abundant in some areas of Australia but less common in other areas.

If Phorid flies manage to enter a stingless bee hive, they run about laying their eggs directly on the nest structures. Their dirty-white coloured larvae grow to about 5 mm long and crawl around the nest feeding on the pollen and honey stores. If in large numbers, they can cause great damage.

Adult Phorid flies look rather like fruit flies. They are also known as scuttle flies because they tend to run across a surface, rather than flying to escape. There are about 4000 species worldwide. Some feed on plants, some are scavengers and others are parasites or predators. One Phorid fly species may be used to help control the devastating fire ant invasion in USA. The grubs of this Phorid fly species parasitise the brains of the fire ants, causing them to wander about like zombies and finally die.

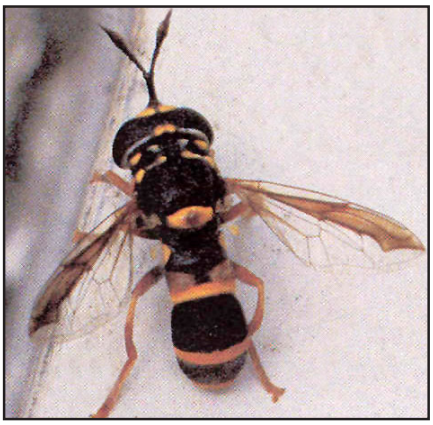
The hunchbacked 2.5 mm long Phorid fly pest

Phorid flies studied in nest of *T. carbonaria* at Atherton, Queensland in 1994 were given the species name *Dohrniphora trigonae*.[6] The adults were living in nest cavities around the honey and pollen pots. One adult female was carrying 34 to 36 eggs. The flies' grubs were found in the pollen pots and also in the bees' recently sealed brood cells that contained nectar and pollen provisions. Both the adults and the grubs of this fly had been feeding on the pollen in the nest.

Syrphid Flies (*Ceriana ornata*): These 11 to 15 mm long flies mimic the colouring of a wasp. They are black with yellow-orange markings and orange legs. However, as they are flies, they only have two wings (unlike wasps and bees that have four wings). Their wings have a deep brown band running along one edge. These flies also have very distinctive antennae that fork from a common stalk on the forehead.

Due to their larger size, Syrphid flies do not often get inside a hive. Instead they try to lay their eggs in the joints of a hive box. The tiny grubs that hatch from the eggs may crawl into the hive and grow to over 10 mm in length, riddling the honey and pollen stores. If allowed to multiply in a weak nest, these grubs can completely destroy it.

There are about 6000 species of Syrphid flies worldwide. They are also known as hoverflies and some species are important pollinators of flowers.



The orange and black Syrphid fly pest. Photograph by Russell Zabel

In areas of Australia where *Ceriana ornata* Syrphid flies are abundant, their presence may help you find a stingless bee nest in the bush, as they hover near the nest attracted by the smell of the honey.

South African Small Hive Beetles (*Aethina tumida*): These dark round beetles were accidentally introduced to Australia in 2002. They are serious pests of commercial honeybee hives and can also threaten a weak or damaged stingless bee nest.

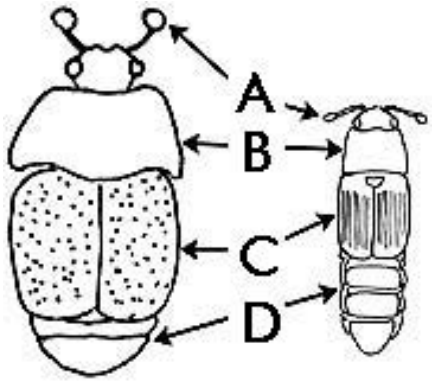
South African Small Hive Beetle adults are dark brown to almost black in colour and 5 to 7 mm long. Their white coloured grubs grow to about 10 to 11 mm long. The grubs have six short legs near their heads and two rows of tiny spines down their backs. The grubs feed on the honey and pollen stores and can extensively damage a nest.

