Terrestrial invertebrate biosystematics research and events at the New Zealand Arthropod Collection (NZAC), Auckland

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Welcome to *NZAC News.* This electronic newsletter appears 3 times a year, with the purpose of highlighting recent biosystematics research and publications on terrestrial invertebrates at NZAC, and NZAC activities.

Armoured scale insects (Diaspididae) of New Zealand

The adult females of all 49 species of Diaspididae (Hemiptera: Coccoidea) known from New Zealand, except the tribe Leucaspidini, are described and illustrated in **Rosa Henderson**'s *Fauna of New Zealand 66* monograph published 23 May 2011. The 1st- and 2nd-instar nymphs of all the endemic species and of 4 Australian species that are of systematic interest are also described and illustrated.

The armoured scale insect family Diaspididae is one of ten families of plant-sucking scale insects present in New Zealand. Unlike members of those other nine families, armoured scale insects do not produce the sugary exudate known as honeydew, and so they are not directly associated with the growth of sooty mould fungi in their habitat, nor do they support honeydew feeders such as birds, geckos, bees, and wasps in natural ecosystems. The reason for this lack of honeydew production is the first unique feature of the family – the stomach of armoured scale insects is not directly connected to the hind gut. They avoid the problem of dealing with large volumes of liquid from phloem sap by feeding instead on plant cells or parenchyma.

The second unique feature of the family is their armour or scale cover, in which they incorporate the cast skins of their juvenile moults, cemented together with waxes from various wax-producing ducts and pores.

The third unique feature is the fused segments of the posterior part of the abdomen called the pygidium; this has special lobes on the margin that are said to act like trowels and often also brush-like appendages, that help spread the waxes when the insect twists and turns during scale cover construction. Having a strong protective cover is important because armoured scale insects are legless and sedentary, except for the first crawler stage and the tiny adult males that only live for a few days.

The native (endemic) species are found only on native host plants and none are of economic importance or do any serious damage. Some of the endemic scale insects are quite host specific, for example, the two *Anoplaspis* species found only on rata and pohutukawa (*Metrosideros*), and leptocarpus scale found only on oioi (jointed wire rush). Among others with wider host ranges, *Poliaspis* and *Symeria* are perhaps the most species-rich genera. Oddly, while there are no records of armoured scale insects on southern beech (*Nothofagus*), felt scale insects (eriococcids) in contrast show a remarkable diversification there. Nearly all the endemic armoured scale species belong to the subfamily Diaspidinae, and there is just one species in the other subfamily Aspidiotinae, which is surprising compared with the many more aspidiotine members of the introduced fauna.

Asiatic rose scale, *Aulacaspis rosarum*, adult females, female and male 2nd-instar nymphs.

Fern scale, *Fusilaspis phymatodidis*, adult females on *Dicksonia*.

Introduced or adventive species arrived accidentally on plants brought by the first European settlers, and by 1879 six species, including greedy scale, oleander scale, and rose scale had established. Since then the adventive species total has reached twenty-one, plus eight Australasian species. A few species still manage to breach the border – most recently zamia (cycad) scale in 2004 and minute cypress scale in 2009. Some of

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the adventive species are cosmopolitan pests and can be problematic, mainly in citrus, apple, pear, and kiwifruit orchards. Only four of them have invaded natural ecosystems but they seem to do little damage there.

Funding: MSI (Ministry of Science and Innovation "Defining New Zealand's Land Biota")

Henderson, R. C. 2011. Diaspididae (Insecta: Hemiptera: Coccoidea). *Fauna of New Zealand 66*, 275 pages. http://www.landcareresearch.co.nz/research/biosystematics/invertebrates/faunaofnz/Extracts/FNZ66/FNZ66ind.asp

Website Images of New Zealand weevil genera now available

The New Zealand weevil fauna contains about 1500 described species in some 300 genera placed in 5 families, with Curculionidae being the largest family. There are few taxonomic treatments available for New Zealand weevils, and reliable identification for many groups can only be made by tapping into a social network of retired and overseas specialists or by comparing specimens to those that have been authoritatively identified in collections.

