"Tidying up some loose ends....."

Dave Seldon [*1]

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Eligible for student prize

Mecodema (Carabidae: Broscini: Nothobroscina) is a hyper-diverse endemic New Zealand genus with species spread throughout the two main islands, as well as many offshore islands. Using specimens from a number of private and institutional collections, plus new specimens acquired by extensive pitfall trapping, we describe / redescribe the North Island *Mecodema* species. Species descriptions were composed using 126 morphological characters, which include external structures, as well as both male and female internal structures. There are four new combinations: *Mecodema antarctica* (*Brullea*), *Mecodema aberrans*, *Mecodema moniliferum* and *Mecodema tibiale* (*Metaglymma*); we synonymise *M. occiputale* under *M. curvidens*, and *M. sulcatum* under *M. oblongum*. We describe 25 new species, 13 of which are found in Northland and Auckland regions, while six are described from Hawke's Bay / East Cape regions. This research increases the total number of described *Mecodema* species to 103, and will give a modern taxonomic framework to complete the revision of the South Island species.

Phylogenetics of New Zealand weevils

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Folks may be familiar with New Zealand species like the Giraffe Weevil, *Lasiorhynchus barbicornis* Lacordaire (Brentidae), Spear Grass weevils (*Hadrampus* Broun) and a number of the strange cryptically coloured genera of Eugnomini. But these icons are just a small part of the New Zealand fauna, which contains approximately 1200 described species placed in 243 genera. There are many lesser-known groups that are equally attractive or bizarre that have not been fully revised or completely understudied. Sufficed to say, weevils require a hard taxonomic look so that their composition and phylogenetic relationships are better understood. One tiny litter dwelling weevil that's been bounced about is the enigmatic *Geochus* Broun, a genus that has been placed within several groups (Enteminae (Brachyderini), Cyclominae, Curculionini (Cryptoplini, Diabathrariini, Geochini, and Ramphini), and Molytinae (Cryptorhynchini, Phryxini)). We examine the phylogenetic relationships of New Zealand weevils based on COI and 28s from exemplars of most genera to determine their phylogenetic placements within a regional sampling as a backbone to further research leading to a full revision of the fauna.

Preliminary insights into the weevil fauna (Coleoptera: Curculionidae) of the Cook Islands

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The Cook Islands occupy an important geographic position in the South Pacific for evaluating biogeographic hypotheses. However, the insect fauna of this archipelago has received little attention, with only sporadic collections resulting in few publications. As part of an effort to document the weevil fauna of the islands, I visited four of the islands of the Southern group of the Cook Islands in March--May 2017: Rarotonga, Mitiaro, Atiu and Mangaia. Insects were primarily collected by beating and litter sampling, with other techniques such as pitfall traps and light sheets used sporadically. The collections obtained from this expedition have resulted in a total of 70 species of weevil. These were dominated by the Cossoninae, representing 21 species. Most species appear to have biogeographic connections with Tahiti or the Austral Islands, with little evidence for connections to Samoa or Niue.

Mealybugs in New Zealand vineyards: a case study of applied science working with and for the wine sector.

Vaughn Bell [*1], D. Maxwell Suckling [1], Tara Taylor [1], Lyn Cole [1], Andrew Twidle [2], Nicola Sullivan [1], Mano Sandanayaka [1], Gonzalo Avila [1], Asha Chhagan [1], Vicky Davis [1]

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In New Zealand vineyards, the citrophilus (*Pseudococcus calceolariae*) and longtailed (*P. longispinus*) mealybugs (Hemiptera: Pseudococcidae) are regarded as important insect pests. As well as contaminating grape bunches, both species transmit (vector) the economically damaging grapevine leafroll associated virus 3 (GLRaV-3). GLRaV-3 negatively alters vine yield and wine quality. With a worldwide distribution, GLRaV-3 is the most important and the most destructive viral disease in New Zealand vineyards. Thus, for a sector aiming to produce high quality wine, this vine/virus/vector association is economically unsustainable in the absence of a robust management plan. We present details of an integrated (multi-tactic) response that has reduced the influence of mealybugs and the spread of GLRaV-3. We also discuss research ideas developed with the sector that are ecologically sustainable and may support an integrated response in future: mealybug synthetic sex pheromones, the use of ground cover plants to separate mealybugs from grapevines, and mealybug biological control.

