

ORIGINAL ARTICLE

The Chinese species of the mealybug genus *Neotrionymus* Borchsenius (Hemiptera: Coccoidea: Pseudococcidae)

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Abstract The genus *Neotrionymus* Borchsenius comprises five species in China, *N. cynodontis*, *N. guandunensis*, *N. monstatus*, *N. yunnanensis* and *N. chinensis* **sp. nov.**, which collected from Beijing, Shanxi and Shandong under the leaf sheath of species of Poaceae. This new species is similar to *N. kerzhneri* Danzig, but can be distinguished by with a large, quadrate (longer than width) or sometimes hour-glass shaped circulus, presence of tubular ducts in median area of thorax on dorsum and venter, presence of translucent pores on apical part of hind tibia and the distribution of trilocular pores not only in cerarii, but also on lips of ostioles and near spiracles. A key to species of genus *Neotrionymus* in China is also given.

Key words Pseudococcidae, *Neotrionymus*, new species, taxonomy, China.

1 Introduction

The genus *Neotrionymus* was erected by Borchsenius (1948) with *N. monstatus* Borchsenius as the type species. It was revised recently by Tang (1992), Danzig (1998) and Danzig & Gavrilov (2015). The diagnostic characters are: body of adult female on microscopic slide elongate oval. Antennae each with 6–8 segments, short. Legs small comparing to size of body; claw without denticle; translucent pores present on hind coxae, sometimes extending anteriorly to surrounding derm. Posterior ostioles always present, anterior pairs either present or absent, poorly developed. Multilocular disc pores numerous, scattered on both body surfaces. Trilocular pores few or absent. Oral collar tubular ducts present on both body surfaces, with small or deep collar. Cerarii numbering 1–3 pairs, situated on posterior abdominal segments; each cerarius containing 2 conical setae, with or without associated trilocular pores.

Currently, there are seven species worldwide, mainly occurring in Palaearctic Region, living under the leaf sheath of species of Poaceae (Danzig & Gavrilov, 2015). The adult female of *Neotrionymus* is similar to those of *Trionymus* Berg, 1899 (type species: *Trionymus perrisii* (Signoret)) and *Miscanthicoccus* Takahashi, 1958 (type species: *Miscanthicoccus miscanthi* (Takahashi)), but differs from the former in the replacement of trilocular pores by multilocular disc pores and the latter in the form of spiracle which is normal, whereas the spiracle of the species of genus *Miscanthicoccus* is surrounded by conspicuous sclerotized areas.

The first record of the genus *Neotrionymus* in China was by Tang (1992), where he recorded *Neotrionymus monstatus* on *Phragmites australis* in Xinjiang, Inner Mongolia and Shanxi. Meanwhile, Tang (1992) listed three other species infesting the species of Poaceae, *Kiritshenkella caudatus* (Borchsenius) in Guangdong, *Cannococcus guandunensis* (Borchsenius) in Guangdong and *Neoripersia yunnanensis* (Borchsenius) in Yunnan. All of them have been transferred to *Neotrionymus* by Danzig (1998), whereas Danzig & Gavrilov (2015) placed *Kiritshenkella caudatus* in genus *Metadenopus* Šulc as *Metadenopus caudatus* (Borchsenius). Wu (1999) recorded *N. borchsenii* (Danzig) and *N. cynodontis* (Kiritshenko) from Henan, but the former has been transferred to genus *Trionymus* by Danzig & Gavrilov (2015). So, up to date, four

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Neotrionymus species have been reported from China.

This paper gives a synopsis of the mealybug genus *Neotrionymus* in China, including a new species, *N. chinensis* sp. nov., and proposing a key to species of *Neotrionymus* in China.