To facilitate identification of our weevils, and also promote the study of this fascinating group of beetles, this new website by **Rich Leschen**, **Birgit Rhode**, and **Leonie Clunie** provides a searchable database of images for representatives of 276 of our genera with dorsal and lateral views for most genera. In morphological or species-rich genera a single representative may not allow for the exact determination of a weevil to genus, so in the future they plan to add additional images.

Weevils are the epitome of insect dominance of terrestrial habitats, with most species that are plant feeding being exclusive to one or a few plant hosts. Many anthribids are fungus or fungusy-wood feeders, whereas platypodines and scolytines inoculate their plant hosts with fungus upon which the larvae develop. Many groups specialise on above-ground plant parts, but there are notable groups in New Zealand that feed on roots or the fallen leaves that accumulate as leaf litter on the forest floor.

Weevils are a significant group of herbivores and their tight relationships with some plants make them vulnerable to extinction: already some of our large-bodied forms are gone, threatened, or confined to refuges on offshore islands. Weevils chew, bore, munch, crunch, and destroy crops, seeds, and trees, sometimes to a devastating degree. They are key pests in forestry and agriculture and also attack many ornamental trees, shrubs, and herbs. No herb is a match for many weevil species, and they seem to overcome many plant defences with great success. Some major pests have already made it to New Zealand, but others that are of biosecurity importance may arrive in the future. On the other hand, some weevils are important biocontrol agents, and have been used in both terrestrial and aquatic ecosystems to control weeds.

The hyperdiversity of weevils together with their immense variety of morphological forms, fascinating associations with plants, and generally restricted natural habitats evoke endless debate about their evolution and ecology. The biological success of weevils may have been facilitated by the presence of a rostrum, which in most species the female uses to bore into the host plant prior to laying her eggs in the hole or incision. Other scientists claim that it is their association with angiosperms over

Curculionid *Postacalles rangirua* Lyal. (Lyal 1993 *Fauna N.Z. 29*: 121).

Anthribid *Gynarchaeus ornatus* (Sharp). (Holloway 1982 *Fauna N.Z. 3*: 40).

millions of years that made weevils species-rich. The answers to pivotal questions of weevil hyperdiversity may be found within the "ancient" New Zealand forests, where podocarp or southern beech dominate many areas.

One hindrance to studying the natural history of New Zealand weevils is that many are unnamed, some have been placed in unnatural generic groupings, and some have even been described repeatedly in the literature. Weevil specialists need to study specimens kept in museum collections around the world in order to stabilise their taxonomic names. The vast number of species that have been named must be verified by careful scrutiny of literature and assessment of external and internal characters. This is still required even for some economically important species that may appear to be well-known.

Funding: TFBIS (Project 226) and MSI (Ministry of Science and Innovation "Defining New Zealand's Land Biota")

Leschen, R.A.B., Rhode, B.E., Clunie, L. 2011 (and updates): New Zealand Weevil Images. weevils.landcareresearch.co.nz

2010 Best Paper Award from Entomological Society of Japan

Rich Leschen shared with Vasily Grebennikov the 2010 Entomological Society of Japan Best Paper Award for their paper published in *Entomological Science.* Their paper reviewed the occurrence of external cavities in beetles and their purported function as mycangia (to carry spores or conidia to facilitate fungal dispersal).

Although exoskeletal pits had been previously reported in about 20 beetle families, and a mycangial function attributed to them in these families, a critical reassessment of the evidence showed that only 2 families had adequately documented evidence for species with functional external exosleletal mycangia. A further 4 families were considered as having one or more species that may have functional mycangia. Exoskeletal pits that were not mycangia but of uncertain function were reported for an additional 18 beetle families.

Funding: MSI (Ministry of Science and Innovation "Defining New Zealand's Land Biota") in part for RABL.

