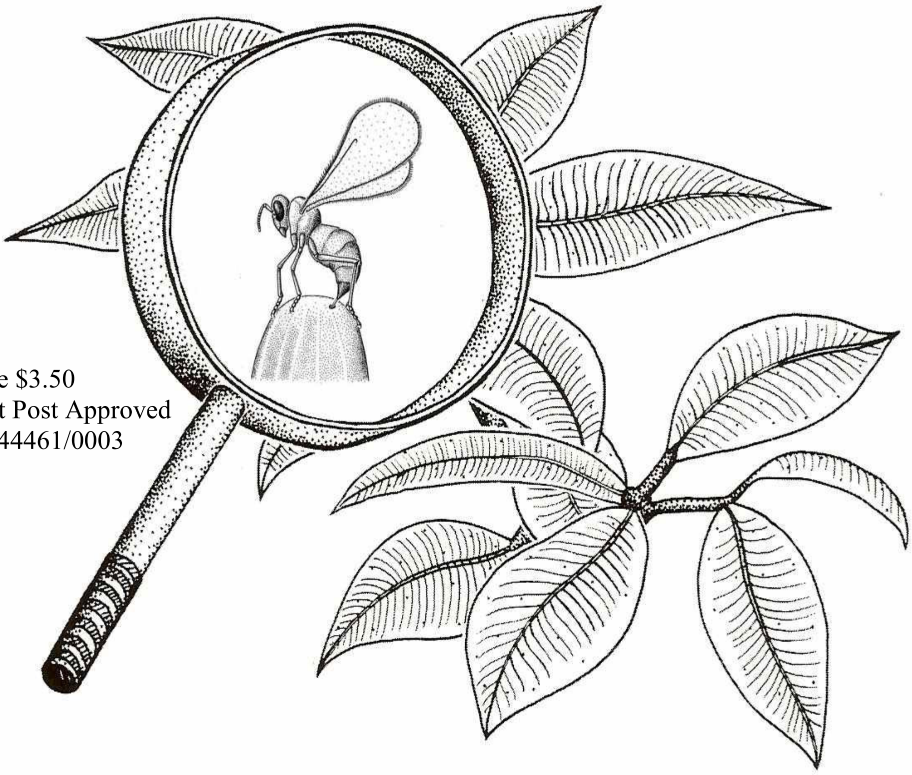
ENTOMOLOGICAL SOCIETY OF QUEENSLAND INC

NEWS BULLETIN



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The **ENTOMOLOGICAL SOCIETY OF QUEENSLAND INC.**, since its inception in 1923, has striven to promote the development of pure and applied entomological research in Australia, particularly in Queensland. Membership is open to anyone interested in Entomology. The Society promotes liaison among entomologists through regular meetings and the distribution of a *News Bulletin* to members. Meetings are announced in the *News Bulletin*, and are normally held in the Goddard Building, University of Queensland at 7.00 pm on the second Monday of each month (March to June, August to December). Visitors and members are welcome. Membership information can be obtained from the Honorary Secretary, or other office bearers of the Society.

Contributions to the *News Bulletin* such as items of news, trip reports, announcements, etc are welcome and should be sent to the *News Bulletin Editor*.

The Society publishes **THE AUSTRALIAN ENTOMOLOGIST**. This is a refereed, illustrated journal devoted to Entomology in the Australian region, including New Zealand, Papua New Guinea and the islands of the South Western Pacific. The journal is published in four parts annually.

EMBLEM: The Society's emblem, chosen in 1973 on the 50th anniversary of the Society, is the king stag beetle, *Phalacrognathus muelleri* (Macleay), family Lucanidae. Its magnificent purple and green colouration makes it one of the most attractive of all Australia Coleoptera. It is restricted to the rainforests of northern Queensland.

COVER: *Trichogramma, sp*., an egg parasitoid. Drawn by Catherine Bryant.

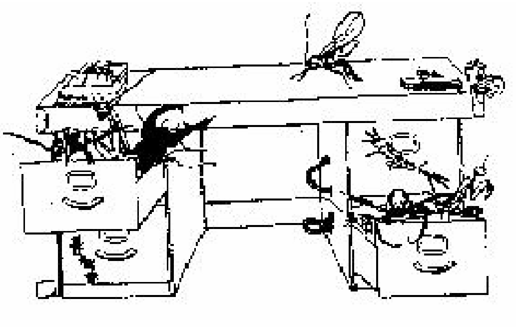


TABLE OF CONTENTS

The Entomological Society of Queensland

General Meeting September 2007

Minutes of the General Meeting of the Entomological Society of Queensland Inc. held in Room 139, Goddard Building, The University of Queensland, on 10 September 2007, at 7 pm. Chaired by Sassan Asgari

Attendance:

Sassan Asgari, Chris Burwell, Lyn Cook, Sarah Corcoran, Jason Jeffery, Ross Kendall, Judy King, Chris Lambkin, Corinna Lange, Anna Marcora, Gunter Maywald, David Merritt, Geoff Monteith, Don Sands, Geoff Thompson, Federica Turco, Susan Wright

Visitors:

none.

