



# Distribution patterns of Chinese Cixiidae (Hemiptera, Fulgoroidea), highlight their high endemic diversity

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## Abstract

## Background

Cixiidae are small strictly phytophagous hemipteran insects worldwide distributed. Ecology and systematics of Chinese fauna remains poorly investigated. For instance, does their distribution follows the patterns of biogeographical distribution established for their host plants or other related-taxa because they are all obligatory phytophagous taxa? Do they follow the usual distributional Chinese realms and boundaries already recognized? Which zoogeographical Chinese regions and connections between them do they depict. To investigate these issues, we provide here a referenced and comprehensive checklist of the 250 cixiid species currently reported from China (77 new records), with their precise distribution at the regional level. In the 8 Chinese main zoogeographical regions usually recognized and 2 adjacent areas, we analyzed further their diversity at the tribal, generic, and specific levels using a non-metric multidimensional scaling and an unweighted pairwise group analysis using an arithmetic mean cluster analyses. The observed distribution patterns shown that an intercalary Sino-Japanese realm is recognisable

between the Palaearctic and Oriental realms. At the regional level, the South China region clusters more closely with the Southwest, Central and North China regions. Taiwan, clearly separated from the South China region and mainland China, is more closely related to the Qinghai-Tibet region and Indochina countries. Although Central and South China regions remain close to each other, the Qinghai-Tibet region appears singularly different.

## New information

An updated checklist of the 250 Cixiidae species, known to occur in China and counting for 10% of the Chinese planthopper fauna, is presented based on literature, recent collections, and museum records. More than 400 records distributed among the 28 provinces and 8 regions in China are extensively provided, including 77 new records. Of these, more than 80% of the species (205 species, 82%) have been only reported from China, and most of them are endemic species, which could reflect the great diversity degree of the Chinese regions and local biotypes highlights the uniqueness of this fauna. These species are found in 8 Chinese zoogeographical regions: The Taiwan region is the most diversified with 161 species and the highest rate of endemic species (69.57%), followed by South China (78 species, 17.95%), Central China (60 species, 33.33%), Southwest China (43 species, 39.53%), North China (29 species, 34.48%), Qinghai-Tibet region (10 species, 20%), Northeast China (8 species, 12.5%), and 5 species found in the Inner Mongolia-Xinjiang region that are not endemic ones. Endemism was analyzed for each region and repeated for species distribution patterns across them, 9 being bi-regionally and tri-regionally distributed. The South China-Taiwan pattern is the most richest one, followed by the Central-South China-Taiwan pattern. Semonini and Pentastirini tribes are widespread among all the zoological regions, representing respectively 21.20% and 17.20% of all the species, while Cixiini being is the most common tribe with 45.20%, remains absent from the North-Eastern China region. Andini with only 5.20% of the species is distributed in the Sino-Japanese - Oriental Region; Eucarpini (6.40%) and Borysthenini (2.00%) are mainly concentrated in the south of the Qingling Mountain-Huai River. The remaining four tribes, Bennini (0.40%), Briixini (0.80%), Oecleini (1.20%) and Stenophlepsiini (0.40%) are relatively rare and restricted to Taiwan. At the generic level, *Kuvera* (7.2%) is the most widely distributed genus in China while *Cixius*, *Betacixius*, *Kuvera*, *Oecleopsis* and *Andes* are the more diversified. One genus (*Oliparisca*) is distributed only in the Tibet region, while 10 genera are distributed only in the Taiwan region. In addition, nearly half of the genera (16 genera, 48.48%) are distributed south of the Palaearctic/Oriental boundary. A non-metric multidimensional scaling and an unweighted pairwise group method analysis using arithmetic mean clustering based on the Jaccard similarity coefficient matrix support a Palaearctic/Sino-Japanese boundary and a South China region closer to the Southwest, Central and North China regions. The Taiwan region appears clearly separated from the South China region and to mainland China, and more closely related to the Qinghai-Tibet region and Indochina countries. The Central and South China regions appear close to each other, but the Qinghai-Tibet region is singularly isolated.

## Keywords

Checklist, zoogeography region, distribution, species richness, endemism, Cixiidae, China

## Introduction

China covers an area of 9,634,057 km<sup>2</sup>, encompassing an area of entire Europe, and spans nearly 50 degrees of latitude from north to south, and more than 60 degrees of longitude from east to west in a world-renowned monsoon region (National Bureau of Statistics of the People's Republic of China, <http://data.stats.gov.cn>). Most regions have cold, dry winters and warm, rainy summers, but in combination with the varying topography and terrain conditions, the climate is actually very complex and locally diverse with a wide variety of temperature zones and precipitation gradients (Ren and Wen 2011). Most regions are located in the temperate zone (semi-tropical, warm, mid-range, and cold-temperatures). A small portion of the country is in the tropics and plateau climate zone (the Qinghai-Tibet plateau temperate zone), and northern regions are close to the boreal zone (Jiang 2017). Annual precipitation decreases from the rain-forest of the southeast coast to the Gobi Desert in the northwestern interior (Jiang 2017). An arid humidity zone covers about 31% of the land area (mainly in northwest China). A semi-arid zone covers 22%, a semi-humid zone covers 15%, and the humid zone (32%) is located primarily in the southeast of China (Ge et al. 2013). Geological complexity of China is also significant, particularly with the uplift of the Qinhai-Tibet Plateau, which occurred in the middle of the Eocene era (45-38 Ma) (Zhou et al. 2018). When this complexity is combined with the monsoonal climate evolution, it has created strongly diversified biotopes, isolated by biogeographical barriers that manage dispersal pathways for species, providing new ecological niches, which has driven the recent evolution of plants and animal diversity (Favre et al. 2015, Liu et al. 2017).

From a biogeographical point of view, China is usually divided in two parts, the Palearctic realm in the north, and the Oriental one in the south (Sclater 1858, Wallace 1876, Morrone 2015, He et al. 2017). From a zoological perspective, Holt et al. (2013) recently recognized an additional Sino-Japanese realm ranging from west of Tibet to the east of the Japanese archipelago standing between them. Accordingly, three main biogeographical lines cross China (Fig.1): the Palearctic/Sino-Japanese boundary at about 40–41N, the Palearctic/Oriental line that follows the Qingling Mountain-Huai River, around 32–34N, and the Sino-Japanese/Oriental boundary at 24–25N in Southeastern China.

The family Cixiidae Spinola, 1839 (Hemiptera: Fulgoromorpha), is a numerous and diverse taxon with a world-wide distribution (Holzinger et al. 2002, Bourgoïn 2021). It comprises 18.6% of the currently known planthopper species (Bourgoïn 2021), and is the largest family of the group. Classical taxonomy has divided the Cixiidae into 3 subfamilies: Borystheninae Emeljanov, 1989, Bothriocerinae Muir, 1923 and Cixiinae Spinola, 1839 (Holzinger et al. 2002). However, recent phylogenetical analyses have shown that these divisions remain artificial and three main lineages should better reflect of evolution of the family: an oecleian lineage (including Bothriocerini), a cixiian lineage and a

pentastirini lineage (including Borysthenini) (Luo et al. 2021). Therefore, without including the fossil taxa, Cixiidae are currently divided into 18 tribes, 250 genera, and 2600 species (Bourgoin 2021).

Cixiidae nymphs usually live underground and feed on plant rootlets, whereas the adults feed on the above ground phloem tissues of woody or *herbaceous* plants and ferns (Wilson 1994, Wheeler 2003), predominally on Asterales (9.2%), Rosales (7.8%), Fabiales (6.7%), Myrtales (6.5%), Lamiales (5.1%) and Ericales (5.1%) in Eudicots and on Poales (8.3%) in Monocots (Bourgoin 2021). Several cixiidae species are considered to be vectors of plant pathogen including viruses, phytoplasmas and other prokaryotic-like organisms (Wilson 2005).

Although the Cixiidae are one of the larger planthopper families, little is known about their ecology, distribution and host plants. In China, knowledge of this fauna is still fragmented and an overall comprehensive study is lacking. The first contribution was by Melichar (1902) who described 2 genera with 5 species from western China. Matsumura (1914) published 'Die Cixiinen Japans', describing 14 genera and 30 species, mostly from Taiwan. Kato (1932) focused on Northeastern China taxa, and published one new species. The first checklist of Cixiidae from the China mainland was provided by Hu (1935), who listed 11 species in 5 genera, which was updated by Metcalf (1936) in his 'Catalogue of the Homoptera'. Since then, many new species have been added. Jacobi (1944) reported 5 new species from the Fujian province. Fennah (1956) added 6 genera and 17 species from South China. Hori (1982) described 3 new *Betacixius* species from Taiwan. Chou et al. (1985) described 7 species in 4 genera in his "Economic Insect Fauna of China (Fulgoromorpha)". Tsaur provided a series of important contributions to the fauna from Taiwan, describing 155 species in 20 genera (Tsaur and Lee 1987, Tsaur et al. 1988, Tsaur 1989a, Tsaur 1989b, Tsaur 1990a, Tsaur 1990b, Tsaur et al. 1991a, Tsaur et al. 1991b, Tsaur and Hsu 2003, Tsaur 2009). Since then, several papers describing new recent taxonomic discoveries have been published (Wang 1991, Wang 1992, Huang 1995, Hua 2000, Liang 2001, Liang 2005a, Liang 2005b, Guo and Wang 2007, Guo et al. 2009, Guo and Feng 2010, Zhang and Chen 2011a, Zhang and Chen 2011b, Zhang and Chen 2013a, Zhang and Chen 2013b, Ren et al. 2014, Xing and Chen 2014, Bai et al. 2015, Li et al. 2016, Zhi et al. 2017, Zhi et al. 2018a, Zhi et al. 2018b, Luo et al. 2019a, Luo et al. 2019b, Zhi et al. 2019, Zhi et al. 2020a, Zhi et al. 2020b, Zhi et al. 2021).

All of these studies primarily focused on taxonomical treats, with limited ecological and geographical interpretations or evaluations. However, Cixiidae are obligatory phytophagous taxa and therefore directly linked to the distribution of their host plants (Attié et al. 2008). They are generally considered feeding on a variety of plants (Larivière 1999) but more precisely documented, they appear mostly oligiphagous or monophagous (Wilson et al. 1994, Bourgoin 2021). The planthopper and its host-plants are both patterned by the historical biogeography of the areas where they are distributed. How Cixiidae do follow the patterns of biogeographical distribution (major biological realms, biogeographical regions) already well established in China? Which boundaries can be identified for Cixiidae and at which taxonomical levels? The aim of this paper is to identify these correlations and to investigate how these zoogeographical regions are connected in China.

This current paper provides the first distribution pattern of the Chinese Cixiidae following current Chinese zoogeographical regions recognized and updated species list of Chinese Cixiidae. Accordingly, the objectives of this paper are: (1) to compare Cixiidae species richness at the level of the Chinese zoogeographical regions and to document their distribution patterns and their endemism in each region, both at the tribal and generic level; (2) to investigate what biogeographical patterns the Cixiidae reflect: are they recognized effectively in a particular Sino-Japanese realm or a simple area of transition between the Palearctic and Oriental realms? (3) to provide a comprehensive species list of the Cixiidae from China.

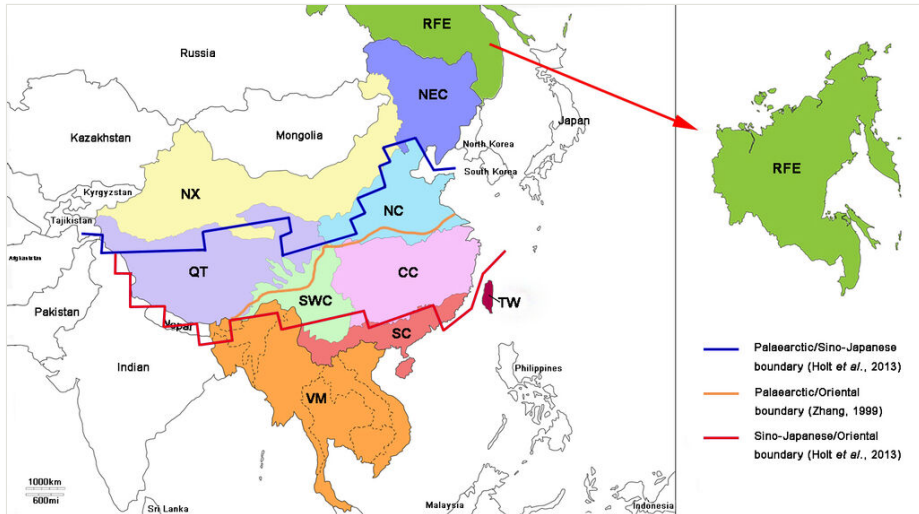


Figure 1. [doi](#)

Map of zoogeographical regions of China and adjacent areas. Abbreviations: NEC, Northeast China; NC, North China; NX, Nei Mongol-Xinjiang; QT, Qinghai-Tibet; SWC, Southwest China; CC, Central China; SC, South China; TW, Taiwan; RFE, Russian Far East; VM, Vietnam, Laos, Thailand, Cambodia, Myanmar, Bhutan, Bangladesh and part of Indian.

## Materials and methods

Eight Chinese zoogeographic regions, based on geographic, climatic, and vegetation characteristics (Gao et al. 2017, He et al. 2017), were used for the bio-geographical analyses: Northeast China, North China, Nei Mongol-Xinjiang, Qinghai-Tibet, South China, Central China, Southwest China and the Taiwan region (Fig. 1). Two other regions were added for countries adjacent to China: 1) a south China 'VM region' including Vietnam, Laos, Thailand, Cambodia, Myanmar, Bhutan, Bangladesh, as well as a small portion of India, and 2) a north East China 'Far East region' including a portion of Russia. The map (Fig. 1) was created using the National Earth System Science Data Sharing Infrastructure (<http://www.geodata.cn>).

The distribution matrix includes 253 Chinese Cixiidae species (of which 87 species were recorded from museums and the remaining species were recorded from the literature). Among them, 3 species: *Cixius narke* Kramer, 1981, *Oliarus splendidulus* Fieber, 1876, and *Tachycixius (Tachycixius) pilosus* (Olivier, 1791), were excluded from the analyses and checklist because we could not confirm their occurrence in China (no specimens information was found in our inspection of museum specimens in the collections) or because of uncertainties about where they were collected. 48 additional Cixiidae species (Suppl. material 1) from adjacent areas based on literature and FLOW (Bourgoin 2021) were added for the cluster analysis. The observed material information of checklist, as a formatted Excel spreadsheet, are provided here in the supplementary materials: Suppl. material 2. Figure 2 and 3 were generated using ArcGIS Version 10.8 statistical software (URL: <https://desktop.arcgis.com/en/system-requirements/latest/arcgis-desktop-system-requirements.htm>). The distribution information of the Cixiidae in China was imported into ArcGIS Version 10.8 software, the latitude and longitude of the distribution sites were set as the coordinate attribute elements, and the symbols in the map were set to different colors for distinguishing different genera of the tribes, and finally the maps of the distribution of the tribes and species were exported.

Presence/absence matrices for species and for genera were built for each of the 10 OGUs (physiographical regions as operative geographical units, Crovello 1981). Similarity coefficients use binary data to measure association between OGU. On the basis of a review of similarity coefficients (Shi 1993), the Jaccard's coefficient in NTSYS Version 2.1 software (Rohlf 2000) was used according to Legendre and Legendre (1983) and Rohlf (2000). Clustering of OGUs using the UPGMA algorithm, UPGMA (an unweighted pairwise group method using arithmetic mean) was used to cluster similarities (Legendre and Legendre 1983). Based on the similarity of clustering results, Jaccard's coefficients were analyzed through nonmetric multidimensional scaling (NMDS) according to Kenkel and Orloci (1986).

## Data resources

This publication follows the classical systematic classification based on Holzinger et al. (2002) and Emeljanov (2002) as synthesized and updated in Bourgoin (2021) and Luo et al. (2021). Fossil species are indicated by the symbol (†). The checklist contains information updated up to April, 2021 compiled from scientific papers, book chapters, conference abstracts, theses, and from the FLOW website (Bourgoin 2021). It also includes our own unpublished taxonomic data and original museum specimens information from the following institutions: Shanghai Entomological Museum C.A.S (SEM), Museum of China Agricultural University (CAU), Entomological Museum of Northwest A&F University (NWAUFU), Museum of Chinese Academy of Forestry (CAF), Institute of Entomology, Guizhou University (GZU), Chongqing Normal University (CQNU) and Muséum National d'Histoire Naturelle (MNHN). Distribution sets were collected from the original sources with their original latitude and longitude information; Those lacking such information were

approximated with the latitude and longitude coordinates of the corresponding administrative center.

