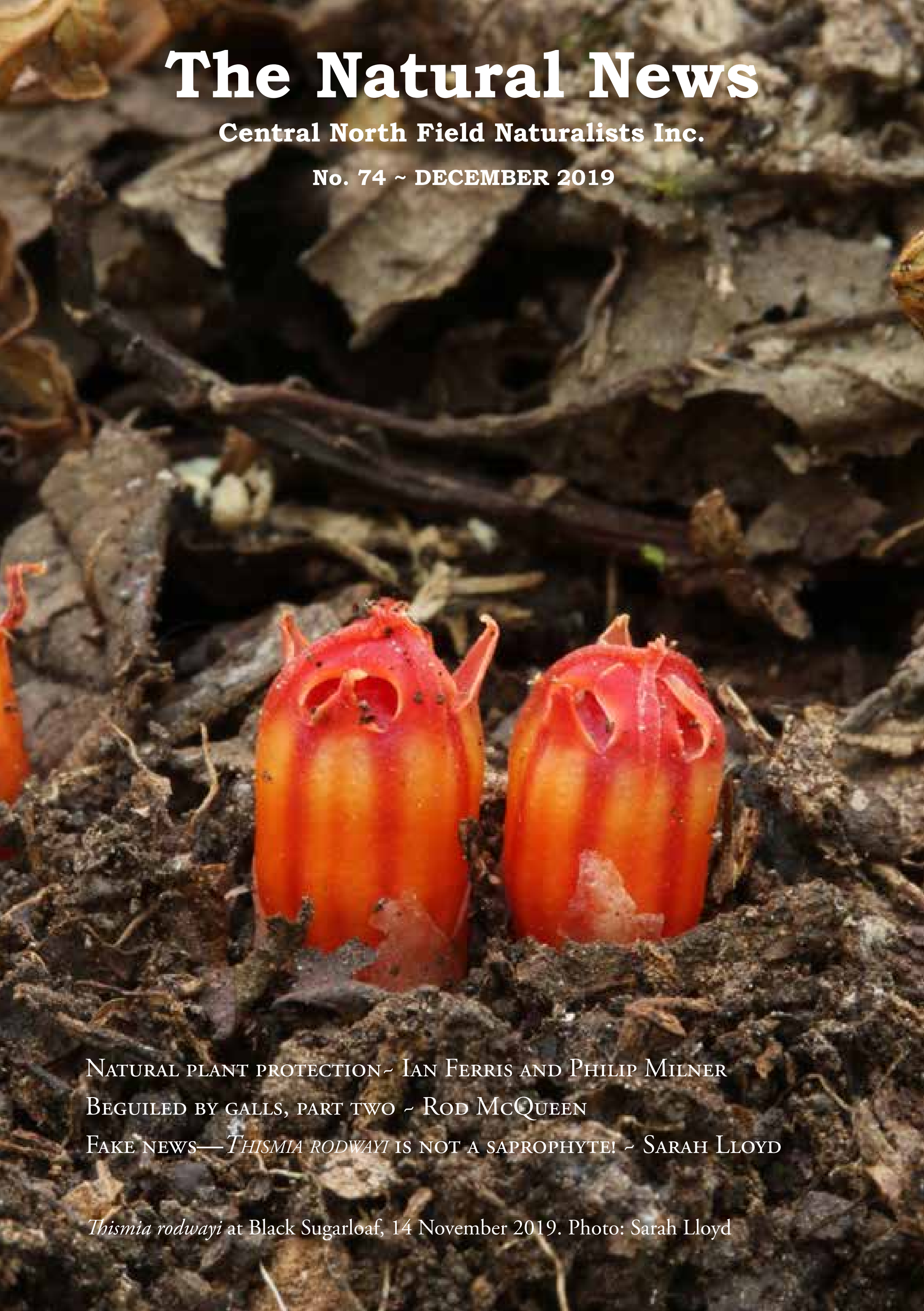
The Natural News

Central North Field Naturalists Inc.

No. 74 ~ DECEMBER 2019



Thismia rodwayi at Black Sugarloaf, 14 November 2019. Photo: Sarah Lloyd

Natural plant protection

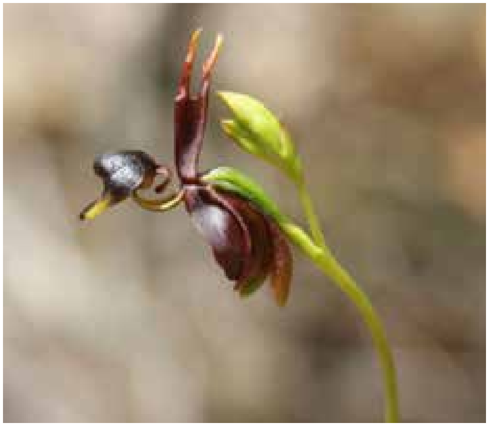
Ian Ferris and Philip Milner

The effectiveness of a vegetation cover has been demonstrated on several communities of *Caleana major*, a terrestrial orchid that usually suffers from browsing by herbivores, presumably Pademelon or Bennett's Wallaby.