2 Material and methods

All specimens were collected individually and stored in 75% alcohol. Slide-mounted specimens were prepared using the method of Borchsenius (1950), stained in acid fuchsin and mounted with Canada balsam. The morphological terms used in the descriptions are explained by Williams (2004). Measurements were made utilizing a compound microscope (Leica DM 1000) fitted with an ocular micrometer. Measurements are in micrometers (μm) except that length and width of body are in millimeters (mm), and all measurements are given as minimum and maximum. The drawings are as usual for illustrating Coccoidea, with the central drawing showing the outline of body and distribution of morphological features and the enlarged drawings (not to scale) showing the detailed structure of important features. Scale insect illustrations show the dorsal surface on the left half and the ventral surface on the right half.

The specimens studied are deposited in the Insect Collection, the Department of Forestry Protection, Beijing Forestry University, Beijing, China (BFUC) except slide of *N. guandunensis* in Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia (ZRAS).

3 Taxonomy

Neotrionymus Borchsenius, 1948

Neotrionymus Borchsenius, 1948: 581; 1949: 182; Ter-Grigorian, 1973: 75; Danzig, 1980: 189; 1998: 156.

Type species: *Neotrionymus monstatus* Borchsenius, 1948, by original designation.

Key to species of genus *Neotrionymus* in China.

1. Circuli numbering 3–4. Sparse trilocular pores present on all body surface *N. monstatus* Borchsenius
Circuli numbering 1–2. Trilocular pores absent or present only on derm near spiracles, on lips of ostioles and in cerarii 2
2. With 2 circuli *N. cynodontis* (Kiritshenko)
With only one circulus 3
3. Oral collar tubular ducts of 2 sizes, with collar occupying more than half of total length of duct. Two pairs of cerarii, each cerarius containing 5–10 trilocular pores *N. yunnanensis* (Borchsenius)
Oral collar tubular ducts of 1 size, with collar occupying no more than half of total length of duct. One pair of cerarius, each cerarius containing trilocular pores no more than 5 4
4. Circulus very large, longer than width, quadrate or hour-glass shaped. Trilocular pores present near spiracles, on lips of ostioles and sometimes in cerarii. Anal ring with 2 or 3 rows of cells *N. chinensis* sp. nov.
Circulus small, quadrate. Trilocular pores entirely absent. Anal ring simple, with reduced numbers of cells *N. guandunensis* (Borchsenius)

Neotrionymus chinensis sp. nov. (Fig. 1)

Material examined. Holotype ♀, China, Shanxi, Jincheng, Lingchuan, Chongan Park (35°46'N, 113°16'E), under the leaf sheath of grasses (Poaceae), 24 September 2016, Xubo Wang & Ming Zhao leg. Paratypes. 25 ♀, same data as holotype; 1 ♀, Beijing, Songshan Natrue Reserve (40°29'N, 115°48'E), under the leaf sheath of grasses (Poaceae), 27 June 2015, Shujing Xu & Xuelian Wang leg.; 29 ♀, Shandong, Zibo, Boshan, Yuanshan Forest Park (36°28'N, 117°49'E), under the leaf sheath of grasses (Poaceae), 18 July 2015, Shujing Xu & Xuelian Wang leg.

Adult female. In life, the body elongate oval, reddish in colour, covered with thin white mealy wax.

Body on microscopic slide elongate oval, sides subparallel, 2.2–3.7 mm long, 0.8–1.7 mm wide. Anal lobes moderately developed, each with ventral surface membranous, bearing an apical seta 150.0–187.5 μm long. Antennae each normally with 7, occasionally with 8 segments, 248–320 μm long. Eye spot present, located at body margin behind antennae. Legs developed; claw slender, curved at tip, without a denticle; both tarsal digitules and claw digitules knobbed, longer than claw. Hind coxa 62.5–112.5 μm long, hind trochanter + femur 180–250 μm long, hind tibia + tarsus 175–262.5 μm long; claw 16.5–26.5 μm long; ratio of lengths of hind tibia + tarsus to hind trochanter + femur 0.89–1.14; ratio of lengths of hind tibia to