Management and control options for a newly invasive paropsine pest in New Zealand

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The Australian eucalypt defoliating beetle *Paropsisterna variicollis* (EVB – Eucalyptus Variegated Beetle) was detected in the Hawkes Bay in March 2016. It has since spread quickly to now inhabit much of the eastern and lower north island. Based on previous studies of paropsine beetles attacking eucalypts in Tasmania, this species is one of the worst the eucalypt growing industry here could have received. EVB damage has now been assessed twice in NZ Drylands Forest Initiative sites where 11 novel eucalypt species are being trialled for their potential in establishing a durable timber industry. Serious damage has been observed, particularly on *Eucalyptus bosistoana*, *E. tricarpa*, and *E. argophloia*. Although *E. camaldulensis* and *E. longifolia* sustained the greatest defoliation, this is being attributed to the Eucalyptus tortoise beetle, *Paropsis charybdis*. Also investigated was whether existing biological control agents present in NZ may be effective in controlling EVB. Unfortunately the only agent quantified, *Enoggera nassaui*, parasitised only 1-3% of EVB egg batches last summer, significantly less than the 75% parasitism it can achieve on *P. charybdis* eggs. Clearly, urgent alternative pest management solutions are needed. Research collaboration with international taxonomists has revealed that there is a specialist larval parasitoid in Australia that could be sufficiently host specific to consider for release in NZ. However, as the parasitoid is univoltine it will not be totally effective against the multiple generations that EVB undergoes in the field. Additional management options, including insecticidal applications in the short term, and breeding for resistant eucalypt genotypes in the long-term, will most likely be required.

Developing integrated pest management for durable eucalypt insect defoliators in dryland New Zealand

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Eligible for student prize

A durable eucalypt industry, which produces naturally durable wood products to replace chemical-treated pine wood products, is being developed in New Zealand. Eucalypt plantations in New Zealand are occupied by a number of exotic insect defoliators and have ongoing risks of new pest incursions. Integrated pest management (IPM) is vital to reduce risks of insect outbreaks and minimise pesticide use that has negative impacts on the environment. A three-year study on durable eucalypt insect defoliators in a dryland plantation has been conducted to, 1) investigate the population dynamics of key defoliators and model the phenology of the most important defoliator *Paropsis charybdis*, 2) assess the impact of insect defoliation on growth of *E. bosistoana*, and 3) detect the between and within eucalypt species variation in insect resistance and tolerance. Results show that 1) *P. charybdis* had one generation in the *E. bosistoana* plantation, and the degree-day model was capable to predict voltinism with appropriate assumptions, 2) moderate defoliation in spring did not significantly affect growth of *E. bosistoana*, and 3) there was significant variation in insect attack between and within durable eucalypt species. These findings can be integrated into an IPM strategy by facilitating effective pest monitoring and determining control thresholds to minimise pesticide use. Selecting insect resistant or tolerant species or families for future breeding will increase productivity by reducing insect outbreaks.

Effects of four fruit species on development of Queensland fruit fly larvae (*Bactrocera tryoni* Diptera: Tephritidae)

Samuel Brown [*1], Lisa Jamieson [1]

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The Queensland fruit fly *Bactrocera tryoni* (Froggatt, 1897) is an extremely serious pest of horticultural crops with a very broad host range. The development of Queensland fruit fly larvae on four fruit species--Dwarf Ducasse bananas, Jazz apples, SunGold kiwifruit and Hayward Green kiwifruit--was tracked over two weeks. Fruit were artificially infested with fruit fly eggs, and the fruit held at a constant 26 °C until fruit were assessed by dissection for the numbers of each larval life stage. Larval development was rapid and consistent in bananas, resulting in high numbers of pupae. Development was similarly rapid in both kiwifruit species, but was not as consistent and survival was much reduced. Additionally, SunGold kiwifruit showed a much reduced egg hatch rate, compared with the other fruits. Larval development was slowest in apples, with larvae still present in the fruit over three weeks after infestation. Survival in apples was highly variable, with some fruit showing high survivorship, while others suffered substantial mortality. Differences between fruit can be attributed to particular properties of the fruit species, including chemical and physical properties.