Apologies:

Peter Allsopp, Richard Bull, Mike Furlong, John Moss, Matthew Purcell, Andrew Ridley, Elly Scheermeyer, Noel Starick, Meron Zalucki.

Minutes: The minutes of the August ordinary General Meeting were circulated in the News Bulletin Vol. 35 Issue 5. It was moved by David Merritt, seconded by Chris Lambkin, that the minutes be accepted without amendment.

Nominations:

No nominations for membership were received during this month.

General Business:

Margaret Schneider informed the members of the death, on September 1, of Elizabeth Exley, a long-time member of this Society. Elizabeth had been in poor health for some time. Margaret briefly outlined some highlights of Elizabeth's life as a highly regarded entomologist and teacher. Elizabeth was Associate Professor of Entomology at the University of Queensland at her retirement in 1992, but continued her work on native Australian bees in an honorary capacity until her death. She had been a member of the Society since 1948, its Honorary Secretary in 1949 and President in 1968. She had strongly supported the Society over the years, and was an Honorary Life Member. She will be much missed by her colleagues and friends. A more detailed obituary will be provided in the October issue of the Bulletin.

Main Business:

The main business of the meeting was a presentation by **Dr. David Merritt**, University of Queensland, entitled "**What makes glow worms glow?**"

As there was no further business, the Chair closed the meeting.

What Makes Glow-worms Glow

David Merritt

School of Integrative Biology, The University of Queensland, Brisbane

Glow-worms are the larvae of a fly from the family Keroplatidae. They are close relatives of the "fungus flies" (Mycetophilidae) that seek out mushrooms for their larvae to consume. Glow-worms have gone out on an evolutionary limb, albeit a successful one. They have lost their association with fungi and have instead become carnivorous. The unique feature of glow-worms is their ability to bioluminesce. Because they are not very mobile the larvae construct webs to trap flying insects, much like spiders, and they use light to bait the trap. The larvae prey on flying insects, mostly small flies that are attracted to the bioluminescence. The web is composed of a horizontal mucous tube suspended by a network of threads from the earth or rock substrate. The larva can move back and forwards in the tube and can turn in its own length. Silk lines dotted with droplets of sticky mucus are suspended from the threads.

The first accurate scientific record of glow-worms was Hudson's (1887) identification of New Zealand glow-worms as dipteran larvae. The first report of Australian glow-worms was a note in *Scientific American* (anonymous, 1895) that Mr Morton, curator of the Royal Society of Tasmania museum, presented a paper at a Royal Society of Tasmania meeting about glow-worms at Ida Bay caves south of Hobart. There is a record of Morton presenting a talk about Tasmanian insects to the Royal Society in 1892 but unfortunately no transcript was published.

My interest in Australian glow-worms arose from a collaboration with Queensland Parks and Wildlife Service and tour operators to provide biological information to help make informed management decisions about tourist numbers at Natural Bridge in Springbrook National Park in the hinterland of the Gold Coast. Subsequent work has focused on the distribution, diversity and physiological ecology of these unusual organisms.

How many species of glow-worms?

There are currently 3 described species of glow-worm in Australia: *Arachnocampa flava* from southeast Queensland, *Arachnocampa richardsae* from the Blue Mountains region, and *Arachnocampa tasmaniensis* from Tasmania. The New Zealand glow-worm is *Arachnocampa luminosa*. Based primarily on a substantial wing venation difference, glow-worms were divided into 2 subgenera, *Arachnocampa* and *Campara* (Table 1) by Edwards (1924).

Table 1. Species and subgenera of genus *Arachnocampa* according to Edwards (1924)

Subgenus *Campara*	**Subgenus *Arachnocampa***
A. flava	*A. luminosa*
A. richardsae	*A. tasmaniensis*

From Claire Baker's PhD research (Baker, 2004) we know that glow-worms are more widespread in Australia and more species are present. Based on extensive investigations of rainforest and caves, along with information from field biologists, their distribution limits have been determined. They are found in rainforest along the east coast of Australia from the wet tropics in the Cairns region of Queensland to southern Tasmania (Fig. 1). Their western-most known distribution is the Otway Ranges of Victoria.

