Tarsus

November 2009

Issue No. 589

CIRCULAR OF THE ENTOMOLOGICAL SOCIETY OF NEW SOUTH WALES Inc

Next Meeting of the Entomological Society of NSW Inc

Where: Meeting Room 2, Ermington Community Centre, River Road, Ermington
When: 7.30 pm on Wednesday, 4th November 2009

PROBING SPIDER VENOMS AS SOURCES OF THERAPEUTICS AND INSECTICIDES

Assoc. Prof. Graham Nicholson

Faculty of Science
University of Technology, Sydney
P.O. Box 123 Broadway
NSW 2007 Australia

Graham will talk to us about why they are looking at spider venoms as a source of new insecticides and the sort of spiders that are likely to have the right sort of toxins. These venoms can be extremely complex and challenging to work with.

CHRISTMAS FUNCTION

28th November, 2009
6.30pm

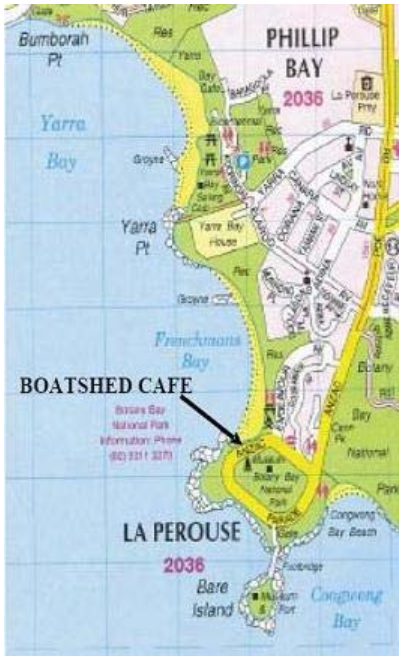
BOATSHED CAFÉ

1609 Anzac Parade
La Perouse
(see map)
Tel: 9661 9315

Cost $38.00 per head
Example menu includes entrée (chicken Caesar salad), main (barramundi or salmon with salad and fries) & dessert (with tea or coffee)

Not licenced so BYO alcoholic drinks

RSVP: Ted Taylor 9661 3627
by 21st November



Synopsis of September 2009 Meeting Talk

INTEGRATED FLEA CONTROL

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SUMMARY

Fleas are ectoparasites found in many countries. They have a complete metamorphosis, developing from egg to larvae to pupae and finally to adults. Fleas are significant pests causing problems to humans ranging from irritation to diseases, which have killed millions of people. Fleas also cause many problems to companion animals such as dogs and cats and are a major source of revenue for the veterinary industry. The biology and pest status of the flea is discussed.

Integrated flea control is a holistic approach aimed at doing the best possible treatment using the available knowledge and technology. The various components of an integrated flea control system are discussed in detail.

INTRODUCTION

Fleas are small, wingless insects belonging to the Order Siphonaptera. Fleas are parasitic and unlike mosquitoes, both the male and female require a warm blood meal. Fleas are often referred to as 'ecotoparasites' i.e. a parasite found on the skin, hair or fur of its host.

Of the 2,400 or so species found worldwide, less than a dozen have been reported as pests. Approximately 94% of the total species worldwide feed on mammals, with the remainder feeding on birds. Of the species feeding on mammals, the vast majority feed on rodents.

Historically and still today, fleas are considered an extremely important insect pest in the areas of veterinary and public health.

FLEA BIOLOGY

LIFE STAGES

Eggs

Flea eggs are large enough to be seen with the naked eye. The eggs are approximately 0.5mm long, smooth, translucent and oval in shape. The eggs are not sticky and tend to roll off the host. The greatest concentrations of eggs are found where the animal rests. Flea eggs generally will hatch within 1.5 to 6 days.

Larvae

Flea larvae are small, legless, worm-like grubs and are white in colour. They possess chewing mouthparts and short antennae. They have a single row of bristles around each segment and these bristles facilitate movement. Under optimal conditions, larvae of the pest species can develop in 4 to 8 days.

Pupae

At the termination of the final larval stage, flea larvae weave a silk-like cocoon, which is spun from its own saliva. The cocoon is somewhat sticky and tends to incorporate small pieces of debris from the surroundings. This gives the pupa further protection as well as providing a degree of camouflage. In the pest species, the pupal stage can last around 7 to 10 days or in some circumstances, much longer. It is in the pupal stage that fleas are most resistant to desiccation and to the effects of insecticides

Adult

Adult fleas are between 1.5 - 4.0mm in length, brown in colour and are laterally compressed. Laterally compressed means fleas are taller than they are wide allowing rapid movement through hair and fur.

Fleas do not have wings, however, they have developed very powerful hind legs, primarily to allow them to jump onto a passing host. Some pest species of fleas have been measured jumping vertically up to 200mm and horizontally 330mm. It has been calculated that a flea jumping these distances can be compared to an average height human male jumping the length of a football field!

Many species of fleas have a row of spines above the mouthparts and on the pronotum. These are important for attachment to the host and are often used for flea identification. The adult flea has piercing and sucking mouthparts and claws on their legs to facilitate holding onto the host.

LIFECYCLE

Fleas undergo a complete metamorphosis i.e. they develop from egg to lava to pupa to adult. This cycle can take from around twenty days to several months depending on the species and environmental conditions. Generally, fleas prefer warm and humid conditions and temperatures around 27 - 30°C and 75% to 90% relative humidity are optimum. Fleas can develop both indoors and outdoors if the substrate and environmental conditions are suitable.

Both adult male and female fleas require a warm blood meal. They will take in much more blood than required to sustain them, excreting the blood as dried faeces. The faeces fall off the animal and will concentrate in the animal's favorite resting sites. The adults produce the faeces in the hope the larvae will find and consume it. It is the mixture of eggs and faeces which gives the classic salt and pepper appearance of debris often found in the bedding of flea infested pets.

After undertaking a blood meal from the host, the male and female flea mate and the female will start to lay eggs, reaching maximum production approximately 4 days after her first blood meal. A female flea may lay several hundred eggs over her lifetime. Most eggs fall off the host and will land by the faeces in the animal's bedding or favourite resting spot.