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Ecology of Mosquito Larvae in Urban Environments of Cairo Governorate, Egypt

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Eligible for student prize

The ecology of mosquito larvae was investigated over a 17-month period in two localities in Cairo representing different levels of urban planning: El-Muqattam (M, planned safe and planned unsafe) and Abu-Seir (A, unplanned unsafe). Sampling frames were obtained by using a geographic information system (GIS) to subdivide satellite images of the study areas. Thirty-seven water bodies in the selected grid cells (20 % of cells) were identified and characterized based on physical, chemical and biological parameters. Six mosquito species (Culex pipiens, Cx. perexiguus, Cx. pusillus, Ochlerotatus caspius, Anopheles multicolor and Culiseta longiareolata) were identified from the two localities. From these, the filarial vector Cx. pipiens was the most common species suggesting a threat of filarial transmission in the two localities specially (A) due to its adjacent to endemic areas. Of the different types of breeding habitats, cesspits (M) and drainage canals (A) were the most common; while springs (M) and drainage canals were the most productive type. Both Cx. pipiens and Cx. perexiguus breed all year round with peaks of abundance coincided with high temperatures. The association of the mosquito species with the physical, chemical and biological characteristics of their breeding habitats was examined. The occurrence of mosquito species did not relate to the occurrence of 13 algal taxa and 2 aquatic plants for most comparisons. The densities of both Cx. pipiens and Cx. perexiguus in the two localities were directly related to temperature, pH, DO and nitrite but indirectly related to the salinity and turbidity of the breeding water. These findings contribute to our understanding of the interactions between mosquito larvae and the biotic and abiotic components of the urban environment. This is important for planning a relevant and effective control programs. Some similarities and contrasts with mosquitoes in New Zealand are noted.

On the quest to locate an endemic chrysomelid species for host testing a potential biocontrol agent (*Eadya*) for the eucalyptus tortoise beetle (*Paropsis charybdis*)

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The endoparasitoid wasp *Eadya* sp. 3 (Braconidae) from Tasmania is being investigated as a potential biocontrol agent for the invasive eucalyptus tortoise beetle (*Paropsis charybdis*; Chrysomelidae). In order to elucidate the potential impact of this wasp on non-target species in New Zealand, we have been undertaking host testing trials with other pest species, beneficial weed biocontrol agents, and native species of chrysomelids at Scion's quaratine facility in Rotorua. Here we report on our expeditions to Kahurangi NP under DoC permit to locate a native chrysomelid species for host testing against *Eadya*. Our target species was either *Chalcolampa speculifera* or a large species of *Allocharis*. In December 2017, we located relatively large numbers of chrysomelid larvae feeding on the leaves of *Veronica albicans* in the Mt Arthur area. Adult specimens reared from these larvae were identified by Rich Leschen of Landcare reserach as *Allocharis* nr. *tarsalis*, and are likely to be an undescribed species. Subsequent searches in the Mt Peel region in January 2018 were also successful in finding what is likely to be the same species on a closely related *Veronica* species. These larvae are black in colour, and feed on the upper sides of leaves during the day. Their feeding damage is quite distinctive and resembles the larvae in shape and colour, which may function as camouflage against visual predators such as birds. Approximately 150 larvae were trasnported to Rotorua, where they were tested against *Eadya* in a series of trials. The outcomes of those trials are also briefly reported here.

Successful wetapunga recovery programme returns giants to Hauraki Gulf islands

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New Zealand's largest giant weta species, the wetapunga (*Deinacrida hetercantha*), was previously distributed throughout Northland and Auckland regions before undergoing a dramatic decline. Habitat loss and exotic predators resulted in a restricted distribution to just one relict population on Te Hauturu-o-Toi / Little Barrier Island. Wetapunga are flightless, nocturnal, arboreal and browse on a range of broadleaf tree and shrub species. To secure the species a recovery programme aimed to set up additional island populations in the Hauraki Gulf. However, field surveys revealed too few adults to facilitate direct translocations to new sites. Thus, only small numbers were collected to establish captive breeding populations at Butterfly Creek and Auckland Zoo to provide progeny for release. Research during captive rearing revealed a 2 - 3 year life cycle involving 11 instars. Reared wetapunga were released on Tiritiri Matangi Island and Motuora Island on 3 occasions during 2010 - 2015 at 3 separate sites on each island. Baited tracking tunnels and visual assessments have verified establishment on both islands.