## **Annotated checklist of Cixiidae from China**

### **Family Cixiidae Spinola, 1839**

### **Subfamily Borystheninae Emeljanov, 1989**

### **Genus *Borysthenes* Stål, 1866**

#### ***Borysthenes acuminatus* Fennah, 1956**

**Nomenclature:**

*Borysthenes acuminatus* Fennah, 1956: 459.| Liang, 2005a: 810.

**Distribution:** China: Hubei (Liang 2005a).

#### ***Borysthenes deflexus* Fennah, 1956**

**Nomenclature:**

*Borysthenes deflexus* Fennah, 1956: 460.| Liang, 2005a: 810.

**Distribution:** China: Guangdong (Fennah 1956).

#### ***Borysthenes emarginatus* Fennah, 1956**

**Nomenclature:**

*Borysthenes emarginatus* Fennah, 1956: 461.| Liang, 2005a: 810.

**Distribution:** China: Guangdong (Fennah 1956).

#### ***Borysthenes lacteus* Tsaur & Lee, 1987**

**Nomenclature:**

*Borysthenes lacteus* Tsaur & Lee, 1987: 9.

**Distribution:** China: Taiwan (Tsaur and Lee 1987).

### ***Borysthenes maculatus* (Matsumura, 1914)**

**Nomenclature:**

*Barma maculata* Matsumura, 1914: 430. | *Bolysthenes* (sic) *guttatus* Kato, 1933: 468. | *Borysthenes maculatus* (Matsumura, 1914), Fennah, 1956: 459. | Chou, 1985: 26. | Tsaur & Lee, 1987: 8. | Liang, 2005a: 810 | Liang, 2005b: 429. | Hayashi & Fujinuma, 2016: 326.

**Distribution:** China: Fujian (Liang 2005a, Liang 2005b), Hainan, Hunan, Guangxi, Sichuan, Taiwan (Tsaur and Lee 1987); Japan: Nansei-shoto (Hayashi and Fujinuma 2016).

**Notes:** New record: China: Hainan (Diaoluo Mountain).

### **Subfamily Cixiinae Spinola, 1839**

#### **Tribe Andini Emeljanov, 2002**

#### **Genus *Andes* Stål, 1866**

### ***Andes formosanus* (Matsumura, 1914)**

**Nomenclature:**

*Brixia formosana* Matsumura, 1914: 432. | *Andes formosanus* (Matsumura, 1914), in Tsaur et al., 1991a: 70.

**Distribution:** China: Fujian, Sichuan, Taiwan (Matsumura 1914).

**Notes:** New record: China: Fujian (Wuyi Mountain).

### ***Andes hemina* Fennah, 1978**

**Nomenclature:**

*Andes hemina* Fennah, 1978: 209.

**Distribution:** China: Yunnan; Malaysia: Kuala Lumpur, Kedah (Fennah 1978); Vietnam: Ninh Binh (Fennah 1978).

**Notes:** New record: China: Yunnan (Menglung).

### ***Andes lachesis* Fennah, 1956**

**Nomenclature:**

*Andes lachesis* Fennah, 1956: 447.

**Distribution:** China: Zhejiang (Fennah 1956).



***Andes luzonensis* Tsaur & Hsu, 1991****Nomenclature:**

*Andes luzonensis* Tsaur & Hsu in Tsaur et al., 1991a: 72.

**Distribution:** China: Zhejiang, Taiwan (Tsaur et al. 1991a).

***Andes marmoratus* (Uhler, 1896)****Nomenclature:**

*Metabrixia marmorata* Uhler, 1896: 280.| *Brixia marmorata* (Uhler, 1896), Matsumura, 1914: 431.| *Andes marmorata* (Uhler, 1896), Chou, 1985: 24.| Liang, 2005b: 429.| Hayashi & Fujinuma, 2016: 323.

**Distribution:** China: Beijing (Liang 2005b), Henan, Jiangsu, Zhejiang, Guangxi, Guizhuo; Japan: Hokkaido, Honshu, Shikoku, Kyushu, Tsushima Island (Palaeartic) (Hayashi and Fujinuma 2016); Russia: Far East.

**Notes:** New record: China: Jiangsu (Suzhou), Zhejiang (Taishun).

***Andes noctua* Fennah, 1956****Nomenclature:**

*Andes noctua* Fennah, 1956: 446.| Zhang, 2008: 33.

**Distribution:** China: Beijing, Henan, Hubei (Fennah 1956), Guizhou.

**Notes:** New record: China: Beijing (Mentougou), Henan (Huixian), Hubei (Lichuan).

***Andes notatus* Tsaur & Hsu, 1991****Nomenclature:**

*Andes notatus* Tsaur & Hsu in Tsaur et al., 1991a: 70.

**Distribution:** China: Guangxi, Tibet, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Guangxi (Jinxiu, Longsheng), Tibet (Motuo).

***Andes othrepte* Fennah, 1956****Nomenclature:**

*Andes othrepte* Fennah, 1956: 445.

**Distribution:** China: Hong Kong (Fennah 1956).

***Andes truncatus* Fennah, 1978****Nomenclature:**

*Andes truncatus* Fennah, 1978: 208.

**Distribution:** China: Guizhou, Zhejiang; Vietnam: Ninh Binh (Fennah 1978).

**Notes:** New record: China: Zhejiang (Fengyang Mountain).

***Andes uncinatus* Fennach, 1956****Nomenclature:**

*Andes uncinatus* Fennach, 1956: 444. | Zhang, 2008: 38.

**Distribution:** China: Guangdong, Sichuan (Fennah 1956).

**Genus *Andixius* Emeljanov & Hayashi, 2007*****Andixius longispinus* Zhi & Chen, 2018****Nomenclature:**

*Andixius longispinus* Zhi & Chen in Zhi et al., 2018b: 57.

**Distribution:** China: Yunnan (Zhi et al. 2018b).

***Andixius trifurcus* Zhi & Chen, 2018****Nomenclature:**

*Andixius trifurcus* Zhi & Chen, in Zhi et al., 2018b: 60.

**Distribution:** China: Yunnan (Zhi et al. 2018b).

***Andixius venustus* Tsaur & Hsu, 1991****Nomenclature:**

*Brixia venusta* Tsaur & Hsu in Tsaur et al., 1991a: 65. | *Andixius venustus* (Tsaur & Hsu, 1991), Emeljanov & Hayashi, 2007: 129.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

**Tribe Bennini Metcalf, 1938****Genus *Kotonisia* Matsumura, 1938*****Kotonisia kanoi* (Matsumura, 1938)****Nomenclature:**

*Benna kanoi* Matsumura, 1938: 152.| *Benna formosana* (Nast), Tsaour, 1988: 76.| *Kotonisia kanoi* (Matsumura, 1938), Tsaour, 2009: 67.| *Kotonisia kanoi* (Matsumura, 1938), Hoch, 2013: 174.

**Distribution:** China: Taiwan (Tsaour 2009).

**Tribe Brixiiini Emeljanov, 2002****Genus *Brixia* Stål, 1859*****Brixia ocellata* Matsumura, 1914****Nomenclature:**

*Brixia ocellata* Matsumura, 1914: 433.

**Distribution:** China: Taiwan (Matsumura 1914).

***Brixia neglecta* Van Stalle, 1983****Nomenclature:**

*Brixia neglecta* Van Stalle, 1983: 272.

**Distribution:** China: Taiwan.

**Tribe Cixiini Spinola, 1839****Genus *Ankistrus* Tsaour & Hsu, 1991*****Ankistrus basalis* Tsaour & Hsu, 1991****Nomenclature:**

*Ankistrus basalis* Tsaour & Hsu in Tsaour et al., 1991a: 19.

**Distribution:** China: Taiwan (Tsaour et al. 1991a).

***Ankistrus choui* Tsaur & Hsu, 1991****Nomenclature:**

*Ankistrus choui* Tsaur & Hsu in Tsaur et al., 1991a: 12.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

***Ankistrus guttatus* Tsaur & Hsu, 1991****Nomenclature:**

*Ankistrus guttatus* Tsaur & Hsu in Tsaur et al., 1991a: 17.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

***Ankistrus montanus* Tsaur & Hsu, 1991****Nomenclature:**

*Ankistrus montanus* Tsaur & Hsu in Tsaur et al., 1991a: 9.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

***Ankistrus pini* Tsaur & Hsu, 1991****Nomenclature:**

*Ankistrus pini* Tsaur & Hsu in Tsaur et al., 1991a: 9.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

***Ankistrus taoi* Tsaur & Hsu, 1991****Nomenclature:**

*Ankistrus taoi* Tsaur & Hsu in Tsaur et al., 1991a: 14.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

***Ankistrus varius* Tsaur & Hsu, 1991****Nomenclature:**

*Ankistrus varius* Tsaur & Hsu in Tsaur et al., 1991a: 14.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

**Genus *Cixius* Latreille, 1804*****Cixius aculeatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius aculeatus* Tsaur & Hsu in Tsaur et al., 1991b: 199.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius acutus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius acutus* Tsaur & Hsu in Tsaur et al., 1991b: 204.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius aduncus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius aduncus* Tsaur & Hsu in Tsaur et al., 1991b: 239.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius alpinus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius alpinus* Tsaur & Hsu in Tsaur et al., 1991b: 242.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius anmashanus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius anmashanus* Tsaur & Hsu in Tsaur et al., 1991b: 266.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius aquilonius* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius aquilonius* Tsaur & Hsu in Tsaur et al., 1991b: 260.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius arisanus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius arisanus* Matsumura, 1914: 386.| Tsaur et al., 1991b: 185.

**Distribution:** China: Zhejiang, Hainan, Taiwan (Tsaur et al. 1991b).

**Notes:** New record: China: Zhejiang (Fengyang Mountain).

***Cixius bicolor* Matsumura, 1914****Nomenclature:**

*Cixius bicolor* Matsumura, 1914: 395.| Esaki, 1932: 1773.| Tsaur et al., 1991b: 175.

**Distribution:** China: Taiwan (Tsaur et al. 1991b), Hainan; Japan.

**Notes:** New record: China: Hainan (Limuling).

***Cixius bidentis* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius bidentis* Tsaur & Hsu in Tsaur et al., 1991b: 279.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius brochus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius brochus* Tsaur & Hsu in Tsaur et al., 1991b: 222.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius broncus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius broncus* Tsaur & Hsu in Tsaur et al., 1991b: 233.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius capillatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius capillatus* Tsaur & Hsu in Tsaur et al., 1991b: 208.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius cathetus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius cathetus* Tsaur & Hsu in Tsaur et al., 1991b: 275.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius chituanus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius chituanus* Tsaur & Hsu in Tsaur et al., 1991b: 236.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius chouorum* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius chouorum* Tsaur & Hsu in Tsaur et al., 1991b: 225.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius chydaeus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius chydaeus* Tsaur & Hsu in Tsaur et al., 1991b: 252.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius circinatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius circinatus* Tsaur & Hsu in Tsaur et al., 1991b: 202.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius circulus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius circulus* Tsaur & Hsu in Tsaur et al., 1991b: 219.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius communis* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius communis* Tsaur & Hsu in Tsaur et al., 1991b: 200.

**Distribution:** China: Guangxi, Zhejiang, Taiwan (Tsaur et al. 1991b).

**Notes:** New record: China: Guangxi (Nanning), Zhejiang (Fengyang Mountain).

### ***Cixius curvus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius curvus* Tsaur & Hsu in Tsaur et al., 1991b: 183.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

### ***Cixius cyclus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius cyclus* Tsaur & Hsu in Tsaur et al., 1991b: 256.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

### ***Cixius deflexus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius deflexus* Tsaur & Hsu in Tsaur et al., 1991b: 300.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

### ***Cixius denotatus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius denotatus* Tsaur & Hsu in Tsaur et al., 1991b: 294.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

### ***Cixius dentatus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius dentatus* Tsaur & Hsu in Tsaur et al., 1991b: 254.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

### ***Cixius denticulatus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius denticulatus* Tsaur & Hsu in Tsaur et al., 1991b: 180.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).



***Cixius diductus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius diductus* Tsaur & Hsu in Tsaur et al., 1991b: 241.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius dilatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius dilatus* Tsaur & Hsu in Tsaur et al., 1991b: 286.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius discretus* Li, Liu, Ren, Li & Yao, 2016****Nomenclature:**

*Cixius discretus*† Li, Liu, Ren, Li & Yao in Li et al., 2016: 2.

**Distribution:** China: Qinghai (Li et al. 2016).

**Notes:** Fossil species

***Cixius elegantulus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius elegantulus* Tsaur & Hsu in Tsaur et al., 1991b: 244.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius elongatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius elongatus* Tsaur & Hsu in Tsaur et al., 1991b: 206.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius fangi* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius fangi* Tsaur & Hsu in Tsaur et al., 1991b: 180.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius flavescens* Matsumura, 1914****Nomenclature:**

*Cixius flavescens* Matsumura, 1914: 405.

**Distribution:** China: Shaanxi, Taiwan (Matsumura 1914).

**Notes:** New record: China: Shaanxi (Hanzhong).

***Cixius furvus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius furvus* Tsaur & Hsu in Tsaur et al., 1991b: 285.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius fustis* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius fustis* Tsaur & Hsu in Tsaur et al., 1991b: 228.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius galeolus* Fennah, 1956****Nomenclature:**

*Cixius galeolus* Fennah, 1956: 449.

**Distribution:** China: Guangdong (Fennah 1956).

***Cixius gladius* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius gladius* Tsaur & Hsu in Tsaur et al., 1991b: 225

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius habunus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius habunus* Tsaur & Hsu in Tsaur et al., 1991b: 188.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius hopponis* Matsumura, 1914****Nomenclature:**

*Cixius hopponis* Matsumura, 1914: 399| Tsaur et al., 1991b: 195.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius hsui* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius hsui* Tsaur & Hsu in Tsaur et al., 1991b: 256.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius hueisunus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius hueisunus* Tsaur & Hsu in Tsaur et al., 1991b: 279.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius inaffectus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius inaffectus* Tsaur & Hsu in Tsaur et al., 1991b: 212.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius incisus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius incisus* Tsaur & Hsu in Tsaur et al., 1991b: 219.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius inflatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius inflatus* Tsaur & Hsu in Tsaur et al., 1991b: 272.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius kommonis* Matsumura, 1914****Nomenclature:**

*Cixius kommonis* Matsumura, 1914: 401| Tsaur et al., 1991b: 301.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius kukuanus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius kukuanus* Tsaur & Hsu in Tsaur et al., 1991b: 269.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius kuyanyanus* Matsumura, 1914**

**Nomenclature:**

*Cixius kuyanyanus* Matsumura, 1914: 398.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius laboriosus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius laboriosus* Tsaur & Hsu in Tsaur et al., 1991b: 272.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius latus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius latus* Tsaur & Hsu in Tsaur et al., 1991b: 248.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius leei* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius leei* Tsaur & Hsu in Tsaur et al., 1991b: 282.

**Distribution:** China: Zhejiang, Taiwan (Tsaur et al. 1991b).

**Notes:** New record: China: Zhejiang (Feng Mountain).

***Cixius linorum* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius linorum* Tsaur & Hsu in Tsaur et al., 1991b: 216.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius luridus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius luridus* Tsaur & Hsu in Tsaur et al., 1991b: 264.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius maculosus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius maculosus* Tsaur & Hsu in Tsaur et al., 1991b: 188.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius meifengensis* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius meifengensis* Tsaur & Hsu in Tsaur et al., 1991b: 208.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius montosus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius montosus* Tsaur & Hsu in Tsaur et al., 1991b: 205.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius mukwanus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius mukwanus* Tsaur & Hsu in Tsaur et al., 1991b: 176.

