ENTOMOLOGICAL SOCIETY OF QUEENSLAND INC

NEWS BULLETIN

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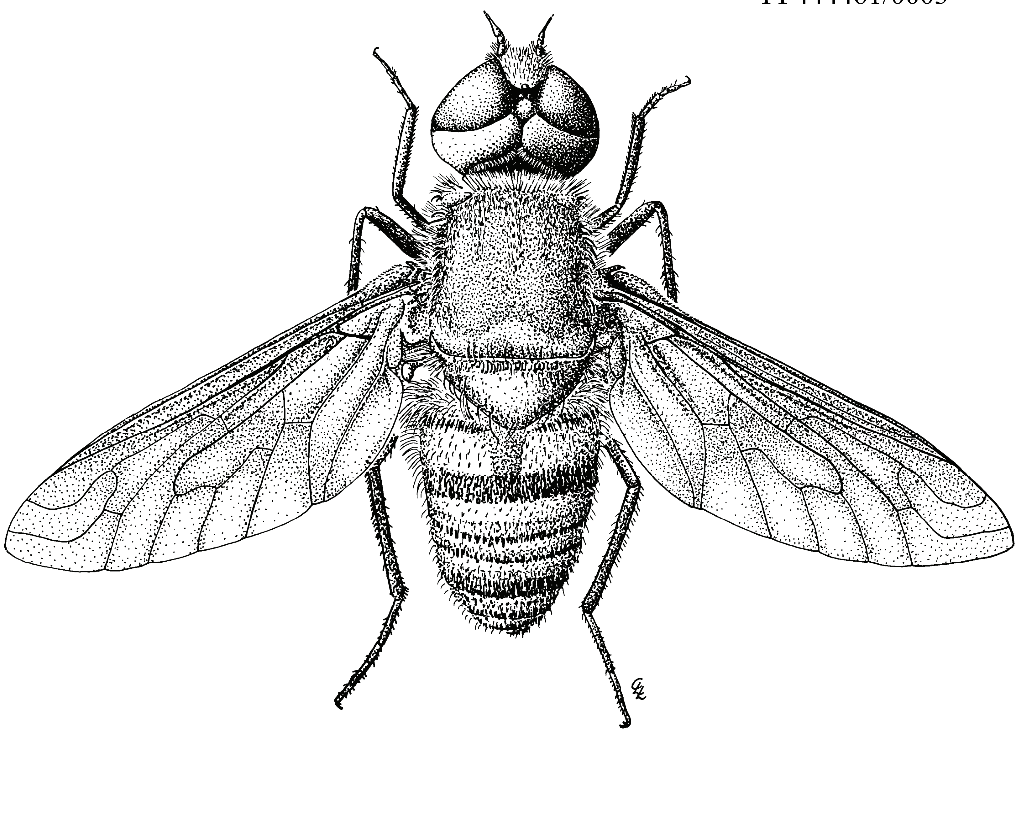

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The **ENTOMOLOGICAL SOCIETY OF QUEENSLAND INC.**, since its inception in 1923, has striven to promote the development of pure and applied entomological research in Australia, particularly in Queensland. Membership is open to anyone interested in Entomology. 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 on the second Monday of each month (March to June, August to December), or on Tuesday if Monday is a public holiday. 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: Habitus of ***Atrichochira commoni*** Lambkin & Yeates 2003 by Chris Lambkin. Invertebrate Systematics 17:p854.


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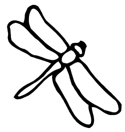

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The issue of this document does **NOT** constitute a formal publication for the purposes of the "International Code of Zoological Nomenclature 4th edition, 1999". Authors alone are responsible for the views expressed.

The Entomological Society of Queensland
Minutes of General Meeting May 11, 2009

Held in the Large Conference Room, CSIRO Entomology, Long Pocket Labs, 120 Meiers Road, Indooroopilly, on May 11, 2009, 12.00 mid-day.