Prevention of exotic pests of honey bees

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For the last twenty years New Zealand has been running a surveillance programme on the honey bee exotic pest and disease to provide an early warning of incursions and give assurance of country freedom for targeted organisms. Every year 350 high risk site samples and more than 300 export samples are collected from both North and South islands and tested in the Plant Health & Environment Laboratory and Animal Health Laboratory. The visual and microscopic examination and washing methods are applied for the detection of external mites and insects, the thoracic disc method for the detection of the tracheal mite (*Acarapis woodi*), and morphological and morphometric analysis for the detection of Africanised honey bee (*Apis mellifera scutellata*) and its hybrids. Recently real-time PCR assays have been developed for the detection of tracheal mite, small hive beetle (*Aethina tumida*) and Africanised honey bee. The assay for tracheal mite detected down to a 1% incidence level in bees and 1000 copies of the target DNA when using plasmid standards. It has been shown to be reliable when the standard thoracic disc method is used as a backup to screen bees where a positive signal is obtained. The assay for small hive beetle showed high specificity and sensitivity for detecting the beetle, with no cross-reaction with closely related species. A dual-target real-time PCR assay for the rapid identification of Africanised honeybee and its hybrids was optimised and validated against a range of internationally sourced test organisms. These assays provide robust protocols for the detection of target pest of honey bees. **Key words:** Surveillance; invasive; mites; pests; Africanised honey bee; small hive beetle; tracheal mite

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Microcosms, Mosquitos and Mites: The behaviour of a Platyseiinae Evans, 1957 mite from a fresh-water spring in Christchurch.

john clark [*1]

[1] none

All active instars of an unnamed species of Platyseiinae Evans, 1957 (Acari; Mesostigmata; Blattiscociidae) consumed freshly killed mosquito larvae in microcosms on a daily basis from February 5 - March 15. Early instar larval mosquitos were sometimes captured, killed and consumed by the mites. Other prey included crustaceans and nematodes. The mite could be placed in *Platyseius* Berlese, 1916, but has a broadly fused ventrianal and dorsal sheild. Aspects of the mite's taxonomy and biology, is presented in videos, illustrations and photos. Highlighted are the water-surface habits of the mite; its agility and the presence of a dorsal detritus mass. Mites used the short, sharp setae of the J, Z, S, R and JV series as a fork to lift detritus which was then moved forward onto the mite's dorsum with the 4th pair of legs. Mating rituals, social interactions and egg-laying were observed. The mite was collected in the Thistledown fresh-water springs Christchurch.

The advantages of mating once, many times or not at all: A study of facultative parthenogenesis in female *Clitarchus hookeri* (Phasmatodea)

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Eligible for student prize

Facultative parthenogenesis is a mode of reproduction whereby females can reproduce either sexually or asexually through parthenogenesis. Species that are known facultative parthenogens represent important models to explore the costs and benefits of different reproductive modes. Sexual and asexual reproduction can incur both relative costs and benefits. Moreover, the number of mates or of copulations can have direct and indirect effects on female fitness. This study investigates the relative costs and benefits of parthenogenesis, monoandry and polyandry in a New Zealand facultative parthenogenetic species, the common stick insect *Clitarchus hookeri*. The specific aims were to assess whether mating had an effect on survival and reproductive output. I compared female *C. hookeri* who mated once, three times or not at all. Overall, mating treatment had an effect on the lifespan of females and the average number of eggs laid. Furthermore, sex is costly for females. I found that parthenogenesis is a better mode of reproduction for female *C. hookeri*, in terms of survival and reproductive output. Parthenogenetic females lived longer and laid more eggs than females in other reproductive mode treatments. Out of the sexual treatments, polyandrous had a higher egg-laying rate and offspring viability. However, monoandrous females had a higher survival than polyandrous females. This study demonstrates that the advantages and costs of various reproductive modes greatly depends on the species, its ecological context and its life history strategy.

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Variation in ladybird (Coleoptera: Coccinellidae) activity and anti-predator behaviour

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Eligible for student prize

Traits associated with the establishment of populations of introduced species are a major focus of ecologists and conservation biologists. Species with greater levels of phenotypic variation are predicted to be more likely to establish in novel environments, but there is currently limited and conflicting evidence for this. Furthermore, there are very few studies that have investigated phenotypic variation in fitness related traits, to identify functionally important traits that influence the establishment of introduced populations. Variation in predator escape and avoidance behaviour is an important factor that facilitates the survival of introduced populations. Ladybird beetles (Coleoptera: Coccinellidae) are an excellent system to study the effect of phenotypic variation on establishment success as they are being introduced and established around the world as biological control agents and some of the introduced species are invasive. In this study, we compared variation in general activity and flight initiation distances of four ladybird species in a controlled setting. Video recordings of the activity of ladybirds were taken before and after a simulated predator approach. Videos were scored in R using ‘pathtrackR’ and analysed using generalised linear mixed effects models. We predicted that species with the widest geographic distribution have the greatest variation in escape behaviour as populations with high levels of variation in behaviour are expected to be more likely to establish in a new habitat compared to species with low levels of variation.