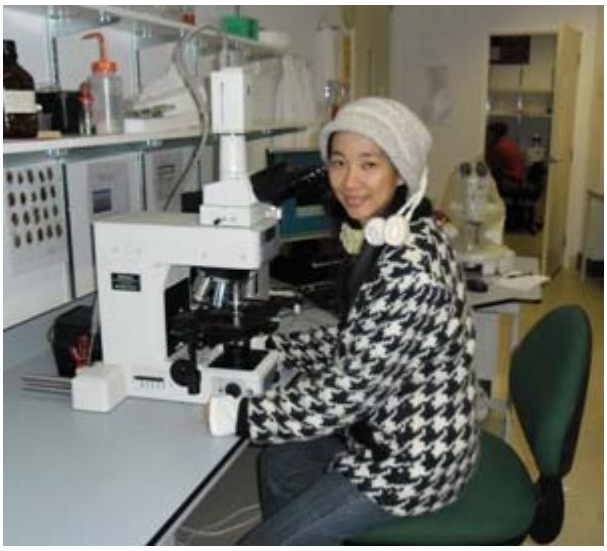
Grebennikov, V. V.; Leschen, R. A. B. 2010. External exoskeletal cavities in beetles (Insecta: Coleoptera) and their possible mycangial functions. *Entomological Science 13*: 81-98.

Specialist stored product mite training for ASEAN visitors

At the end of July two ASEAN scientists arrived in Auckland for 3-weeks specialist training on stored product mites with **Zhi-Qiang Zhang**. **Ploychompoo Konvipasruang** came from Thailand and **Siti Nur Hanani Zainol** came from Malaysia. Both are emerging scientists who have begun to specialise in mites, and which contain pest species that are notoriously difficult to identify. The short-term attachment to New Zealand was to enable them to develop their diagnostic skills and confidence in advanced slide preparation, using specialist diagnostic keys and interference microscopy, and in preparing protocols or reports suitable for peer review. It was also an opportunity to establish networks with New Zealand specialists at Landcare Research and MAF Biosecurity N.Z.

ASEAN is the Association of Southeast Asian Nations: Brunei Darussalam, Burma (Myanmar), Cambodia, Indonesia, Laos, Malaysia, The Philippines, Singapore, Thailand, and Vietnam. The ASEAN Regional Diagnostic Network Project comes under the ASEAN–Australia–New Zealand Free Trade Agreement; the Economic Cooperation Work Program is an AusAID-funded, $20–25 million, five year, regional programme that provides a framework for trade- and investment-related cooperation.

Funding: AusAID.



Ploychompoo at the interference microscope

Zhi-Qiang explaining techiques to Hanani

Recent and Coming Events

Trevor Crosby attended the "Regional workshop for the review of draft International Standards for Phytosanitary Measures (ISPMs) and Capacity Strengthening Planning" held 5–9 September 2011 in Nadi, Fiji. The workshop was organised by the Secretariat of the Pacific Community (SPC), Suva in association with the Department of Agriculture, Fisheries, and Forestry (DAFF), Australia. A senior biosecurity or quarantine official represented each of the 16 Pacific Island Countries and Territories attending this workshop.

Rich Leschen was in China 18–30 August for a 10-day beetle classification workshop sponsored by the Institute of Zoology, Academy of Sciences in Beijing. Rich was one of 3 lecturers, teaching a class of 40 students who were hard-working and enthusiastic. Everyone had a great time!

Zhi-Qiang Zhang attended the Encyclopaedia of Life meeting on Cybertaxonomy at the Biodiversity Synthesis Centre, Field Museum of Natural History, Chicago (31 May–2 June). This meeting targeted both already published taxonomic literature (retrospective) and to-be-published taxonomic articles (proactive) in order to extract taxonomic content (e.g., species descriptions and re-descriptions, diagnoses, and material examined) and automatically provide it to the EOL. Several journal editors attended the meeting that will now implement some of the cybertaxonomic tools developed primarily by Plazi and collaborators in order to provide XML-based output of taxonomic content automatically to the EOL. As Chief Editor Zhi-Qiang represented the largest zoological taxonomic journal *Zootaxa*, which previously provided only small proportions of its contents (i.e., papers on fishes and ants bfore 2008) to cybertaxonomic databases. The meeting facilitated the collaboration between Plazi and *Zootaxa* to

make relatively small adjustments to its publishing workflow that could potentially generate lots of content for the EOL in the future.