Chairman: Chris Lambkin

Attendance: Christine Lambkin, Richard Bull, Geoff Monteith, Ross Kendall, Don Sands, Justin Bartlett, Judy King, Noel Starick, Lyn Cook, Rergis Goebel, Peter Allsopp, Bill Palmer, Greg Anderson, Desley Tree, Graham Forbes, Mark Schutze, Helen Nahrung, Felix Bianchi, Shon Schooler, Gunter Maywald, Judy Grimshaw

Visitors: Alisha Steward, Nate Hardy, Karen Bell, Mary Whitehouse, Greg Harper, Amy Carmichael, K. Dakeepan, Tony Clarke

Apologies: Matt Purcell, Anna Marcora, Bryon Cantrell, Pamela Mills, John Mills

Minutes: The minutes of the last General Meeting, were circulated in the News Bulletin Vol. 37, Issue 2 of April 2009.
Moved the minutes be accepted as a true record: Desley Tree
Seconded: Geoff Monteith

Nominations for Membership:
Alisha Steward of Salisbury, Brisbane
Graham Moore of Kensington, Victoria
Mark Thompson of Meringandan West, Queensland

The chairman called for members to vote by a show of hands to elect the nominees. All members were in favour.

General Business
The Chairman announced there had been no applicant for the Student Award.

Main Business

An address by Mary Whitehouse, CSIRO, Narrabri, entitled "From Lynx Spiders to Cotton: Four Trophic Levels of behaviorally Mediated Predator Effects"

From Lynx Spiders to Cotton: The effect of behavour over Four Trophic Levels

Presented by M.E.A. Whitehouse (co-authors: S. Mansfield, M.C. Barnett and K. Broughton)

Abstract

Food web studies often examine how predators influence the density and the behaviour of herbivores, but rarely extend this analysis to changes in plant density. This study incorporated four trophic levels, examining the effect of two predators (damsel bugs and lynx spiders) on damage to cotton fruit (squares and bolls) caused by green mirids.

We found that lynx spiders were better mirid predators than damsel bugs (Fig. 1), and lynx spiders attacked damsel bugs, but not vice versa. Cotton plants caged with mirids, lynx spiders and damsel bugs had lower numbers of mirids; while those caged with mirids and lynx spiders not only had lower numbers of mirids, but also less boll damage. Mirids altered their behaviour in response to increasing predator pressure, but this was not specific to lynx spiders or damsel bugs. When half the predators were damsel bugs, there were more lynx spiders at the top of the plant, away from the bolls found lower on the plant.

Why is there a discrepancy between mirid numbers and damage in cages with lynx spiders but with or without damsel bugs? These results suggest that that cotton plants housing mirids, lynx spiders and also damsel bugs had more boll damage because lynx spiders may have moved to the top of the plant in the presence of damsel bugs. By moving to the top of the plant, lynx spiders may have exposed the bolls lower down to mirid attack.

Thus even when the top predator can control prey density, the presence of a minor predator can disrupt the top predator's ability to suppress prey feeding. This work emphasises the importance of behaviourally mediated effects in food webs extending over four trophic levels.

The work is detailed in a paper submitted to Ecological Entomology, so only a general presentation of the work will be given here.

Introduction

Food webs have proven to be remarkably complex. In a simple three species system in which a top predator attacks a secondary predator and both attack a prey, there is chaotic variability in the way that they influence each other's densities (Xiao et al. 2002). This is because the presence of a second predator can either reduce or enhance prey survivorship. It can do this either by changing the number of prey or changing the numbers of the other predator (density mediated effects), or by altering their behaviour (behaviourally mediated effects) so that more or less of the prey species survives. There is strong evidence that behaviourally-mediated effects can have as strong or stronger effects on overall prey numbers than density-mediated effects (Gude et al. 2006; Werner & Peacor 2006).

With such high levels of complexity in only three trophic levels, it is not surprising that very few studies have extended their work to four trophic levels. For example, it is well known that prey often modify their foraging rate in the presence of predators as a trade-off between food and safety (e.g. Whitehouse 1997) and that predators can alter the feeding behaviour of herbivores (Beckerman et al. 1997). But the influence of behaviourally-mediated effects between the top and secondary predators in this trade-off has not been well studied, especially in terms of conservation biological control.