Eggs usually hatch in 2 - 14 days. The emerging larvae crack the eggshell by means of a tooth on its head, which disappears after the first molt. The larvae then forage for the dried blood excreted by the adult. Larvae may also feed on food crumbs, human skin and other organic debris. The larvae undergo three instars and are ready to pupate in 4 - 8 days under optimal conditions.

Once feeding is complete, the larvae will then weave a silken cocoon and the pupa is formed within this.

The pupal stage may last from 7 - 14 days or much longer in some cases. The stimulus for the adult flea to emerge from the pupa is vibration, changes in air pressure, changes in temperature or a combination of the above.

It is often reported that persons entering a deserted home which had previously been inhabited by flea infested pets, are suddenly inundated by many fleas. It is the human presence, which has stimulated the adult fleas to emerge from the pupal stage.

Once the adults have emerged they will attempt to jump onto a passing host and if that host is suitable, the lifecycle will begin again.

FLEAS AS PESTS

IRRITATION FROM FLEA BITES

Humans

Fleas are common sources of skin lesions in humans. Their habit of biting can cause mild to severe irritation. Most fleabites received by humans occur around the ankles and lower legs. The irritation, which can persist for days in some individuals, is due to the flea saliva, which acts as an anticoagulant.

Typically, a flea bite leads to a small red spot where the mouthparts have penetrated the skin and around it is a red halo. There is usually not much swelling associated with flea bites. Further complications can develop when scratching of flea bites leads to infection.

Pets

It has been estimated that fleas and flea related problems account for greater than 50 per cent of all dermatological cases and greater than 35 per cent of the total small animal cases presented to veterinarians. Problems caused by fleas to pets include fleabite dermatitis and tapeworm infestation. In extreme flea infestations, animals (usually puppies and kittens) can become anemic and death has been known to occur.

Some animals become hypersensitive to flea bites resulting in intense itching, loss of hair and often-secondary lesions occur. This condition is known as Flea Allergy Dermatitis (FAD). Animals suffering from FAD have a significantly reduced quality of life.

DISEASE TRANSMISSION

The most serious human disease transmitted by fleas is the bubonic plague (Black Death) of the middle ages. This disease has claimed untold millions of lives. In India alone, this plague resulted in more than seven million deaths from 1896 to 1911. This disease is caused by bacteria, *Yersina pestis*, spread from infected rats to humans by the Oriental rat flea. The plague exists in several forms and is still present today in many countries including the USA, Africa, Asia and South America.

Murine or endemic typhus is another disease spread to humans by both rats and fleas. Again it is the Oriental rat flea and the microorganism in this case is *Rickettsia typhi*. Murine typhus is transmitted when the faeces or crushed bodies of fleas infected with the microorganism are rubbed into an open wound. This disease is not spread by the bite of the flea.

Intestinal worm parasites such as the dog tapeworm and rodent tapeworm are spread by certain species of fleas. Flea larvae ingest tapeworm eggs and the immature tapeworm develops in the flea larvae and adult. Ingestion of the adult flea by humans or pets leads to the establishment of a tapeworm.

IMPORTANT PEST SPECIES

Cat Flea (*Ctenocephalides felis*)

This is probably the most common pest flea in urban areas worldwide including Australia. The flea infest dogs and cat alike and attacks humans, rodents and other mammals.

Dog Flea (*Ctenocephalides canis*)

This flea is very similar morphologically to the cat flea with only very small structural differences. The dog flea also attacks a wide range of mammals including dogs and cats. It does not appear to be as widespread as the cat flea.

Human Flea (*Pulex irritans*)

This flea is now very uncommon in Australia and is much less important worldwide due to sanitary improvements such as the vacuum cleaner and improved personal hygiene. As well as humans, this flea also attacks dogs, rodents and pigs.

Oriental Rat Flea (*Xenopsylla cheopsis*)

This flea is found in many countries throughout the world. This flea is the main vector of bubonic plague and murine typhus. It mainly lives on rodents, particularly the Roof rat, Norway rat and House mouse. This flea readily bites and feeds on humans.

FLEA CONTROL

INTEGRATED PEST CONTROL

A textbook definition of Integrated Pest Control;

"The use of chemical, biological and sanitation procedures to reduce the target pest population to tolerable or nil levels". i.e. using a combination of available technology and knowledge to bring about a desirable outcome.

If we consider flea control involving an animal with a severe case of Flea Allergy Dermatitis (FAD) our desirable outcome is a nil flea population.

INTEGRATED FLEA CONTROL

The various components of an integrated flea control program appear below;

1. Sanitation
2. Environment modification
3. Inspection and monitoring
4, Non chemical control
5. Treating the animal
6. Treating the environment (indoor and/or outdoor)

1. Sanitation

Thorough vacuuming of carpets or rugs or sweeping areas where pets frequent will remove at least some of the flea eggs, larvae, pupae and adults. This includes soft furnishings as well as flooring areas. Vacuum bags should be treated with an insecticide, sealed and disposed of.

Pet bedding should be removed and cleaned every 1 to 2 weeks. As this period of time is within the flea lifecycle, it will

interrupt flea development within the animal's bedding. If washing of the bedding is problematic, the bedding can be placed in a black plastic bag and placed out in the sun for several hours. If the temperature in the bag is warm enough, a combination of heat and low humidity will kill all life stages of the flea.

A homeowner should vacuum thoroughly and clean pet bedding immediately prior to a flea control treatment. Research has shown that vacuuming following a pest control treatment can improve the treatment by stimulating the emergence of adult fleas. Research has also shown vacuuming does not significantly affect the residual efficacy of insecticides.

2. Environment Modification

As with most pests, modifying the physical environment can reduce or even eliminate an infestation. Flea larvae develop indoors in substrates such as carpets, rugs or floorboards which provide a suitable harborage. Fleas will not develop readily on smooth flooring such as linoleum or ceramic tile in good condition. Many people with chronic flea problems, especially those living in tropical climates, have had the carpets removed from their homes, to reduce or eliminate an environmental flea infestation.

Often the sub floor areas of buildings are perfect environments for flea development, particularly during the warmer months. Prevention of pets gaining access to the sub floor areas will often significantly reduce a flea. Infestation. Restricting pet access to shady and sandy areas of a garden may also reduce flea infestations. Proofing of areas to prevent a flea infestation may also include modifying access to rodents and other animals such as stray animals, which may harbor fleas.