tarsus 1.61–2.04; translucent pores present on anterior and posterior surface of hind coxa, a few also occurring on apical part of hind tibia. Circulus large, always longer than width, 75–132.5 µm long, 50–100 µm wide, usually slightly notched on each side, not so obvious, sometimes divided by an intersegmental line, quadrate or sometimes hour-glass shaped. Clypeolabral shield about 130–155 µm long. Labium with 3 segments, about 80–97.5 µm long. Ratio of lengths of labium to clypeolabral shield 0.55–0.67. Spiracles surrounded by slightly sclerotized areas. Ostioles represented by anterior and posterior pairs, with inner edges of lips slightly sclerotized; lower lips of posterior pair normally without trilocular pores and setae, anterior lips of posterior pair bearing 3–8 trilocular pores, sometimes 1–3 setae, occasionally 1–2 multilocular disc pores or tubular ducts present; each lip of anterior pair with 0–3 trilocular pores, 1–2 setae sometimes present on lower lips. Anal ring 67.5–85 µm in diameter, with 2 rows of cells on anterior half and 2 or 3 rows on posterior half; bearing 6 setae, each seta 112.5–180 µm long. Only one pair of cerarii on anal lobes present, each containing 2 slender conical setae (each seta about 12–20 µm long), 0–4 trilocular pores, occasionally 1 auxiliary setae or 1 multilocular disc pores or 1–2 tubular ducts, situated on a membranous to lightly sclerotized area.

Dorsum. Setae slender and flagellate, mostly each 10–25 µm long, some on abdominal segment VII each about 40–45 µm long. Multilocular disc pores each about 6 µm in diameter, present across segments, mainly at anterior edges and some at middle and posterior edges of abdominal segments, and evenly distributed on head and thorax. Trilocular pores present on lips of ostioles and sometimes in cerarii. Oral collar tubular ducts, each about 4.5 µm long, 2.2 µm wide, distributed across segments, mainly near posterior edges and some at middle and anterior edges of abdominal segments, becoming scattered on head and thorax, varying in number.

Venter. Setae normal, flagellate, mostly each about 10–55 µm long, a few on head sometimes each as long as 65–90 µm long. Multilocular disc pores same as those on dorsum, distributed in transverse rows near anterior and posterior edges of abdominal segments IV–VII, elsewhere they evenly distributed. Trilocular pores present near spiracles. Oral collar tubular ducts same as those on dorsum, mainly distributed in groups around lateral margins and in transverse rows at posterior edges of abdominal segments IV–VIII, also sparsely at anterior segments of abdomen, thorax and head.

Remarks. In the general distribution of multilocular disc pores and the type of tubular ducts, this species comes close to *N. kerzhneri* Danzig, 1972, but differs in: 1) the form of the circulus which is quite large, longer than width, quadrate or hour-glass shaped, whereas the circulus of the latter is small and round; 2) the presence of tubular ducts in median area of thorax on dorsum and venter; 3) the presence of translucent pores on apical part of hind tibia; (4) the distribution of trilocular pores not only in cerarii, but also on lips of ostioles and near spiracles.

Distribution. China (Beijing, Shandong, Shanxi).

Etymology. The specific epithet refers to the distribution of this species.

***Neotrionymus cynodontis* (Kiritshenko, 1932)**

Rippersia cynodontis Kiritshenko, 1932: 139.

Neotrionymus cynodontis (Kiritshenko): Borchsenius, 1949: 163; Ben-Dov, 1994: 243; Danzig, 1998: 156 (lectotype designation).

Trionymus cynodontis (Kiritshenko): Williams, 2004: 827.

Balanococcus mediterraneus Kozár, 1983: 140; Danzig, 1998: 156 (synonymy).