**Distribution:** China: Fujian, Taiwan (Tsaur et al. 1991b).

**Notes:** First record: China: Fujian (Wuyi Mountain).

***Cixius nervosus* (Linné, 1758)****Nomenclature:**

*Cicada nervosa* Linné, 1758: 437.| *Cixius nervosus* (Linné, 1758), Beirne, 1951: 315.| Kramer, 1981: 8.| Bartlett et al., 2014: 90.| Hayashi & Fujinuma, 2016: 324.

**Distribution:** China: Ningxia; Algeria (Nast 1972, Holzinger et al. 2003) Austria (Nast 1972, Holzinger et al. 2003) Belgium (Nast 1972, Holzinger et al. 2003); Canada: Alberta, British Columbia, Manitoba, New Brunswick, Newfoundland, Nova Scotia,

Ontario, Quebec, Saskatchewan (Bartlett et al. 2014) Czechoslovakia (Nast 1972, Holzinger et al. 2003); Denmark (Nast 1972, Holzinger et al. 2003); Finland (Nast 1972, Holzinger et al. 2003); France (Nast 1972, Holzinger et al. 2003); Germany (Nast 1972, Holzinger et al. 2003); Great Britain (Nast 1972, Holzinger et al. 2003); Hungary (Nast 1972, Holzinger et al. 2003); Italy (Nast 1972, Holzinger et al. 2003); Japan: Hokkaido, Honshu; Macedonia; Morocco; Netherlands; Norway; Poland; Romania; Russia; Serbia; Spain; Sweden; Switzerland; Tunisia; USA: Alaska, Arizona, California, Colorado, Connecticut, Delaware, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, Wisconsin (Bartlett et al. 2014).

**Notes:** New record: China: Ningxia (Liupan Mountain).

### ***Cixius nitobei* Matsumura, 1914**

**Nomenclature:**

*Cixius nitobei* Matsumura, 1914: 401. | Jacobi, 1944: 14. | Schumacher, 1915: 131.

**Distribution:** China: Fujian, Taiwan (Matsumura 1914).

### ***Cixius obvius* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius obvius* Tsaur & Hsu in Tsaur et al., 1991b: 288.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

### ***Cixius operosus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius operosus* Tsaur & Hsu in Tsaur et al., 1991b: 247.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

### ***Cixius parallelus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius parallelus* Tsaur & Hsu in Tsaur et al., 1991b: 251.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius paucus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius paucus* Tsaur & Hsu in Tsaur et al., 1991b: 289.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius perexiguus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius perexiguus* Tsaur & Hsu in Tsaur et al., 1991b: 236.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius perpendicularis* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius perpendicularis* Tsaur & Hsu in Tsaur et al., 1991b: 291.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius petilus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius petilus* Tsaur & Hsu in Tsaur et al., 1991b: 231.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius phonascus* Fennah, 1956****Nomenclature:**

*Cixius phonascus* Fennah, 1956: 449 (Fennah 1956).

**Distribution:** China: Guangdong.

***Cixius pilosellus* Matsumura, 1914****Nomenclature:**

*Cixius pilosellus* Matsumura, 1914: 405.

**Distribution:** China: Taiwan (Matsumura 1914).

***Cixius polydentis* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius polydentis* Tsaur & Hsu in Tsaur et al., 1991b: 297.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius privus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius privus* Tsaur & Hsu in Tsaur et al., 1991b: 244.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius procerus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius procerus* Tsaur & Hsu in Tsaur et al., 1991b: 278.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius quinarius* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius quinarius* Tsaur & Hsu in Tsaur et al., 1991b: 249.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius rarus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius rarus* Tsaur & Hsu in Tsaur et al., 1991b: 190.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius reversus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius reversus* Tsaur & Hsu in Tsaur et al., 1991b: 260.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius scrupeus* Fennah, 1956**

**Nomenclature:**

*Cixius scrupeus* Fennah, 1956: 450. | Tsaur et al., 1991b: 297.

**Distribution:** China: Anhui (Fennah 1956), Hunan, Henan, Taiwan (Tsaur et al. 1991b).

**Notes:** New record: China: Hunan (Mang Mountain), Hunan (Huping Mountain), Anhui (Guniujiang), Henan (Yuhuang).



***Cixius segregatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius segregatus* Tsaur & Hsu in Tsaur et al., 1991b: 263.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius separatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius separatus* Tsaur & Hsu in Tsaur et al., 1991b: 214.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius serratus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius serratus* Tsaur & Hsu in Tsaur et al., 1991b: 266.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius spinosus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius spinosus* Tsaur & Hsu in Tsaur et al., 1991b: 282.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius spirus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius spirus* Tsaur & Hsu in Tsaur et al., 1991b: 186.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius stallei* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius stallei* Tsaur & Hsu in Tsaur et al., 1991b: 291.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius suturalis* Matsumura, 1914****Nomenclature:**

*Cixius suturalis* Matsumura, 1914: 401| Tsaur et al., 1991b: 301.

**Distribution:** China: Taiwan (Matsumura 1914).

***Cixius taipingshanus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius taipingshanus* Tsaur & Hsu in Tsaur et al., 1991b: 275.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius taiwanus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius taiwanus* Tsaur & Hsu in Tsaur et al., 1991b: 294.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius tappanus* Matsumura, 1914**

**Nomenclature:**

*Cixius tappanus* Matsumura, 1914: 398| Tsaur et al., 1991b: 195.

**Distribution:** China: Zhejiang, Taiwan (Tsaur et al. 1991b).

**Notes:** New record: China: Zhejiang (Longwang Mountain).

***Cixius transversus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius transversus* Tsaur & Hsu in Tsaur et al., 1991b: 229.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius tsuifenghuensis* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius tsuifenghuensis* Tsaur & Hsu in Tsaur et al., 1991b: 259.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius tungpuus* Tsaur & Hsu, 1991**

**Nomenclature:**

*Cixius tungpuus* Tsaur & Hsu in Tsaur et al., 1991b: 233.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius tzuenus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius tzuenus* Tsaur & Hsu in Tsaur et al., 1991b: 222.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius vatius* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius vatius* Tsaur & Hsu in Tsaur et al., 1991b: 216.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius velox* Matsumura, 1914****Nomenclature:**

*Cixius velox* Matsumura, 1914: 403.

**Distribution:** China: Taiwan (Matsumura 1914).

***Cixius vittatus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius vittatus* Tsaur & Hsu in Tsaur et al., 1991b: 211.

**Distribution:** China: Guangxi, Ningxia, Taiwan (Tsaur et al. 1991b).

**Notes:** New record: China: Ningxia (Liupan Mountain), Guangxi (Huaping nature reserve).

***Cixius wui* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius wui* Tsaur & Hsu in Tsaur et al., 1991b: 178.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius wusheus* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius wusheus* Tsaur & Hsu in Tsaur et al., 1991b: 269.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

***Cixius yangi* Tsaur & Hsu, 1991****Nomenclature:**

*Cixius yangi* Tsaur & Hsu in Tsaur et al., 1991b: 192.

**Distribution:** China: Taiwan (Tsaur et al. 1991b).

**Subgenus *Acanthocixius* Wagner, 1939*****Cixius (Acanthocixius) stigmaticus* (Germar, 1818)****Nomenclature:**

*Flata stigmaticus* Germar, 1818: 199. | *Cixius stigmaticus* (Germar, 1818), Stephens, 1829: 357. | *Cixius (Acanthocixius) stigmaticus* (Germar, 1818), Mozaffarian & Wilson, 2011: 9. | *Cixius stigmaticus* (Germar, 1818), Emeljanov, 2015: 115.

**Distribution:** China: Guangxi, Guizhou, Zhejiang; France (Ribaut and Lacroix 1958); Germany (Holzinger et al. 2003); UK (Holzinger et al. 2003); Iran: Kandovān (Mozaffarian and Wilson 2011); Netherlands (De Haas and Den Bieman 2018); Poland (Gebicki et al. 2013).

**Notes:** New record: China: Guangxi (Huaping), Zhejiang (Hangzhou).

**Subgenus *Ceratocixius* Wagner, 1939*****Cixius (Ceratocixius) subsimplex* Vilbaste, 1968****Nomenclature:**

*Cixius subsimplex* Vilbaste, 1968: 5. | Anufriev & Emeljanov, 1988: 452. | *Cixius (Ceratocixius) subsimplex*, Emeljanov, 2015: 98.

**Distribution:** China: Gansu.

**Notes:** New record: China: Gansu (Wenxian).

**Genus *Gonophallus* Tsaur & Hsu, 1991*****Gonophallus trinus* Tsaur & Hsu, 1991****Nomenclature:**

*Gonophallus trinus* Tsaur & Hsu in Tsaur et al., 1991a: 25.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

**Genus *Macrocixius* Matsumura, 1914*****Macrocixius giganteus* Matsumura, 1914****Nomenclature:**

*Macrocixius giganteus* Matsumura, 1914: 394. | Schumacher, 1915: 131. | Fennah, 1956: 459. | Tsaour et al., 1991a: 3. | Liang, 2005: 429. | Orosz, 2013: 107. | Zhang & Chen, 2013b: 279. | Hayashi & Fujinuma, 2016: 325.

**Distribution:** China: Fujian, Hainan, Jiangxi (Zhang and Chen 2013a), Taiwan (Tsaour et al. 1991a); Japan: Kyushu; Vietnam (Hayashi and Fujinuma 2016).

**Notes:** New record: China: Fujian (Chongan), Hainan (Jianfeng), Jiangxi (Wuyishan).

***Macrocixius grossus* Tsaour & Hsu, 1991****Nomenclature:**

*Macrocixius grossus* Tsaour & Hsu in Tsaour et al. 1991a: 5. | Orosz, 2013: 108. | Zhang & Chen, 2013b: 281.

**Distribution:** China: Guizhou, Sichuan, Yunnan, Zhejiang (Zhang and Chen 2013a), Taiwan (Tsaour et al. 1991a); Vietnam.

**Notes:** New record: China: Guizhou (Luodian).

***Macrocixius rarimaculatus* Zhang & Chen, 2013****Nomenclature:**

*Macrocixius rarimaculatus* Zhang & Chen, 2013a: 283. | Orosz & Redei, 2016: 376.

**Distribution:** China: Guizhou (Zhang and Chen 2013a), Jiangxi, Taiwan (Tsaour et al. 1991a); Nepal: Ganesh Himal.

***Macrocixius unispinus* Zhang & Chen, 2013****Nomenclature:**

*Macrocixius unispinus* Zhang & Chen, 2013a: 285.

**Distribution:** China: Yunnan (Zhang and Chen 2013a) .

**Genus *Semicixius* Tsaur & Hsu, 1991*****Semicixius denticulus* Tsaur & Hsu, 1991****Nomenclature:**

*Semicixius denticulus* Tsaur & Hsu in Tsaur et al., 1991a: 23.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

**Genus *Tsauria* Kocak & Kemal, 2009*****Tsauria brevispina* Zhi & Chen, 2019****Nomenclature:**

*Tsauria brevispina* Zhi & Chen, 2019: 57.

**Distribution:** China: Guizhou, Hubei (Zhi et al. 2019).

***Tsauria cehengensis* (Zhang & Chen, 2011)****Nomenclature:**

*Discophorellus cehengensis* Zhang & Chen, 2011a: 61.| *Tsauria chengensis* (Zhang & Chen, 2011), Xing, 2014: 149.

**Distribution:** China: Guizhou (Zhang and Chen 2011a).

***Tsauria longispina* Zhi & Chen, 2019****Nomenclature:**

*Tsauria longispina* Zhi & Chen, 2019: 63.

**Distribution:** China: Fujian, Guizhou, Hainan (Zhi et al. 2019).

***Tsauria major* (Tsaur & Hsu, 1991)****Nomenclature:**

*Discophorellus major* Tsaur & Hsu in Tsaur et al., 1991a: 21.| *Tsauria major* (Tsaur & Hsu, 1991), Kocak, 2009: 6.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

***Tsauria transspinus* (Zhang & Chen, 2011)****Nomenclature:**

*Discophorellus transspinus* Zhang & Chen, 2011a: 64. | *Tsauria transspinus* (Zhang & Chen, 2011), Xing, 2014: 150.

**Distribution:** China: Guizhou (Zhang and Chen 2011a).

**Tribe Eucarpiini Emeljanov, 2002****Genus *Bajauana* Distant, 1907*****Bajauana mestra* Fennah, 1980****Nomenclature:**

*Bajauana mestra* Fennah, 1980: 285.

**Distribution:** China: Hunan; Indonesia: Irian Jaya (Fennah 1980).

**Notes:** New record: China: Hunan (Nanyue).

***Bajauana smaragus* Fennah, 1980****Nomenclature:**

*Bajauana smaragus* Fennah, 1980: 277.

**Distribution:** China: Hainan; Indonesia: Irian Jaya (Fennah 1980).

**Notes:** New record: China: Hainan (Qixianling).

**Genus *Dilacreon* Fennah, 1980****Subgenus *Dilacreon* Fennah, 1980*****Dilacreon (Dilacreon) semiramis* Fennah, 1980****Nomenclature:**

*Dilacreon (Dilacreon) semiramis* Fennah, 1980: 242.

**Distribution:** China: Hainan; Indonesia: Irian Jaya; Papua New Guinea: Hollandia (Fennah 1980).

**Notes:** New record: China: Hainan (Wuzhi Mountain).

**Genus *Eucarpia* Walker, 1857*****Eucarpia specialis* Tsaur & Hsu, 2003****Nomenclature:**

*Eucarpia specialis* Tsaur & Hsu, 2003: 438.

**Distribution:** China: Hainan, Taiwan (Tsaur and Hsu 2003).

**Notes:** New record: China: Hainan (Wuzhi Mountain).

***Eucarpia stellata* Tsaur & Hsu, 2003****Nomenclature:**

*Eucarpia stellata* Tsaur & Hsu, 2003: 436.

**Distribution:** China: Fujian, Hainan, Taiwan (Tsaur and Hsu 2003).

**Notes:** New record: China: Hainan (Liping), Fujian (Meihua).

***Eucarpia truncata* Tsaur & Hsu, 2003****Nomenclature:**

*Eucarpia truncata* Tsaur & Hsu, 2003: 438.

**Distribution:** China: Taiwan (Tsaur and Hsu 2003).

***Ptoleria indica* (Distant, 1916)****Nomenclature:**

,*Caneirona indica* Distant, 1916: 39.] *Ptoleria indica* (Distant, 1916), Fennah, 1956: 448.

**Distribution:** China: Hubei (Fennah 1956); India (Distant 1916).

**Notes:** This species is recorded here from China based on female specimens of literature data.

**Genus *Kirbyana* Distant, 1906*****Kirbyana aspina* Zhi & Chen, 2021****Nomenclature:**

*Kirbyana aspina* Zhi & Chen in Zhi et al., 2021: 7.

**Distribution:** China: Hunan (Zhi et al. 2021).



***Kirbyana furcata* Zhi & Chen, 2021****Nomenclature:**

*Kirbyana furcata* Zhi & Chen in Zhi et al., 2021: 8.

**Distribution:** China: Yunnan, Guangxi (Zhi et al. 2021).

***Kirbyana lini* Tsaur & Hsu, 2003****Nomenclature:**

*Kirbyana lini* Tsaur & Hsu, 2003: 434.

**Distribution:** China: Taiwan (Tsaur and Hsu 2003).

***Kirbyana pagana* (Melichar, 1903)****Nomenclature:**

*Kirby pagana* Melichar, 1903: 248.| *Kirbyana pagana* (Melichar, 1903), Distant, 1907: 262.| Tsaur, 2003: 432.

**Distribution:** China: Hainan, Taiwan (Tsaur and Hsu 2003); India; Malaysia; Sri Lanka: Peradeniya.

**Notes:** New record: China: Hainan (Wuzhi Mountain).

**Genus *Neocarpia* Tsaur & Hsu, 2003*****Neocarpia acutata* Zhi & Chen, 2017****Nomenclature:**

*Neocarpia acutata* Zhi & Chen in Zhi et al., 2017: 23.