For several years a number of colonies of *C. major,* the Flying Duck orchid, have been monitored in a cleared area forming a firebreak on the eastern boundary of Rocky Cape National Park. The vegetation is heathy woodland, mainly dominated by *Leptospermum scoparium*, *Banksia serrata*, *Eucalyptus nitida*, and various graminoids and shrubs, on sandy gravels forming over Precambrian Quartzite. This habitat supports a wide variety of terrestrial orchids, especially *Thelymitra* spp., *Acianthus* sp., and *Caladenia* spp., most of which prefer the dry conditions and well drained soils.

At least 12 colonies of *C. major* are known within a 300 m radius of the protected sites described. The orchid forms groups by sending out subsurface runners, and a tuber forms a new plant at a suitable location a few centimetres away. Over several years the colonies tend to "migrate" across the ground, usually down slope. The tubers may produce a single linear purple leaf up to 7 cm long in April to May, and a flower spike may appear in October, although very few plants will flower. The flower spike is up to 600 mm high, and has the well-known flying duck shape.

It appears that the leaves are decidedly delicious to herbivores. Most will be chewed at the end while they grow, and most simply disappear prior to the flowering period. Observation shows that most are taken off close to the ground, and do not regrow. It takes a reasonable amount of energy to produce a leaf, and a lot of energy to produce a flower. If the single leaf is eaten the bulb would not be able



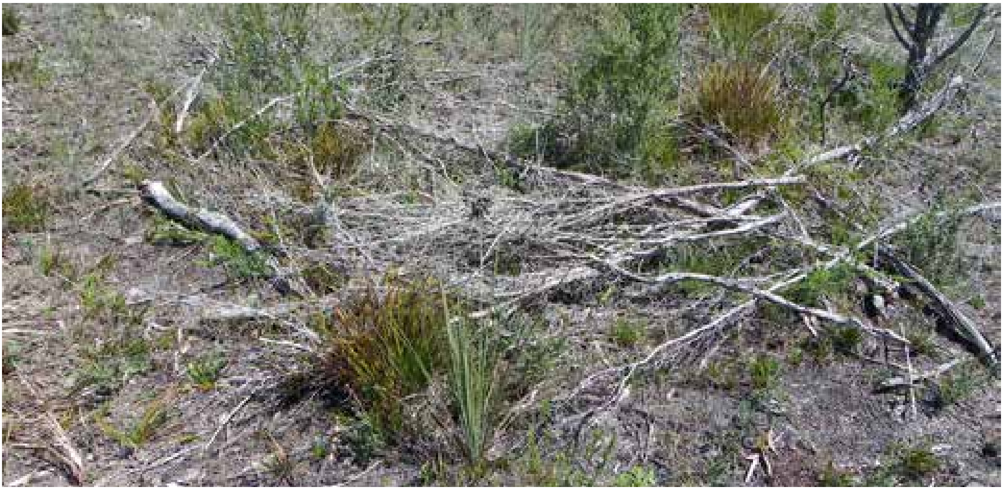
Caleana major flower, "Flying Duck"

to replace that energy until next year, if at all, and this loss to the plant strongly affects the growth and the survival of the colony.

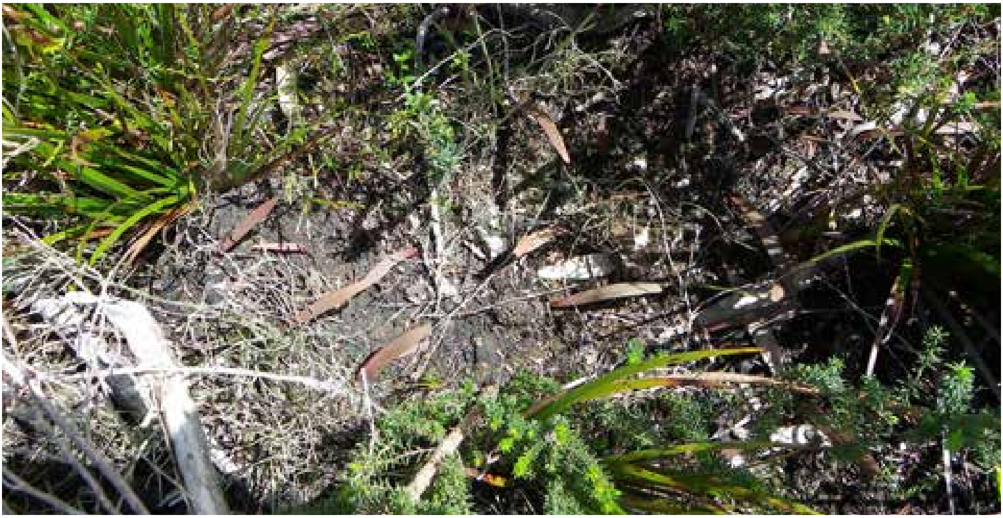
Having noticed that the leaves of most colonies were being almost totally eaten, and that flowers were subsequently rare or nonexistent, it was decided to cover several colonies with loose branches and thin sticks to provide some protection from herbivores. One site was chosen as it has a colony of a green-leafed aberration of *C. major*, which is unusual locally although recorded elsewhere.