‘Multifaceted deception in the North Island lichen moth, Declana atronivea’.

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Eligible for student prize

Predation places significant selection pressures on prey taxa and many species have evolved various behavioural, chemical, and/or morphological defensive mechanisms in response to these pressures. While some mechanisms, such as secondary chemical defences and warning displays are important for post-detection survival, other defences, such as camouflage, allow prey to avoid detection or recognition in the first place. Camouflage can be achieved through several different mechanisms, including background matching, disruptive colouration, and masquerade. The former two encompass strategies that prevent detection: in background matching, the colouration and patterning of the animal are indistinguishable from the background, thereby allowing it to blend in and remain undetected by predators; conversely, disruptive colouration utilises high-contrast markings to obscure the animals outline, thereby preventing predators from detecting its true shape. Slightly removed from the former two is masquerade; rather than preventing detection, the purpose of masquerade is to inhibit recognition through misclassification as an object of no value. The North Island lichen moth, Declana atronivea, presents a fascinating system for investigating camouflage as a defensive mechanism. Not only do the adults possess forewing colouration and patterning that allows them to be disguised amongst lichen, but the caterpillars display two different behaviours that allow them to be misclassified as inedible objects: in one instance, the caterpillars can extend their rigid body to resemble a dead twig, and in the other, they can curl up and look like a bird dropping. These descriptions are based only on human observations however, and there is no current scientific evidence that validates the value of such traits as anti-predation strategies. I therefore aim to investigate the effective multi-faceted camouflage of this species using a combination of image analysis, predation experiments, behavioural observations, and computer modelling.

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Poisonous personalities: Does exposure to a vertebrate pesticide bait, brodifacoum, alter the behaviour of Wellington tree weta?

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Eligible for student prize

Vertebrate pesticide baits are commonly used in New Zealand to control introduced mammalian predators, primarily to protect endemic avian species. Consumption of these baits by non-target species including birds and invertebrates has been observed in a number of studies. In weta, an endemic orthopteran and known consumer of the bait, limited studies suggest that pesticides do not significantly affect mortality. However, no studies have investigated whether the baits alter behaviour of these insects. We tested whether consumption of a widely dispersed pesticide, brodifacoum, influences behavioural aspects of Wellington tree weta, *Hemideina crassidens*. A sample of 34 *H. crassidens* were collected from weta motels stationed in Wellington; 17 were placed in a control group, fed on a diet of apples, cat food and leaves, and 17 in a treatment group, fed on the same diet, supplemented with brodifacoum bait pellets. Using video recordings and Ethovision behavioural quantification software, differences in activity (distance travelled, velocity of movement and exploratory range), refuge-seeking behaviour (number and duration of refuge visits, and urgency to seek refuge), aggression (response to facial probe) and emergence (whether the weta has emerged from their refuge at three points of the day) between the two groups were measured. Behavioural assays were repeated at four evenly spaced intervals over fourty days in order to test for cumulative effects of bait exposure. We anticipate that our study will provide important insight into how pesticide baits might influence the natural behaviour of weta, as traits like activity, emergence and aggression undoubtedly influence foraging, mating, competitive interactions and anti-predator responses.

Better the devil you know: familiarity reduces contest aggression in spiders

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Animals fight over mates, social rank, food and territories. However, fighting takes energy and is dangerous. Therefore, we expect individuals to be less aggressive toward familiar than unfamiliar individuals as familiar individuals have established dominance rank. Many species follow this pattern of aggression (called the 'dear enemy effect'), with research effort concentrating on vertebrates. The dear enemy effect prevents unnecessary fighting but requires complex cognitive processes, including accurate risk assessment, individual recognition and memory. We decided to test the dear enemy effect in daddy long-legs spiders (*Pholcus phalangioides*) - highly aggressive spiders with small brains. We placed spiders into paired training boxes to familiarise for three days. The boxes allowed passive flow of chemical cues between the spiders, but no physical contact. On the fourth day, spiders were placed into either a 'familiar' or 'unfamiliar' contest treatment. Familiar spiders were placed in staged contests with their training partner. Unfamiliar spiders were placed in staged contests with a spider that they were not trained with. We filmed interactions for one hour and checked spiders for cannibalism and position the following morning. Familiarity had no effect on whether or not a contest occurred, but contests were more violent between unfamiliar individuals. This indicates that spiders are capable of complex cognitive processing to reduce the risk of injury, or death, during contests.