At the end of August 2011, Dr **Eric Palevsky** (acarologist of Newe-Ya'ar Research Center, Agricultural Research Organization, Ministry of Agriculture, P.O. Box 1021, Ramat Yishay 30095, Israel) completed a one-year sabbatical leave at NZAC, where he collaborated with **Zhi-Qiang Zhang** on a number of acarological projects. Eric was a major contributor to the set-up and running of the new desktop SEM at NZAC. A large number of images of mite ultrastructure from the SEM will form the basis for a joint paper on the functional morphology of mouthparts in phytoseiid mites.

From 31 May–6 June **Trevor Crosby** was in Brunei to continue the project on rehabilitation of the Brunei Agricultural Research Centre (BARC) insect collection (see *NZAC News 6*). With the BARC entomologists he visited the entomological collections at Brunei Museum and the University of Brunei Darussalam. In October he will provide further training at BARC.

Four staff (**Robert Hoare**, **Zhi-Qiang Zhang**, **Grace Hall**, and **Darren Ward**) and two associated students (**Shelley Myers** and **Christina Painting**) attended the 3rd Combined Australian and New Zealand Entomological Societies Conference at Lincoln University (28 August–1 September). **Trevor Crosby** was co-author on a presentation updating the audience on the revision of the *Austrosimulium* black flies led by **Douglas Craig** (University of Alberta). **Zhi-Qiang Zhang** gave a presentation entitled "Australasian contributions to systematic entomology: a decade of *Zootaxa*". **Robert Hoare** presented on his research into the classification of New Zealand Noctuidae "The blue-rinse moth with the secret inflatable hair-drier, the star-spangled can-opener and other wonders of the wainscot world". **Darren Ward** was a co-author on a talk reviewing diversity of New Zealand parasitic wasps titled "Parasitic wasps of the Proctotrupoidea, Platygastroidea and Ceraphronoidea in New Zealand: review and analysis". PhD student **Christina Painting**, co-supervised by **Thomas Buckley** and **Robert Hoare** won best student talk prize for her presentation on "Sneaking versus fighting: alternative reproductive tactics in the New Zealand giraffe weevil (*Lasiorhynchus barbicornis*)". **Shelley Myers**, a PhD student based in the NZAC and supervised by **Thomas Buckley** also presented on her research looking at behaviour, morphology, genetics, and hybridisation in the stick insect genus *Clitarchus*. The Wine & Cheese evening was sponsored by Landcare Research on behalf of the Invertebrate Biosystematics Group.

Pham Quang Huy has just submitted his M.Sc. thesis in Biosecurity and Conservation on "Response of fruit fly populations to new management tools in mango orchards in Tien Giang Province, Viet Nam", co-supervised by **Jacqueline Beggs** (The University of Auckland) and **Trevor Crosby**.

Publications

This section includes recent publications by staff associated with NZAC, or publications by other researchers using NZAC specimens or expertise of NZAC staff.

Burckhardt, D.; Bochud, E.; Damgaard, J.; Gibbs, G. W.; Hartung, V.; Larivière, M.-C.; Wyniger, D.; Zürcher, I. 2011. A review of the moss bug genus *Xenophyes* (Hemiptera: Coleorrhyncha: Peloridiidae) from New Zealand: systematics and biogeography. *Zootaxa 2923*: 1–26.

Dubois, A.; Minelli, A.; Zhang, Z.-Q. 2011. Recommendations about nomenclature for papers submitted to *Zootaxa. Zootaxa 2943*: 58–62.

Fernandez-Triana, J. L.; Ward, D. F.; Whitfield, J. B. 2011. *Kiwigaster* gen. nov. (Hymenoptera: Braconidae) from New Zealand: the first Microgastrinae with sexual dimorphism in number of antennal segments. *Zootaxa 2932*: 24–32.