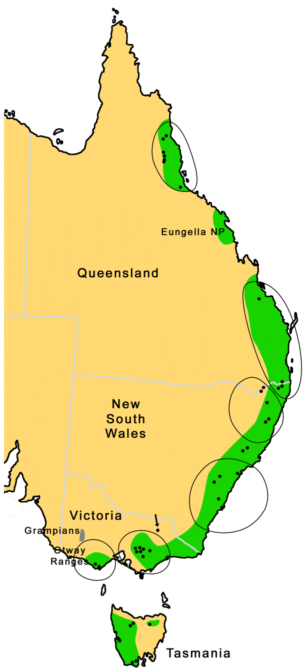


Fig. 1. Distribution of glow-worms in Australia

The glow-worms found in the Wet Tropics of northern Queensland are to be described as a new species (Baker, submitted). There is a large distribution gap along the coast of central Queensland. Southern Queensland and northern New South Wales is home to *Arachnocampa flava,* the species found at Natural Bridge. Its northern-most known limit is rainforest at Kroombit Tops. *Arachnocampa flava* is widespread in the border ranges region of northern New South Wales. A new species is to be described that is distributed through northern New South Wales. A cave population of this species is found in boulder caves at Girraween National Park. Further south, the Blue Mountains glow-worm, *Arachnocampa richardsae,* extends into southern New South Wales. This species is found throughout the Blue Mountains region in the many narrow and moist canyons.

In Victoria, two new species are to be described, one in the wet forest and caves of the Gippsland region and the other in the Otway Ranges. The glow-worms at Melba Gully in the Otway Ranges west of Melbourne are visited by many tourists. A most interesting glow-worm is found in a granite boulder cave at Mt Buffalo in the Victorian Alps. The larva and adult show some very specific features indicating that this is a new, undescribed species. At the moment its known distribution is confined to a single cave, so the species has been listed as potentially threatened through Victoria's Department of Natural Resources and Environment and Parks Victoria. It is possible that it is distributed more widely in gorges of the rugged alpine region; however specific searches will have to be carried out. Glow-worms are common in Tasmania where they are found in the wet limestone caves. They are also found in the tree fern-filled gullies of Tasmania's rainforests. All Tasmanian glow-worms belong to a single species, *Arachnocampa tasmaniensis*.

Phylogenetic Relationships

Analysis of mtDNA sequences was used to determine the relationships among Australasian glow-worms. Most of the new species described by Claire Baker (submitted) belong to the existing subgenus *Campara* (Table 2). The Mount Buffalo species belongs to the subgenus *Arachnocampa*, along with *A. tasmaniensis* and *A. luminosa*. However the molecular analysis indicated that *A. tasmaniensis* and the Mount Buffalo species are sister taxa and they in turn are sister to the remaining Australian mainland glow-worms. It became obvious that the existing subgenus *Arachnocampa*, erected by Edwards (1924), is paraphyletic and consequently a new subgenus is to be described that will contain *A. tasmaniensis* and the Mount Buffalo species. A morphological feature that separates them from *A. luminosa* in New Zealand is the nature of the pupal suspension. In all Australian (mainland and Tasmania) species the pupa is suspended horizontally from the hardened mucus lines, one in front and one in back. In contrast, the pupa of the New Zealand species is suspended vertically from a single anterior line (Fig. 2).

Figure 2. **Left**. Pupa of *Arachnocampa flava* suspended horizontally (photo: A. O'Toole). **Right**. Pupa of *A. luminosa* suspended vertically (From Hudson, 1887)

Table 2. Species and subgenera of genus *Arachnocampa* according to Baker (submitted)

Subgenus *Campara*	**New subgenus**	**Subgenus *Arachnocampa***
A. flava	*A. tasmaniensis*	*A. luminosa*
A. richardsae	New species 5 Mt Buffalo	
New species 1 wet tropics		
New species 2 nthn NSW		
New species 3 east Vic		
New species 4 west Vic		

General Biology

Glow-worms are found in caves and rainforest where there is deep shade and near flowing water. The adults are sluggish fliers and frequently rest on the walls of embankments or caves in the midst of a colony or larvae. Adults are very short-lived, surviving for only a few days after emergence from the pupa and apparently do not feed (Baker and Merritt, 2003). The males will find a female pupa and wait for her to emerge so that they can mate. Males are more slender than the females who emerge from the pupa with an abdomen swollen with eggs. The female flies live only 2 days so mating and oviposition begin immediately upon emergence. Each female lays 130 eggs that take 7-9 days to hatch.

Larvae are the predominant bioluminescent stage (pupae of Australian glow-worms will occasionally glow). The bioluminescence is produced by internal cells located in a swelling at the posterior end of the larva. The cells are part of the Malpighian tubules so glow-worms have evolved the ability to produce light from cells whose original function was presumably excretory. Interestingly, a distant relative of glow-worms, the keroplatid fly *Orfelia fultoni,* found in the central to southern mountain ranges of eastern North America, also produces light to attract prey but it produces light in a completely different type of tissue. In Australasian glow-worms the light producing cells are surrounded by a reflective structure composed of a mass of very fine air-filled trachea that appear as a silvery white mass under close examination. The light-producing chemical reaction is similar to the well-known firefly luciferin/luciferase reaction. However the enzyme and substrate are not identical to those used in fireflies. The luciferase protein of Australian glow-worms was recently identified and sequenced by Stephen Trowell (CSIRO, Entomology Division).