One female beetle is capable of laying hundreds of eggs. Fortunately stingless bees in intact nests seem to have an effective strategy that can defeat a beetle that gets through the nest entrance. They daub the beetle with blobs of resin, immobilising it and finally completely entombing the beetle.

Tetragonula stingless bees, with their resin-rich nests, are particularly good at killing invading beetles in this way. However researcher, Megan Halcroft, found that even the *Austroplebeia* stingless bees can effectively use this defence. *Austroplebeia* bees use far less resin in their nest structures than do the *Tetragonula* bees. Nevertheless when Megan presented 32 Small Hive Beetles to a colony of *Austroplebeia* bees, they ejected 19 beetles within four hours and entombed the remaining beetles within six hours. For full details about this Small Hive Beetle experiment, read the free article on our website:
Aussie Bee Online Article 12 — Stingless Bees Entomb Beetle Invaders.
www.aussiebee.com.au/abol–current.html

South African Small Hive Beetles should not be confused with the similar looking native Australian *Brachypeplus* beetles (see diagram on right) that are sometimes seen in nests. The native beetles scavenge for spilt pollen and do not normally harm a nest. The native beetles are only about 3 to 5 mm long and are narrower and flatter than the introduced pest beetles.

A South African Small Hive Beetle, Aethina tumida. Photograph by James D Ellis, Wikimedia Commons.



South African Small Hive Beetle *Native beetle*

Diagrams on lower right: Comparison of the South African Small Hive Beetle (SHB) with the Australian native Brachypeplus beetle sometimes seen in stingless bee hives.
A: The antennae of the SHB have slightly more prominent clubs at their tips than those of the Australian beetle.
B: The SHB has a much larger and broader shield over the thorax part of its body than the Australian beetle does.
C: The hardened wing covers (elytra) of the SHB are longer than those of the Australian beetle. The elytra of the SHB also are covered with a pattern of minute dots, while those of the Australian beetle have a series of fine parallel grooves.
D: Only about two of the final segments of the SHB's abdomen are visible beneath its elytra, whilst more abdominal segments are visible on the Australian beetle.

Propagating Your Stingless Bees

There are two major methods of making new hives of stingless bees:

— **The Eduction Method (also called the Budding Method or Soft-Splitting)**: encourages a nest of stingless bees that is inside a log, tree, box or wall cavity to slowly build a new nest inside an attached box.

— **The Splitting Method:** quickly divides a strong hive of stingless bees that is already established in a box.

The Eduction or Budding Method

If you have a strong and active nest of stingless bees in a tree, a log, a wall cavity or even in a box, you can use the eduction method to coax the bees to build a new hive in an attached box. The eduction method can take months to produce a new hive, whereas the splitting method can produce a new hive in a matter of minutes. However, the eduction method is much more gentle on the bees and does not disturb the original nest.

We were first shown the eduction method by Tom Carter of Rockhampton. It is best begun in spring or summer when the bees can easily produce a queen and gather stores for a new hive.

A log nest and a hive box set up for an eduction by Rob Raabe

The basic steps in the eduction method are:

1. Prepare a standard empty stingless bee hive box (see designs on pages 6–8) with a normal entrance hole in the front wall. Drill another hole (20 mm wide) in the back wall of the box.

2. Mount the empty box in front of your strong nest, as close as possible to the nest entrance.

3. Use some plastic tubing to connect the nest entrance to the hole in the back of the empty box. All the bees leaving the nest must be forced to walk through the empty box and out through its entrance hole. Carefully check that there are no gaps or breaks in your connections that will allow the bees to get out in a different way. If the tubing is transparent, cover it with some opaque material or tape.

After a few months the bees should have built a new brood and stores in the empty box. Once the new hive is well established, it can be disconnected and moved to another location. The original nest will continue to operate as before in its original cavity.

If the bees seem reluctant to begin building a new brood in the empty box, you can assist them by placing two small discs of brood comb from another colony into the empty box.