3. Inspection and Monitoring

Inspecting and monitoring of the animals and environment for fleas is an excellent way to determine if the flea population is increasing. In this way the animal and/or environment can be treated before the infestation becomes too severe.

A homeowner should observe flea numbers on pets as well as fleabites on themselves and family members, flea egg presence etc. If an increase in the flea population is noticed homeowners should treat themselves or contact a Pest Control Operator (PCO) as soon as possible. This may allow the treatment to occur before the infestation becomes too severe and harder to control.

4. Non-Chemical Flea Control

Fine-toothed combs can be purchased which physically remove fleas from the pet's coat. Captured fleas are generally placed in water to drown. This method may suit pet owners who are averse to using any form of chemical control. This method is not always feasible if the coat of the animal has thick and tangled fur.

This method has been employed very successfully to remove Head lice from children's hair. Hair conditioner is applied to the child's hair and an extremely fine comb is used to physically remove head lice and their eggs (nits).

Again, his type of control is usually only practical in the case of pet owners who are averse to applying chemical treatments to their pets.

5. Treating the Animals

The Traditional Approach

The traditional approach to on-animal flea control consisted of insecticidal shampoos, soaps, dusts and rinses. Other traditional forms of control were insecticidal sprays (aerosol or pump sprays). Flea collars were another approach.

Insecticides used in the products include natural pyrethrins, synthetic pyrethoids, carbamates and organophosphates. These products are sold through supermarkets, pet stores, hardware stores and veterinarians.

Although the individual cost of these products are relatively low, often the efficacy is poor and residual life is short, leading to the frequent use of one or a combination of products. Over time, this form of control can be quite expensive, especially dealing with multi-animal households with chronic flea problems.

The Modern Systemic and Spot-on Animal flea treatments

This more modern form of flea control has changed the flea control market. In the past, people mainly purchased insecticide products from retail stores for consumer products or called in a pest control professional. The new products have shifted the market significantly from the above areas to the veterinary clinics. Sales of these products usually form a significant proportion of a veterinary clinic's income during the flea season.

The big shift away from the consumer and professional market was precipitated by Program™, containing a systemic chitin synthesis inhibitor delivered mainly in the form of an oral tablet. The active ingredient of this product is lufenuron. This product works by interrupting the life cycle of the flea by inhibiting the formation of chitin, a major component of the insect's exoskeleton.

When Program™ is introduced to the pet, the lufenuron remains present in the blood in sufficient concentrations for a period of approximately one month. When the adult flea bites it will take in the lufenuron in the blood. The lufenuron will not kill the adult flea, however it may prevent the flea eggs from hatching. As the concentration of lufenuron decreases the eggs may hatch, however the larvae will die as they try to molt due to chitin not forming properly in the exoskeleton. As the vast majority of the fleas exist as eggs and larvae, this form of flea control can work extremely well, especially when combined with a fast acting adulticide (a flea control insecticide targeting the adult life stage of the flea). Program™ is also available as a paste, a six month inject able for cats only and combined with a heartworm and intestinal worm preventative in a once a month oral tablet called Sentinel Spectrum™.

Rapidly following on the heels of Program were the 'Spot-on' products Frontline™ and Advantage™. Frontline™ uses the active ingredient fipronil, a phenyl pyrazole and Advantage™ uses the active ingredient imidacloprid, a chloronicotinyl. It is interesting to note both these molecules are now used in the professional urban pest control industry including cockroach gel products. Frontline™ is now sold as Frontline Plus™, which uses methoprene, a juvenile hormone analogue, along with the original active ingredient, fipronil.

Both the above products work extremely well in killing the adult stage of the flea. A small amount placed between the shoulder blades just behind the head will permeate throughout the animal's coat and provide excellent control of the flea for up to one month. Frontline Plus™ has the added claim of killing ticks, including the paralysis tick, *Ixodes holocyclus,* for up to two weeks.

A newer spot-on is Revolution™. Revolution™ uses the active ingredient selamectin, and is active against internal parasites such as heartworm as well as having activity against fleas. It also has a one-month claim.

Another product released in recent times is Capstar™, an oral tablet with the active ingredient nitenpyram. Nitenpyram is a short lasting systemic chloronicitinyl. Fleas start dying within 30 minutes when Capstar™ is presented to a flea-infested animal. Residual life is usually less than 24 hours for this product, however, a treatment can safely be given every twenty-four hours for as long as necessary.

The vast majority of flea-infested properties will have pets present. The odd infestation may result from the incursion of stray animals (usually stray cats) or perhaps native or feral animals. .

If pets are present and obviously flea infested then these need to be treated to prevent further infestation. Treatment of pets is usually left in the hands of the owner or a veterinarian. It is not normally carried out by a PCO, however, it is important that the animal is treated as soon as possible. If the animal has a large flea infestation, flea eggs will be added to the environment at a relatively high rate.

The author recommends an integrated approach to the animal treatment, which involves an adulticide (a flea control product targeting the adult life stage of the flea), and an Insect Growth Regulator (IGR) targeting the egg and larval life stages of the flea. One such product combination is the Novartis product Capstar™ combined with another Novartis product Sentinel Spectrum™. The Capstar quickly kills adult fleas present on the pet and the Sentinel Spectrum™ prevents development of the egg/ larval stages of the flea. The author has undertaken several flea field studies using this adulticide/IGR combination and found extremely good results under tough tropical conditions.

6. Environmental Control of Fleas

Despite the success of the new on-animal treatments, for fast results a flea infestation will usually require both the animal/s and the environment to be treated. As with any realistic attempt at pest control, the job must start with a thorough inspection to gain an understanding of the problem. This will sometimes involve both the indoor and outdoor environments.

In the situation of an on-going flea infestation there is usually adult fleas present on the animal, and newly emerged adult fleas present in the environment. It is usually the newly emerged adult fleas, which are biting the homeowners. It is unusual for fleas to leave their hosts once they are established. Generally this only occurs in the death of the host where fleas detect a drop in temperature and leave the dead animal.

As well as the adult stage there is often many more individual fleas present as, eggs, larvae or pupae. A well-executed environmental flea control program should aim at killing the adult fleas present and also stopping the development of the immature stages.