Larvae spend a considerable amount of time maintaining their “snares”—the many fine silken fishing lines that hang downwards, decorated by periodically placed sticky droplets. Flying insects are caught in the droplets and hauled up for consumption by the larvae. Infra-red illumination and time-lapse digital imaging allow us to record the behaviours of larvae. Movies of prey capture, web-building and aggressive interactions between adjacent larvae were shown at the presentation. These movies are used at Te Anau caves in New Zealand to inform tourists about the behaviours of the glow-worms.

Larval polyphenisms

A notable trait of glow-worms is the difference between cave and rainforest specimens. Cave glow-worms that have never seen the light of day are pale and tend to be larger than rainforest specimens. Rainforest glow-worms are heavily pigmented. In caves where the airflow is gentle the snares can reach 50 cm in length. In rainforest where they are exposed to stronger air movement they are usually up to 5 cm long. In rainforest the snares are usually built on earth banks and the larva tends to retreat into a crack or crevice in the soil during the day. Phylogenetic analysis using mtDNA sequences indicated that levels of DNA variation are much higher between species than between members of these species from either habitat, so cave populations are not cryptic, cave-adapted species (Baker et al., submitted).

Physiological ecology of bioluminescence

Bioluminescence output can be modulated, for example, when disturbed or exposed to bright light larvae are known to douse their own light. In some caves of New Zealand the glow-worms can be made to increase the intensity of their light by splashing the water in these otherwise quiet environments. Postgraduate student research projects at the University of Queensland have carried out investigations of the effects of parameters such as light exposure, vibration and sound, temperature variations and increased carbon dioxide levels on the light outputs of glow-worms. Briefly the projects are summarised below.

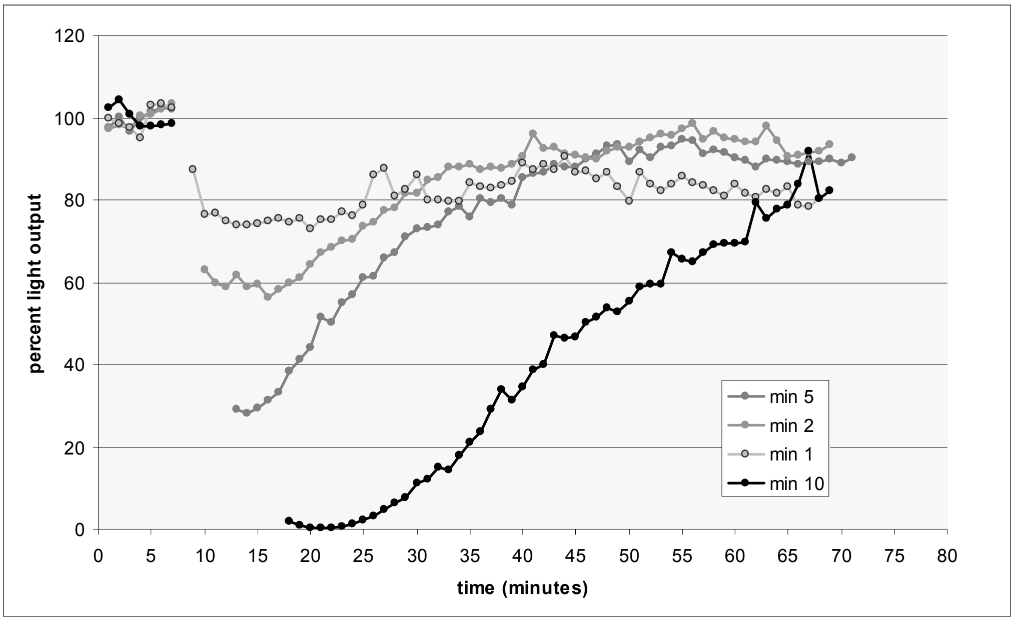
Temperature (Niu Chang Ying): Glow-worms increase and decrease their light output as temperature rises and falls, within limits.

Carbon dioxide (Evan Davies): CO_2 anaesthetises insects and the glow-worms are no exception. Elevated CO_2 levels cause larvae to emit light even during the day. The light output increases over about 5 minutes then declines.

Vibration and sound (Julie-Anne Popple): Glow-worms are sensitive to vibrations, responding with a rapid increase in light output. They are more sensitive to 100Hz than 1 KHz. Controlled vibration of a single fishing line with a probe at 50 Hz causes the same response so it is likely that the larval light emission response to vibration is a reaction to the presence of prey. By comparison, even very loud sounds are relatively ineffective at causing the glow-worm to increase its light output.

Light exposure: exposure to light causes larvae to dim and switch off over a course of about 5 minutes. The shorter the exposure and the dimmer the light, the less effect there is on the light output (Fig. 3). Preliminary experiments using filtered light indicate that larvae can see red light because they dim in response to red light exposure (insects are commonly regarded as being insensitive to red light).