Conservation biological control is the use of natural enemies to control the pests in the crop. It may be particularly relevant to the management of Green mirids (*Creontiades dilutus* (Stål)) in cotton. Transgenic Bt cotton receives very few insecticide applications because the main pest, *Helicoverpa armigera,* is largely controlled by the Bt protein produced by the plant. The lack of insecticides in Bt cotton has enabled predators to play a greater role in the management of secondary pests. The green mirid is an emerging pest in Bt cotton whose damage is not always linked to its numbers. Green mirids are easily controlled by insecticides such as fipronil and dimethoate. However, these chemicals are not very selective and reduce predator numbers, which in turn can trigger the outbreak of other pests such as whitefly or mites. Thus it is important to manage mirids without resorting to unnecessary insecticide applications.

One means of controlling mirids in cotton without resorting to sprays is to enhance key mirid predators. Two animals in the predator guild which are common in cotton are the damsel bug (*Nabis kinbergii* Reuter) and the lynx spider, *Oxyopes molarius* L. Koch (Whitehouse and Grimshaw 2007). Studies using ELISA techniques (enzyme-linked immunosorbent assays) indicate that both of these predators attack mirids in the field (unpublished data, M.E.A. Whitehouse, S. Mansfield, J. Nobilo & J. Hagler). However, the effectiveness of these predators at controlling mirids is unclear, as is the nature of the interactions between them. As lynx spiders are larger than damsel bugs, based on a size advantage they are likely to be predators of damsel bugs, but this needs to be confirmed. In addition, even if the mirid numbers are controlled, can these predators control mirid damage?

The aim of this work was to examine the interactions within a food web extending over four trophic levels involving lynx spiders, damsel bugs, mirids and cotton. In particular, we looked at the role of the food web in controlling mirid numbers and damage to cotton. Next, interactions between trophic levels were teased apart, such as whether lynx spiders and damsel bugs attacked mirids or each other (density mediated effects); or whether behaviourally mediated effects influenced interactions between the prey (mirid) and the primary producer (cotton). The ultimate aim was to study the importance of density and behaviourally mediated effects in food webs extending over four trophic levels in relation to the control of herbivory.

Figs 1-2. 1) Lynx spider eating a mirid; 2) Field cages used in the food web experiment.

The food web

In the field, cages were set up with 5 different combinations of mirids and predators. These included: 15 mirids only (5 small, 5 medium and 5 large); 15 mirids and 4 lynx spiders; 15 mirids and 4 damsel bugs; 15 mirids, 4 lynx spiders, and 4 damsel bugs; and a Control where nothing was added (Fig. 2). These were left in the field for a week after which time the entire cage including the enclosed plants were removed from the field and then checked for squares (buds), bolls (fruit), mirids, damsel bugs, and spiders. This was repeated 4 times.

The results were that more mirids survived in the cages containing just mirids or mirids and damsel bugs, and that there was no difference in the number of mirids surviving in cages containing mirids and lynx spiders or all the animals (mirids, lynx spiders and damsel bugs; Fig 3a). So lynx spiders reduced mirid numbers, but damsel bugs did not.

There was no difference between treatments in the number of undamaged squares on the plants, although there was a difference in the number of undamaged bolls (Fig 3b). The only treatment that had less damaged bolls than the “mirids only” treatment was the cage containing mirids and lynx spiders. The cage containing all three animals (“all”) suffered boll damage that was not significantly different from cages with mirids only.

Density mediated interactions

To test if lynx spiders and damsel bugs attacked each other, lynx spiders and damsel bugs were paired in a manor that manipulated the size advantage. In one set of pairs, adult lynx spiders and damsel bugs were used, giving lynx spiders a size advantage (7x heavier). In the second set, adult damsel bugs and juvenile lynx spiders were used, so that there was no size advantage. In the third set adult damsel bugs and very small lynx spiders were used so that damsel bugs had a size advantage (5x heavier). In these tests, lynx spiders ate the damsel bugs when they had a size advantage, neither were attacked when they were the same mass, and only one lynx spider was attacked when damsel bugs had a size advantage. So lynx spiders will attack damsel bugs when they have a size advantage, but damsel bugs rarely attack lynx spiders, even with a size advantage. Thus lynx spiders are the top predator in this system.