Protection is considered necessary as the populations of some herbivores are generally higher than "natural", due to greater availability of grass in pastures and cleared areas, and probably a decrease in predators. This leads to greater pressure on some plant species.

This method is well known, and has the advantages of being simple, natural, locally available, biodegradable and zero in cost. Another example of its use is at Hawley Beach, where is has been used to protect *Spyridium obcordatum*. It is superior to wire mesh fencing, although brush cover requires more maintenance/replacement. It will not protect plants from small herbivores, or invertebrates such as caterpillars, snails and slugs, but neither will mesh.



Above: The orchid colony was covered with sticks and branches to protect it from browsing herbivores resulting in healthy leaves of *C. major* (below). Photos: Ian Ferris



The method is simply to cover the plants with brush so that herbivores cannot easily access the plants, but also to ensure that sufficient light gets through. Larger sticks are used to form a structure, and smaller brush forms a thin cover. In the example shown above, not a single leaf has survived outside the cover, but underneath, the growth of *C. major* leaves is prolific and vigorous. Several flower stems are present. Other colonies in the same area (within 100 m) have almost disappeared.

In conclusion, it is clear that where protection from grazing is desirable for a small plant, the use of brush cover can provide a survival aid that has many advantages over other methods such as wire mesh, plastic plant guards, area fencing or other artificial methods.

Beguiled by galls, part two, *Rod McQueen*

In 2009 the number of galling insect worldwide was increased from 13,000 to 130,000 species. Estimates of the proportion of vascular plant species affected in different regions of the world range from 15–50%, with Australia coming in at the lower end.

Galling is concentrated in only a few plant groups. E.g. in South America, Africa and India, leguminous plants (Fabaceae) are most commonly attacked, whereas in Europe and North America approximately half the gall-inducing species are found on oaks (Fagaceae).

In Australia, insect galls are found on about fifty of the approximately 2250 genera of vascular plants. The Myrtaceae family bears the lion's share, with eucalypts (*Eucalyptus, Corymbia, Angophora*) hosting about 50% of Australia's gall fauna. Of the remaining 50%, about 18% occur on acacia and 32% are spread evenly across other genera.

Gall-inducing insects are found in six of the twenty nine insect orders, including Hemiptera (true bugs), Hymenoptera (ants, bees, wasps—only wasps are responsible for galls), Diptera (flies), Thysanoptera (thrips), Coleoptera (beetles), and Lepidoptera (butterflies and moths). All insects except thrips undergo one of two life cycles, complete or incomplete (gradual). Complete life cycles involve four life stages: egg, larva, pupa (e.g. chrysalis) and adult. The larva looks completely unlike the adult, and metamorphosis, which occurs in the pupal phase, transforms the larva (e.g. caterpillar) into the adult. Incomplete life cycles (often called "incomplete metamorphosis") forego metamorphosis and, thus, the pupal stage. These insects have only three stages: egg, nymph (instar), adult. The nymph undergoes a series of moults, with each instar looking more and more like the adult. Of the six galling orders, one (Hemiptera) shows incomplete metamorphosis; the other four undergo complete life cycles. Thrips are weird — more on them later.

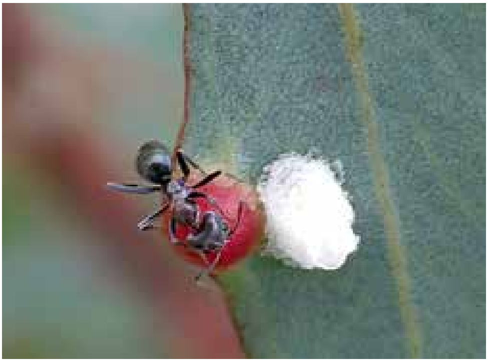
In Australia, there are only six species of gall-inducing beetles, and only three or four moth species. By contrast, galls induced by wasps, bugs, thrips and flies are common, with midges followed by wasps making up most of the galling species.