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'pathtrackr': an R package for video tracking and analysing animal movement

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Techniques for visualising and analysing animal movement patterns are widely used in behavioural studies. While commercial options exist for analysing animal movement via video, the cost of these is often prohibitive. To meet the need for an efficient and cost-effective video tracking and analysis tool, we have developed the 'pathtrackr' package for the open-source programming environment R. The 'pathtrackr' package allows for an automated and consolidated workflow, from video input to statistical output, of an animal's movement. The tracking functions work across a variety of visual contexts, including heterogenous backgrounds and variable lighting, can deal with localised background movement, and do not need training like many other solutions. We also include diagnostic tools in the package for troubleshooting. Future updates will include the ability to track multiple animals simultaneously. In this talk we will demonstrate the practical applications of 'pathtrackr'. Version 1.2.2 of the 'pathtrackr' package is available on github (https://github.com/aharmer/pathtrackr).

Artificially-reared honey bee larvae express a normal behavioural repertoire as adults

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Cooperative behaviours observed in social insects are often regarded as simple instinctual responses to positive and negative feedback. However, learning and cognition have been demonstrated in some behaviours within eusocial colonies. We have utilized the dramatic differences in environment between natural and artificial rearing systems of honey bee, *Apis mellifera* L., larvae to explore the extent to which developmental environment may affect adult honey bee behaviour. During natural development in a hive, honey bee larvae interact extensively with nurse bees, whereas social interactions are almost eliminated when honey bee larvae are reared artificially in the laboratory. Naturally- and artificially-reared adult honey bees were introduced into an observation hive and observed twice daily for 28 days. Artificially-reared bees engaged in every behaviour in which naturally-reared bees engaged including: attending the queen, ventilation, guarding, attending a waggle dance, performing a waggle dance, and foraging. These observations highlight that artificially-reared bees are capable of preforming a myriad of honey bee behaviours. Additionally, there was not a detectable effect of rearing environment on the mean age at which bees were observed conducting specific age related behaviours, suggesting that artificially reared bees are responding appropriately to colony level cues that coordinate task allocation within age-related polyethism. However, we did observe a statistically detectable reduction in lifespan of bees that were reared artificially compared to bees that had been reared naturally. Our results indicate that rearing environment may not have pronounced impact on the likelihood that adult bees will perform a task. However, we only detected execution of each task and did not assess the quality of that task execution. Furthermore, these data do not address questions regarding collective behaviours that emerge at the colony level such as brood and/or honey production, swarming, or nest construction.

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Climate Change and New Zealand's Alpine Grasshoppers (Orthoptera: Acrididae)

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Eligible for student prize

Rapid anthropogenic climate change has stimulated interest in climate and the impacts it will have on biodiversity around the globe. Many types of biological outcomes are indicated, including local adaptation and extinction, but on steep environmental gradients population responses are most readily detected. One such system exists among the New Zealand alpine fauna. Among insects, many lineages independently evolved in response to particular local climatic conditions on mountains, and the elevational gradient means that habitat availability and connectivity changes quickly as global climate changes. The specialised New Zealand alpine fauna includes >13 species of short-horn grasshoppers (Orthoptera: Acrididae), that provide an opportunity to explore evolution in light of global changes in climate. By investigating when these species lineages diverged, their ancestral relatives, population genetic structure and the ecological niche space they inhabit, we can infer how these species have responded to past climate events, and in turn predict how they will respond to future climate change.

Directional selection on body size but no apparent survival cost to being large in New Zealand giraffe weevils

Rebecca Le Grice [*1], Gabriela Tezanos-Pinto [2], Pierre de Villemereuil [1], Greg Holwell [1], Christina Painting [1]

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Eligible for student prize

To reproduce is the ultimate aim for an individual during their lifespan. When an individual's reproductive success relies on winning fights to secure mating opportunities, larger body size and weaponry are typically advantageous. However, sexual selection can be extremely complex, and over an animal's life history the opportunity to reproduce is influenced by many different elements including environmental conditions, competition, and lifespan. In this study we investigated a wild population of giraffe weevils (*Lasiorhynchus barbicornis*) which exhibit enormous intra and intersexual size variation. In addition, males bear an elongated rostrum used as a weapon to fight other males for access to females. However, males also employ alternative reproductive tactics where smaller males will choose to try and mate with females using sneaking behaviour rather than fighting. We investigated sexual selection in a wild population by tracking individual males and females daily over two 30-day periods to measure long-term mating success. Using capture-mark-recapture analyses we also assessed how both survival and recapture probabilities vary with sex and body size for giraffe weevils using longitudinal datasets collected over three breeding seasons at coarse (weekly) and fine (daily) sampling intervals. Finally, we considered whether there was any evidence for size assortative mating. Our overall findings provide evidence for direction selection on body size in both sexes. Most interestingly, we found no apparent survival trade-off to greater body size. Larger males mate more often and have a higher survival probability, suggesting an accumulation of mating success benefits to bigger individuals. Finally, we found evidence of size assortative mating. All males choose to mate with bigger and probably more fecund females, but larger and more competitive males mate with larger females more often, furthering their potential reproductive success.