To test if lynx spiders and damsel bugs attacked each other or mirids, 10 adult female lynx, 10 juvenile lynx, and 10 adult damsel bugs were tested with 4 different size classes of mirids for an hour. The results were that adult lynx spiders were more likely to attack larger mirids, while small lynx spiders were more likely to attack smaller mirids. Only one mirid was caught by a damsel bug in this experiment.

To observe lynx spiders catching mirids, please go to: http://www.cottoncrc.org.au/content/Industry/Publications/PestsandBeneficials/SuckingPestPublications/Mirid_Predation_by_Lynx_Spiders.aspx .

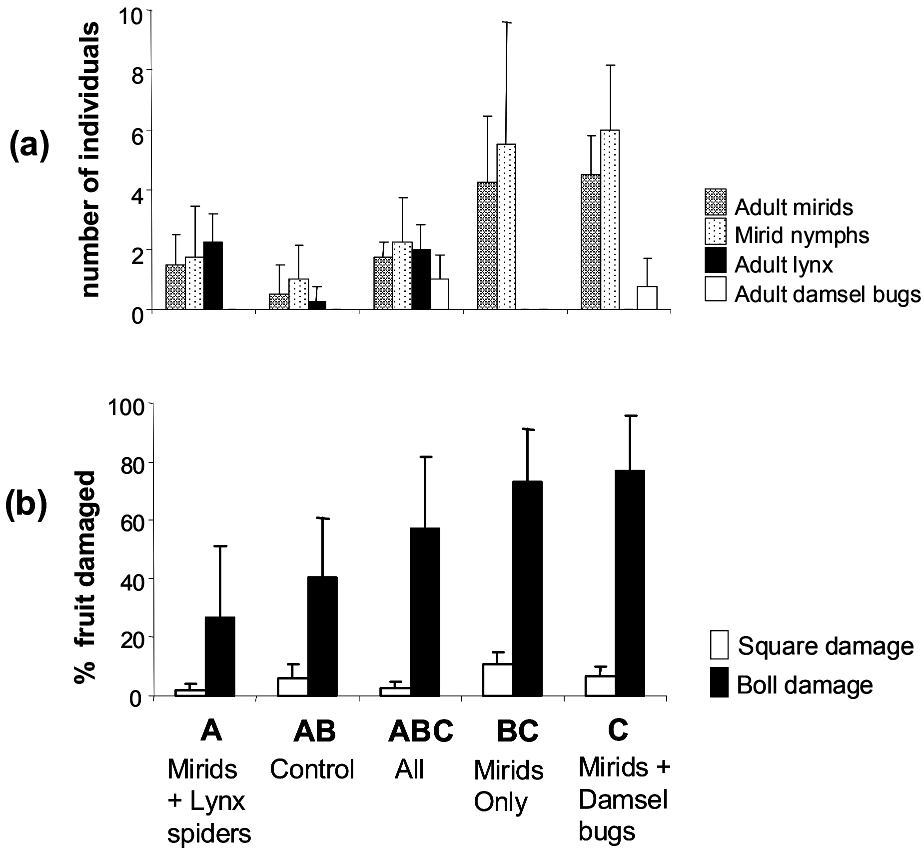

Fig 3. The effect of the different treatments on the number of mirids, lynx spiders and damsel bugs surviving the different treatments (a) and the proportion of squares and bolls damaged (b). The letters under the graph refer to significant differences between the amount of boll damage between treatments (b).

This suggests that lynx spiders are keen predators of mirids while damsel bugs are not, indicating that this food web may be an example of trivial multiple predator effects (Sih et al. 1998) where one predator causes significant mortality of the prey but the other predator has no significant impact, either on the prey or the other predator. Such interactions are very common and indicate that the strength of the connections within a food web can have more of an effect on community dynamics than web connectivity (Vance-Chalcraft & Soluk 2005).