For more details on this method, read our free article on the Aussie Bee website:
Aussie Bee Online Article 3 — Natural Hive Duplication: www.aussiebee.com.au/abol–current.html

The Splitting Method

If you have a hive of stingless bees that is already established in a box with a midline division (such as the three designs described on pages 6–8), you can use the splitting method to produce a new hive.

The colony must be strong for a split to be successful. In southeast Queensland, the weight of the nest itself (not including the box) should be about 3 kg before you attempt to split it. In cooler areas such as Sydney, the nest should always weigh 3 kg or more.

Splitting is best done during in the warmer months when new queen bees should be emerging from the brood and the worker bees can quickly build up provisions in a new hive.

Preparing to split a hive of stingless bees — part of a demonstration by Russell Zabel

With experience and good conditions, the success rate for nest splitting can be very high. Tim Heard recorded the following success rates from 786 hives that he split in his stingless bee collection between 1985 and 2010:

— cases where both split nests survived — 94%;
— cases where one of the two split nests survived — 6% and
— cases where both split nests died — only 0.3%.

Tim has found that in Brisbane nests can be split on average once every eighteen months. However, individual nests may take between six months and three years to build up before they are ready for another split. In cooler areas, such as NSW, hives need to be given longer intervals to build up between splits.

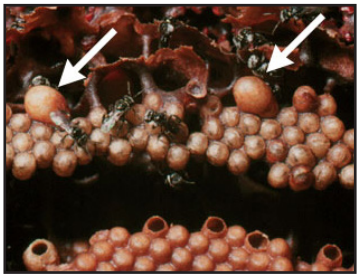
A complete step-by-step guide to splitting a hive of stingless bees is presented in another ebook in this series, *Boxing and Splitting Hives* — see page 18. It is recommended that you obtain a copy of this ebook before attempting to split a hive.

The basic steps in splitting a hive are as follows:

1. Prise the box open along the midline division. The brood must be cut or broken into two halves. Les Felhaber uses a heated wire to cut the brood neatly into two even pieces. Other beekeepers let the brood break open naturally at the level of the advancing front (see our ebook, *Nests of Australian Stingless Bees* — page 18).

2. Fit each half of the hive box with a new, empty half box, matching the one which was removed.

3. Seal up all gaps, other than the entrance hole, to keep out ants and other predators. Set up the two new hives and allow the bees to rebuild.



Two large queen cells in a T. carbonaria brood comb

One of the new hives should contain the mature queen bee from the original hive. However, the other hive will need a new queen bee in order to survive. Fortunately, during the warm months, there are several ways that the bees can get a new queen bee. There are usually several large cells containing developing queen bees, scattered through the brood comb of a strong colony. There may also be some virgin queen bees in the hive.

However, if this is not the case, a *T. carbonaria* colony can produce an 'emergency queen' for itself.[7] The workers will build a new brood cell on top of a recently-sealed worker cell. The new cell is fully provisioned but contains no egg. The young worker larva in the lower cell eats the food in its own cell. Then it breaks into the upper cell and eats those provisions too. Having eaten this larger amount of food, the young worker larva will develop into a queen bee. So if a *T. carbonaria* colony loses its queen bee during a split, it is quite capable of replacing her.

Harvesting Honey

The honey of stingless bees has a delightful, tangy flavour and is a real delicacy. Unfortunately, stingless bees do not generally produce much excess honey. Removing too much honey can severely weaken or even kill a nest. However, in warm areas such as Queensland some honey can be harvested from a strong boxed hive without harm.

Stingless bees store their honey inside small wax and resin pots which resemble a bunch of grapes. It is not possible to automatically spin honey out of structures such as these, as can be done with the honeycomb of commercial honeybees. Furthermore stingless bees cannot be persuaded to build regular hexagonal combs for their honey. If commercial honeybee foundation wax is given to stingless bees, they gleefully tear it apart and build their irregular pots with it!

A honey super, full of pots, removed from one of Tim Heard's honey hives

Tim Heard has designed a small additional 'honey super' compartment for the top of his hive boxes. Strong colonies will fill this compartment with virtually pure banks of honey pots. The honey super can be removed from the hive box without disturbing the rest of the colony or spilling honey into the hive. Tim uses a special tool, that looks like a mini bed of nails, to pierce the honey pots in the super. He then collects the honey that drains out.