Material examined. 5♀, China, Henan, Nanyang, Neixiang, Getiaopa, under the leaf sheath of *Calamagrostis epigeios*, 14 July 1998, San'an Wu leg.; 2♀, China, Henan, Nanyang, Xixia, under the leaf sheath of *Calamagrostis epigeios*, 18 July 1998, San'an Wu leg.; 6♀, China, Anhui, Maanshan, under the leaf sheath of *Puccinellia distans*, 11 May 1999, San'an Wu leg.; 11♀, China, Guangxi, Hechi, Chuanshan, Duchuan, under the leaf sheath of a species of Poaceae, 24 July 2015, Jiangtao Zhang leg.

Distribution. China (Anhui, Guangxi, Henan).

Host plants. Poaceae: *Calamagrostis epigeios*, *Cynodon dactylon*, *Iseilema laxum*, *Iseilema* sp., *Puccinellia distans*.

Biology. Living under the leaf sheath of its host.

***Neotrionymus guandunensis* (Borchsenius, 1958)**

Pseudantonina guandunensis Borchsenius, 1958: 159.

Kiritshenkella guandunensis (Borchsenius): Yang, 1982: 57.

Cannococcus guandunensis (Borchsenius): Tang, 1992: 138; Ben-Dov, 1994: 68; Tao, 1999: 10.

Neotrionymus guandunensis (Borchsenius): Danzig, 1998: 156.

Material examined. 1♀, China, Guangdong, Guangzhou, on a species of Poaceae, 14 November 1954, Youshen Wang