Fig. 3. The dousing response of glow-worms to different durations of exposure to light



Rhythmic light output (Sakiko Aotani): To establish whether bioluminescence comes under endogenous control, larvae of the local rainforest species, *A. flava*, were placed in a cave-like environment under constant darkness in the laboratory. They maintained cyclical light output for at least 28 days in the absence of any external light cues. Over time, individuals showed an increase in the time spent glowing per day and a reduction in the maximum light output, resulting in a marked decrease in maximum daily light output level and a reduction in the time they are switched off. Based on these results, we expected that cave inhabitants would glow continuously because light is not present to elicit a switch-off. Recording of light output of a colony of *Arachnocampa tasmaniensis* in a completely dark cave showed strong, synchronised rhythmicity. Remarkably, they glow most brightly during the external day and most dimly around midnight. At the moment we don't the cues that entrain the rhythmicity of bioluminescence in cave populations and the basis of the inverted phase remain unknown.

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Notice of Next Meeting
Monday 8th October 7 pm 2007

Room 139, Goddard Building

University of Queensland, St Lucia

Why are there so many head lice, *Pediculus capitis*?

Steve Barker

People & Projects

News from University of Queensland:

Successful Application for Distance Entomological Education Project

In his role as chair of the Education Committee of the Australian Entomological Society, David Merritt coordinated a project application to the Carrick Institute, a federal government-funded institute supporting teaching innovations in higher education, to support entomological education Australia-wide. The application was accepted and the project will proceed over 2 years from November. A consortium of four institutions are initially involved; the University of Queensland, Charles Sturt University, the University of Adelaide and the University of Western Australia. The immediate aim is to develop four 3rd level undergraduate subjects in entomology that will be offered through the consortium in distance-education mode, allowing students from all over Australia to enroll. Most of the funds will be used to develop the interactive course material and adapt it for remote delivery. Hopefully, successful implementation and adoption of the initial 4 subjects will allow the roll-out of further subjects over the next few years. One of the first steps will be to consult with entomological educators throughout Australia to see how the proposed national subjects can dovetail with existing subjects.

The committee is grateful to the Entomological Society of Queensland for backing the application with a pledge of cash support. Further pledges came from the Australian Entomological Society, the University of Queensland, Charles Sturt University and Grains Research and Development Corporation. The committee is also grateful to the following for their support and input into the application: Geoff Gurr (CSU), Helen Spafford (UWA), Mike Keller (UA) and Nigel Andrew (UNE).

Appendix

Project Description

This proposal has come about through a recognition by professional entomologists that the ongoing decline in entomological education will inevitably lead to a reduction in quality and availability of entomologists to meet Australia's future needs. Emerging issues such as market globalisation, biosecurity imperatives, the biodiversity focus, management of pesticide resistance and utilisation of GMOs indicate Australia will experience a steady demand for entomologists.

The primary aim of the Australasian Entomology Education Strategy is to develop a comprehensive educational program in Entomology, to be delivered through a consortium of several partnering Australian universities. Courses will initially be targeted at the third level of a 3-year Bachelor's degree, and will be based on flexibly-delivered, remotely offered coursework. The program will draw on a cross-national pool of academic staff, leading to economies of scale in the cost to universities to teach these fields. Courses will be implemented using a flexible delivery model, and will use cross-promotion to draw on an international student base. Courses will be developed based on existing course-work and expertise throughout Australia's universities.

A second aim is to offer tailored courses for vocational training and professional development for entomology practitioners. This presents an opportunity for Australian universities to meet an emerging, but relatively untapped, international market for professional accreditation and training. End-users within this market include entomologists within government agencies, as well as para-professionals, such as laboratory technicians and pest controllers in urban and rural industries. The educational model being proposed is adaptable for the type of specialist, short-term workshops that are required in this field.

Effective flexible course delivery has already been tested on a local scale from some institutions. We have learnt that academic material needs to being tailored specifically to a remote audience, and support personnel required to produce graphics and publish material in online formats. Executive support will also be required for administration of the consortium model itself, and we are able to learn from the experiences of other consortium models in this respect: the Tropical Marine Network and the Biostatistics Collaboration of Australia are two examples.

Several meetings have taken place to establish a working model for the entomology curriculum and discuss course content and academic teams. Professional societies such as the Australian Entomological Society and the Queensland Entomological Society have indicated cash support. Financial support from several Research and Development Corporations will also be sought. Because the courses have the potential to draw on a wide student base, enrolments in individual courses are projected to reach a self-sustaining level after 5 years.

Scientists and managers in agencies such as CSIRO, AFFA, and various state research and extension agencies have been contacted and are ready to provide letters of support for this initiative.

News from Queensland Museum

Arachnology and Entomology did their bit for Science-week, with spectacular specimens and live animals on display to enthuse the crowds (mostly school-children) and the curators on hand to talk with. Yasuoki Takami (Department of Zoology, Kyoto University, Japan) visited the collection for about a week for his work on the carabid beetle genus Pamborus. Coincidentally, Owen Seeman has started a small project on the large Promegistus mites that associate with Pamborus. These mites belong to a monotypic family (Promegistidae) and occur at least between Dorrigo and Mossman on large rainforest-dwelling carabid beetles.