**Distribution:** China: Yunnan (Zhi et al. 2017).

***Neocarpia bidentata* Zhang & Chen, 2013****Nomenclature:**

*Neocarpia bidentata* Zhang & Chen, 2013b: 43.

**Distribution:** China: Guizhou (Zhang and Chen 2013b).

***Neocarpia hamata* Zhang & Chen, 2013****Nomenclature:**

*Neocarpia hamata* Zhang & Chen, 2013b: 45.| Zhi et al., 2017: 27.

**Distribution:** China: Guizhou, Hubei (Zhang and Chen 2013b).

### ***Neocarpia maai* Tsauro & Hsu, 2003**

**Nomenclature:**

*Neocarpia maai* Tsauro & Hsu, 2003: 441.

**Distribution:** China: Zhejiang, Taiwan (Tsauro and Hsu 2003).

**Notes:** New record: China: Zhejiang (Fengyang Mountain).

### ***Neocarpia reversa* Zhi & Chen, 2017**

**Nomenclature:**

*Neocarpia reversa* Zhi & Chen in Zhi et al., 2017: 30.

**Distribution:** China: Yunnan (Zhi et al. 2017).

### **Tribe Oecleini Muir, 1922**

### **Genus *Haplaxius* Fowler, 1904**

### ***Haplaxius ovatus* Ball, 1933**

**Nomenclature:**

*Myndus ovatus* Ball, 1933: 473. | *Haplaxius ovatus* (Ball, 1933), Caldwell, 1946: 203. | *Myndus ovatus* (Ball, 1933), Kramer, 1979: 344. | *Haplaxius ovatus* (Ball, 1933), Emeljanov, 1989: 62. | Bartlett et al., 2014: 99 | Wheeler, 2014: 360.

**Distribution:** China: Guizhou; USA: Delaware, Georgia, Illinois, Iowa, Kansas, Maryland, Massachusetts, Minnesota, Missouri, Nebraska, New Jersey, Oklahoma, South Dakota, Virginia, Wisconsin (Bartlett et al. 2014).

### **Genus *Mundopa* Distant, 1906**

### ***Mundopa kotoshonis* Matsumura, 1914**

**Nomenclature:**

*Mundopa kotoshonis* Matsumura, 1914: 430. | Tsauro et al., 1991a: 76.

**Distribution:** China: Taiwan (Tsauro et al. 1991a).

**Genus *Myndus* Stål, 1862*****Myndus kotoshonis* Matsumura, 1940****Nomenclature:**

*Myndus kotoshonis* Matsumura, 1940: 45.| Tsaur et al., 1991a: 74.

**Distribution:** China: Taiwan (Tsaur et al. 1991a).

**Tribe Pentastirini Emeljanov, 1971****Genus *Oteana* Hoch, 2006*****Oteana oryzae* (Matsumura, 1911)****Nomenclature:**

*Oliarus oryzae* Matsumura, 1911: 134.| Van Stalle, 1991: 34.| *Oteana oryzae* (Matsumura, 1911), Emeljanov, 2007: 291.

**Distribution:** China: Taiwan (Van Stalle 1991).

**Subtribe Pentastirina Emeljanov, 1971****Genus *Arosinus* Emeljanov, 2007*****Arosinus hopponis* (Matsumura, 1914)****Nomenclature:**

*Oliarus boninensis* Matsumura, 1914: 423.| Fennah, 1956: 83; Van Stalle, 1991: 46.| *Arosinus boninensis* (Matsumura, 1914), Emeljanov, 2007: 291.| Hayashi & Fujinuma, 2016: 323.

**Distribution:** China: Taiwan (Matsumura 1914).

***Arosinus velox* (Matsumura, 1914)****Nomenclature:**

*Oliarus velox* Matsumura, 1914: 425.| *Arosinus velox* (Matsumura, 1914), Emeljanov, 2007: 291.

**Distribution:** China: Taiwan (Matsumura 1914).

**Genus *Atretus* Emeljanov, 2007*****Atretus horishanus* (Matsumura, 1914)****Nomenclature:**

*Oliarus horishanus* Matsumura, 1914: 418. | Schumacher, 1915: 131. | Van Stalle, 1991: 84. | Liang, 2005: 429. | *Atretus horishanus* (Matsumura, 1914), Emeljanov, 2007: 291.

**Distribution:** China: Taiwan (Matsumura 1914).

***Atretus hsui* (Tsauro, 1990)****Nomenclature:**

*Oliarus hsui* Tsauro, 1990b: 135. | *Atretus hsui* (Tsauro, 1990), Emeljanov, 2007: 291.

**Distribution:** China: Taiwan (Tsauro 1990b).

***Atretus nigronervatus* (Fennah, 1956)****Nomenclature:**

*Oliarus nigronervatus* Fennah, 1956: 451. | Liang, 2005a: 429. | *Atretus nigronervatus* (Fennah, 1956), Emeljanov, 2007: 291.

**Distribution:** China: Fujian, Guangxi, Hubei (Fennah 1956).

**Notes:** New record: China: Guangxi (Baiyangsi).

***Atretus shiao* (Tsauro, 1990)****Nomenclature:**

*Oliarus shiao* Tsauro, 1990b: 137. | *Atretus shiao* (Tsauro, 1990), Emeljanov, 2007: 291.

**Distribution:** China: Taiwan (Tsauro 1990b).

***Atretus yangi* (Tsauro, 1989)****Nomenclature:**

*Oliarus yangi* Tsauro, 1989a: 171. | Van Stalle, 1991: 84. | *Atretus yangi* (Tsauro, 1989), Emeljanov, 2007: 291.

**Distribution:** China: Taiwan (Tsauro 1989a).

**Genus *Indolipa* Emeljanov, 2001*****Indolipa fopingensis* Luo, Liu & Feng 2019****Nomenclature:**

*Indolipa fopingensis* Luo, Liu & Feng, 2019b: 184.

**Distribution:** China: Shaanxi (Luo et al. 2019b).

***Indolipa longlingensis* Zhi & Chen, 2020****Nomenclature:**

*Indolipa fugongensis* Zhi & Chen in Zhi et al., 2020b: 22.

**Distribution:** China: Yunnan (Zhi et al. 2020b).

***Indolipa gansuensis* Guo & Feng, 2010****Nomenclature:**

*Indolipa gansuensis* Guo & Feng, 2010: 35.

**Distribution:** China: Gansu (Guo and Feng 2010).

***Indolipa huapingensis* Luo, Liu & Feng, 2019****Nomenclature:**

*Indolipa huapingensis* Luo, Liu & Feng, 2019b: 189.

**Distribution:** China: Guangxi (Luo et al. 2019b).

***Indolipa kurseongensis* (Distant, 1911)****Nomenclature:**

*Oliarus kurseongensis* Distant, 1911: 737.| Fennah, 1956: 451.| Van Stalle, 1991: 51.|  
*Indolipa kurseongensis* (Distant, 1911), Emeljanov, 2001: 72.| Guo & Feng, 2010: 38.|  
Luo, Liu & Feng, 2019b: 192.

**Distribution:** China: Hubei (Fennah 1956), Guangxi, Hunan, Yunnan (Luo et al. 2019b), Tibet (Guo and Feng 2010); India: Darjeeling (Van Stalle 1991).

***Indolipa longlingensis* Zhi & Chen, 2020****Nomenclature:**

*Indolipa longlingensis* Zhi & Chen in Zhi et al., 2020b: 25.

**Distribution:** China: Yunnan (Zhi et al. 2020b).

***Indolipa tappanus* (Matsumura, 1914)****Nomenclature:**

*Oliarus tappanus* Matsumura, 1914: 424.| Tsaour, 1988: 46.| Van Stalle, 1991: 51.| *Indolipa tappanus* (Matsumura, 1914), Emeljanov, 2001: 72.| Guo & Feng, 2010: 41.

**Distribution:** China: Hainan, Taiwan (Guo and Feng 2010).

**Notes:** New record: China: Hainan (Diaoluo Mountain).

**Genus *Melanoliarus* Fennah, 1945*****Melanoliarus canyonensis* (Mead & Kramer, 1981)****Nomenclature:**

*Oliarus canyonensis* Mead & Kramer, 1982: 381.| *Melanoliarus canyonensis* (Mead & Kramer, 1981), Bartlett et al., 2014: 92.

**Distribution:** China: Taiwan; Japan; USA: California, New Mexico (Bartlett et al. 2014).

**Notes:** This species is recorded here from China based on female specimens of literature data.

***Melanoliarus vicarius* (Walker, 1851)****Nomenclature:**

*Cixius vicaria* Walker, 1851: 343.| *Oliarus vicarius* (Walker, 1851), Distant, 1907: 282.| *Oliarus lucidus* Metcalf, 1936: 79.| *Oliarus vicarius* (Walker, 1851), Mead & Kramer, 1981: 390.| *Melanoliarus vicarius* (Walker, 1851), Emeljanov, 2001: 122.| Bartlett et al., 2014: 96.

**Distribution:** China: Hunan; USA: Florida, Colorado; Georgia; Illinois; Maryland; Massachusetts; Mississippi; New Jersey; North Carolina; South Carolina; Texa (Bartlett et al. 2014).

**Notes:** This species is recorded here from China based on female specimens of literature data.

**Genus *Oecleopsis* Emeljanov, 1971*****Oecleopsis articara* Van Stalle, 1991****Nomenclature:**

*Oecleopsis articara* Van Stalle, 1991: 22.| Guo et al., 2009: 48.

**Distribution:** China: Hainan, Henan, Sichuan (Guo et al. 2009), Guizhou; Malaysia: Borneo, Pahang (Van Stalle 1991).

**Notes:** New record: China: Guizhou (Duyun). This species is recorded here from China only based on female specimens.

### ***Oecleopsis bifidus* (Tsaour, Hsu & Van Stalle, 1988)**

**Nomenclature:**

*Oliarus bifidus* Tsaour, Hsu & Van Stalle, 1988: 52.| *Oecleopsis bifidus* (Tsaour, Hsu & Van Stalle, 1988), Van Stalle, 1991: 25.| Guo et al., 2009: 48.

**Distribution:** China: Fujian, Taiwan (Tsaour et al. 1988).

**Notes:** New record: China: Fujjian (Shaowu).

### ***Oecleopsis chiangi* (Tsaour, Hsu & Van Stalle, 1988)**

**Nomenclature:**

*Oliarus chiangi* Tsaour, Hsu & Van Stalle, 1988: 50.| *Oecleopsis chiangi* (Tsaour, Hsu & Van Stalle, 1988), Van Stalle, 1991: 26.| Guo et al., 2009: 49.

**Distribution:** China: Fujian, Taiwan (Tsaour et al. 1988).

**Notes:** New record: China: Fujjian (Shaowu).

### ***Oecleopsis elevatus* (Tsaour, Hsu & Van Stalle, 1988)**

**Nomenclature:**

*Oliarus elevatus* Tsaour, Hsu & Van Stalle, 1988: 53.| *Oecleopsis elevatus* (Tsaour, Hsu & Van Stalle, 1988), Van Stalle, 1991: 26.| Guo et al., 2009: 49.| Hayashi & Fujinuma, 2016: 325.

**Distribution:** China: Guangxi, Taiwan (Tsaour et al. 1988); Japan: Honshu (Hayashi and Fujinuma 2016).

**Notes:** New record: China: Guangxi (Lingchuan).

### ***Oecleopsis laminatus* Zhi & Chen, 2018**

**Nomenclature:**

*Oecleopsis laminatus* Zhi & Chen in Zhi et al., 2018a: 5.

**Distribution:** China: Yunnan (Zhi et al. 2018a).

***Oecleopsis mori* Matsumura, 1914****Nomenclature:**

*Oecleopsis mori* Matsumura, 1914: 426.| Van Stalle, 1991: 23.| Guo et al., 2009: 50.| Zhi et al., 2018a: 9.

**Distribution:** China: Guangxi, Yunnan (Zhi et al. 2018a), Taiwan (Van Stalle 1991).

***Oecleopsis petasatus* (Noualhier, 1896)****Nomenclature:**

*Oliarus petasatus* Noualhier, 1896: 255.| Fennah, 1956: 455.| *Oecleopsis petasatus* (Noualhier, 1896), Van Stalle, 1991: 22.| Guo et al., 2009: 50.

**Distribution:** China: Hainan, Sichuan, Yunnan (Guo et al. 2009); Cambodia: (Noualhier 1896).

**Notes:** New record: China: Yunnan (Yaoqu, Mengla, Longling, Kunming), Sichuan (Yaan), Hainan (Yinggeling).

***Oecleopsis productus* Zhi & Chen, 2018****Nomenclature:**

*Oecleopsis productus* Zhi & Chen in Zhi et al., 2018a: 9.

**Distribution:** China: Yunnan (Zhi et al. 2018a).

***Oecleopsis sinicus* (Jacobi, 1944)****Nomenclature:**

*Mnemosyne sinica* Jacobi, 1944: 12.| Chou, 1985: 23.| *Oliarus sinicus* (Jacobi, 1944), Van Stalle, 1988: 46.| *Oecleopsis sinicus* (Jacobi, 1944), Van Stalle, 1991: 23.| Liang, 2005b: 429.| Guo et al., 2009: 45.| Hayashi & Fujinuma, 2016: 325.

**Distribution:** China: Beijing, Anhui, Fujian (Jacobi 1944), Guangdong, Guangxi (Guo et al. 2009), Henan, Hubei, Hunan, Sichuan, Guizhou, Zhejiang, Taiwan; Cambodia; Japan: Kyushu (Hayashi and Fujinuma 2016).

**Notes:** New record: China: Beijing (Mentougou), Hunan (Chenzhou, Huping), Fujian (Fuzhou), Guangxi (Lingchuan), Guangdong (Lohchan).

***Oecleopsis spinosus* Guo & Wang, 2009****Nomenclature:**

*Oecleopsis spinosus* Guo & Wang in Guo et al., 2009: 54.



**Distribution:** China: Shaanxi (Guo et al. 2009).

### ***Oecleopsis tiantaiensis* Guo & Wang, 2009**

**Nomenclature:**

*Oecleopsis tiantaiensis* Guo & Wang in Guo et al., 2009: 54.

**Distribution:** China: Shaanxi (Guo et al. 2009), Gansu.

**Notes:** New record: China: Shaanxi (Hanzhong), Gansu (Xiaolong Mountain).

### ***Oecleopsis wuyiensis* Guo & Wang, 2009**

**Nomenclature:**

*Oecleopsis wuyiensis* Guo & Wang in Guo et al., 2009: 56.

**Distribution:** China: Fujian, Shaanxi, Henan, Hunan (Guo et al. 2009), Yunnan.

**Notes:** New record: China: Yunnan (Lvchun).

### ***Oecleopsis yoshikawai* (Ishihara, 1961)**

**Nomenclature:**

*Oliarus yoshikawai* Ishihara, 1961: 228.| *Oecleopsis yoshikawai* (Ishihara, 1961), Van Stalle, 1991: 22.| Guo et al., 2009: 58.| Zhi et al., 2018a: 12.

**Distribution:** China: Guizhou (Zhi et al. 2018a), Yunnan; Thailand: Doi Inthanon (Van Stalle 1991).

**Notes:** New record: China: Yunnan (Sumie).

### ***Oecleopsis cucullatus* (Noualhier, 1896) comb. nov.**

**Nomenclature:**

*Oliarus cucullatus* Noualhier, 1896: 255.| Jacobi, 1917: 11.| Fennah, 1956: 453.| *Oecleus cucullatus* (Noualhier, 1896), Emeljanov, 1971: 621.

**Distribution:** China: Guangdong, Hubei (Fennah 1956); Cambodia (Van Stalle 1991).

**Notes:** This species was originally belonged to *Oecleus*, and when the authors observed the paratype specimens of this species, we found that its morphology indicates the misclassification of this species, this species with strongly elevated and foliaceous lateral carinae, consistent with the diagnostic characteristics of *Oecleopsis*, so in this study this species was transferred to *Oecleopsis* as a new combination.

**Genus *Oliarus* Stål, 1862*****Oliarus bizonatus* Kato, 1932****Nomenclature:**

*Oliarus bizonatus* Kato, 1932: 216.