Today, any serious attempt at controlling fleas in the environment should involve an integrated approach using an adulticide in combination with an Insect Growth Regulator (IGR). Within the veterinary industry the IGR's are often referred to as Insect Development Inhibitors or (IDI's)

As the name suggests the adulticide is the insecticide which primarily targets the adult life stage of the flea. The adulticides have the ability to affect the egg or more commonly the larval stage of the flea, however, these stages are generally protected

within their environment from adulticide treatments. Adulticides are usually in the form of conventional pest control treatments such as residual wet sprays, which target the nervous system of the flea. These are now available to the homeowner as DIY formulations sold through supermarkets and hardware stores.

The available flea control IGR's are in two distinct groups; the Juvenile Hormone Analogues (JHAs) and the Chitin Synthesis Inhibitors (CSI's). This group of insecticides generally has no lethal affect to the adult stage of the flea.

The JHA's are synthetic versions of a naturally occurring juvenile hormone, which is present in the immature life stages of most insects including fleas. As an insect goes through its life cycle the level of juvenile hormone diminishes and the insect eventually reaches maturity and is capable of reproduction.

If a JHA is present in the environment, development is compromised and the insect fails to reach maturity. In the case of the flea, the presence of a JHA often results in the flea failing to emerge from the pupa. Molecules available to the professional pest control industry for flea control in this group include methoprene and pyriproxyfen.

The CSI's (Chitin Synthesis Inhibitors) have a different mode of action to the JHAs, yet still affect the development of an insect. Chitin is a major component of an insect's exoskeleton. If a CSI is present in sufficient concentration, the exoskeleton does not form properly and the insects die either as a result of loss of mobility or desiccation. Molecules available to PCOs for flea control in this group include triflumuron. Generally, IGR only formulations for control of fleas are not sold over the counter.

The correct adulticide should kill any adult fleas present at the time of treatment plus have enough residual activity to quickly knockdown any fleas emerging from the pupal stage. The IGR should prevent any eggs or larvae developing into the later stages even after the residual action of the adulticide has stopped.

As mentioned previously, it is the pupal stage, which is most resistant to insecticides. Commonly, the adulticide will kill the adults that are present but does not have enough residual action to kill the emerging adults before they have a chance to find a human host and bite. The adulticide and the IGRs generally do not have any affect on the developed pupal stage. This is known as the pupal window in the Pest Control Industry. It is this relatively short period of adult emergence from the pupal stage, which results in customer complaints for consumer products and callbacks for the professional pest control operator. The correct residual product can help to reduce this problem if adults can be killed quickly after emergence.

Indoor Environmental Control

Indoors, fleas develop in rugs, carpets, floorboards and other flooring with cracks and crevices as well as in pet bedding and soft furnishings.

Professional products available to the PCO include residual surface sprays with active ingredients such as synthetic pyrethroids, organophosphates and carbamates and IGRs including methoprene, pyriproxyfen and triflumuron. Over the counter products available to the home owner include total release aerosols (Flea Bombs) usually containing a synthetic pyrethroid as an adulticide and an IGR.

Areas treated indoors should include all surfaces where eggs, larvae, pupa and adults may be present. Treatments should involve a surface spray treatment of all rugs, carpets etc. and a crack and crevice treatment to relevant areas. Particular care should be taken in areas where pets frequent. The entire area of carpets and rugs should be treated.

If the premises can be vacated for a period of time after treatment, a space spray can be a good adjunct treatment to the surface spray/crack and crevice treatment. This treatment has the possibility of killing off fleas, which have been missed in the surface spray treatment or are in difficult to reach areas such as under furniture. Dust treatments may also be used in areas, which are difficult or dangerous to reach with wet sprays.

Outdoor Environmental Control

In some properties with a flea infestation, it is necessary to treat the outdoor environment in relatively close proximity to the building. This may include the sub-floor areas of buildings where animals have gained access or in animal resting sites in garden areas.

Often it is the areas with sandy soils where fleas seem to do well outdoors. Research has shown the heaviest populations of fleas occur outdoors in the areas around dog kennels, sandy soil areas and shaded protected areas, which provide a microhabitat for flea development.

Many pest control operators will lightly hose down outside areas before applying the insecticide to help penetration into the soil profile.

CONCLUSION

- Carefully inspect the area and look for flea hotspots.
- Proof areas to prevent animal entry to flea breeding areas
- Vacuum carefully before and after an environmental treatment and wash all pet bedding regularly
- Treat pets using both an adulticide and IGR.
- Treat environment using both an adulticide and an IGR
-

FURTHER READING

Bennett G, Owens J. and Corrigan R. 1997. Truman's Scientific Guide to Pest Control Operations. Fifth Edition. Advanstar, Cleveland, Ohio USA.

Gerozisis J. & Hadlington P. 2001. Urban Pest Control in Australia, Fourth Edition. NSW University Press, Kensington, Australia.

Mallis A. 1990. Handbook of Pet Control. Seventh Edition. Franzak & Foster Co, Cleveland, Ohio USA.

The Companion Animal Parasite Council (CAPC) Website www.petsandparasites.org

Ku-Ring-gai Wldflower Festival - 30 August, 2009

Robin Parsons and Ted Taylor

At the Table

For the one day festival this year the Society manned an exhibit table and sent one of our members on the official walk into the surrounding bush. It was well that they had picked Sunday, every body had done their chores on Saturday and had nothing better to do than explore windows into nature and community at the festival.

The exhibit was set up efficiently and creatively by Ted, Gith and Graeme then manned and womaned stoically by them, Robin, Barbara and Howard through the busy day.

The exhibit was composed of (amongst other things);

- Wood damaging insects: specimens and samples of their wood work, presented by Ted.
- Set specimens on themes such as Bees & Wasps (Native & introduced), Insect diversity associated with trees, a large *Xyleutes* (Cossidae) moth (Robin) and a general collection of Sydney insects (Barbara).
- Various entomological books & periodicals and high quality posters were on display (Gith, Ted & Barbara).
- Macro photos of insects and funnel-webs (Robin)
- Live insects represented by wingless bush cockroaches (Robin), silverfish (Howard) and stick insects (Graeme).
- More than life size, sometimes frightening pseudo-invertebrates.
- An insect knowledge competition, (with prize), being principally for the children which however did not stop John, '65 going on 12' from having a go.