Take great care not to spill any honey into the hive as stingless bees can drown in even a tiny amount of honey. The honey is thinner than commercial bee honey and should be stored in a fridge or a freezer. The unique qualities of stingless bee honey are best appreciated when it is served cold. (In fact, heating will destroy the special flavours!) This delicacy makes a great topping for ice cream or cold speciality desserts.

More details of Tim Heard's honey collection technique can be found on his *Sugarbag Bees* website and in his book, *The Australian Native Bee Book*. This publication can be purchased through Tim's website: sugarbag.net

Further Reading

Other eBooks in the *Native Bees of Australia Series*:
— *Introduction to Australian Native Bees*
— *Nests of Australian Stingless Bees*
— *Behaviour of Australian Stingless Bees*
— *How to Recognise the Different Types of Australian Stingless Bees*
— *Boxing and Splitting Hives: A Complete Do-It-Yourself Guide*
The above ebooks are available from the Aussie Bee website: **www.aussiebee.com.au/abshop.html**

The Australian Native Bee Book by Tim Heard (2016). Available from: **nativebeebook.com.au**

The Authors

Dr Anne Dollin, Aussie Bee
Specialist in the species and behaviour of Australian stingless bees
Australian Native Bee Research Centre
PO Box 74, North Richmond NSW 2754
Website: www.aussiebee.com.au
Facebook: www.facebook.com/aussiebeewebsite

Keep up to date on native bee news with Aussie Bee Email Updates, a free email newsletter available through the Aussie Bee website.

Dr Tim Heard, Sugarbag Bees
Specialist in stingless beekeeping, honey production and crop pollination
473 Montague Road, West End QLD 4101
Telephone: 0434 416 053
Email: tim@sugarbag.net
Website: sugarbag.net
Facebook: www.facebook.com/sugarbagbees

Dr Tim Heard periodically holds workshops on stingless beekeeping in QLD and NSW.
Please visit Tim's website for details.

References in the Text

(1) Smith JP, Heard TA, Beekman M and Gloag R (2016) Flight range of the Australian stingless bee *Tetragonula carbonaria* (Hymenoptera: Apidae). *Austral Entomology* 56: 50–53.

(2) Kaluza BF, Wallace H, Heard TA, Klein A and Leonhardt SD (2016) Urban gardens promote bee foraging over natural habitats and plantations. *Ecology and Evolution* 6: 1304–1316.

(3) Valdovinos-Nunez GR et al (2009) Comparative toxicity of pesticides to stingless bees (Hymenoptera: Apidae: Meliponini). *Journal of Economic Entomology* 102: 1737-1742.

(4) Evans HE et al (1982) Observations on the nests and prey of Australian *Bembix* Wasps (Hymenoptera: Sphecidae). *Australian Journal of Zoology* 30: 71-80.

(5) Parasitoid of the stingless bee *Trigona carbonaria* Smith (Hymenoptera: Apidae: Meliponinae). *Australian Journal of Entomology* 48: 8-14.

(6) Disney RHL and Bartareau T (1995) A new species of Dohrniphora (Diptera: Phoridae) associated with a stingless bee (Hymenoptera: Apidae). *Sociobiology* 26: 229-239.

(7) Nunes TM, Heard TA, Venturieri GC and Oldroyd BP (2015) Emergency queens in *Tetragonula carbonaria* (Smth, 1854) (Hymenoptera: Apidae: Meliponini). *Austral Entomology* 54: 154–158.

Notes on Australian species name changes:
— The *Trigona* stingless bees in Australia are now called *Tetragonula*.
See: www.aussiebee.com.au/tetragonula–name–change.html
— The *Austroplebeia symei* stingless bees are now called *Austroplebeia cassiae*.
See Aussie Bee Online Article 25, Meet the *Austroplebeia* species: www.aussiebee.com.au/abol–current.html