Australian fauna is characterized by a paucity of native gall-inducing aphids (order Hemiptera: Aphidoidea), saw-flies (order Hymenoptera: Symphyta), and an absence of cynipid wasps (Hymenoptera: Cynipoidea), groups that contain many gall-inducing species in the northern hemisphere.

Hemiptera: Psyllids and Scale Insects

Members of the order Hemiptera have piercing-and-sucking mouthparts condemning them to an all-liquid diet. Australian hemipteran gallers come from two major groups: psyllids and scale insects. One of the characteristics of these insects is that their first-instar nymphs, known as crawlers, are mobile, so the task of finding a suitable nursery site rests with them, as later instars are virtually immobile.

Cup-like gall from *E. microcarpa* cut open to show thrip, *Trioza*, inside. Photo: Leuba Ridgway



Psyllid gall next to a psyllid lerp.
Photo: Jenny Holmes

Separate male and female galls of *Apiomorpha frenchi* on eucalypt, Queensland. Photo: Glenda Walter

Australia boasts numerous gall-inducing psyllid bugs from the superfamily Psylloidea. Adult psyllids are generally only 2–5 mm long and resemble leafhoppers due to their habit of holding their wings tent-like over their abdomen. Tiny newly-hatched nymphs produce honeydew, which is often a liquid in free-living species while most galling species produce a white, curly, wax-like honeydew known as a lerp which protects the insect. Some species form large, bubble-shaped galls of waxy material bearing an orifice at the base.

In most galling insects, the adult female lays her eggs inside plant tissue at just the right spot for the gall to grow. Not so with many psyllids and scale insects. Instead, psyllid females lay their eggs in growing leaf and twig tips and the mobile nymphs find the best sites. This may take a day or two, even though they may move only a few centimetres in the process. They search the lower side of leaves for **stomata**, and when they find one with actively growing cells, they insert their stylets and commence feeding. The plant responds by rolling the leaf or growing a tent-like covering or globular sac. In some species something spooky occurs; the gall forms five to ten centimetres away from where the nymph starts feeding! By the time it is ready to support visitors — about thirty days later — the nymph has moulted into its second instar stage. It then crawls to the gall, breaks in and settles down. (The author could not find data on the presence of this phenomenon in Australia.) It seems that most psyllid galls are occupied by a lone insect. Here it goes through five instar stages before the final moult into an adult resembling a miniature cicada. *Eucalypts* are the usual hosts, but psyllid galls can also be found on a range of other plant species.

One of the most interesting groups of galling insects is the superfamily Coccoidea (Hemiptera: Sternorrhyncha) known as scale insects. Although only 27% of scale insect species occur in Australia, more than 80% (over 200) of the gall-inducers occur here. Galling scale insects have modified legs and antennae to fit them for life in a gall. *Eucalypts* are the main host for coccid gallers, with smaller numbers affecting banksias, casuarinas, acacias, hoop and kauri pines and beeches. Stems, leaves and flower buds are the parts most affected. Weirdly, some initiate galls on the surface of other, mature coccid galls.

Galls are initiated when a female first instar nymph starts feeding. The plant responds by sprouting an arch, or “knobby tumour”, enclosing her nearly completely except for a tiny hole. She spends the rest of her life there, tapping the sap and enjoying an orgiastic existence mating with male insects via the small opening and producing numerous progenies of both sexes. Development takes from two to over nine months, depending on the species. The body cavity of mature females is almost entirely filled with developing embryos. Thus, scale insect galls, unlike psyllid galls which contain only one insect, house a colony.

Unlike the case of psyllids, these first instar nymphs are produced inside an established gall elsewhere! In many cases, the female crawlers travel short distances and induce galls on the same plant. However, they often colonize other plants, reaching them by either the wind or by hitching a ride on winged brothers.

Scale insect galls have an opening at one end through which crawlers escape. It is also used for excreting honeydew that prevents infection. Males and females of the same species can, though not always, induce different shaped galls, a phenomenon known as dimorphism. The female gall can be large (up to 11 cm) and ornate, with, in some cases, blade-like appendages extending the size to 14 cm. The male gall is invariably small (1 cm) and cylindrical. In those cases without dimorphic galls, male nymphs develop within the chamber or bracts of the maternal gall.