President's Address

Greg Holwell [*1]

[1] University of Auckland

I will be discussing some reflections on the conference and the society

Physiological Costs of Bearing Weaponry in New Zealand Harvestmen (Arachnida, Opiliones)

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Eligible for student prize

Across animal taxa, many males brandish exaggerated structures which are used in male-male competition to secure access to mates. Within a single species, male weapons may exhibit variation in size and shape. To explain the evolution and maintenance of weapon polymorphism, studies have focused on exploring the morphological and behavioural fitness costs and compensatory traits that allow males to bear the most extreme weapons, yet few have attempted to quantify the costs of bearing exaggerated weaponry utilizing a physiological approach. We predicted that differences in metabolic processes (indicating aerobic or anaerobic respiration) would reflect morphological differences and accompanying behavioural strategies (fighting style). Males of the harvestmen *Forsteropsalis pureora* bear exaggerated chelicerae which vary in size and shape, forming three discrete morphs. Using this uniquely trimorphic species, we tested for differences between male morphs using multiple physiological approaches. A combination of respirometry, assays of metabolic enzyme activity, and treadmill performance have provided insight into the relative physiological costs involved with bearing extreme weapons. Our comprehensive approach reveals physiological costs of bearing weaponry rarely considered in the pursuit to understand the evolution of exaggerated structures.

Invertebrate Monitoring Relating to Predator Control: A Citizen Science Project at Ark in the Park, Auckland.

Don Morrison [*1]

[1] Ark in the Park

Ark in the Park is a conservation and restoration project between Forest & Bird, and the Auckland Council to restore a unique piece of New Zealand rainforest at Cascade Kauri Park, Waitakere Ranges, Auckland. A five-year citizen science project aimed to investigate whether rat control is having a positive effect on the abundance of invertebrates within the park. The research was carried out by a group of conservation project volunteers based at the Ark in the Park in the Waitakere Ranges, and supported by Grace Hall (Landcare Research) and David Seldon (Auckland University).It consisted of counting some easily identifiable invertebrate taxa (e.g., Mecodema, beetles, spiders and weta), which were collected three times a year from 72 pitfall traps. Half of pitfall traps were located within the predator-controlled area, and the other half were in similar locations without predator control. Results have showed that there is no significant link between predator control and invertebrate abundance as measured by this monitoring programme. All samples have been stored at Landcare Research, Auckland and are available for further research.

Bee aware of what is in your neighbourhood: Resin Bee, *Megachile ustulata* (Hymenoptera: Megachilidae), in Whanganui

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The Ministry for Primary Industries (MPI) were notified of a suspect exotic bee found in Whanganui on 10 January 2018. MPI's Plant Health and Environment Laboratory identified the bee as *Megachile ustulata* (Hymenoptera: Megachilidae). *M. ustulata* is a species of resin bee native to Australia and little is known about the biology of this bee. Five specimens have been found by the notifier. However, it was not known if a locally established population exists or if these individuals arrived in an isolated incident. The details of the MPI investigation is discussed here.

The natural history of tree wētā and diversity of New Zealand cave wētā

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New Zealand tree wētā *Hemideina* spp. are a common and abundant part of our forest and urban ecosystems. They provide food for numerous insectivores and as arboreal omnivores they eat our forests. Using studies of the Wellington tree wētā *H. crassidens* we now have basic knowledge of their diet, behaviour and life history. Highlights of their natural history will be presented. In contrast, the diversity of New Zealand Rhaphidophoridae is very poorly documented. We have begun to understand the weaknesses of the current taxonomy and the level of species diversity that exists. A radiation of elaborate male reproductive structures suggests sexual selection and reproductive isolation have combined to produce many species rapidly. I will illustrate evidence for this radiation with preliminary genetic data and photos of novel secondary sexual structures.