The professionally presented live stick insect (Goliath, spiny and Sydney's *Acrophylla*) interactive display enthralled children and adults alike. Stick insects walking across hands and up arms, never fails to attract eager hands.

Even the bush cockroaches were popular and many children and adults were pleased to handle them. Aside from the wonderful questions and responses from children a most pleasing aspect of public response was the frequent occasions that adults demonstrated their active interests in insects. Some of these people conversed at length with society members about their concern for such things as; missing creatures, native versus introduced wasps and bees, photographic projects and ecological management of their gardens.

The Society contributed to a broad exhibition involving conservation groups, local government, & community support groups covering native mammals, frogs, birds, plants, fire brigades, weed and human behaviour control. In doing so the Society has contributed a small piece of encouragement and education.

A boy of around nine came again to me to ask many simple but important questions about insects, "You probably don't remember me I was here before but I had my hat on." I did recognise him from before. "I ask too many questions." He observed. "No' I assured him "You are not asking too many questions".

The Walks

The Festival of Wildflowers includes various different theme walks through the bush at Ku-ring-gai Wildflower Garden. This year there were six main walks and one especially for children. The themes included Australian plants, photography, bush tucker and insects. The one day Festival certainly packed them in this year with a steady stream passing our exhibit all day. All the walks appeared to be well attended - there was an attendance of more than thirty people on the insect walk alone.

The "Investigating Insects" walk was conducted by Dennis Collins (SFIS) and Ted Taylor along a bush track that traverses some of the ridges and valleys of this typical Sydney sandstone countryside. The track was a bit rough in places but accessible to our group that included very small children all the way up to eighty year olds. The track was dry because of the lack of rain throughout August – this made the going easier but lessened the number of insects you could expect to see.

At the start of the walk there is a mature termite colony (*Nasutitermes walkeri*) in a eucalypt beside the path. This ensures plenty of live insects to start off with and gives a chance to explain that not all termites are bad and to detail their vital place in the scheme of things and in this colony there was another tenant in the form of a blue-winged kookaburra. Another of the insects always present is the honey bee (*Apis mellifera*), This is a mixed blessing because although vital to some agricultural crops it displaces some of our native pollinators and is regarded as a pest in natural bushland such as the area we were walking through. On these walks you always get insect related questions. This year they included "How can I stop ticks in my garden?" and about various spiders including red back and funnel web spiders.

Towards the end of the walk we came to some wattle in full bloom in a sheltered and warm spot. This turned out to be a bonanza of different insects although at first glance there was nothing to be seen. We employed the old trick of "shake and see" and out came a small green and black jewel beetle (Buprestidae), a beautiful bright green leaf beetle (Chrysomelidae), a ladybird beetle (Coccinellidae), many thrips, lots of very small flies and of course a spider or two.

On that high note we ended our "Investigating Insects" walk for 2009.

Australian Entomological Society
40th Annual General Meeting and Scientific Conference 2009
Darwin, Northern Territory
25–28th September 2009

This conference was combined with that of the Society of Systematic Biologists and the 9th Invertebrate Biodiversity & Conservation was accordingly much bigger than most Australian Entomological Society conferences. The conference was held in the Holiday Inn where the air-conditioning was a trifle too cold but otherwise an excellent venue. The food at morning and afternoon tea and lunch was more than adequate and everyone seemed satisfied by the smorgasbord at the conference dinner.

Some 200 people attended including several members or visitors to the Ent Soc NSW (Debbie Kent - "City trees: a bug's superhighway to the bush".; Cathy Car – "Another piece in the puzzle: more millipedes"; Graham Brown (who lives in Darwin) – "The Northern Territory: a taxonomist's perspective" and "Northern Territory Insects"; Sarah Mansfield – "Production and testing of novel formulations of entomopathogenic fungi"; Markus Riegler " Climate change and herbivory on *Eucalyptus*" & Graeme Smith - "Zygentoma an over-looked order in Australia").

The conference opened with some depressing presentations about the disappearance of fauna (especially small mammals) from much of the Northern Territory, and on the need to identify the greatest amount of genetic diversity quickly so that decisions can be made on slowing the rate of loss. It seems we have given up on trying to prevent it happening.

That evening there was a welcome reception in the Territory Parliament where we could view a first edition of Darwin's "Origin of species".

It is clear that the effort needed to describe the Australian fauna far outweighs the resource (both money and trained people) available and no politician wants to throw money at a lost cause. Several papers suggested ways to speed up the process by bar-coding DNA of species rather than describing them, using photographs rather than drawings (in fact why use any words at all when a 3D image can be generated using X-ray scanning equipment?), having the computer measure your specimen from the photos and write the description for you (using for example face recognition software), using the internet to link various workers to speed up descriptions and enlisting selected members of the public to help collect and sort material in survey work. The use of electronic journals is also becoming very important. They are cheaper and faster and if the Zoological Nomenclature Committee does approve these as valid for new species as expected, then there will be a rapid move towards this means of publication.

There were a large number of presentations on various modeling systems to assess the impact of things like climate change on distribution and biodiversity. Papers without DNA sequence data were very much in the minority, at least in the sessions I attended. There was also a parallel session on applied entomology and one on biosecurity that I did not attend.

But there were also some papers on the biology of interesting species such as the wingless fly that breeds in the native Pitcher plant near Albany, the biology of the Scribbly Gum moths and the only social beetle *Austroplatypus incompertus* (Curculionidae). It was also interesting to see the positive impact of termites and ants on biodiversity and soil quality. The termites improve the soil fertility and moisture content with their tunneling activities. And the presence of a dominant native ant species seems to increase the diversity of other native ant species possibly by preventing the secondary species from dominating all the available niches. There was also an interesting paper on the resilience of our insect fauna to fire.

The Aust. Ent. Soc. held their AGM. The issues raised included the need to keep their membership up above 500 as they are committed to this number for the journal production. All members are asked to encourage other entomologists to join. It was also suggested that discounts to future conferences be concentrated on students rather than Aust. Ent. Soc. members. The issue of speeding up the process of the Journal of Australian Entomology is clearly a sensitive issue and one that won't go away in the face of the move towards electronic publications.

For me it was a good opportunity to get to know the entomological (and especially the taxonomic) community in Australia, something that hasn't been possible when working as an entomologist in the chemical industry. I established some good

contacts with people that could help me to include some DNA analyses in my silverfish work and a couple of groups have asked to put my key to the Australian silverfish genera on their web pages.

