

Taxonomic studies of eriophyoid mites in China

Last year, there was great progress in the taxonomic study of eriophyoid mites in China. Acarologists in both mainland China and Chinese Taiwan achieved great success compared with previous years, and the exchange of scholarly achievements between the two sides went smoothly and frequently. The quality of the research projects on the mites has reached high levels and attracted attention from scientific communities around world. The following is a brief summary of last year's major research findings on the eriophyoid mites in China.

1. *New descriptions and new records*

One new genus, one new subgenus, 19 new species and four new records were reported from China. Dr. Kun-Wei HUANG of National Museum of Natural Science of Taiwan described one new genus, one new subgenus and four new species, and Prof. Jan BOCZEK described three new species from Taiwan (Huang & Boczek, 1996). Prof. Tsan HUANG, Dr. Chin-Fah WANG of National Chung Hsing University of Taiwan and Dr. Kun-Wei HUANG described four new species and one new record from Taiwan (Huang *et al.*, 1996). Prof. Haiyuan KUANG and his associates Mr. Jian ZHAO, Prof. Guoji GONG and Mr. Suigai WEI of Nanjing Agricultural University described eight new species and reported two new records from mainland China (Kuang & Gong, 1996; Zhao & Kuang, 1996; Wei & Kuang, 1996). In addition, Dr. Xiaoyue HONG proposed a new name, *Knorella thailandica* for *Knorella bambusae* Chandrapatya (HONG, 1996).

The following is the list of names, hosts and localities of new eriophyoid mite species and new records found in China last year. They are arranged alphabetically.

Abacarus oplismeni Kuang & Gong. ex *Optismenus undulatifolius* in Jiangsu (Rugao City).

Aceria dendranthemae Zhao & Kuang. ex *Dendranthem nanjingensis* in Jiangsu (Nanjing City).

Aceria granati (Canestrini & Masalongo). ex *Prunus granatum* in Sichuan (Ya'an City).

Aceria indigoferae (Nalepa). ex *Indigofera pseudotinctoria* in Zhejiang (Quzhou City). New record in China.

Aceria pteridii Kuang & Gong. ex *Pteridium* sp. in Guangxi (Guilin City).

Aceria pterocaryae Kuang & Gong. ex *Pterocarya stenoptera* in Guangxi (Yangsu County) and Zhejiang (Jinhua City).

Aceria zhejiangensis Zhao & Kuang. ex *Rhus chinensis* in Zhejiang (Jiande City).

Aculops mumis Kuang & Gong. ex *Prunus mumae* in Jiangsu (Nanjing City).

Colopadacus millettiae Huang, Huang & Wang. ex *Millettia pulchra* in Taiwan (Kukuan, Taichung).

Cosella longana Huang, Huang & Wang. ex *Euphoria longana* in Taiwan (Puli, Nantou).

Cosella rubi Huang, Huang & Wang. ex *Rubus lambertianus* in Taiwan (Hoping, Taichung).

Eptrimerus yunbimus Huang. ex *Juniperus chinensis* in Taiwan (Alishan, Chiai).

Knorella thailandica Hong. ex *Bambusa* sp. in Thailand (Nonhaburi).

Levongia randiae Wei & Kuang. ex *Randia cochinchinensis* in Guangxi (Long'an County).

Rhynacus sargentodoxae Wei & Kuang. ex *Sargentodoxa cuneata* in Guangxi (Long'an County).

Nalepella tisamae Huang. ex *Tsuga chinensis* in Taiwan (Alishan, Chiai).

Pentaporca Huang. Type species: *Pentaporca taiwanensis* Huang. ex *Tsuga chinensis* in Taiwan (Alishan, Chiai).

Phyllocoptes limsamus Boczek. ex *Abies kawakamii* in Taiwan (Alishan, Chiai).

Setoptus (Orientis) Huang, subgenus. Type species: *Setoptus (Orientis) inaequalis* Huang. ex *Tsuga chinensis* in Taiwan (Alishan, Chiai).

Setoptus (Orientis) inusitatus Boczek. ex *Tsuga chinensis* in Taiwan (Alishan, Chiai).

Setoptus undatus Boczek. ex *Tsuga chinensis* in Taiwan (Alishan, Chiai).

Spinacus longinquus Huang, Huang & Wang. ex *Mangifera indica* in Taiwan (Tapu, Chiai)

Spinacus pagonis Keifer. ex *Mangifera indica* in Taiwan (Tapu, Chiai), new record in China.

Trisetacus distinctus Smith. ex *Juniperus chinensis* in Taiwan (Alishan, Chiai), new record in China.