Christine Lambkin continues to direct the morphological component of the Assembling the Tree of Life (AToL) project: FLYTREE: which aims to build the Dipteran phylogenetic tree. Ultimately a comprehensive new phylogeny for all of Diptera will provide a valuable framework for testing evolutionary hypotheses critical in comparative studies of dipteran development, behaviour, genomics, and neurobiology. Chris has been working on updating the morphological character list and matrix which now contains 399 characters, all fully described. As well, 109 Images have been professionally edited to publication standard, 11 new images have been prepared using automontage or macro-photography, 15 scanned images have been accessed from photographs, SEMs, or slides by Geoff Thompson for the Lower Brachyceran First Tier taxa**.** These 135 images are being prepared for deposition on the web in MorphBank.

REMINDER: NEXT BUGCATCH TRIP - WEEKEND NOVEMBER 2-4

We already have a good lot of folk enrolled for our next collecting camp which is to "Yandooya" at the lower edge of Lamington National Park. Details were in the last News Bulletin. There's plenty of room to camp so come along. Essential to register with one of us below so we can send you the screed about how to get there.

Geoff Monteith (geoff.monteith@qm.qld.gov.au; Phone 38407690)
Christine Lambkin (christine.lambkin@qm.qld.gov.au; Phone 38407699)

INSECT GATHERING IN THE FAR NORTH

Well known insect identities from Sydney, Max Moulds, late of the Australian Museum, and Margaret Humphrey, late of the Macleay Museum, have retired and taken up residence in their swish new home in the rainforest on Saddle Mountain Road, near Kuranda. Though secluded, we are told you may see their mercury vapour light reflecting off the low clouds if you look to the right as you drive past on the way to Kuranda at night!

To celebrate their arrival, and to show that entomology is alive and well in the tropical north, no less than 30 insect enthusiasts, together with their partners, gathered at their home on June 16 for a barbecue and social get together. Several more couldn't make it and are requesting a repeat event. Endless insect chat alternated with checking the light sheets that ran throughout the evening. Word has it that several "good things" were taken or photographed at the light sheets, despite the inevitable jostling between collectors and photographers which provided entertainment for the rest of the party. The weather was kind and the rain held off until just after the last participant called it a night at 1.30am.

Participants are shown in the photograph. Left to Right:- **BACK ROW**: David Rentz, Tony Postle, Mike Cermak, John Olive, Peter Grimbacher, Jeff Watson, Paul Zborowski, James Walker, Scott Richie, Harry Fay, Garry Sankowsky. Peter Shanahan, David Lane, Ian Hill, Robert Ham. **FRONT ROW**: Ross Storey, Ros Blanche, Sally Cowan, Leonie Wittenburg, Margaret Humphrey, Max Moulds, Richard Piper, Michael Gorton, Kerrie Huxham, Mohamed Sallam. Missing (probably jostling at the light sheet): Donna Baldwin, Rob Bauer, David Hancock, Buck Richardson, Judy Thompson.

THE BUZZ ON BLUE-BANDED BEES FOR TOMATO POLLINATION.

Dr. Katja Hogendoorn
School of Agriculture and Wine, The University of Adelaide

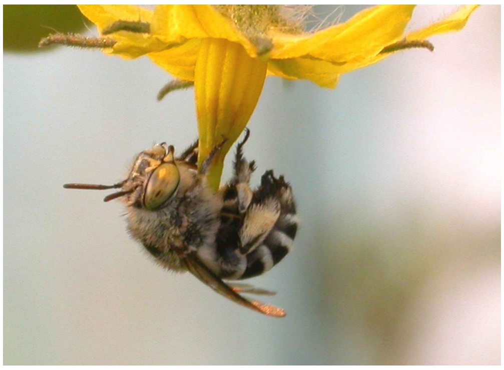

Photo: Blue-banded bee buzz pollinating a tomato flower

At the University of Adelaide, an ARC funded project is developing a breeding program of blue-banded bees that will allow the use of these bees for greenhouse tomato pollination. Tomato flowers need to be vibrated to achieve successful pollination. Australian greenhouse tomatoes are hand pollinated using a vibration wand, with labour costs of $16,000 per hectare per year. Overseas, bumblebees are used, but there are no bumblebees on mainland Australia. Honeybees are unsuitable because they do not buzz-pollinate.

The blue-banded bee project, lead by Dr Katja Hogendoorn and Ass. Prof. Mike Keller, has shown that compared to wand pollination, tomato yield increases by 20% when blue-banded bees are used. Blue-banded bees are solitary, buzz pollinating bees. Females collect pollen to provision their brood, which is produced in artificial mudbrick nests in the greenhouse. About 280 actively foraging females are needed per hectare of greenhouse tomatoes. These numbers can be bred in an area of 32 m^2.