However, although this explains why in the food web experiment mirid numbers only dropped in the cages containing lynx spiders, it doesn't explain why there was more damage to cotton bolls in the cages that contained both predators.

Behaviourally mediated interactions

To look for behavioural changes in mirids and their predators, different combinations of mirids and their predators were observed on individual cotton plants in the laboratory. On each plant, 4 mirids were tested in one of 5 treatments: no predators (control); 1 lynx spider; 2 lynx spiders; 2 lynx spiders and 2 damsel bugs; and 4 lynx spiders. Every 30 mins during a 2 hour period the location of the mirid (whether it was at the top, middle or bottom of the plant) was recorded, as was its behaviour (whether it was standing still, walking or fidgeting).

We found that mirids moved to the top of the plant as predator pressure increased, and that in the presence of any predators, mirids were less likely to stand still and more likely to fidget. As mirids need to stand still to feed, this suggests that in the presence of predators, mirid feeding is suppressed. However, mirids behavioural response did not differentiate between lynx spiders and damsel bugs.

In respect to the predator's behaviour, damsel bugs moved to the top of the plant. This is a well known characteristic of damsel bugs. However, lynx spiders changed their location on the plant depending on whether damsel bugs were present or not. There were fewer lynx spiders at the top of the plant as predator density increased, except in the presence of damsel bugs. At the predator density of 4/plant, there were more lynx spiders at the top of the plant when half the predators were damsel bugs than when all were lynx spiders (Fig. 4).

Changes in the location of lynx spiders on a cotton plant could influence the degree to which bolls are exposed to predation. Bolls first develop lower down on the plant, so most bolls are found in the middle section of the plant, while the squares are found at the top of the plant. If there are fewer lynx spiders in the middle of the plant, then the mirids that are there may be exposed to less predator pressure, and therefore more able to attack the fruit.

The food web experiment showed that while the lynx spiders reduced mirid numbers, the presence of another less significant predator (the damsel bug) influenced the amount of damage caused by mirids. The behavioural observations indicated that the most likely explanation for this is that the presence of the damsel bugs altered the behaviour of the lynx spiders, drawing them to the top of the plant, and leaving the bolls, which occur lower down on the plant, more exposed to mirid attack. The argument is that the same number of mirids in treatments with and without damsel bugs could do more damage to bolls in the treatment with damsel bugs because there were fewer lynx spiders near the bolls to suppress the mirids' feeding.

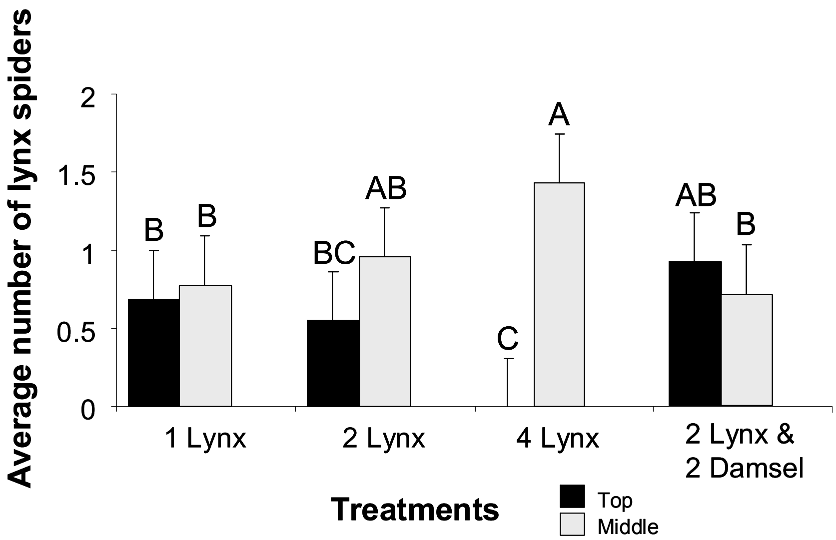

Fig 4. The average number of lynx spiders found on the top, and in the middle of the plant. The letters above the columns indicate significant differences (based on the LSD) in the number of lynx spiders found at the different locations in the different treatments. The standard error is also shown.