2. Morphometric analysis

Three species of eriophyoid mites on the same host *Mangifera indica* were collected by Dr. Kun-Wei HUANG, Prof. Tsan HUANG and Dr. Chin-Fah WANG, and were identified as *Cisaberoptus kenyae* Keifer, *Spinacus pagonis* Keifer and *Spinacus longinquus* Huang, Huang & Wang. Since the latter two species are similar to each other, morphometric analyses were used to discriminate them. Distances between homologous structures (microtubercles) were measured, and the ratios of these variables were calculated. Cluster analysis, principal component analysis, minimum spanning tree and Burnaby's method were used. It was found that males are distinguishable from females by size variables; *Spinacus longinquus* is separated from *Spinacus pagonis* by shape variables, and the same variables could not be used to distinguish differences in sex and age of the two species. The major differences between the latter two species are the length of dorsal setae, the distances between the 3rd coxal tubercles, and the distance between the 3rd ventral tubercles (Huang *et al.*, 1996).

Morphometrics provides another way to distinguish the eriophyoid mites by analysis of assembled variables. According to the authors, it is useful to make morphometric measurements of eriophyoid mites, because the microtubercles of eriophyoid mites are the homolog. It may also be of practical value in the taxonomy of eriophyoid mites.

3. Cladistic research

Cladistic research was conducted by Dr. Xiaoyue HONG and Dr. Zhi-Qiang ZHANG on both the tribe and the superfamily levels (Hong & Zhang, 1996b & 1996c). The tribe Cecidophyini contains 9 genera and 64 species and occurs throughout the world. The phylogenetic relationships among these genera were analysed based on a total of twenty-one characters which were polarized by comparison with *Phytoptus*, *Phylocoptes*, *Eriophyes* and *Colomerus*. Two distinct clades were revealed: clade A: (*Achaetocptes*, *Johmella*, *Cecidophyes*, *Coptophylla*, *Glyptacus*, *Chrecidus*, *Cecidophyopsis*), and clade B (*Dechela*, *Neserella*). The pattern of geographic distribution and mite-host plant relationships of the tribe were described and discussed.

Furthermore, a cladistic analysis of relationships at the generic level was carried out for the Eriophyoidea. The analysis was based on a total of 35 characters drawn from the examination of investigated specimens and original descriptions of species in 17 genera examined. These characters were polarized by comparison with the generalized Tydeidae, which was chosen as the outgroup. PAUP was used. It was found that the Phytoptidae is paraphyletic, whereas the Eriophyidae (Sierraphytoptus) and the Diptilomiopidae are both monophyletic. The current classification system within the Eriophyoidea were appraised, with suggestions on further study on the phylogeny of the superfamily, and on the revision of the classification systems to reflect the natural relationships at the familial and generic levels.

4. Monograph and doctoral dissertation

"The Eriophyoid Mites of China: An Illustrated Catalog and Identification Keys (Acari: Prostigmata: Eriophyoidea)" by Dr. Xiaoyue HONG and Dr. Zhi-Qiang ZHANG was published by Associated Publishers in April 1996 (Hong & Zhang, 1996a). It deals with the eriophyoids of China. The catalog

comprises 205 species belonging to 3 families, 9 subfamilies and 77 genera. Illustrations of 190 species are given. Identification keys to the families, subfamilies, tribes, genera and species are included, followed by a list of references and a taxonomic as well as a host plant index. This book together with the book "Acari: Eriophyoidea (1)" (Kuang, 1995) is very useful in helping to know the eriophyoid mite fauna in mainland China.

Doctoral dissertation "A taxonomic study of Eriophyidae of Taiwan (Acarina: Eriophyoidea)" by Dr. Kun-Wei HUANG is the systematic research on the aerified mite fauna in Taiwan, and is also the first doctoral dissertation on the eriophyoid mite fauna in China (Huang, 1996). The work is tremendous and consists of two parts. The first part is the traditional taxonomy, describing 143 species, of which 16 genera and 109 species are new and 2 species are new records from Taiwan. The second part deals with the cladistics. A total of 121 species were selected, twenty-three characters were treated as unnurtured. The results showed that the Eriophyidae of Taiwan could be divided into three holophyletic groups. These three holophyletic groups are not consistent with the traditional taxonomic system. Also, the origin and average diversification rate of eriophyoid mites were inferred based on the fossil, morphology, host plant, classification system, and plate tectonics evidence, and by means of principle of evolutionary continuous dictomony. The author deduced that the eriophoid mites originated at about 280 (million) years ago on *Laurasia* and the average diversification rate is 0.18 per million years.

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