The best-known genus, *Apiomorpha*, with over forty described species restricted to eucalypts, stands out as the Liberace for its flamboyant galls. The large, showy galls of females occur mainly on stems while the small, tube-shaped galls of the males can occur on the stems, leaves or fruits, or even as outgrowths off a female gall.

Adult females are large and can live for three to five years. *Apiomorpha* eggs hatch within the female's body so nymphs are "born" fully developed. By contrast, adult males are inconspicuous and rarely live more than a day or two after leaving their gall and mating. The first instar nymphs usually gather at the base of the gall chamber before emerging.

Aphids

Like scale insects, aphid galls house an entire colony. Colonies of the aggressive samurai aphid (*Ceratoglyphina bambusae*) from Taiwan often house over 100,000 individuals, all descendants of one foundress. Like many other galling aphids, these colonies are characterized by **eusociality**. (Thrips also share these characteristics.) Aphid galls are induced by live-born nymphs. Most aphid galls are simple galls found on leaves in the form of leaf curl and distortion which only partly enclose the residents. Australia is poor in aphid-induced galls.

Wasp gallers

The chief Australian gall-forming wasps are members of the superfamily Chalcidoidea, with over eighty known galling species found in 25 genera from six of the nineteen families (Agaonidae, Eulophidae, Eurytomidae, Pteromalidae, Tanaostigmatidae, Torymidae); the realistic number is undoubtedly much higher. The majority of chalcidoid galls are found in the stems, leaves and flowers of eucalypts while some are found in parts of *Ficus*, *Hakea*, and *Acacia* species and even in the fruit of the desert lime, *Eremocitrus glauca*. A few Eurytoma species form galls in seeds.

Wasp, *Ophelimus maskelli*, oviposits into *E. camaldulensis* leaf. bicep.net.au

Four species of gall-inducing wasps from the family Braconidae (superfamily Ichneumonoidea) have been discovered in Australia, all of which form stem galls on *Banksia marginata* (not in Tasmania). In other parts of the world various braconids form galls on fruit.

Larvae are maggot-like, often cream in colour, legless and with chewing mouthparts.

Dipteran gallers

Worldwide, seven families of flies or midges (order Diptera) are known to induce galls, comprising about 64% of all gall-inducing insects. Midges are the leading gallers in Australia, where four of the seven families are found: Cecidomyiidae (gall midges), Tephritidae (fruit flies), Agromyzidae (leaf-miner flies) and Fergusoninidae.

Cecidomyids are found on banksias, cypress-pines, black palms, sheoaks, eucalypts, tea tree, acacias, hop bush, glassworts, grey mangrove, and *Solanum* species. Tephritids induce galls in the families Asteraceae, Heliantheae and Goodeniaceae. They do not induce galls through oviposition but, rather, the larvae hatching from externally laid eggs actively penetrate host tissue.

More than 6,000 species and 783 genera of Cecidomyiidae have been described worldwide with the number growing daily. There

A "typical" cecidomyid galler.
abc.net.au/news/2017-09-29/gall-midges/9001786

Leaf galls of a fergusonid species, Melbourne.
Photo: Mark Ridgway

are possibly over 1 million species, making it the most speciose single family in the entire animal kingdom. Though adult flies are notoriously difficult to tell apart, each species induces a structurally distinct gall. Virtually all feeding is done during the larval stage.

Cecidomyiidae adults (usually 1–3 mm long) are fragile insects characterised by hairy wings and long antennae. Most females sport a needle-sharp ovipositor for injecting eggs into the appropriate plant tissue. Those with blunter ovipositors usually lay eggs on the undersurfaces of fresh leaves; when they hatch, the first-stage larvae "sink" into the leaf directly beneath the eggshell.

Cecidomyiid larvae are moderately stout and rounded at both ends and usually yellowish to yellowish-orange. Like all fly larvae, maggots have mouthparts designed for rasping food. The completely-enclosed galls they induce vary greatly in form and size. Larvae pupate either in the gall or in the soil. Species in which the larva leaves the gall to pupate underground are able to snap or throw themselves to a distance several times greater than their body. This enables them to explore the ground for a suitable substrate to burrow into for pupating.

One of the largest genera of galling Cecidomyidae is *Asphondylia*. In 2010 there were over 320 described species with new species being discovered and described at a prodigious rate. Some *Asphondylia* species gall up to eight *Acacia* species. Most *Asphondylia* species feed on a thick, fungal mycelial mat lining the inside of the gall chamber by puncturing hyphal cells and sucking out their contents. This relationship between maggot and fungus is obligatory; kill the grub and the fungus dies, and vice versa. In most cases, the chamber is filled with a viscous fluid, possibly containing breakdown products of plant tissue, bathing both mycelium and larva.