While it isn't cheap to attend such conferences, it is a great opportunity to keep in touch with our peers and have a good time in the process. The next conference will be held in Perth where the conference will take place at a resort NE of Perth. Here it won't be so easy to get away from the conference venue and this is seen as a way to ensure that everybody gets to mix and socialise rather than breaking up into smaller groups. The conference after that will probably be a joint conference with the NZ Entomological Society.

Society web site

www.entsocnsw.org.au

I'm still not receiving any contributions to the web site other than our regular posting of Tarsus, but hits are still reaching about 700 per month. Just imagine if we had more information available.

Don't be shy. Send me a new photo for our front page.

I would be more than happy to train anyone who would like to learn how to manage the site. It's not that hard once you get used to a few things. I knew nothing about web pages until I volunteered to set this one up and we now have a manual that leads you through the steps.

For any problems (e.g. lost passwords), submission of photos for publication or suggestions for improvement get in contact with Graeme Smith. (0421 617 377) or le_gbsmith@optusnet.com.au

Show & Tell – September Meeting

Dinah bought along a 2 wasps (winged male and wingless female typhiids) found on bare soil at Beecroft. The *Carpocapsa* caterpillar reported a few years ago during a warm season have not been there this year even though it was also warm this year. **Howard** however still has them at Winston Hills.

Ted reports that during the bug walk at Kur-in-gai on weekend they commented that wattle trees didn't usually have a lot of insects but then found a jewel beetle, a bright green Chrysomelid and a Coccinellid as well as thrips on an *Acacia* with ball flowers. This lead to discussion that the Botany Bay weevil appears to be becoming rarer.

Gith bought a sample which was identified as the larvae of a Neuroptera

Howard gave a progress report on the butterfly mentioned in March. The Australian Crowe butterflies, have been active at his home over the entire winter. Jasmin is a host plant so there is plenty of food available. They flutter around pencil pines at his home in Winston Hills.

Stephen Doggett from Westmead informed us about another Symposium this time on "Emerging pest management challenges" They have an international speaker. Cost is $270

(Apologies for the lack of photos- I remembered to bring my camera, but I forgot to check whether the batteries were charged. *Graeme*)

Council Position(s) to become vacant

Journal Editor

Garry Levot has decided to stand down at the next AGM after 10 years in the position of Honorary Journal Editor. Garry has done an outstanding job of ensuring the membership has a quality journal in which to publish their research. He has maintained the high standard of our Journal, greatly reduced our publication costs and published it on time. We are really grateful for the effort that Garry has put in to the Society.

If you'd like to step into this role please let the Council know. He has offered to still do the layout work but the new incumbent will still have plenty to do. For more information give Garry a call on 4640 6376.

The responsibilities of the position can be checked if you log in as a member to our web site http://www.entsocnsw.org.au/ and go to the Constitution section. Duties are spelled out on page 14.

Circular Editor

After 3 terms in the job (15 issues to date) Graeme Smith is running out of stories to print and would like to have a go at the Journal Editor's role if elected to the position. This means we would need a new Circular Editor and we can all have a break from stories about silverfish.

The responsibilities of the position can be checked if you log in as a member to our web site http://www.entsocnsw.org.au/ and go to the Constitution section. Duties are spelled out on page 13.

The role is not too onerous and it should be possible to do the job even if you can't get to the meetings (but you'd need to co-opt a Show & Tell reporter). The newsletter is currently created as a simple Microsoft Word document but this then needs to be turned into a pdf document using Adobe Acrobat or something similar. This can probably be arranged within the membership if you don't have access to this programme.

The bulk of the content comes from the speakers notes (prepared by the speaker themselves), some notes and photos of the Show & Tell sessions, an Insect of the Month (I still have a couple of spare ones ready for use when needed), the future programme plus anything else that might turn up (e.g. conference reports, stories from members etc).

Tarsus needs to be e-mailed to the membership using Microsoft Outlook which takes about half an hour in general. Maintaining the membership list also comes with the job (using an Excel spreadsheet) but this only requires a few changes per year.

The Circular is important to keeping the membership informed of Society activities so we hope somebody would like to have a go, even if just for a year (5 issues). Give Graeme a call if you want to know more on 9857 2470 (w) or 9981 3749 (h).

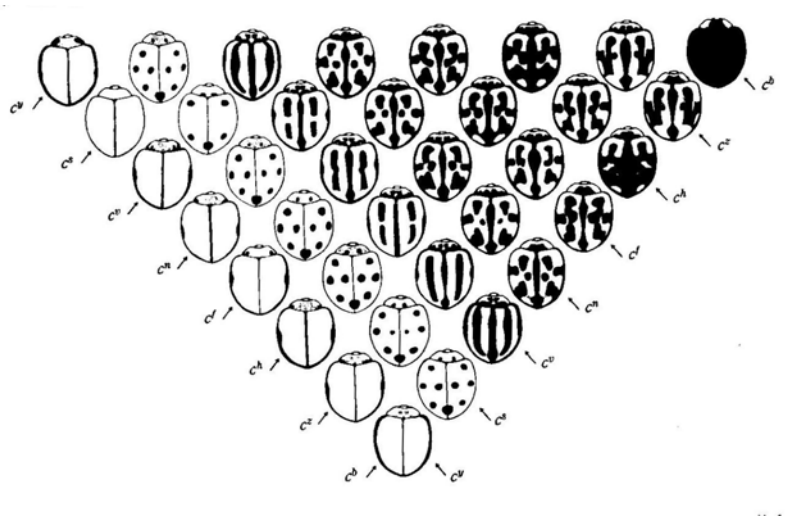
Life and death on a rose bush, Sydney, 9-11 September, 2009

Dinah Hales

We have a climbing rose – in autumn we cut it back heavily because it was blocking a path. Now, after an unseasonably warm end of August, it is busily shooting and most mornings when I have time, I'm out looking at the wildlife that are taking advantage of this food source. Every shoot is furred with the bodies of rose aphids (*Macrosiphum rosae*), stylets plugged in, bodies overlapping, tails wagging in the way happy aphids have. Both the green and the pink form are present, with the pink far outnumbering the green. The greens and the pinks are genetically determined, and because of the parthenogenetic reproduction of aphids, a pink mother will only have pink offspring. This isn't the case for all aphid species – some green aphids (like the peach-potato aphid, *Myzus persicae*, for example) produce pink individuals in stressed environments, while others, like the green sowthistle aphid *Hyperomyzus lactucae*, produce green female but pink male offspring. My colleagues in Tübingen showed that the pink rose aphids are somewhat resistant to endoparasitoid attack, as well as having other adaptive differences.