Exploring tools for use in the management of threatened grasshoppers

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Brachaspis robustus is a national endangered grasshopper restricted to the braided rivers and associated river terraces of the Mackenzie Basin, South Island, New Zealand. Since 2015, research has been undertaken to develop tools and actions to facilitate the grasshopper's conservation, which can ideally be adapted to benefit conservation of other threatened insect species in the future. Details of the species biology and ecology have been assessed to determine requirements for captive rearing, translocation and mitigating threats. A translocation method has been devised and successfully trialled. Biologically meaningful methods for monitoring population size and change over time have been developed, and in 2017 these were implemented in a pilot trial across the distribution of the grasshopper. To conserve the species in its current range, or in new sites from which threats have been removed, an understanding of how the grasshoppers utilise and move through their environment is also necessary. Here we present two methods trialled to track grasshopper movement in the wild; traditional radio telemetry with transmitters, and tracking with RFID (radio-frequency identification) tags. Forty-six grasshoppers were tracked between October 2017 and February 2018. We compare the success of each tracking method, their pros and cons as conservation tools and the data each was able to provide.

Update on the status of the Giant Willow Aphid, *Tuberolachus salignus* (Gmelin) in the Gisborne - East Coast area.

John McLean [*1]

[1] ApiNZ Science and Research Focus Group

The Giant Willow Aphid (GWA) populations have been monitored monthly on a group of 20 willow trees in the Matokitoki Valley since the last conference. Special attention has been given to monthly sticky band captures of various life stages on two of the trees. In addition, patterns of GWA movements have been observed, especially around fence lines. We have a new insect visitor on our willows in recent months which will be described.

A Tour of New Zealand’s weird and wonderful Diptera and their Scientists

Julia Kasper [*1]

[1] Te Papa

If people hear “New Zealand” and “flies”, 90% would think “Bugger, this summer the sand flies were really bad!” (Some would even go “I need to go fly fishing with ma mates again.”) Though very interesting, Simuliidae (and handcrafted midge hooks) are definitely not all New Zealand has to offer when it comes to Diptera. Often disfavoured, many fly species are indeed a nuisance, as their larvae feed on crops or plant roots, others feed on blood or poo and may transmit nasty diseases. On the other hand it is often ignored that Diptera are very important pollinators and a healthy ecosystem cannot be imagined without them. Besides, flies have the most amazing life histories and shapes, especially in New Zealand, and many species are ideal candidates for biocontrol. Diptera have their place in Maori mythology and entomologists have collected, described and studied them since the Endeavour’s arrival in New Zealand. Their extraordinary work shall be acknowledged in this presentation. Nevertheless, there are so many gaps in our knowledge about endemic species, so our increasing workload in the fields of biosecurity and conservation is sometimes overwhelming. In other words there is heaps to do and wonderful research projects are waiting. Let’s roll up the sleeves!

Refuge or opportunity? Mosquitoes in some forest remnants: Bushy Park (Wanganui) and Keebles Bush, Himatangi Bush, Round Bush (Manawatu).

Mary McIntyre [*1]

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Lowland forest in the Whanganui-Manawatu area is largely reduced to small remnant patches on farmland. A survey of mosquito species at the Bushy Park Sanctuary, was initially undertaken as part of a 'BioBlitz' in Feb & Mar 2016 then repeated in 2017. Findings are compared with similar surveys using the same methods (overnight CO2-baited light trapping, ovipots) & seasonal time-frame (Feb-Mar) at three Manawatu remnant sites (Keebles Bush, Himatangi Bush, Round Bush) in 2010. Trapping counts at Bushy Park were low (max/trap.night 7 c.f. Manawatu sites 210) in both years, despite mild humid conditions. Two endemic species were dominant all sites and up to three others present but there is evidence of decline or benefit from habitat fragmentation according to species. Two widespread introduced species were also present, typically near the forest edge. Notable at all sites was occurrence of the Australian species, *Aedes notoscriptus* around visitor entry areas. Exclusion of pest mammals by a perimeter fence at Bushy Park may also have some influence, since these night active hosts are not available inside the sanctuary. Furthermore, the fence, as intended, has greatly enhanced forest bird populations of both local and translocated indigenous species. The presence of both the bird-biting introduced mosquito vector, *Culex quinquefasciatus* & endemic co-vector *Culex pervigilans* of the recently introduced avian malaria parasite and avian pox virus highlight a need for vigilance. Apparent absence of the endemic swampland *Coquilletidia* spp from Bushy Park may relate to relatively recent restoration of the wetland area from farmland. A perspective on fragmentation effects is provided by recent survey data from two large old growth forest sites (Totara Reserve - Manawatu, Wainuiomata Water Catchment - Rimutaka).