**Distribution:** China: Northwestern of China (Kato 1932).

***Oliarus cingalensis* (Distant, 1911)****Nomenclature:**

*Mnemosyne cingalensis* Distant, 1911: 738.| *Oliarus cingalensis* (Distant, 1911), Van Stalle, 1988: 46.| Van Stalle, 1991: 82.

**Distribution:** China: Yunnan; Sri Lanka: Trincomalee (Distant 1911); USA: Puerto Rico.

**Notes:** New record: China: Yunnan (Yuanmou).

***Oliarus indicus* Distant, 1911****Nomenclature:**

*Oliarus indicus* Distant, 1911: 735.| Van Stalle, 1991: 80.

**Distribution:** China: Beijing; India: (Van Stalle 1991).

**Notes:** New record: China: Beijing (Xishan).

***Oliarus mlanjensis* Van Stalle, 1987****Nomenclature:**

*Oliarus mlanjensis* Van Stalle, 1987: 66.

**Distribution:** China: Guangxi, Hubei; Malawi; Tanzania; Zimbabwe: ex Rhodesia (Van Stalle 1987).

**Notes:** New record: China: Guangxi (Longsheng), Hubei (Shennongjia).

***Oliarus speciosus* Matsumura, 1914****Nomenclature:**

*Oliarus speciosus* Matsumura, 1914: 424.

**Distribution:** China: Taiwan (Matsumura 1914).

***Oliarus zaoensis* Wang, 1991****Nomenclature:**

*Oliarus zaoensis* Wang, 1991: 85.

**Distribution:** China: Hebei (Wang 1991).

**Genus *Oliparisca* Emeljanov, 2001*****Oliparisca pundaloyensis* (Van Stalle, 1991)****Nomenclature:**

*Oliarus pundaloyensis* Van Stalle, 1991: 72.| *Oliparisca pundaloyensis* (Van Stalle, 1991), Emeljanov, 2001: 72.

**Distribution:** China: Tibet; Sri Lanka: (Van Stalle 1991).

**Genus *Pentastiridius* Kirschbaum, 1868*****Pentastiridius apicalis* (Uhler, 1896)****Nomenclature:**

*Myndus apicalis* Uhler, 1896: 281.| *Oliarus apicalis* (Uhler, 1896), Matsumura, 1900: ?.| Chou, 1985: 21.| *Pentastiridius apicalis* (Uhler, 1896), Emeljanov, 1979: 223.| Anufriev & Emeljanov, 1988: 463.| Van Stalle, 1991: 15.| Liang, 2005b: 429.| Anufriev, 2009: 68.| Hayashi & Fujinuma, 2016: 326.

**Distribution:** China: Beijing (Liang 2005b), Shanghai, Fujian, Jiangxi, Jiangsu, Shaanxi, Sichuan, Zhejiang; Japan: Hokkaido, Honshu, Kyushu, Shikoku (Hayashi and Fujinuma 2016); Russia: Khabarovsk, Primorye.

**Notes:** New record: China: Hebei (Shijiazhuang), Jiangsu (Jinshan), Shanghai (Songjiang).

***Pentastiridius bohemani* (Stål, 1859)****Nomenclature:**

*Cixius bohemani* Stål, 1859: 272.| *Oliarus bohemani* (Stål, 1859), Stål, 1862: 306.| *Pentastiridius bohemani* (Stål, 1895), Van Stalle, 1991: 12.

**Distribution:** China: Hainan, Hongkong (Van Stalle 1991).

**Notes:** New record: China: Hainan (Xisha).

### ***Pentastiridius leporinus* (Linné, 1761)**

#### **Nomenclature:**

*Cicada leporinus* Linné, 1761: 242. | *Cixius leporinus* (Linné, 1761), Curtis, 1829: 194. | *Flata leporina* (Linné, 1761), Germar, 1830: 50. | *Oliarus leporinus* (Linné, 1761), Scott, 1870: 720. | *Pentastiridius leporinus* (Linné, 1761), Van Stalle, 1985: 441. | Kalkandelen, 1990: 3.

**Distribution:** China: Nei-Mongol, Heilongjiang; Iran: bādeh, Albāji, Bampur, Bazmān, Birjand, Chābahār, Dālaki, Evin, Gambuyeh, Gāvbandi, Gharechaman, Hafttappēh, Hamidieh, Hāresābād, Hashtpar, Irānshahr, Kandovān (Māzandarān), Marand, Miāneh-ZanjānRd, Minushahr, Mollāsāni, Shādegān, Shieh, Susangerd, Suza, Tabriz, Varāmin, Zābol (Kalkandelen 1990); Afghanistan (Nast 1972, Holzinger et al. 2003); Albania; Algeria: (Nast 1972, Holzinger et al. 2003) Armenia; Austria; Azerbaijan (Nast 1972, Holzinger et al. 2003); Belgium: (Nast 1972, Holzinger et al. 2003); Cyprus; Czech Republic; Denmark: (Nast 1972, Holzinger et al. 2003); Estonia: (Nast 1972, Holzinger et al. 2003); Finland: (Nast 1972, Holzinger et al. 2003); France: (Nast 1972, Holzinger et al. 2003); Georgia: (Nast 1972, Holzinger et al. 2003); Germany: (Nast 1972, Holzinger et al. 2003); UK: (Nast 1972, Holzinger et al. 2003); Greece: (Nast 1972, Holzinger et al. 2003); Hungary: (Nast 1972, Holzinger et al. 2003); Ireland: (Nast 1972, Holzinger et al. 2003); Israel: (Nast 1972, Holzinger et al. 2003); Italy: (Nast 1972, Holzinger et al. 2003); Jordan: (Nast 1972); Kazakhstan: (Holzinger et al. 2003); Kyrgyzstan: (Nast 1972, Holzinger et al. 2003); Libya: (Nast 1972); Lithuania; Moldova: (Holzinger et al. 2003); Mongolia; Netherlands: (Nast 1972, Holzinger et al. 2003); Poland: (Nast 1972, Holzinger et al. 2003); Portugal: (Nast 1972, Holzinger et al. 2003); Romania: (Nast 1972, Holzinger et al. 2003); Russia: Primorye; Slovakia; Spain; Sweden; Switzerland; Tadjikistan: (Nast 1972, Holzinger et al. 2003); Tunisia (Nast 1972); Turkey (Kalkandelen 1990); Turkmenistan (Kalkandelen 1990); Ukraine: (Nast 1972, Holzinger et al. 2003); Yugoslavia: (Nast 1972, Holzinger et al. 2003).

### ***Pentastiridius pachycephs* (Matsumura, 1914)**

#### **Nomenclature:**

*Oliarus pachycephs* Matsumura, 1914: 420. | Schumacher, 1915: 131. | *Pentastiridius pachycephs* (Matsumura, 1914), Van Stalle, 1991: 13. | Hayashi & Fujinuma, 2016: 326.

**Distribution:** China: Hainan, Taiwan (Van Stalle 1991); Nansei-shoto: Ryukyu Islands (Hayashi and Fujinuma 2016).

**Notes:** New record: China: Hainan (Lingshui).

***Pentastiridius tsoui* (Muir, 1925)****Nomenclature:**

*Oliarus tsoui* Muir, 1925: 365.| *Nesopompe tsoui* (Muir, 1925), Fennah, 1956: 455.|  
*Pentastiridius tsoui* (Muir, 1925), Van Stalle, 1991: 16.

**Distribution:** China: Jiangsu, Hubei (Fennah 1956); Japan (Fennah 1956).

**Genus *Reptalus* Emeljanov, 1971*****Reptalus arcbogdulus* (Diabola, 1985)****Nomenclature:**

*Oliarus arcbogdulus* Diabola, 1965: 87.| *Reptalus arcbogdulus* (Diabola, 1965),  
Emeljanov, 1971: 622.| Emeljanov, 1982: 111.| Emeljanov, 2015: 209.

**Distribution:** China: Beijing; Mongolia: Uburchangaj aimak (Anonymous 2015).

**Notes:** New record: China: Beijing (Mentougou).

***Reptalus basiprocesus* Guo & Wang, 2007****Nomenclature:**

*Reptalus basiprocesus* Guo & Wang, 2007: 276.| Bai et al., 2015: 37.

**Distribution:** China: Fujian (Bai et al. 2015), Hubei, Hunan (Guo and Wang 2007),  
Zhejiang, Sichuan, Guizhou, Hebei, Qinghai, Jiangsu.

**Notes:** New record: China: Jiangsu (Xinghua), Jiangsu (Zhenze).

***Reptalus iguchii* (Matsumura, 1914)****Nomenclature:**

*Oliarus iguchii* Matsumura, 1914: 419.| *Reptalus iguchii* (Matsumura, 1914), Rahman,  
2011: 35.| Hayashi & Fujinuma, 2016: 326.

**Distribution:** China: Guizhou, Hunan; South Korea: Gyeongsangbuk-do (Rahman et  
al. 2011); Japan: Honshu, Kyushu (Hayashi and Fujinuma 2016).

**Notes:** New record: China: Guizhou (Duyun), Guizhou (Tongren), Guizhou (Kaili),  
Hunan (Suining).

### ***Reptalus quadricinctus* (Matsumura, 1914)**

#### **Nomenclature:**

*Oliarus quadricinctus* Matsumura, 1914: 419. | Chou, 1985: 20. | *Reptalus quadricinctus* (Matsumura, 1914), Emeljanov, 1971: 622. | Anufriev & Emeljanov, 1988: 464. | *Reptalus quadricinctus* (Matsumura, 1914), Van Stalle, 1991: 17. | Liang, 2005b 429 | Guo & Wang, 2007: 27. | Rahman, 2011: 35. | Bai et al., 2015: 35. | Emeljanov, 2015: 215. | Hayashi & Fujinuma, 2016: 326.

**Distribution:** China: Beijing, Anhui, Fujian, Hunan, Hubei, Jinlin, Shaanxi, Zhejiang, Jiangsu, Shanghai, Sichuan, Guizhou; Japan: Honshu, Kyushu, Shikoku (Hayashi and Fujinuma 2016); Russia: Primorye; South Korea: Daegu (Rahmam et al. 2011).

**Notes:** New record: China: Anhui (Anhui labor university), Shaanxi (Foping nature reserve, Taibai Mountain, Ningqiang, Shiquan, Suining, Chenxi), Hunan (Hupengshan nature reserve, Zhangjiajie nature reserve), Hubei (Houhe nature reserve, Shennongjia), Jilin (Linjiang), Fujian (Shaowu, Huangkeng, Jianning, Daan), Anhui (Anhui labor university), Zhejiang (Fengyangshan), Beijing (Mentougou), Zhejiang (Hangzhou), Jiangsu (Zhenze, Suzhou), Shanghai (Qingpu, Bao Mountain, Sheshan, Jinshan), Sichuan (Qianjiang).

### ***Reptalus quinquecostatus* (Dufour, 1833)**

#### **Nomenclature:**

*Cixius quinquecostatus* Dufour, 1833: 224. | *Reptalus quinquecostatus* (Dufour, 1833), Emeljanov, 1971: 622. | Lodos & Kalkandelen, 1980: 23. | Jovic, 2009: 1055. | Bertin, 2010: 552. | Cvrkovic, 2010: 222. | Jovic, 2010: 238. | Drobnjaković, 2010: 313. | Cvrkovic, 2011: S130. | Mozaffarian & Wilson, 2011: 14. | Emeljanov, 2015: 209. | Mozaffarian, 2018: 480.

**Distribution:** China: Chongqing; Armenia; Austria; Bulgaria; Czech Republic; France; Germany; Greece; Hungary: Andornaktalya; Iran: North (Mozaffarian and Wilson 2011); Italy: Emilia Romagna, Piemonte; Kazakhstan; Portugal; Romania: Csı 'kszereda, Fundulea; Russia: Azov; Serbia: Vršac, Topla, Rajac, South Banat District; Slovakia; Spain; Tadzhikistan; Turkey; Ukraine; Yugoslavia.

**Notes:** New record: China: Chongqing.

### ***Reptalus shunxiwuensis* Bai, Guo & Feng, 2015**

#### **Nomenclature:**

*Reptalus shunxiwuensis* Bai, Guo & Feng, 2015: 38.

**Distribution:** China: Anhui, Sichuan, Zhejiang (Bai et al. 2015).

**Genus *Siniarus* Emeljanov, 2007*****Siniarus formosanus* (Matsumura, 1914)****Nomenclature:**

*Oliarus formosanus* Matsumura, 1914: 427. | Van Stalle, 1991: 31. | Schumacher, 1915: 131. | *Siniarus formosanus* (Matsumura, 1914), Emeljanov, 2007: 291.

**Distribution:** China: Taiwan (Matsumura 1914).

***Siniarus insetosus* (Jacobi, 1944)****Nomenclature:**

*Oliarus insetosus* Jacobi, 1944: 13. | Fennah, 1956: 454. | *Siniarus insetosus* (Jacobi, 1944), Emeljanov, 2007: 291.

**Distribution:** China: Fujian (Jacobi 1944), Guangdong, Hongkong, Hubei, Sichuan (Fennah 1956), Yunnan, Tibet, Guangxi, Guizhou, Hunan, Taiwan.

***Siniarus scalenus* (Tsaur, Hsu & Van Stalle, 1988)****Nomenclature:**

*Oliarus scalenus* Tsaur, Hsu & Van Stalle, 1988: 41. | Van Stalle, 1988: 29. | *Siniarus scalenus* (Tsaur, Hsu & Van Stalle, 1988), Emeljanov, 2007: 291.

**Distribution:** China: Taiwan (Tsaur et al. 1988).

**Tribe Semonini Emeljanov, 2002****Genus *Betacixius* Matsumura, 1914*****Betacixius bispinus* Zhang & Chen, 2011****Nomenclature:**

*Betacixius bispinus* Zhang & Chen, 2011b: 53.

**Distribution:** China: Sichuan (Zhi et al. 2020a), Guangxi, Guizhou (Zhang and Chen 2011b), Xinjiang, Yunnan (Zhi et al. 2020a).

**Notes:** New record: China: Xinjiang (Changji Temple), Guangxi (Lintian).

***Betacixius brunneus* Matsumura, 1914****Nomenclature:**

*Betacixius brunneus* Matsumura, 1914: 417. | Hori, 1982: 181. | Tsaour et al., 1991b: 37. | Zhang & Chen, 2011b: 50. | Hayashi & Fujinuma, 2016: 323.

**Distribution:** China: Fujian, Zhejiang, Taiwan (Zhang and Chen 2011b); Japan; Nansei-shoto: Ryukyu Islands (Hayashi and Fujinuma 2016).

**Notes:** New record: China: Fujian (Taoyuan valley scenic spot of wuyi Mountain).

***Betacixius clypealis* Matsumura, 1914****Nomenclature:**

*Betacixius clypealis* Matsumura, 1914: 415. | Hori, 1982: 181. | Tsaour et al., 1991b: 39.

**Distribution:** China: Zhejiang, Taiwan (Matsumura 1914).

**Notes:** New record: China: Zhejiang (Jiulong Mountain, Wuyanling).

***Betacixius clypealis* subsp. *vitifrons* (Matsumura, 1914)****Nomenclature:**

*Betacixius clypealis vitifrons* Matsumura, 1914: 416.

**Distribution:** China: Taiwan (Matsumura 1914).

***Betacixius delicates* Tsaour & Hsu, 1991****Nomenclature:**

*Betacixius delicates* Tsaour & Hsu in Tsaour et al., 1991a: 29.

**Distribution:** China: Shaanxi, Zhejiang, Yunnan, Taiwan (Tsaour et al. 1991a).

**Notes:** New record: China: Zhejiang (Fengyang Mountain).

***Betacixius euterpe* Fennah, 1956****Nomenclature:**

*Betacixius euterpe* Fennah, 1956: 458; Zhang & Chen, 2011b: 50.

**Distribution:** China: Guangdong (Fennah 1956).



***Betacixius flagellihamus* Zhang & Chen, 2011****Nomenclature:**

*Betacixius flagellihamus* Zhang & Chen, 2011b: 54.

**Distribution:** China: Guizhou (Zhang and Chen 2011b).

***Betacixius flavovittatus* Hori, 1982****Nomenclature:**

*Betacixius flavovittatus* Hori, 1982: 179.| Tsaur et al., 1991a: 41.| Zhang & Chen, 2011b: 50.