Looking at the rose aphids, I notice that they all look extremely healthy, with no sign of fungal attack or attack by wasp endoparasitoids. Hmmph, I think, the introduction of an aphidiid parasite (*Aphidius rosae*) with much fanfare in the 1990s doesn't seem to have been very successful. No wasps have made it to Beecroft[1]. But my condemnation was premature – there they are, the slim black aphidiids, much smaller in body mass than their prey, insinuating their way in among the aphids to lay a single egg in an early-instar host. Next week, if not before, those aphids will have been eaten up internally by larvae hatching from eggs, and their exoskeletons will have taken on the tough brown rounded shape of an aphid mummy. A little later still, we'll see holes in the mummies and the adult wasps will have emerged to seek out more hosts. Perhaps, though, my initial view was right – the wasps are too late to prevent stunting of the rose shoots. Have they nevertheless exerted selection pressure on past years of Sydney rose aphids, such that pink clones have increased relative to green ones?

Bright on the leaves and stems are scattered individuals and mating pairs of one of my favourite insects, the highly polymorphic ladybird *Coelophora inaequalis*. I can see at least three of the colour pattern genotypes elucidated by Ken Houston and me in the 1970s and 80s, following our independent observations of apparently interspecific matings of individuals with different elytral patterns[2]. We found that there existed at least 8 alleles for colour pattern, and Ken made the mental leap that clarified their relationship – they exhibit mosaic dominance, with the effect that offspring of a mating will show orange pigment wherever the homozygote of either inherited allele shows orange pigment, but will be black where both were black. In the figure below, homozygotes for each identified allele are along the top, while the appearance of the heterozygote between any two appears at the apex of the triangle between them (e.g. for the all-yellow one at the top left hand corner, crossed with the all black one at the top right-hand corner, the phenotype of the heterozygote is at the apex of the triangle between them, in this case the individual right at the bottom of the diagram).



Most of the ladybirds are deep orange in background colour, suggesting to me that they have overwintered somewhere – but where? We never found aggregations of this species, although we did of some others in NSW. The males are easy to recognise because of the white patterning on the head and prothorax, while the females have pale orange. Strangely, no eggs or larvae seem to be present yet. The aphids have the jump on these predators as well. It's generally agreed that the parasitic wasps are more likely to exert biological control than are more generalist predators. Watching the ladybirds hunt

is very frustrating. Despite the masses of aphids on the shoots, the ladybirds advance slowly up each stem, examining each rose leaflet, front and back, and often backtracking. I resist the opportunity to "help" them, and wonder whether I still have the papers by Tony Dixon and colleagues about ladybird searching behaviour. Can it be that they can't smell the aphids? If they can't, how do they find the hostplants? *C. inaequalis* is not the only ladybird species looking for a meal here. The small black slightly downy ladybird with the yellow prothoracic markings (*Diomus ementitor*) is here, and also a less commonly seen one (*Harmonia testudinaria*), larger than *Coelophora* and yellow with a pattern of lines dividing its elytra into somewhat rectangular areas. All these native ladybirds pig out on introduced aphids on introduced host plants and, not for the first time, I wonder how they got by before we brought them all this bounty. Native aphids are rare and limited in time and space – few species form the large colonies needed to support ladybird larvae. Psyllids are a possible alternative, but these ladybird species aren't usually found on psyllid-infested plants.

Apart from the aphids, the only other herbivore is a large well-camouflaged grasshopper. It has remained on the same small group of shoots for at least a week. A couple of younger individuals of (presumably) the same species are present on other parts of the plant. Ants are there as well, perhaps two species or else small and large workers of one. They are not directly soliciting aphid honeydew, but seem to be licking it up off the leaflets. Large free-living aphids like the rose aphid are not usually actively attended by ants.

Hovering nearby is a large syrphid, neatly striped in yellow and black. I can see the terminal abdominal segments telescoping in and out before she swoops in to lay first one, then another egg near an aphid colony. The ridged white eggs lie flat on the leaflet. Before too long the larva – a sticky-looking maggot – will emerge and start feeding, and will wreak havoc among the aphids. But here the hunter becomes the hunted – a wasp around 1 cm long is searching among the aphids. She darts in, curls her abdomen under and lays an egg. I can't see her target, but I've recognised her by her white-banded tibiae as *Diplazon laetatorius*, endoparasitoid of syrphid larvae (see http://nathistoc.bio.uci.edu/hymenopt/Diplazon.htm). Does she lay her egg in (or on) the syrphid egg or the young larva?? RR Askew[3] remarks that that Diplazontinae "sometimes (oviposit) in eggs" and that fits with what I'm seeing. I've seen at least three syrphid species hanging around so there should be plenty of prey. The wasp larva will hatch but remain in the first instar till its host pupates.

One more aphid predator makes its appearance later in the day. The brown lacewing, *Micromus* sp., flutters around the aphid colonies. The next few days may see some *Micromus* larvae tucking into the aphids.