These results suggest that although lynx spiders may have the potential to control mirid numbers, they may be less effective at controlling mirid damage in cotton in the presence of other minor mirid predators such as damsel bugs. This has implications for mirid management in cotton, and may be one explanation of the inconsistent relationship between mirid numbers and mirid damage recorded in cotton fields.

Nevertheless, this system indicates the importance of behaviourally mediated effects in food webs extending over four trophic levels.

Acknowledgments

Thanks to Judy Nobilo for managing the damsel bug and mirid cultures and technical assistance; Trudy Staines for technical assistance and Dave Murray for supplying the infra-red cameras and recording unit. This work was supported by a CRC summer scholarship grant to MB and KB, and CRDC and Cotton CRC research grants to MEAW.

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Vote of thanks:
Noel Starick thanked Mary for a most interesting presentation.

Chairman's closing statement:
The next meeting would be notes & Exhibits, be held at this venue on June 9, 2009 noon. Chris asked that any contributions be to her before 20 May.
Meeting closed 12.55pm.

Notice of Next Meeting

<u>Entomological Society of Queensland</u>

Tuesday 9th June, 2009 12pm

~ NOTES AND EXHIBITS ~

"Backyard Explorer: a Qld Museum and Qld Education teacher resource incorporating entomological studies"
Christine Lambkin

"Noonbah *Axynaon* (Coleoptera: Tenebrionidae)"
Noel Starick

CSIRO Long Pocket Laboratories
Large Conference Room
120 Meiers Rd, Indooroopilly

ALL WELCOME

People & Projects

The Trouble with Toads

Geoff Monteith, Queensland Museum

Four or five years ago Doug Cook and I spent a few nights light trapping at the "Heartbreak Hotel". It's a big truckstop/caravan park/pub/servo in the middle of nowhere at the junction of the Carpentaria and Tablelands Highways, 120 kms north of Borroloola, on the Gulf of Carpentaria lowlands of the Northern Territory. It's a perfect place for a collecting base because good bitumen highways head for hundreds of km in several directions through practically uninhabited wilderness. The "Heartbreak" has 24 hr power and is surrounded by bush, so it was a very convenient situation to run light traps without the headache of portable generators. This was at the height of our "bioprospecting" phase at the Queensland Museum when we were after 10 gram samples of as many species of insect as possible, and the spectacular light-trapping we had there in the post-wet period was quite rewarding.

A few weeks ago, I returned to "Heartbreak" for a week with Gerry Cassis and Nik Tatarnic from the University of New South Wales. We were chasing Heteroptera for DNA purposes and hopeful of having a repeat of the light-trapping success. On the first afternoon we plugged the light into their power and set the light sheet up just beyond the edge of their extensive mowed and watered campground. After a meal at the pub we strolled down to start the harvest from the light trap. As we approached we could see the light sheet quivering from the impact of a mass of leaping, moving critters which proved to be cane toads. Every insect arriving on the ground and up as high as 25cm on the sheet itself disappeared down the gullets of the toads.

Figs 1-2. 1) Toads at the front of the light sheet; 2). Detail of toads in feeding frenzy.

The relentless spread of cane toads, *Bufo marinus,* westwards across the top of Australia has been well documented recently and they had clearly arrived at "Heartbreak" since our earlier visit. It's well known that toad numbers increase enormously in the first few years of arrival in a new area and this was what we were seeing. The great proportion were small toads, in the size range up to about 10cm length, with just a few big mothers in the 15+cm size. Presumably these represented the original invaders and their first generation of progeny. Gerry actually found one of the large females with a 10cm juvenile head-first, half way down its throat....an intrinsic population control factor?

So we moved the light trap out into the spinifex beyond the toad-friendly lawns of the establishment, but on the second night they found us there too. Finally we set the sheet up on the raised verandah of a building where we were pleased to feed the resident green tree frogs but not the toads. If you are heading to the NT for light trapping, be warned!