Australia is the stronghold of the only known case of obligate mutualism between an insect and a nematode, that of the Fergusonina fly and the *Fergusobia* nematode that together form galls on Myrtaceae species. The nematodes live inside the fly larva on which they feed, and they rely on the adult for transport. Female flies deposit juvenile nematodes along with eggs at oviposition. Each fly-nematode pair is species-specific and together they display host specificity. This complex is rich in species pairs, with many groups forming different gall types on different myrtaceous genera.

Thrip gallers

Thrips (order Thysanoptera) demand their own encyclopaedia because they do some truly weird things. For starters, their life cycle consists of five stages: egg, larva, prepupa, pupa and adult.

Over 6000 species of these minute insects are found worldwide. Many are wingless (winged species are characterised by a dense fringe of long hairs) and asymmetrical mouthparts crown their weirdness. The vast majority live by sucking out the contents of individual plant cells. Thrip gallers are mainly

Klambothrips (thrip) gall on boobialla.

tropical, and of the roughly 830 species found in Australia, only about thirty are known to induce galls.

Thrips are considered "less-advanced" as gallers and they seem to have far less influence over the development of surrounding plant tissue than other galling taxa. The foundress gives birth to numerous off-spring and the probing and feeding behaviour of so many asymmetrical mouthparts rasping, piercing and sucking at the plant tissue produces considerable wounding and cell necrosis. The final shape of the house depends more on the totality of damage done than on a clever usurping of the plant's development program.

As with scale insects and aphids, thrip galls are colonial, consisting of both nymphs and adults. Unique among gallers, more than one species is commonly found within a single gall, making identification of the species responsible for inducing the gall difficult. Some thrip galls are invaded and occupied by other thrip species.

Australian thrip galls are often associated with acacias that have phyllodes rather than true leaves. Some of the genera that are known to have thrip galls on true leaves include *Pittosporum, Myoporum, Olearia, Callistemon,* and *Ficus*. No thrips galls are recorded from eucalypts.

Asphondylia floriformis. Midge larva with parasitoid attached. Photo: Teresa Lebel

A crowded house — gall ecology

Many gall chambers occupy centre stage in an intricate web of mutual interrelationships that involve the insect, the host plant on which it feeds and a variety of other more or less dependent organisms. The original occupant often ends up being replaced by or sharing its house with invaders. As such, galling insects can be considered microhabitat engineers in that they provide a food source and habitat that other organisms can exploit.

The most benign exploiters of galls are freeloading **inquilines**, which find shelter and food in the gall. Inquilines may belong to the same insect group, e.g. midges in midge galls or psyllids in psyllid galls, or a different insect group as the inducer. Inquilines restrict their attacks to galls on woody plants, and galls on trees harbour richer inquiline communities than those on shrubs and bushes.

Inquilines are thieves but not murderers; they depend on the host remaining alive to keep the plant pumping nutrients. In some cases, their presence may result in the death of the gall maker, probably by gluttonising the resources. Some inquilines modify the structure of the host gall.

And then there are the fiends: kleptoparasitoids, **parasitoids** and hyperparasitoids. Kleptoparasites are often considered a special variation on the inquiline theme in that they are murderers as well as thieves—they kill and replace the inducer. The commonest kleptoparasites in Australian are certain thrip species that specialise in taking over the galls of other thrip species. A few fly and moth larvae are members of the kleptoparasite guild.

Early in the life of a gall, the inducer may be attacked by a parasitoid species which in turn may be parasitised by another parasitoid species – a hyperparasitoid. And different parasitoid species attack at different life stages of the inducing host, a parasitoid being attacked by a hyperparasitoid which in turn falls prey to yet another hyperparasitoid — up to four tiers of such parasitism have been discovered. As a result, these chamber communities grow in richness over the course of the season, so as the gall matures, its menagerie increases. The sheer number of variables makes it impossible to predict the exact identity of the final victor.

One consequence of this complex colonization sequence is that more often than not the original gall-maker never gets to have sex; it perishes in the feeding frenzy. Yet by dint of mathematical chance enough inducers manage to scrape through the season unscathed to provide seed for the next season's circus.

In Australia, one species of tachinid fly is known to parasitize a psyllid that induces leaf galls in eucalypts. Otherwise, the rest of gall parasitoids are wasps, mainly chalcidoid species.