**Distribution:** China: Zhejiang, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Zhejiang (Fengyang).

***Betacixius fuscus* Tsaur & Hsu, 1991****Nomenclature:**

*Betacixius fuscus* Tsaur & Hsu in Tsaur et al., 1991a: 44.| Zhang & Chen, 2011b: 50.

**Distribution:** China: Fujian, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Fujian (Longyan City Contour Park).

***Betacixius herbaceus* Tsaur & Hsu, 1991****Nomenclature:**

*Betacixius herbaceus* Tsaur & Hsu in Tsaur et al., 1991a: 28.

**Distribution:** China: Yunnan, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Yunnan (Yangyang Valley, Matang Reservoir).

***Betacixius latistilus* Zhi, Zhang, Yang & Chen, 2020****Nomenclature:**

*Betacixius latistilus* Zhi, Zhang, Yang & Chen, 2020a: 8.

**Distribution:** China: Yunnan (Zhi et al. 2020a).

***Betacixius maculosus* Tsaur & Hsu, 1991****Nomenclature:**

*Betacixius maculosus* Tsaur & Hsu in Tsaur et al., 1991a: 31.

**Distribution:** China: Fujian, Sichuan, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Fujian (Wuyi Mountain), Sichuan (Emei Mountain).

***Betacixius maguanensis* Zhi, Zhang, Yang & Chen, 2020****Nomenclature:**

*Betacixius maguanensis* Zhi, Zhang, Yang & Chen, 2020a: 11.

**Distribution:** China: Yunnan (Zhi et al. 2020a).

***Betacixius michioi* Hori, 1982****Nomenclature:**

*Betacixius michioi* Hori, 1982: 176. | Tsaur et al., 1991a: 35. | Zhang & Chen, 2011b: 50.

**Distribution:** China: Yunnan, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Yunnan (Yangyang Valley, Matang Reservoir).

***Betacixius nelides* subsp. *atrior* Fennah, 1956****Nomenclature:**

*Betacixius nelides atrior* Fennah, 1956: 458.

**Distribution:** China: Zhejiang (Fennah 1956).

***Betacixius nelides* subsp. *nelides* Fennah, 1956****Nomenclature:**

*Betacixius nelides nelides* Fennah, 1956: 457.

**Distribution:** China: Guangdong (Fennah 1956).

***Betacixius nigromarginalis* Fennah, 1956****Nomenclature:**

*Betacixius nigromarginalis* Fennah, 1956: 457.

**Distribution:** China: Hubei (Fennah 1956).

***Betacixius obliquus* Matsumura, 1914****Nomenclature:**

*Betacixius obliquus* Matsumura, 1914: 414. | Chou, 1985: 23; Chou, 1998: 382. | Liang, 2005b: 429. | Zhang & Chen, 2011b: 50. | *Betacixius obliquus* (Matsumura, 1914), Hayashi & Fujinuma, 2016: 323.

**Distribution:** China: Fujian, Guizhou, Guangxi, Guangdong, Hainan, Hunan, Sichuan (Liang 2005b), Yunnan, Zhejiang; Japan: Honshu, Kyushu, Shikoku (Hayashi and Fujinuma 2016).

**Notes:** New record: China: Hainan (Diaoluoshan, Limu Island), Fujian (Wuyi Mountain, Chongan, Guangze, Yongan), Sichuan (Emei Mountain), Guangxi (Huaping nature reserve), Hunan (Shenzhou); Guangdong (Dinghu Mountain), Zhejiang (Qingyuan, Longquan).

***Betacixius ocellatus* Matsumura, 1914****Nomenclature:**

*Betacixius ocellatus* Matsumura, 1914: 412. | Esaki 1932: 1774. | Hori, 1982: 181. | Tsaour et al., 1991b: 33.

**Distribution:** China: Yunnan, Fujian, Taiwan (Tsaour et al. 1991a).

**Notes:** New record: China: Fujian (Shaowu Jiangshi Nature Reserve).

***Betacixius pallidior* Jacobi, 1944****Nomenclature:**

*Betacixius pallidior* Jacobi, 1944: 15. | Fennah, 1978: 213.

**Distribution:** China: Fujian (Jacobi 1944); Vietnam: Hanio (Fennah 1978).

***Betacixius rinkihonis* Matsumura, 1914****Nomenclature:**

*Betacixius rinkihonis* Matsumura, 1914: 417. | *Betacixius rinkihonis* Hori, 1982: 180. | Tsaour et al., 1991a: 42.

**Distribution:** China: Guangdong, Taiwan (Tsaour et al. 1991a).

**Notes:** New record: China: Guangdong (Shaoguan Nanling).

***Betacixius robustus* Jacobi, 1944****Nomenclature:**

*Betacixius robustus* Jacobi, 1944: 15. | Zhang & Chen, 2011b: 50.

**Distribution:** China: Fujian (Jacobi 1944).

***Betacixius shirozui* Hori, 1982****Nomenclature:**

*Betacixius shirozui* Hori, 1982: 178. | Tsaur et al., 1991a: 48. | Zhang & Chen, 2011b: 50.

**Distribution:** China: Yunnan, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Yunnan (Mengla).

***Betacixius sparsus* Tsaur & Hsu, 1991****Nomenclature:**

*Betacixius sparsus* Tsaur & Hsu in Tsaur et al., 1991a: 46. | Zhang & Chen, 2011b: 50.

**Distribution:** China: Fujian, Hainan, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Fujian (Longyan), Hainan (Jianfengling).

***Betacixius transversus* Jacobi, 1944****Nomenclature:**

*Betacixius transversus* Jacobi, 1944: 14 | Zhang & Chen, 2011b: 50.

**Distribution:** China: Fujian (Jacobi 1944).

**Genus *Kuvera* Distant, 1906*****Kuvera communis* Tsaur & Hsu, 1991****Nomenclature:**

*Kuvera communis* Tsaur & Hsu in Tsaur et al., 1991a: 59.

**Distribution:** China: Fujian, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Fujian (Fengyang Mountain).

***Kuvera flaviceps* (Matsumura, 1900)****Nomenclature:**

*Oliarus flaviceps* Matsumura, 1900: 208. | *Kuvera flaviceps* (Matsumura, 1900), Matsumura, 1914: 407. | Anufriev, 1987: 14. | Anufriev & Emeljanov, 1988: 449. | Hayashi & Fujinuma, 2016: 325.

**Distribution:** China: Gansu, Jilin; Japan: Hokkaido, Honshu, Kyushu, Shikoku ( Hayashi and Fujinuma 2016); Korea; Russia: Sakhalin.

**Notes:** New record: China: Gansu (Wen County).

***Kuvera hama* Tsaur & Hsu, 1991****Nomenclature:**

*Kuvera hama* Tsaur & Hsu in Tsaur et al., 1991b: 61.

**Distribution:** China: Jilin, Fujian, Hunan, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Fujian (Wuyi Mountain), Hunan (Huping Mountain).

***Kuvera huoditangensis* Luo, Liu & Feng, 2019****Nomenclature:**

*Kuvera huoditangensis* Luo, Liu & Feng, 2019a: 140.

**Distribution:** China: Shaanxi (Luo et al. 2019a), Henan, Gansu.

***Kuvera kurilensis* Anufriev, 1987****Nomenclature:**

*Kuvera kurilensis* Anufriev, 1987: 15. | Anufriev & Emeljanov, 1988: 449.

**Distribution:** China: Jilin, Fujian, Hunan, Tibet, Taiwan; Russia: Kuril Islands (Anufriev 1987).

**Notes:** New record: China: Tibet (Motlin Green).

***Kuvera laticeps* (Metcalf, 1936)****Nomenclature:**

*Cixius latifrons* Melichar, 1902: 85. | *Cixius laticeps* Metcalf, 1936: 180. | *Kuvera laticeps* (Metcalf, 1936), Anufriev, 1987: 6.

**Distribution:** China: Sichuan (Anufriev 1987).

***Kuvera longipennis* Matsumura, 1914****Nomenclature:**

*Kuvera longipennis* Matsumura, 1914: 411.

**Distribution:** China: Taiwan (Matsumura 1914).

***Kuvera longwangshanensis* Luo, Liu & Feng, 2019****Nomenclature:**

*Kuvera longwangshanensis* Luo, Liu & Feng, 2019a: 144.

**Distribution:** China: Zhejiang (Luo et al. 2019a).

***Kuvera pallidula* Matsumura, 1914****Nomenclature:**

*Kuvera flaviceps* var. *pallidula* Matsumura, 1914: 409.| *Kuvera pallidula* Matsumura, 1914, Anufriev, 1987: 10.| Anufriev & Emeljanov, 1988: 449.| Hayashi & Fujinuma, 2016: 325.

**Distribution:** China: Jilin, Guangxi, Shaanxi, Sichuan; Japan: Hokkaido, Honshu (Hayashi and Fujinuma 2016); Russia: Far East (Anufriev 1987).

**Notes:** New record: China: Jilin (Antu County), Guangxi (Longsheng), Sichuan (Yaan).

***Kuvera semihyalina* Distant, 1906****Nomenclature:**

*Kuvera semihyalina* Distant, 1906: 261.| Anufriev, 1987: 6.

**Distribution:** China: Liaoning, Shaanxi; Myanmar: (Distant 1906).

**Notes:** New record: China: Liaoning (Baling County National Balding National Nature Reserve), Shaanxi (Shiquan, Qinling).

***Kuvera similis* Tsaur & Hsu, 1991****Nomenclature:**

*Kuvera similis* Tsaur & Hsu in Tsaur et al., 1991a: 55.

**Distribution:** China: Beijing, Fujian, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Beijing (Mentougou), Fujian (Meihua).

***Kuvera taiwana* Tsaur & Hsu, 1991****Nomenclature:**

*Kuvera taiwana* Tsaur & Hsu in Tsaur et al., 1991a: 50.

**Distribution:** China: Hainan, Shaanxi, Yunnan, Ningxia, Zhejiang, Tibet, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Zhejiang (Fengyang Mountain, Linan), Hainan (Yinggeling), Tibet (Yadong); Shaanxi (Huayin), Yunnan (Lvchun), Ningxia (Liupan Mountain).

***Kuvera tappanella* Matsumura, 1914****Nomenclature:**

*Kuvera tappanella* Matsumura, 1914: 410.

**Distribution:** China: Hubei, Jiangxi, Hunan, Jilin, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Hubei (Shennongjia), Jiangxi (Jinggang Mountain), Hunan (Mang Mountain), Hubei (Shennongjia), Jilin (Changbai Mountain).

***Kuvera toroensis* Matsumura, 1914****Nomenclature:**

*Kuvera toroensis* Matsumura, 1914: 410. | Anufriev, 1987: 18.

**Distribution:** China: Yunnan, Jiangxi, Zhejiang, Hunan, Tibet, Taiwan (Matsumura 1914).

**Notes:** New record: China: Hunan (Qianyang), Jiangxi (Lu Mountain), Yunnan (Mengla Longmen, Matang Reservoir), Zhejiang (Hangzhou), Tibet (Langxian Cuona).

***Kuvera transversa* Tsaur & Hsu, 1991****Nomenclature:**

*Kuvera transversa* Tsaur & Hsu in Tsaur et al., 1991a: 57.

**Distribution:** China: Yunnan, Taiwan (Tsaur et al. 1991a).

**Notes:** New record: China: Yunnan (Tengchong Laifeng Mountain).

***Kuvera ussuriensis* (Vilbaste, 1968)****Nomenclature:**

*Betacixius ussuriensis* Vilbaste, 1968: 9. | *Kuvera ussuriensis* (Vilbaste, 1968), Anufriev, 1987: 17.

**Distribution:** China: Sichuan; Russia: Primorsky Territory, South of the Khabarovsk Territory (Anufriev 1987); Japan: Hokkaido.

### ***Kuvera vilbastei* Anufriev, 1987**

**Nomenclature:**

*Kuvera vilbastei* Anufriev, 1987: 7. | Anufriev & Emeljanov, 1988: 448. | Anufriev, 2009: 68.

**Distribution:** China: Shaanxi, Zhejiang, Tibet; Russia: Primorye (Anufriev 1987).

**Notes:** New record: China: Tibet (Bomi Yigong, Yadong), Shaanxi (Hua Mountain, Huxian), Zhejiang (Tianmu Mountain).

### ***Kuvera yecheonensis* Rahman, Kwon & Suh, 2017**

**Nomenclature:**

*Kuvera yecheonensis* Rahman, Kwon & Suh, 2017: 10.

**Distribution:** China: Guizhou; South Korea: Gyeongsangbuk-do (Rahman et al. 2017).

**Notes:** New record: China: Guizhou (Qiandong).

## **Tribe Stenophlepsiini Metcalf, 1938**

### **Genus *Euryphlepsia* Muir, 1922**

#### ***Euryphlepsia yamia* Tsaur, 1989**

**Nomenclature:**

*Euruphlepsia yamia* Tsaur, 1989: 82.

**Distribution:** China: Taiwan (Tsaur 1989b).

## **Analysis**

### **Checklist**

Ten cixiid tribes are reported in China: Cixiini Spinola, 1839, Oecleini Muir, 1922, Bennini Metcalf, 1938, Stenophlepsiini Metcalf, 1938, Pentastirini Emeljanov, 1971, Borysthenini Emeljanov, 1989, Emeljanov, 2002; Brixiiini Emeljanov, 2002, Eucarpiini Emeljanov, 2002, and Semonini Emeljanov, 2002. These tribes include 35 genera and subgenera, 250 species and 400 collection records from 28 Chinese provinces. In this study, 77 new species were recorded for the first time from China.



## Regional richness and endemism

A species richness gradient occurs from north to south and from west to east for Cixiidae as shown in Fig. 2. Substantial variation in species richness and endemism among the different zoogeographic regions were observed. Table 1 describes the species richness of Cixiidae by region, ranging from 5 species and no endemic species in the Nei Mongol-Xinjiang region, to 161 species and 69.57% of endemic species in Taiwan region. In-between, species richness and endemism ratios are distributed in two groups: the Northeast China and the Qinghai-Tibet regions, respectively with 8 and 10 species and 12.5% and 20% of endemism, and the North, Southwest and Central China regions, which have comparable numbers of species and endemism, respectively, with 29, 43 and 60 species and 33-40% of endemism. No significant differences in endemism among regions was observed. More than five-fourths of the species (205 species; 82%) are reported to occur in only in China, depicting a high level of endemism of the Chinese fauna for this family (Table 1).

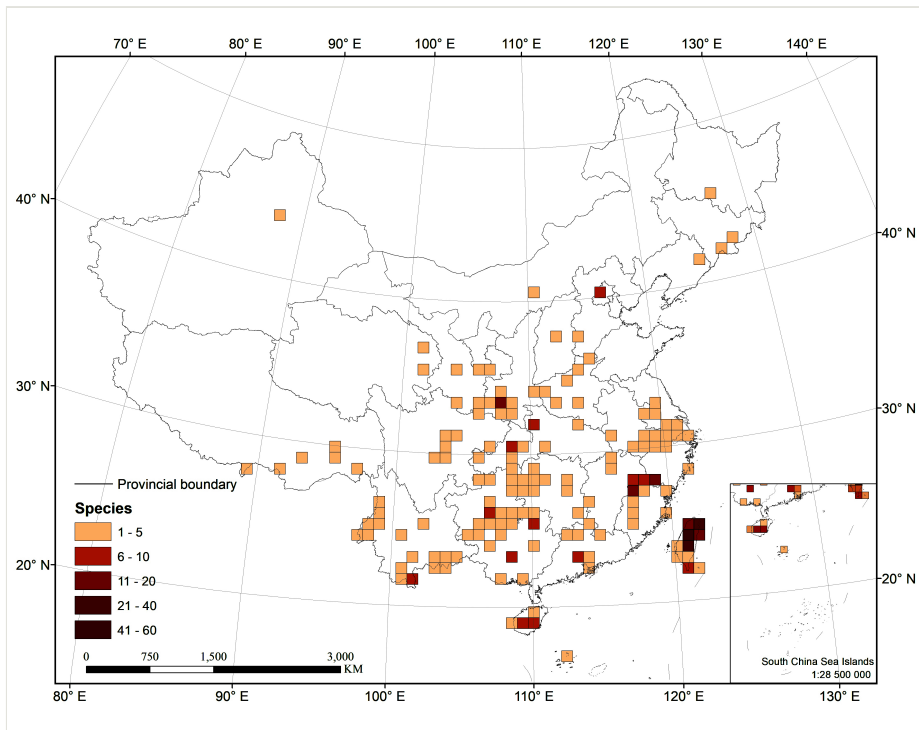


Figure 2. [doi](#)

The distribution of species records of Cixiidae species in China.