The greenhouses need to have mesh in their vents and should be fully enclosed; otherwise the bees will escape, even through small holes. The females only live for six weeks and brood hibernates over winter. However, the researchers have successfully manipulated the breeding cycle and have maintained a continuously active greenhouse population for two years. Current focus is on the management of a fungal disease of the brood and fine-tuning of hibernation patterns.

To keep stakeholders and other interested persons informed about the progress of the project, a newsletter, 'The Buzz', is produced about three times per year. For more information contact **katja.hogendoorn@adelaide.edu.au**.

BUMBLEBEES ON THE AUSTRALIAN MAINLAND?

Andrew B. Hingston
School of Geography and Environmental Studies, University of Tasmania, Private Bag 78, Hobart, Tas. 7001, Australia.

Two applications have been made to import the European bumblebee *Bombus terrestris* to the Australian mainland for pollination of crops inside greenhouses, particularly tomato *Solanum lycopersicum*. The first of these (Goodwin & Steiner 1997) was rejected. The second (Australian Hydroponic & Greenhouse Association 2005) is currently being assessed by the Commonwealth Department of Environment and Heritage.

Opponents of the use of *B. terrestris* on the Australian mainland have stated that queens will escape from greenhouses and initiate feral colonies (Griffiths 2004; Australian Hydroponic & Greenhouse Association 2005). Climatic modeling suggests that feral populations of this species could establish over a large area on the Australian mainland, including most of Victoria, the eastern half of NSW, almost all the way up the Queensland coast, south-eastern SA, and a large area in south-western WA from Eyre to Geraldton (McClay 2005). Within this range, *B. terrestris* is likely to reach high densities across a wide variety of vegetation types and forage on many species of introduced and native plants because a feral population has already done this in Tasmania (Hingston & McQuillan 1998a; Hingston *et al.* 2002, 2006; Hingston 2005, 2006a). This invasive capacity means that *B. terrestris* could potentially compete with native animals and commercial honeybees for food, and also affect the pollination of both introduced and native plants in Australia (Hingston 2005, in press).

Research in Tasmania suggests that *B. terrestris* threatens the nationally endangered swift parrot *Lathamus discolor* by removing nectar and pollen from *Eucalyptus globulus* and *E. ovata* (Hingston *et al.* 2004a,b, 2006; Hingston in press). In addition, *B. terrestris* visited flowers of *Gompholobium huegelii* in Tasmania so frequently that it appeared to displace two species of native megachilid bees (Hingston & McQuillan 1999). Many plants that are important to the Australian honey industry, such as eucalypts, banksias, clovers, thistles and blackberries, are also visited frequently by *B. terrestris* in Tasmania (Hingston & McQuillan 1998a; Hingston *et al.* 2002, 2004a,b, 2006; Hingston in press), raising the possibility of increased hardship for Australian apiarists.

Bumblebees are the major pollinators of several taxa of weeds that are not invasive in Australia, suggesting that the introduction of *B. terrestris* might cause some currently benign introduced plants to become weeds. For example, *Rhododendron ponticum* and *Agapanthus praecox* ssp. *orientalis* have become more invasive in Tasmania since *B. terrestris* arrived there (Hingston 2006b; Hingston in press).

Bombus terrestris may also reduce seed production in some Australian plants by removing nectar, without contacting anthers and stigmas, by biting through corollas. Such nectar robbing has been observed in Tasmania on the native species *Epacris impressa* (Hingston & McQuillan 1998b), *Richea scoparia* (Olsson *et al.* 2000), *R. dracophylla*, *Billardiera longiflora*, and a *Correa* cultivar with tubular corollas (Hingston in press).

Hence, the importation of *B. terrestris* onto mainland Australia for crop pollination involves considerable ecological and economical risks that might outweigh the proposed benefits to the greenhouse tomato industry (Goulson 2005).

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BUMBLEBEES – USING THEM IN GREENHOUSE VEGETABLES

Australian Hydroponic & Greenhouse Association www.ahga.org.au

Frequently Asked Questions

Why do we need bumblebees?

Greenhouse tomatoes require artificial pollination of the flowers to set fruit. Bumblebees are used in over 36 countries as commercial pollinators of greenhouse crops including North America, Europe and New Zealand. In Australia, pollination is currently achieved by mechanical hand-held vibrators touching each plant 3 times a week. Bumblebees will do this job far more cheaply and efficiently. It is estimated that it costs $25,000 to manually pollinate 1ha of tomatoes, against $7,000 for bumblebees. The expected savings are $18,000 per hectare. Pollination using bumblebees not only results in improved fruit set, but fruit quality is increased.

Why can't honey bees be used in greenhouses?