Keeping track of which parasitoids can strike which galling insects over the course of its life cycle and which hyperparasitoids in turn attack them would require a very large database indeed. Here are a few random facts to illustrate the complexity:

Though the number of parasitoid and associated hyperparasitoid species attacking any given galling species varies, the figure ten seems to be a rough average;

Eleven species of parasitoid wasp have been reared from banksia stem galls induced by one species of braconid wasp;

In Tasmania, a study identified twenty-one insect species reared from galls formed by *Trichilogaster acaciaelongifoliae* on *A. longifolia sophorae;*

A total of twelve hymenopteran species were reared from late season galls induced by the fly *Fergusonina flavicornis* on the river red gum (*E. camalduensis*) at Goolwa, South Australia.

Only the female searches for a host. Numerous studies conducted on oviposition have demonstrated a fairly predictable behaviour with variations dictated by the structure of the gall. When she has found a suitably-infected gall by using clues such as volatile chemicals released by the gall, the female walks rapidly around the gall, constantly stopping and tapping the surface with the tips of her antennae, a process known as "antennation". If the gall has an ostiole, she usually finds it and thrusts her ovipositor through it. Enclosed galls are a little different. Antennation may last two to three minutes. When she has determined the precise location of her prey, she unsheaths her ovipositor, raises her abdomen in such a way as to place the tip of the ovipositor at the precise spot where her antenna last tapped, and starts drilling right through the gall material. Drilling can involve horizontal swinging of the abdomen and vertical vibration.

GLOSSARY

Eusociality: as illustrated by bee colonies, eusocial insects are characterized by brood care and cooperative division of labour between different castes (such as drones and soldiers), each of which is morphologically and functionally specialized.

Guild: a group of insects, related or not, united by their common use of a particular resource.

Inquiline: an animal exploiting the living space of another, e.g. an insect that lays its eggs in a gall produced by another.

Parasitoid: an insect whose larvae live as parasites and eventually kill their host.

Stomata: a pore, found in the epidermis of leaves, stems, and other organs, that facilitates gas exchange.

References

Askew, R.R. 1984, The biology of gall wasps, in Ananthakrishnamn T.N. (ed.), *Biology of Gall Insects,* London, Hodder Arnold H&S, 223–271

Blanche, R. 2012, *Life in a Gall: The Biology and Ecology of Insects that Live in Plant Galls,* CSIRO Publishing, Collingwood, VIC

Blanche, R. May, 1995, *Factors Influencing the Diversity of Gall-forming Insect Species on Australian Plants,* Thesis submitted for the degree of Doctor of Philosophy at the School of Biological Sciences, Macquarie University, North Ryde

Egan, S.P., Hood, G.R., Martinson, E.O. & Ott, J.R. December, 2018, Quick Guide: Cynipid Gall Wasps, *Current Biology 28*, R1365–R1381

Espirito-Santo, M.M, and Fernandes, G. W., *How Many Species of Gall-Inducing Insects Are There on Earth, and Where Are They*?, Annals of the Entomological Society of America, January 2009, 95-99

Raman, A. 2011 Morphogenesis of insect-induced plant galls: facts and questions, *Flora* 206, 517–533

Raman, A. 2012 Gall induction by hemipteroid insects, *Journal of Plant Interactions*, 7:1, 29-44

Rohfritsch, O. 2008, Plants, gall midges, and fungi: a three-component system, *Entomologia Experimentalis et Applicata*, 128: 208–216

Tokuda, M. 2012, Biology of Asphondyliini (Diptera: Cecidomyiidae), *Entomological Science*, (2012) 15, 361–383

Fake news: *Thismia rodwayi* is not a saprophyte!

Sarah Lloyd

Thismia rodwayi was first observed at Birralee in November 2004 and has only occasionally been seen since. Despite being bright red, it is easy to miss because of its subterranean habit.

The habitat at Black Sugarloaf is typical for the species: tall eucalypts (*Eucalyptus* spp.) and blackwoods (*Acacia melanoxylon*) emerge above a sub-canopy of dogwood (*Pomaderris apetala*), musk (*Olearia argophylla*) and prickly currant-bush (*Coprosma quadrifida*); there is very little understorey. The deep soil is covered with leaf litter, and it is when birds, marsupials and wind disturb this material that the 'fairy lanterns' are revealed.

Thismia spp. are herbs in the Burmanniaceae family. (This is disputed; the family Thismiaceae is recognised by some authors). They grow almost entirely underground, are usually leafless, lack chlorophyll and thus can't photosynthesise. Once regarded as a saprophyte, they are actually mycoheterotrophs that rely on a saprophytic fungus, i.e. a fungus that gets its nutrients from rotting organic material. Nutrients absorbed by the fungus are stocked as fat globules that are discharged into the plant via fungal hyphae that surround the plant's roots and penetrate the root's cortical cells.