A further note on the Green Emperor (Re: ESQ News Bulletin volume 37, issue 1)

John V. Peters

Further to the article on the Green Emperor in volume 37, issue 1, of the ESQ News Bulletin, I offer this very short note.

I was interested in the sightings and captures of the Green Emperor dragonfly reported in the March News Bulletin because my daughter, Vanessa Bugg, captured a male specimen on 18th November 2008 at Tuchekoi, a town some 20 minutes west of Cooroy. The interesting thing about the capture is that the specimen was collected on a fly screen covering a lighted window at 9pm. Perhaps the specimen had been disturbed and was then attracted to the light! The specimen is in my collection.

News from School of Biological Sciences (BIOL), The University of Queensland

David Merritt attended the 18th Australasian Conference on Cave and Karst Management at Margaret River, Western Australia, where he presented a talk entitled *Bioluminescence in Cave Glow-worms: Signs of Altered Circadian*

Rhythmicity, co-authored with Arthur Clarke. **Claire Baker**, who completed her PhD on glow-worm phylogenetics and species identities at UQ in 2004 also attended the meeting.

Lindsay Popple (Walter lab), cicada expert and long-time member of the ESQ, has submitted his PhD thesis and accepted a postdoctoral position with Mike Crisp at The Australian National University in Canberra. He will be shifting his attention to the dark side (plant phylogeny and evolution).

Recent news and media releases

"Dungbeetle diversity linked to urban ecosystem health" ABC News (28 March 2009)
http://www.abc.net.au/news/stories/2009/03/28/2528827.htm

"A new twist in the sex life of silk worms" CSIRO Media release (23 April 2009)
Link: http://www.csiro.au/news/Sex-life-of-the-silkworm.html

"$30m for Atlas of Living Australia" CSIRO Media release (12 May 2009)
http://www.csiro.au/news/Funds-for-Atlas-of-Living-Australia.html

"Eaten alive by Moorooka midges" City South News (14 May 2009)
http://city-south-news.whereilive.com.au/news/story/eaten-alive-by-moorooka-midges/

"Plant cells help bees get a grip" ABC News (15 May 2009)
http://www.abc.net.au/news/stories/2009/05/15/2572161.htm

Notice for holders of ESQ Collecting Permits

The permit officer will be unavailable from 10 June - 10 August 2009. Information regarding our permits are available on the society website (www.esq.org.au). Any further queries to be forwarded to the president Christine Lambkin or Geoff Thompson (contact details on back cover).

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Yours sincerely,

Desley Tree (Treasurer)

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DIARY DATES 2009

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

Monday March 9th	Dr Mike Furlong (UQ)	AGM & Presidential Address
Tuesday April 14th	Nate Hardy (QDPI)	Mealybug Classification
Monday May 11th	Mary Whitehouse (CSIRO Narrabri)	From Lynx Spider to Cotton
Tuesday June 9th	Student Award and Notes & Exhibits	Notes and Exhibits session
Monday August 10th	Perkins Memorial Lecture: Professor Gerry Cassis (UNSW) and BBQ	
Monday September 14th	Trevor Lambkin (QDPI)	
Monday October 12th	Chris Burwell (QM)	
Monday November 9th	Myron Zalucki (UQ)	
Monday December 14th	Notes & Exhibits and BBQ	

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 QLD 4068.**

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 **12:00 pm** on **TUESDAY, 9th June 2009** in the **Large Conference Room**, **CSIRO Long Pocket Laboratories**, 120 Meiers Rd Indooroopilly. The main business will be a **NOTES & EXHIBITS** session, with presentations by:

Christine Lambkin "Backyard Explorer: a Qld Museum and Qld Education teacher resource incorporating entomological Studies" and **Noel Starick** "Noonbah *Axynaon*"

VISITORS ARE WELCOME
(Please sign in at CSIRO reception before attending the meeting)

HONORARY LIFE MEMBERS OF THE SOCIETY

R.A.I. Drew	D.L. Hancock	M.J. Harslett
D.S. Kettle	D.P.A. Sands	R.P. Kleinschmidt