Table 1.

Species richness, endemism and the proportion of endemic species in the 8 zoogeographical regions of China.

Zoogeographical regions	Species richness	Number of endemic species	Endemic species %
South China	78	14	17.95
Southwest China	43	17	39.53
Central China	60	20	33.33
North China	29	10	34.48
Northeast China	8	1	12.5
Nei Mongol-Xinjiang	5	0	0
Qinghai-Tibet	10	2	20.00
Taiwan	161	112	69.57
China	250	205	82.00

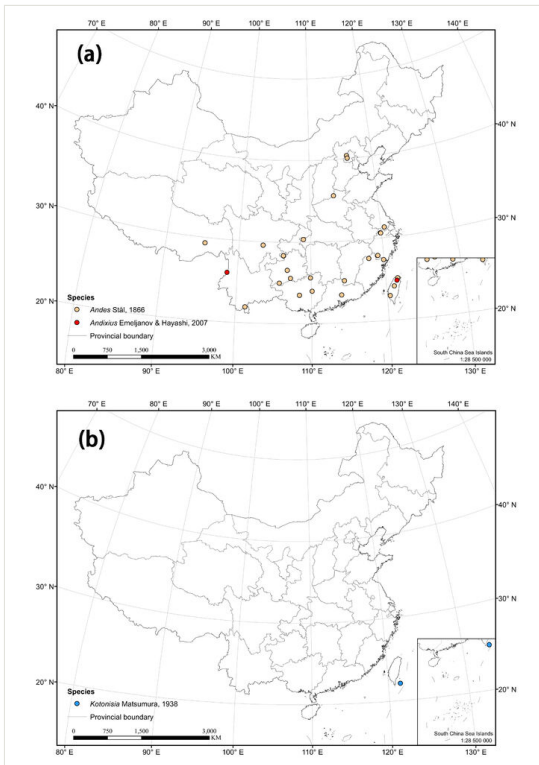


Figure 3. [doi](#)

Distribution of records of the tribes Andini and Bennini in China. (a) Andini Emeljanov, 2002; (b) Bennini Metcalf, 1938.

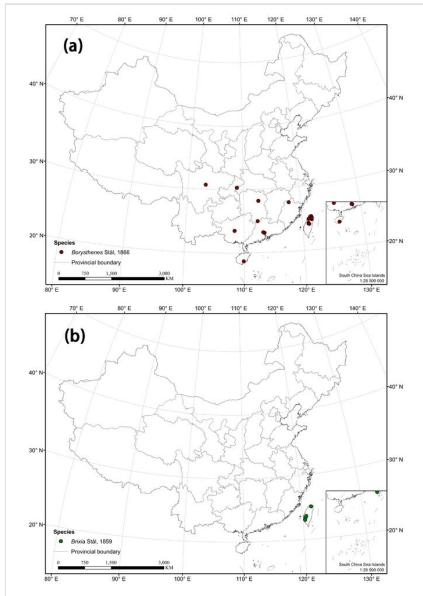


Figure 4. [doi](#)

Distribution of records of the tribes Borysthenini and Brixini in China. (a) Borysthenini Emeljanov, 1989; (b) Brixini Emeljanov, 2002.

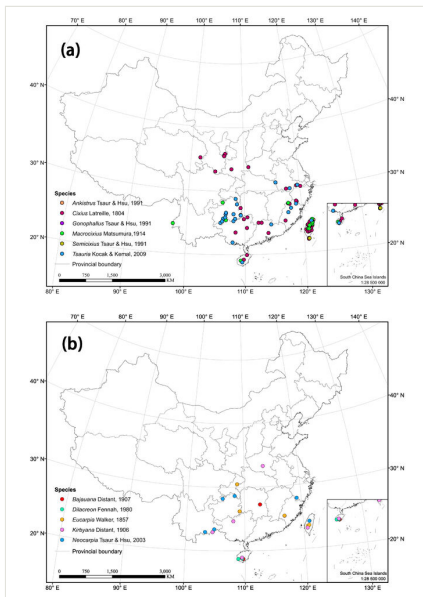


Figure 5. [doi](#)

Distribution of records of the tribes Cixiini and Eucarpiini in China. (a) Cixiini Spinola, 1839; (b) Eucarpiini Emeljanov, 2002.

## Distribution patterns of cixiid species in China

Based on the eight zoogeographic regions of China (Fig. 1), 38 main distribution patterns are observed (Table 2). The number of species distributed in a single region (accounting for regional endemism) is highly variable among the regions: Taiwan (44.80%), Central China (8.00%), Southwest China (6.80%), South China (5.60%), North China (4.00%), Qinghai-Tibet (0.80%) and Northeast China (0.40%). No endemic species were observed in the Nei Mongol-Xinjiang region (Table 2). Nine bi-regional distribution patterns were observed, and among them the South China-Taiwan pattern has the greatest number of species (15 species, 6.00% of the species). Nine tri-regional distribution patterns were also observed, among which, the largest number of species (11 species, 4.40% of the species) was for the Central-South China-Taiwan distribution pattern. The Southwest-South China-Taiwan distribution pattern is depicted by 6 species (2.40% of the species). Five distribution patterns occur in 4 zoogeographic regions, among which the North Southwest-Central-South China region and the Northeast-Central-South China-Taiwan region have two species (0.80% of the total number of cixiids in China). All the remaining four-, five-, six- and seven-regional distribution patterns have only a single species, accounting for 0.40% of the total number of cixiids in China (Table 2).

Table 2.

Distribution patterns of Cixiidae among China zoogeographical regions and proportion of species in these patterns of the total number of species.

\* Abbreviations: NEC, Northeast China; NC, North China; NX, Nei Mongol-Xinjiang; QT, Qinghai-Tibet; SWC, Southwest China; CC, Central China; SC, South China; TW, Taiwan.

Distributed pattern	Number of species	Species number %
TW	112	44.80
CC	20	8.00
SWC	17	6.80
SC	14	5.60
NC	10	4.00
QT	2	0.80
NEC	1	0.40
SC-TW	15	6.00
SWC-SC	3	1.20
SWC-CC	3	1.20
CC-SC	2	0.80
NC-CC	2	0.80
CC-TW	1	0.40
NEC-NC	1	0.40
NC-SC	1	0.40

Distributed pattern	Number of species	Species number %
NEC-NX	1	0.40
CC-SC-TW	11	4.40
SWC-SC-TW	6	2.40
NC-SC-CC	2	0.80
SWC-SC-CC	2	0.80
NC-SC-TW	2	0.80
NX-SC-TW	2	0.80
NC-QT-CC	1	0.40
NX-CC-SC	1	0.40
QT-SC-TW	1	0.40
NC-SWC-CC-SC	2	0.80
NEC-CC-SC-TW	2	0.80
NC-CC-SC-TW	1	0.40
QT-SWC-CC-SC	1	0.40
SWC-CC-SC-TW	1	0.40
NC-SWC-CC-SC-TW	2	0.80
NEC-NC-SWC-CC-SC	1	0.40
NC-QT-SWC-CC-SC	1	0.40
NEC-QT-CC-SC-TW	1	0.40
QT-SWC-CC-SC-TW	1	0.40
NEC-NC-SWC-CC-TW	1	0.40
NC-QT-SWC-CC-SC-TW	1	0.40
NC-NX-QT-SWC-CC-SC-TW	1	0.40

### Cixiid patterns of distribution at the tribal level and generic level

Of the ten cixiid tribes distributed in China (Table 3), Pentastirini (21.20%, Fig. 6b) and Semonini (17.20%, Fig. 7a) are the two most widely distributed tribes in China. Cixiini (Fig. 5a), which is the most species-rich tribe with 45.20% of the species, is distributed in 7 regions of China, but has not been reported from the Northeast China region. Andini (5.20%, Fig. 3a) is not distributed in the Palaearctic realm in China; Eucarpiini (6.40%, Fig. 5b) and Borysthenini (2.00%, Fig. 4a) are distributed only in the Southwest, Central, South China, and in the Taiwan regions. The remaining tribes, Bennini (0.40%, Fig. 3b), Brixiini (0.80%, Fig. 4b), Oecleini (1.20%, Fig. 6a) and Stenophlepsini (0.40%, Fig. 7b) are only found in Taiwan.

Table 3.

Number and percentage of cixiid species distributed in China by tribes among the Chinese zoogeographical regions. Abbreviations: NEC, Northeast China; NC, North China; NX, Nei Mongol-Xinjiang; QT, Qinghai-Tibet; SWC, Southwest China; CC, Central China; SC, South China; TW, Taiwan.

Chinese tribes of Cixiidae	Number of species	Species %	Zoogeographical distribution
Andini Emeljanov, 2002	13	5.20	NC, QT, SWC, CC, SC, TW
Bennini Metcalf, 1938	1	0.40	TW
Brixiini Emeljanov, 2002	2	0.80	TW
Cixiini Spinola, 1839	113	45.20	NC, NX, QT, SWC, CC, SC, TW
Eucarpiini Emeljanov, 2002	16	6.40	SWC, CC, SC, TW
Oecleini Muir, 1922	3	1.20	TW
Pentastirini Emeljanov, 1971	53	21.20	NEC, NC, NX, QT, SWC, CC, SC, TW
Semonini Emeljanov, 2002	43	17.20	NEC, NC, NX, QT, SWC, CC, SC, TW
Stenophlepsiini Metcalf, 1938	1	0.40	TW
Borysthenini Emeljanov, 1989	5	2.00	SWC, CC, SC, TW

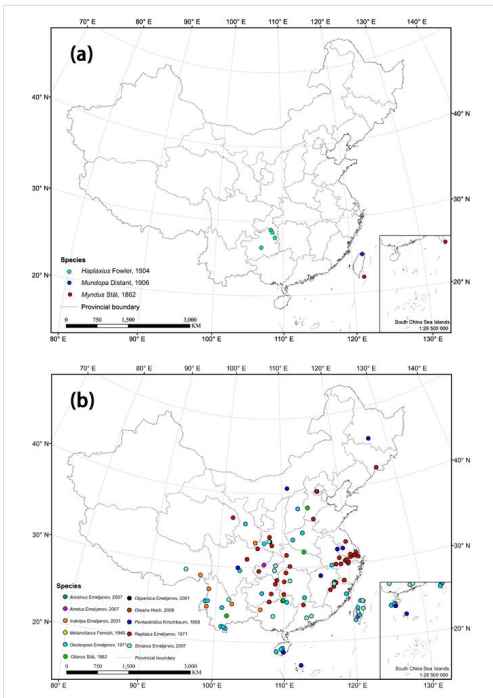


Figure 6. [doi](#)

Distribution of the tribes Oecleini and Pentastirini in China. (a) Oecleini Muir, 1922; (b) Pentastirini Emeljanov, 1971.

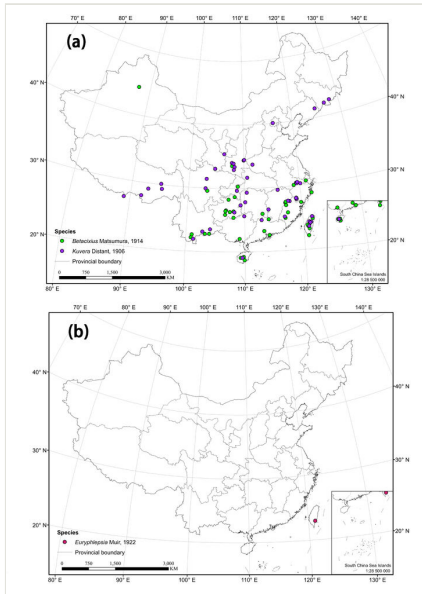


Figure 7. [doi](#)

Distribution of the tribes Semonini and Stenophlepsini in China. (a) Semonini Emeljanov, 2002; (b) Stenophlepsini Metcalf, 1938.

Thirty-three Cixiidae genera are present in China (Table 4; Fig. 3; Fig. 4; Fig. 5; Fig. 6; Fig. 7), with *Kuvera* (18 species, 7.2%) being the most widespread genus in China although *Pentastiridius* (5 species, 2%) is only unreported from the Qinghai-Tibet region. *Cixius* is the most diverse (95 species, 38%) but is not distributed in the Southwest and Northeast China regions. *Betacixius* (25 species, 10%) is not distributed in the Northeast China and Qinghai-Tibet regions. *Oliarus* and *Reptalus* (each with 6 species 2.4%) are both undistributed in the Nei Mongol-Xinjiang region, while the former is not reported from the Qinghai-Tibet region and the latter not reported from the Taiwan region. *Oliparisca* (1 species, 0.4%) is only distributed in the Qinghai-Tibet region and 10 genera are only reported from the Taiwan region. In addition, we also found that 16 genera are all distributed in the south of Sino-Japanese/Oriental boundary.

Table 4.

Number and percentage of cixiid genus and species distributed in China by genera amongst the Chinese zoogeographical regions. Abbreviations: NEC, Northeast China; NC, North China; NX, Nei Mongol-Xinjiang; QT, Qinghai-Tibet; SWC, Southwest China; CC, Central China; SC, South China; TW, Taiwan.

Chinese genera of Cixiidae	Number of species	Species %	Zoogeographical distribution
<i>Andes</i> Stål, 1866	10	4	NC, QT, SWC, CC, SC, TW
<i>Andixius</i> Emeljanov & Hayashi, 2007	3	1.2	SWC, TW
<i>Ankistrus</i> Tsaur & Hsu, 1991	7	2.8	TW

Chinese genera of Cixiidae	Number of species	Species %	Zoogeographical distribution
<i>Arosinus</i> Emeljanov, 2007	2	0.8	TW
<i>Atretus</i> Emeljanov, 2007	5	2	CC, SC, TW
<i>Bajauana</i> Distant, 1907	2	0.8	CC, SC
<i>Betacixius</i> Matsumura, 1914	25	10	NC, NX, SWC, CC, SC, TW
<i>Borysthenes</i> Stål, 1866	5	2	SWC, CC, SC, TW
<i>Brixia</i> Stål, 1859	2	0.8	TW
<i>Cixius</i> Latreille, 1804	95	38	NC, NX, QT, CC, SC, TW
<i>Dilacreon</i> Fennah, 1980	1	0.4	SC
<i>Eucarpia</i> Walker, 1857	4	1.6	SC, TW
<i>Euryphlepsia</i> Muir, 1922	1	0.4	TW
<i>Gonophallus</i> Tsaur & Hsu, 1991	1	0.4	TW
<i>Haplaxius</i> Fowler, 1904	1	0.4	CC
<i>Indolipa</i> Emeljanov, 2001	7	2.8	NC, QT, SWC, CC, SC, TW
<i>Kirbyana</i> Distant, 1906	4	1.6	SWC, CC, SC, TW
<i>Kotonisia</i> Matsumura, 1938	1	0.4	TW
<i>Kuvera</i> Distant, 1906	18	7.2	NEC, NC, NX, QT, SWC, CC, SC, TW
<i>Macrocixius</i> Matsumura, 1914	4	1.6	SWC, CC, SC, TW
<i>Melanoliarus</i> Fennah, 1945	2	0.8	CC, TW
<i>Myndus</i> Stål, 1862	1	0.4	TW
<i>Neocarpia</i> Tsaur & Hsu, 2003	5	2	SWC, CC, TW
<i>Oecleopsis</i> Emeljanov, 1971	14	5.6	NC, SWC, CC, SC, TW
<i>Oliarus</i> Stål, 1862	6	2.4	NEC, NC, SWC, CC, SC, TW
<i>Oliparisca</i> Emeljanov, 2001	1	0.4	QT
<i>Oteana</i> Hoch, 2006	1	0.4	TW
<i>Pentastiridius</i> Kirschbaum, 1868	5	2	NEC, NC, NX, SWC, CC, SC, TW
<i>Reptalus</i> Emeljanov, 1971	6	2.4	NEC, NC, QT, SWC, CC, SC
<i>Semicixius</i> Tsaur & Hsu, 1991	1	0.4	TW
<i>Siniarus</i> Emeljanov, 2007	3	1.2	NC, QT, SWC, CC, SC, TW
<i>Tsauria</i> Kocak & Kemal, 2009	5	2	CC, TW
<i>Mundopa</i> Distant, 1906	1	0.4	TW

## Cluster and Ordination

In both the generic and specific taxonomic levels (Fig. 8a, c), the dendograms clearly separate the northernmost regions (Russian Far East, Nei Mongol-Xinjiang and Northeast China regions) from all other regions and with the similar relationships for Chinese zoogeographical regions: South-Central + SouthWest + North + Taiwan + Qinghai-Tibet. At the species-level the south adjacent China country region appears as sister to all of China.