Kadowaki, K.; Leschen, R. A. B.; Beggs, J. R. 2011. No evidence for a *Ganoderma* spore dispersal mutualism in an obligate spore-feeding beetle *Zearagytodes maculifer. Fungal Biology 115(8)*: 768–774.

Kadowaki, K.; Leschen, R. A. B.; Beggs, J. R. 2011. Competition–colonization dynamics of spore-feeding beetles on the long-lived bracket fungi *Ganoderma* in New Zealand native forest. *Oikos 120(5)*: 776–786.

Kadowaki, K.; Leschen, R. A. B.; Beggs, J. R. 2011. Spore consumption and life history of *Zearagytodes maculifer* (Broun) (Coleoptera: Leiodidae) on *Ganoderma,* its fungal host. *New Zealand Journal of Ecology 35(1)*: 61–68.

Kean, J. M.; Vink, C. J.; Till, C.; Crosby, T. K.; Marris, J. W. M.; Fagan, L. 2011. Real-time remote diagnostics for ecology: Wheeler *et al.*'s vision realized. *Frontiers in Ecology and the Environment* 2011; doi:10.1890/110065.

Kuschel, G.; Leschen, R. A. B. 2011. Phylogeny and taxonomy of the Rhinorhynchinae (Coleoptera: Nemonychidae)**.** *Invertebrate Systematics 24(6)*: 573–615.

Leschen, R. A. B. 2011. World review of *Laricobius* (Coleoptera: Derodontidae). *Zootaxa 2908*: 1–44.

Mathis, W. N.; Sueyoshi, M. 2011. New species of the genus *Cyamops* Melander from New Zealand (Diptera, Periscelididae, Stenomicrinae). *ZooKeys 114*: 29–40.

Montgomery, M. E.; Shiyake, S.; Havill, N. P.; Leschen, R. A. B. 2011. A new species of *Laricobius* (Coleoptera: Derodontidae) from Japan with phylogeny and a key for native and introduced congeners in North America. *Annals of the Entomological Society of America 104(3)*: 389-401.

Seldon, D. S.; Leschen, R. A. B. 2011. Revision of the *Mecodema curvidens* species group (Coleoptera: Carabidae: Broscini). *Zootaxa 2829*: 1–45.

Shaw, S.; Speare, R.; Lynn, D. H.; Yeates, G.; Zhao, Z.; Berger, L.; Jakob-Hoff , R. 2011. Nematode and ciliate nasal infection in captive Archey's frogs (*Leiopelma archeyi*). *Journal of Zoo and Wildlife Medicine 42(3)*: 473-479.

Zhang, Z.-Q. 2011. Describing unexplored biodiversity: *Zootaxa* in the International Year of Biodiversity. *Zootaxa 2768*: 1–4.

Zhang, Z.-Q. 2011. Accelerating biodiversity descriptions and transforming taxonomic publishing: the first decade of *Zootaxa*. *Zootaxa* 2896: 1–7.

Zhang, Z.-Q. 2011. Authorship and date of two family-group names in the Trombidiidae (Acariformes: Parasitengona). *Systematic & Applied Acarology 16*: 192.

Zhao, Z. Q.; Davies, K.; Alexander, B.; Riley, I. T. 2011. *Litylenchus coprosma* gen. n., sp. n. (Tylenchida: Anguinata), from leaves of *Coprosma repens* (Rubiaceae) in New Zealand. *Nematology 13(1)*: 29–44.

Videos

Crosby, T. K.; Hoare, R. J. B. 2011. The *Fauna of New Zealand* series. http://www.youtube.com/watch?feature=player_embedded&v=qhx2HxzCDi4

Hoare, R. J. B.; Hall, G.; Ward, D. F. 2011. NZAC: The New Zealand Arthropod Collection. http://www.youtube.com/watch?v=S8WvSSV-VcU&feature=player_embedded

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