More is coming to light about their distribution, ecology and method of pollination. A likely explanation for the elaborately-shaped flower is that pollen is spread by small invertebrates that inhabit the litter layer. Several plants I sent to the Tasmanian Herbarium were punctured through the corolla tube, and in one flower there was a small arthropod and several tiny faecal pellets. The curator of the herbarium at the time, the late Alex Buchanan, had also noticed small faecal pellets around or within the flowers of other specimens he'd received, suggesting that a small arthropod may be involved in pollination. The strong fishy smell of the flower may attract litter detritivores to perform this function. Recent research has found that fungus gnats (themselves attracted to fungal smells) pollinate *T. tentaculata*. The researchers are yet to determine if the flowers have an odour. (see link below)

Thismia species are found in the tropics and subtropics, including central and south America, Asia, Japan, Australia and New Zealand. In some cases the story of their discovery is as intriguing as the plants themselves.

T. americana was found on the Chicago Lake Plain in Illinois in 1912 and again in 1913, the last reported sighting. The site is now highly industrialized and extensive searches in the remaining undisturbed potential habitats have failed to find it.

In 2000 researchers conducting botanical surveys in the Yushan National Park, which covers Taiwan's central mountain range, collected a white-tentacled thismia, *T. taiwanensis* believed to be endemic to the area.

In 2001, a third *Thismia* species for Australia, *T. clavariode*s, was found by fungi enthusiast, the late Pat Jordon, at Bundanoon, in New South Wales. It was initially mistaken for a coral fungus (*Clavaria* sp.) because of its tentacle-like projections—hence the species name.

In 2011 *T. megalongensis* was found in New South Wales. It is similar in appearance (and smell!) to *T. rodwayi* but molecular evidence indicates it is more closely related to *T. hillii* (formerly *T. rodwayi*) from New Zealand.

In 2018 *T. kelabitiana* from Borneo was described. Check out its amazingly-shaped flower and 'google' *Thismia* for more information about these intriguing plants:

http://novataxa.blogspot.com/2018/10/thismia-kelabitiana.html

https://www.botany.one/2019/06/thismia-and-its-unusual-number-of-specialist-relationships/

Walks and other events

Bring food, water, clothes for all weather, hand lens, binoculars, note book and curiosity.

Weekend 25-27 January 2020 Rosebery area Kevin Dogrusever is organizing a full weekend of activities. Depending on the weather suggested itinerary is Saturday to Montezuma Falls, and Sunday to Mt Read and the 1,000 year old Huon Pine (permits have been arranged). Please register via secretary Peter Lawrence 0400457039 / disjunctnaturalists@gmail.com

Sunday February 2 Don River Gorge through Philip Milner's property at Lower Barrington. Meet at the property 144 Allisons Road, Lower Barrington at 10am. Philip Milner 0417052605

Sunday March 1 A moderately easy walk along the Postman's Track, near Sisters Beach. Leader Ian Ferris.

Sunday April 5 Copper Cove, Narawntapu National Park. The walk will follow the coastal track to the Archers Knob junction (about 2km) and continue along to the eastern end of Bakers Beach (about 1.2km) then follow the coastal track over Little Badgers Head to Copper Cove, a further 1.8km. Leader Philip Milner (0417052605) plus one other.

Sunday May 3 Rubicon Estuary, Harford Explore Linda Barker's property on the banks of the Rubicon Estuary. Meet at 9:45 on the Frankford Highway at the turn-off to Narawntapu National Park. Linda's detailed directions to her house will be circulated in the April e-news. The walk starts at Linda's house at 10:00 am. Attendance Patricia Ellison, 6428 2062; 0437 282 073

Sunday June 7 Eden Rivulet Track, Cluan Tiers Walk along an old logging railway line following Eden Rivulet in forest that was last logged in 1977. Assuming normal rainfall, fungi will abound. Meet at Westbury Village Green, Lonsdale Promenade. Leaders Rod and Martha McQueen (63932121).

A parasitoid wasp (*Callibracon*) ovipositing in a scale insect gall. Photo: Martin Lagerwey

Apiomorpha gall cut open showing nymph. alchetron.com/Apiomorpha

President: Patricia Ellison / 6428 2062 / pellison@iinet.net.au
Secretary: Peter Lawrence / 0400457039 / disjunctnaturalists@gmail.com
Treasurer: Martha McQueen / 63932121 / martha.mcqueen@iinet.net.au
Walks Coordinator: Sue Gebicki / 0400860651 / suegebicki@yahoo.com.au
The Natural News editor: Sarah Lloyd / 63961380 / sarahlloyd@iprimus.com.au
E-news editor: Rod McQueen / rod.mcqueen@iinet.net.au
Patrons: Dr Peter McQuillan and Jim Nelson