In contrast, at the generic level, this south adjacent China region sister to the central and south Chinese regions. In the northernmost regions, Russian Far East is closer to the Northeast China region at the species level and closer to the Nei Mongol-Xinjiang region at the generic level. In both analyses, the cophenetic correlation coefficient ( $r > 0.8$ ) is high, indicating close agreement between the cluster assignment and the original Jaccard similarity coefficient matrix.

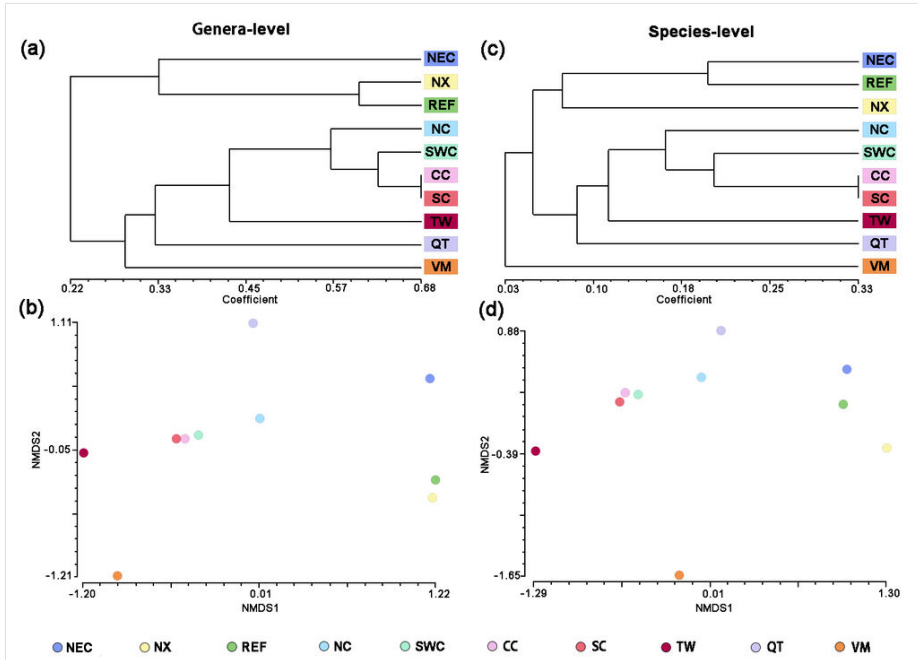


Figure 8. [doi](#)

Dendrograms from UPGMA clustering and NMDS ordination of Jaccard similarity coefficients based on Chinese zoogeographical regions and adjacent areas for Chinese Cixiidae genera (a), (b) and species (c), (d). Abbreviations: NEC, Northeast China; NC, North China; NX, Nei Mongol-Xinjiang; QT, Qinghai-Tibet; SWC, Southwest China; CC, Central China; SC, South China; TW, Taiwan; RFE, Russian Far East; VM, Vietnam, Laos, Thailand, Cambodia, Myanmar, Bhutan, Bangladesh and part of Indian.

The cluster analysis and the NMDS ordination generally showed similar interrelationships among regions (Fig. 8b, d). The stress values of 0.18 (generic level) and 0.30 (species level) demonstrate the accuracy of the projections in the matrix in the 2D ordination space. At the generic level (Fig. 8b), the Nei Mongol-Xinjiang and Russian Far East regions are closely related to each other, and the Northeast China, Nei Mongol-Xinjiang, and Russian Far East regions are clearly separated from the other 7 regions. The Southwest, Central, and South China regions are closely grouped together, and are also related to the North China and Taiwan regions, but the Qinghai-Tibet and VM regions are more separated. At the species level (Fig. 8d), a roughly similar pattern occurs and the Russian Far East is

closer to the Northeast China region, but the VM region is clearly separated and more distant from all other regions.

## Discussion

### Current Chinese Cixiidae diversity and distribution

More than 80% of the Cixiidae species are considered to be endemic to China. The highest endemism is found in Taiwan (69.57%), followed by the Southwest China (39.53%), North China (34.48%) and Central China (33.33%) regions. These figures are consistent with the species richness and endemism patterns observed in other Hemiptera groups, such as aphids (Huang et al. 2008, Gao et al. 2018), leafhoppers (Yuan et al. 2014), or more specifically for planthoppers (Zhao et al. 2020a, Zhao et al. 2020b). For the patterns of distribution, the South China-Taiwan pattern (6.00%), the Central-South China-Taiwan one (4.40%) and the South-Western-South China-Taiwan one (2.40%) are the richer in term of species. This pattern probably results from the past interconnection of the island of Taiwan with the Asian continent during the Quaternary period, when the sea level fell, facilitating the species flow between these areas (Lei et al. 2003, Tang et al. 2006). Its subsequent geographical isolation after the Quaternary period explains its relatively independent pattern of speciation (Gao et al. 2018) and its high endemism of species.

At the tribal level Cixiini, Pentastirini, and Semonini are widely distributed in China, except in the Northeastern China region for the Cixiini, which is probably a collect artefact as Cixiini are known to occur in higher latitudes (Bourgoin 2021). With 5.20% of the species, Andini is distributed in the Sino-Japanese - Oriental Region (NC, QT, SWC, CC, SC, TW), and Eucarpini and Borysthenini (6.40% and 2.00% respectively) are mainly concentrated south to the Qingling Mountain-Huai River (SWC, CC, SC, TW). The remaining four tribes [Bennini (0.40%), Briixini (0.80%), Oecleini (1.20%) and Stenophlepsini (0.40%)] are all distributed in Taiwan.

At the generic level, *Kuvera* (7.2%) is the most widely distributed genus in China. *Pentastiridius* (2%) is not distributed in the Qinghai-Tibet region. *Cixius* (38%) is not distributed in the Southwest and Northeast China regions, but the genus was reported from the Russian Far East, so it may be a collection bias. In addition, one genus is distributed only in the Tibet region, while 10 genera are distributed only in the Taiwan region. We also found that nearly half of the genera (16 genera, 48.48%) are distributed south of the Sino-Japanese/Oriental boundary.

### Biogeographical history shaped Chinese Cixiidae diversity

Cixiidae have a wide range of host plants, including mostly angiosperm Eudicot shrubs: Asterales, Rosales, Fabales, Myrtales, Lamiales, etc., but also Monocots as Poales and Arecales and tall trees such as Gymnosperm Pinales, or Magnolids Laurales, etc (Bourgoin 2021). Known from fossil records since the Barremian period, 130MYA (Luo et al. 2020) and probably occurring at least since 200MYA (Urban and Cryan 2012, Song and

Liang 2013, Johnson et al. 2018), it is likely that the radiation of angiosperms around 145 MY (Condamine et al. 2020), has greatly influenced the diversification of the major Cixiidae lineages (Labandeira 2014, Szwedo 2016, Luo et al. 2020).

More recently, the uplift of the Qinghai-Tibetan Plateau starting in the middle of the Eocene period (45-38 Ma), also had profound effects on the topography and watersheds of East Asia, the aridity of inland Asia, and the Asian monsoon system. These abiotic factors produced a three-stage pattern of species distribution, from high in the west to low in the east (Zhang et al. 2000). The vertical differentiation in plant distribution (Jin et al. 2003), affected their diversity and increased the richness of local speciation events (Wen et al. 2014, Favre et al. 2015, Ye et al. 2017), and subsequently influenced the species distribution and speciation of the Cixiidae. During the late Oligocene to early Miocene periods (25-15Ma), the expansion of the Tibetan Plateau continued, and the East Asian monsoon and Indian monsoon prevailed in the Asian continent. This resulted in an increase of both temperature and sea levels (Ye et al. 2017), which allowed the northward propagation of fauna and flora. This area was pushed back southwards at the end of the Miocene period (10 Ma) by the uplift of the Hengduan Mountains (Li et al. 2020), which caused the climate to cool (Xie et al. 2019, Yu et al. 2020). Since the middle of the Holocene period (6Ka), rainfall declined and monsoon strength weakened, resulting in a dramatic decrease in precipitation in northern China, which affected the vegetative environment (Zhao et al. 2009, Huang et al. 2012). Quantitative precipitation reconstructions based on pollen collected from northern China indicated that a strong sea-land pressure and temperature gradient caused by strong summer insolation in the northern hemisphere during the early Holocene period (0.14-0.07 Ma) caused enhanced monsoons (Zhao et al. 2009, Cook et al. 2011, Chen et al. 2015, Ge et al. 2017). Obviously the cixiid fauna diversity fluctuated at the same periods along with the diversity of their host-plants. However, without more robust phylogeny studies of Cixiidae, it remains difficult to better infer a more precise biogeographic historical scenario for the family and to link their distribution patterns to any of these important past events.

### **Biogeographical patterns of Chinese cixiids**

Traditionally, the global biogeographical regionalization of China covers both the Oriental and Palearctic realms, which are bounded by the Qingling Mountain-Huai River, around 32–34N in the east of China (Sclater 1858, Wallace 1876, Zhen 1960, Zhang 1999, Cox 2001, Kreft and Jetz 2010, Morrone 2015, Song et al. 2016, He et al. 2017). In 2013, based on its zoological fauna, Holt added a Sino-Japanese realm standing between the Palearctic and Oriental realms, and from west of Tibet to east of the Japanese archipelago. He located the Palearctic/Sino-Japanese boundary at about 40–41N, and the Sino-Japanese/Oriental boundary at 24–25N in southeast China (Fig. 1). Kreft and Jetz (2013) questioned the validity of this realm because they regarded it as just a biogeographical transition zone between the Palearctic and Oriental realms. According to their taxa etho-ecological characteristics, the Sino-Japanese realm boundaries are generally clustered with the Oriental realm (Kreft and Jetz 2010, Song et al. 2016, He et al. 2017, Gao et al. 2017, He et al. 2018).

This result is also observed here for the Chinese Cixiidae divided into two major zoogeographic areas: the Nei Mongol-Xinjiang and Northeast China regions from the rest of China. This boundary corresponds to the Palearctic/Sino-Japanese north boundary and appears to be more well defined than the Palearctic/Oriental boundary. The Andini tribe serves as a landmark for the Palearctic/Sino-Japanese north boundary, while the Eucarpini and Borysthenini tribes are primarily concentrated south to the Qingling Mountain-Huai River point to the traditional Palearctic/Oriental boundary as proposed by Zhang (2011). Eucarpini and Borysthenini are landmarks for the south Sino-Japanese realm, clustering with the Oriental realm. Bennini, Briixini, Oecleini and Stenophlepsiini, which are all distributed in Taiwan, may either indicate the northern limit of older and wider distributions of these tribes or might have resulted from occasional dispersions from neighbouring south regions.

At the genus level, the south parts of China cluster with the Indochina region in our analyses, but at the species level all of China forms a unique group. This may be related to the late Eocene uplift of the Himalayas and recent uplift of the Himalayan-Hengduan Mountains in the late Miocene, with a peak before the late Pliocene (Harrison et al. 1992, Sun et al. 2011). These geographical uplifts resulted in the formation of large topographic barriers isolating South China fauna and favorizing recent speciation events and endemism as already shown in several other taxa such as frogs (Che et al. 2010), insects (Ye et al. 2016; Chen et al. 2016), birds (Liu et al. 2016, Cai et al. 2018, Dong et al. 2020), mammals (Ge et al. 2017) and plants (Feng et al. 2013, Favre et al. 2016, Ebersbach et al. 2017, Liu et al. 2017, Ye et al. 2017). Moreover, Quaternary (2.6 Ma) tectonic movements and the influence of the Indian and Pacific monsoons greatly contributed also to the segregation, dispersal and speciation of Cixiidae in southern China and Southeast Asia (Shi et al. 1998, Liang 2003).

The South China region is usually included in the Oriental realm in other studies (Zhang 1999, Zhang 2011), but our analysis indicates that for Cixiidae the South China region is closer to the Central, Southwes, and North China region (Sino-Japanese realm). This is consistent with the results of a quantitative analysis of terrestrial mammals in China and adjacent regions by Xiang et al. (2004), where clustering analysis showed the proximity of South China region to Central and Southwest China regions, and they suggested these regions as the South China Division.

## Conclusions

This study is the first zoogeographic analysis based on grid cells of Cixiidae in China and adjacent areas, including all the available data for the family. However this dataset has its own limits: 1) the stronger collecting efforts into southern China and taxonomic studies clearly advanced in the Taiwan region because of studies by Tsaur over the past three decades (Tsaur and Lee 1987, Tsaur et al. 1988, Tsaur 1989a, Tsaur 1989b, Tsaur 1990a, Tsaur 1990b, Tsaur et al. 1991a, Tsaur et al. 1991b, Tsaur and Hsu 2003, Tsaur 2009), 2) the limited to very limited knowledge of Cixiidae in countries adjacent to China, despite studies by Distant (1911), Emeljanov (1974), Fennah (1978), Anufriev (1987), Anufriev and

Emeljanov (1988), Hoch (2013), Anonymous (2015), 3) it does not take into account host-plants, which are however key factors also affecting the distribution of these obligatory, phytophagous planthoppers, although host-plants and the planthopper species complex are also together affected by other complex topographic and climatic factors embedded in a long dynamic geological process. Accordingly, if the high diversity of Chinese Cixiidae - no less than 8.6% of the current total species richness of the family (Bourgoin, 2021) - is probably related to the high diversity of Chinese biotopes, the figures presented here probably over-estimate the level of endemism of the fauna in comparison with the adjacent countries.

With the current available data, the observed distribution patterns reveals that an intercalary Sino-Japanese realm is recognizable between the Palaearctic and Oriental realms. At the regional level, the South China region clusters more closely with the Southwest, Central and North China regions. Taiwan is clearly separated from the South China region and mainland China, but is more closely related to the Qinghai-Tibet region and Indochina countries. The Central and South China regions are close to each other, but the Qinghai-Tibet region is singularly different. However a much better knowledge of the cixiid fauna in the adjacent countries will be needed in the future for a better evaluation and analysis of the singularity of the Chinese fauna. Additionally, a yet to be done phylogenetic analysis of the Cixiidae family will be essential to provide the frame of reference allowing to support any reliable historical biogeography scenario of the evolution, development, and distribution of Cixiidae in China.

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## Author contributions

Conceptualization, Y.L., J.F. and T.B.; Specimen identification, Y.L. and J.Z.; Methodology and Experiments, Y.L., J.Z. and T.B.; Data analysis, Y.L., J.F. and T.B.; writing—original draft preparation, Y.L.; writing—review and editing, Y.L., J.F. and T.B.; funding acquisition, J.F. All authors have read and agreed to the published version of the manuscript.

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## Supplementary materials

### Suppl. material 1: 48 additional Cixiidae species from adjacent areas based on literature and FLOW (Bourgoin, 2021). [doi](#)

**Authors:** Yang Luo, Thierry Bourgoin, Ja-Lin Zhang and Ji-Nian Feng

**Data type:** Table

**Brief description:** Presence (1) or absence (0) of 48 Cixiidae species in VM (Bangladesh, Bhutan, Cambodia, Laos, Myanmar, Thailand, Vietnam) and RFE (Russian Far East).

\* BD, Bangladesh; BT, Bhutan; KH, Cambodia; LA, Laos; MM, Myanmar; TH, Thailand; VN, Vietnam.

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### Suppl. material 2: The observed material information of checklist [doi](#)

**Data type:** spreadsheet

**Brief description:** Excel version of the observed specimen information for Checklist.

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