SILENT STORIES

-- The Surprisingly Modern Roles of Insects in Two Mid Mesozoic Ecosystems of N.E. China

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Two Formations in the Mesozoic of NE China

- Jiulongshan Fm. (Middle Jurassic)
- Yixian Fm. (Early Cretaceous)
Insect Fossil Treasures – CNU Collection
more than 250,000 insect fossils
Insect associations with plants

- Pollination or “flower” visits
- Mimesis or camouflage

Photos by Jason Shih or CK Shih
Siphonate Mecopterans


*Lichnomesopsyche gloriae*
Ren, Labandeira et Shih, 2010.
- Siphonate mouthparts, from 3-14 mm, associated with the ovular tube of gymnosperms
- Fed on gymnosperm pollination drops
- Engaged in pollination mutualisms with gymnosperms during the Mid-Jurassic
  (Ren et al. 2009, Science)
Siphonate Mecopterans

*Pseudopolycentropus janeannae*
Ren, Shih et Labandeira, 2010
Siphonate Mecopterans

_ Jeholopsyche liaoningensis_ Ren, Shih et Labandeira, 2011.
Lepidoptera – Beauty and Grace

Photos by Chung Kun Shih
(A) (B) *Spiniferlepidopterix elachiptera* Zhang, Shih Labandeira et Ren 2013, (C) a cluster of bristles on hind wing. (D) spines on hind wing.

Zhang et al. 2013. PLoS ONE
Mouthparts most likely for pollen feeding

*Sinolepidopterix dualis* Zhang, Shih Labandeira et Ren 2013. PLoS ONE
Hymenoptera – Pollination and Parasitoid

Photo by Jason Shih

Photo by Chung Kun Shih
**Pelecinids**

*Pelecinus* polyturator (Drury) Schletterer, 1890


*Shoushida regilla* Liu, Shih et Ren, 2009

*Pelecinus polyturator* (Drury) Schletterer, 1890
Pelecinids

**Megapelecinus nashi** Shih et al. 2010

**Megapelecinus changi** Shih et al. 2010, An. of Ento. Soc. of Am.
Pelecinidae and two outgroups with their respective characteristic forewings in geological context.
Reproduction

Forever Love: The Hitherto Earliest Record of Copulating Insects

*Anthoscytina perpetua* Li, Shih et Ren, 2013. PLoS ONE
Artwork by Chen Wang

Reported by the New York Times on page A-12, 11/7/2013, and by numerous on-line media.

Photo by Jason Shih
The Earliest Case of Extreme Sexual Display with Exaggerated Male Organs

Fortiholcorpa paradoxa Wang, Shih et Ren 2013. PLoS ONE

Artwork by Chen Wang
Neuroptera - ancient pinnate leaf mimesis among lacewings

Bellinympaha filicifolia Wang, Ren, Liu et Engel, 2010. PNAS

Pre angiosperm origin for leaf mimesis
*Bellinymptha dancei* Wang, Ren, Shih et Engel 2010. PNAS

Artwork by Zhihua Ma
Venation of *Bellinympha filicifolia* imitated leaves of gymnosperms

(Wang et al. 2010. PNAS)
Jurassic mimicry between a hangingfly and a ginkgo leaf from China

*Juracimbrophlebia ginkgofolia*  Wang, Labandeira, Shih and Ren, 2012. PNAS
Named as one of the top 10 new species in 2012 by International Institute for Species Exploration (IISE)

Artwork by Chen Wang
Insect Associations with Vertebrates

Blood-Sucking Insects – the earliest fleas

- Long serrated stylets for piercing tough and thick skin or hides of hosts
- Primitive ectoparasites: lived on and sucked the blood of relatively large hosts, e.g. feathered dinosaurs, pterosaurs, and medium-sized mammals

*Pseudopulex jurassicus* Gao, Shih et Ren 2012.
Blood-Sucking Insects: Basal Fleas

_Pseudopulex magnus_ Gao, Shih et Ren 2012. Current Biology
Saurophthis exquisitus (female) Gao, Shih, Rasnitsyn, et Ren 2013. Current Biology
Saurophthirus exquisitus (male) Gao, Shih, Rasnitsyn, et Ren 2013. Current Biology
A Transitional Flea with Fully Distended Abdomen

*P. tanlan* might have consumed 0.02 milliliter (ml) of blood, which is about 15 times of the intake volume by extant fleas.
The Earliest Record of Blood-feeding True Bugs from the Early Cretaceous of China

Torirostratus pilosus (male) Yao, Shih, et Engel, 2014. Current Biology
Flexicorpus acutirostratus (female) Yao, Cai, et Engel, 2014. Current Biology
Ecological reconstruction of blood-feeding torirostratid true bugs feeding on blood from a sleeping feathered dinosaur. (Artwork by Ms. Chen WANG).
1. The Mesozoic Era was biotically richer and more complex than previous realized.

2. Insects in both Yanliao and Jehol Biota were diverse systematically, biologically and ecologically.

3. In the ecosystems, insects played important roles in maintaining food chains and circulation of substances and energy by close interactions with plants and vertebrates.

4. Our research provide a rare glimpse of lost worlds of interactions among insects and plants and vertebrates, some of which were now extinct or less diverse.
**Future Action Plans**

- To continue building on our strengths & upgrading our research capabilities
- To enhance cooperation with collaborators in China and internationally
- To apply high-tech instruments and better methodologies
- To publish high-quality papers and books on our research
- To arrange for exhibitions in CNU or in museums outside China

**Papers**


**Books**

2010 2012
Thank you for your attention!

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