Honey bees do not work in greenhouses. The environment within a commercial greenhouse is unfavourable to honey bees whereas bumblebees are very happy to fly around and visit flowers. Bumblebees are less aggressive than honey bees and are more suitable for using among people. Bumblebees work long hours and have a high flower visitation rate (around 450 flowers/hour). They buzz pollinate and breed in sufficient numbers to provide the correct ratio of bees to open flowers.

Why can't native bees be used?

Some research has been carried out on some native bees but it is still very much early days. It would be many years before more is known about these insects. It is not known whether they can be bred in commercial quantities or whether they are efficient in pollinating greenhouse crops.

How will bumblebees be used?

It is not intended to release bumblebees into the Australian mainland environment. Tasmania is the only state to have bumblebees in the general environment. Bumblebees will be raised in commercial insectaries and delivered to greenhouse growers in card board hives. They would be available all year round to match production cycles in all major greenhouse tomato growing areas. Once hives are delivered to the greenhouse, they will have a working life of about eight weeks, after which the hives are destroyed along with the bees. Growers will have to ensure they receive fresh hives over the growing period of the greenhouse crop.

What if bumblebees escape from greenhouses?

Bumblebees would be confined to greenhouses within hives specially fitted with a queen bee excluder device that would allow only non-breeding worker bees outside the hive and into the crop. This is already used in the USA and Canada. The queen excluder door is too small for the queen bee to pass through but the smaller worker bees are able to come and go as they please. Commercial greenhouses are designed to minimise the entry and exit of any insect. It is in the best interests of the grower to make sure no pests enter the enclosed greenhouse.

What if bumblebees escape from the greenhouse?

If a worker bee escapes from the greenhouse, without the safety of the hive and the protected environment of the greenhouse, their survival will depend on what the outdoor climate is like and prevalence of predators such as birds. Worker bees are unable to lay eggs and reproduce. Previous releases of bumblebees in the late 1800's and early 1900's on the Australian mainland failed to colonise. Bumblebees are present in Tasmania which has a much more suitable climate. No adverse effects have been shown there. While bumblebees are already established in settled areas of Tasmania, studies have shown that similar environments favourable to bumblebees only exist in other temperate areas in Victoria, southern NSW and South West Western Australia. Bumblebees are not regarded as pests anywhere in the world. Claims that bumblebees are another cane toad or fox are untrue when we know bumblebees are used safely in 36 countries in over 25 different crops.

Do bumblebees sting?

Bumblebees can sting people but they are far less aggressive than honey bees. Their placid nature makes them ideal for being used in greenhouses where people are working.

Are bumblebees harmful to native plants?

Studies in Tasmania have shown bumblebees prefer to gather pollen from introduced plant species (90%), compared to native species (only 10%). Therefore, there is little likelihood of any competition for native floral resources.

Will bumblebees spread disease?

Only certified pathogen and parasite-free bumblebee stock will be imported from reputable producers for commercial rearing in Australia. Any parasite or pathogen that has been associated with bumblebees is unique to bumblebees and poses no risk to Australian honey bees or native bees. Therefore, no deleterious health effects on Australian honey bees or Australian native bees are likely.

1. *Bombus terrestris* colony

2. Bumble bee hives in a glasshouse tomato crop

3. *Bombus terrestris* pollinating a tomato flower

4. Bumble bee hive

Announcements

Perkins Memorial Lecture

Monday 12th November at 12 Midday
CSIRO Long Pocket Laboratories
Large Conference Room
120 Meiers Rd Indooroopilly 4068
'Taxonomy, biology and DNA - essential components for studying the evolution of insects'
Andrew Austin

Please note for those who have being trying to get in contact with John Goolsby his contact details are as follows:
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DIARY DATES 2007

Meetings held 2nd Monday of the month (or Tuesday if Monday is a Public holiday)

October 8th	Steve Barker	Why are there so many head lice, *Pediculus capitis*?"
November 12th	Andrew Austin (Perkins Memorial lecture)	Taxonomy, biology & DNA– essential components for studying the evolution of insects
December 10th	Notes & Exhibits	

IMPORTANT NOTICE

The official address for the Entomological Society of Queensland and *Australian Entomologist* and to which all communications should be addressed is:

PO Box 537, Indooroopilly 4068, Qld.

Sustaining associate of the News Bulletin:

TROPICAL FRUIT FLY RESEARCH GROUP, GRIFFITH UNIVERSITY

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NOTICE OF NEXT MEETING

The next meeting of the Society will be held at 7:00 pm on **Monday**, **8th October** in **Room 139**, GODDARD Building, University of Qld. The main business will be **Steve Barker: Why are there so many head lice, *Pediculus capitis*?** Refreshments will be served before the meeting at 6:30 pm in the tea room, Level 2 of the Goddard Building (to the right of the main stairs), with a gold coin donation required. No donation is required to attend the talk alone.

VISITORS ARE WELCOME

HONORARY LIFE MEMBERS OF THE SOCIETY

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M.J. Harslett R.P. D.S. Kettle R. P. Kleinschmidt