17-18 September

Over the past week the large grasshopper has disappeared, though young ones are still present. A few new players have arrived on the scene – a single specimen of the large ladybird *Harmonia conformis*, and one of the small *Diomus notescens*. *C. inaequalis* is still the most numerous ladybird, but larvae and eggs are still not to be seen. Syrphid larvae, from recently hatched to almost fully grown, can be spotted here and there, as can black splotches where they have defecated. And as

predicted, some aphid mummies (only a few) are now present. As to the aphids, there are still thousands. For the first time (Duh!) I notice that they are all orientated "head-down" on the stems. Gravity or plant physiology? None of the shoots is growing downwards, but some are drooping or horizontal. The aphids maintain their position with heads towards the base of the shoots. Winged aphids are beginning to be more numerous. In aphids, crowding is the major factor inducing the production of winged offspring. Since the genotype of winged aphids in a lineage is exactly the same as that of their wingless sisters, this polyphenism must be controlled by gene switching, and is most likely a result of a cascade of sensory/neurohormonal and hormonal interactions with the genes. Juvenile hormone still sounds like a logical control factor and although doubt has been thrown on this, the evidence (either for or against) is not strong. Bruce Johnson (ex University of Tasmania) coined the phrase "two's a crowd" because the tactile interactions between as few as two aphids in an experimental arena are enough to stimulate the mothers to switch to producing winged offspring. Other signs of stress among the aphids on our rose bush are becoming apparent, too. Instead of staying plugged into the phloem, some of the wingless individuals are walking around. Some colonies seem to have been very much reduced by migration or predation – only the exuviae show where they used to be. For the first time I notice that some ants are carrying aphid exuviae. Another wasp, about the same size as *D. laetatorius*, is behaving like *D. laetatorius*, but lacks the white-banded legs and has an orange abdomen. I should have caught one to identify – the only other syrphid endoparasite I can find on the web is *Syrphophagus*, an encyrtid, and it's definitely not that. Maybe it was looking for something else entirely.

24-25 September

Phew! the week of the dust storm and accompanying high winds. The aphid colonies have crashed, but was it the weather, or predation and emigration? Or most likely, all three? My idea of collecting aphid mummies to check for hyperparasites (i.e. parasites of the aphidiids) has to be put aside, as there are few mummies and the wasps have already emerged. Some hungry looking ladybird and syrphid larvae are still about. Will I take them into care or let nature take its course? One shoot is still heavily populated with aphids. The syrphid and ladybird adults are still around. Some of the little roses have opened, and at least two species of native bees are collecting pollen (*Trigona* and something a bit bigger with orange bands on the abdomen).

1-2 October

A few new aphid colonies are forming, on previously uninfested shoots or among the exuviae on others. Maybe this will be enough to keep some ladybird larvae going. I collect half a dozen ladybird larvae, but lack of aphids and pressure of other business mean they go on short rations. One of them , moribund when collected, dies. I don't see any syrphid pupae. Did you know that experts can identify syrphid species from their pupae or pupal exuviae, from the detailed morphology of the spiracles?

In the next few days, the rains came, wiping out most of the new aphid colonies. This story is nearly over.

8-9 October

Yes, the story is over for now. A few adult *C.inaequalis* and a *Harmonia conformis*, plus a few hopeful syrphid flies, are still taking an interest, but there's nothing for them to eat. Of the ladybird larvae collected, one more (*H. testudinaria*) died of starvation, leaving two *C. inaequalis*, now pupae, and two *H. conformis* (still larvae, eating like teenagers). Despite the pyramid of predators and parasites, my guess is that almost the only group to mature and survive the population crash would be the emigrating rose aphids.

1 "In the early 1990s, scientists from the Waite Agricultural Research Institute at the University of Adelaide successfully introduced a tiny parasitic wasp from Italy, Aphidius rosae, as a biological control agent for the rose aphid. They first bred the wasp in large numbers in quarantine conditions to determine any unwanted, harmful side effects. They found that the wasp was specific to the rose aphid and attacked no other insects (including those that might be beneficial). It was released into the wild in Adelaide, and spread rapidly (over 40 km in one year). The wasps are now spreading successfully through eastern and south-eastern Australia, and were deliberately introduced into the rose garden at the Royal Botanic Gardens Sydney in 1996." From RBG website, http://www.rbgsyd.nsw.gov.au/plant_info/pests_diseases/fact_sheets/rose_aphids , accessed 10.ix.09.

2 Hales, D.F. 1976. Inheritance of striped elytral pattern in *Coelophora inaequalis* (F.) (Coleoptera: Coccinellidae). Aust. J. Zool. 24, 273-276; Hales, D.F. 1977. *Coelophora veranioides* Blackburn: a variety of *Coelophora inaequalis* (F.) (Coleoptera: Coccinellidae) Aust. ent. Mag. 3, 55-56; Houston, K.J. and Hales, D.F. 1980. Allelic frequencies and inheritance of colour pattern in *Coelophora inaequalis* (F.) (Coleoptera: Coccinellidae). Aust. J. Zool. 28, 669-677.

3 Askew, RR. 1971. *Parasitic Insects*. Heineman, London.

Bi-monthly Meetings

The Society meets **BI-MONTHLY** unless otherwise advertised. General meetings with a speaker will generally be held only on the "odd numbered" months (March, May, July, September, November) while the Council will meet more frequently. Speakers tentatively scheduled for the coming general meetings are shown below.

This timing allows us to alternate meetings with the Society for Insect Studies (SFIS) which meets at the Australian Museum at 7.30 on the second Tuesday of the "even numbered" months.

Future Events

Date	Speaker	Title
4 Nov, 2009 7.30 pm	Graham Nicholson, UTS	Probing spider venoms as sources of therapeutics and insecticides
28th November, 2009	Ted Taylor	Christmas Function
3 rd March 2010	AGM	AGM
Early 2010	Warrick Angus	Burrowing Bees

Venue:
Meeting Room 2
Ermington Community Centre
10 River Road Ermington

Meetings start at 7:30 p.m. (directly following the Council meeting)
Talks run for around 45 minutes, with 10 minutes for questions, followed by a light supper. Guests are most welcome.

Getting there:

By Car: From Victoria Rd turn into Spurway St (head towards Parramatta River). Turn right into Jackson St then left into River Rd. If heading north on Silverwater Rd, turn right into Victoria Rd then proceed as above. If heading south on Silverwater Rd take the Parramatta off ramp, cross Victoria Rd and proceed into River Rd. If you miss the off ramp, turn left into South St, then left into River Rd.

By Bus: Routes 525, 523 and L20 depart from Argyle St near Westfield shopping centre near Parramatta station. Routes 523 and L20 depart from West Ryde station. Get off at the Ermington shops. River Rd passes between the supermarket and the hotel.

SOCIETY POSTAL ADDRESS
C/- ENTOMOLOGY DEPARTMENT
THE AUSTRALIAN MUSEUM
6 COLLEGE STREET
SYDNEY NSW 2000

MEMBERSHIP FEES 2009

ORDINARY MEMBERS	$50
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STUDENT MEMBERS	$25
CORPORATE MEMBERS	$50