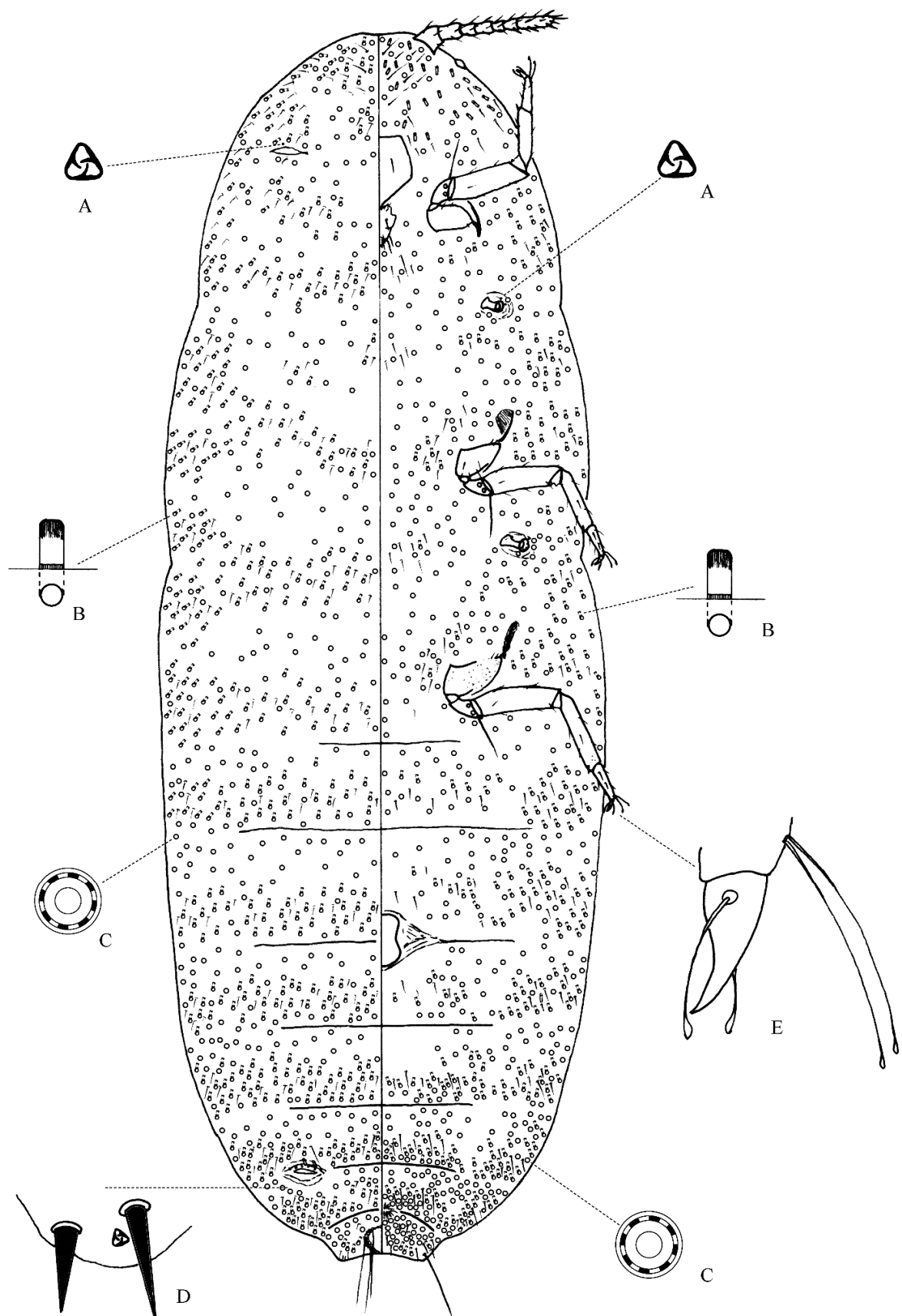


Figure 1. Adult female of *Neotrionymus chinensis* sp. nov. A. Trilocular pore. B. Oral collar tubular duct. C. Multilocular disc pore. D. Cerarius on anal lobe. E. Claw.

(transliteration of Russian) leg.

Distribution. China (Guangdong).

Host plants. Poaceae.

Biology. Living under the leaf sheath of its host.

***Neotrionymus monstatus* Borchsenius, 1948**

Neotrionymus monstatus Borchsenius, 1948: 582; 1949: 162; Ter-Grigorian, 1973: 76; Danzig, 1980: 189 (lectotype designation); 1998: 156; Tang & Li, 1988: 26; Tang, 1992: 144.

Neotrionymus ibericus Hadzibejli, 1960: 302; Danzig, 1980: 189 (synonymy).

Neotrionymus maritimus Borchsenius & Kozarzhevskaya, 1966: 40; Danzig, 1980: 189 (synonymy).

Material examined. 4♀, China, Henan, Anyang, Linzhou, under the leaf sheath of *Phragmites australis*, 26 July 2014, San'an Wu & Yingda Wu leg.; 4♀, China, Shanxi, Changzhi, Huguan, under the leaf sheath of *Phragmites australis*, 30 July 2014, San'an Wu & Yingda Wu leg.; 3♀, China, Shanxi, Yuncheng, Yongji, under the leaf sheath of *Phragmites australis*, 3 August 2014, San'an Wu leg.; 1♀, China, Beijing, Miyun, Wuzuolou Forest Park, under the leaf sheath of *Phragmites australis*, 27 July 2015, Xubo Wang leg.; 2♀, China, Hebei, Xingtai, Tianti Mountain; under the leaf sheath of a species of Poaceae, Qingang Dong & Jiangtao Zhang leg.

Distribution. China (Beijing, Hebei, Henan, Inner Mongolia, Shanxi, Xinjiang (Tang, 1992)).

Host plants. Poaceae: *Phalaris arundinacea*, *Phragmites* sp., *Phragmites australis*, *Saccharum ravennae*.

Biology. Living under the leaf sheath of its host.

***Neotrionymus yunnanensis* (Borchsenius, 1960)**

Kiritshenkella yunnanensis Borchsenius, 1960: 932.

Neoripersia yunnanensis (Borchsenius): Tang, 1992: 143.

Neotrionymus yunannensis (Borchsenius): Danzig, 1998: 156.

Material examined. 1♀, China, Yunnan, on a species of Poaceae, 10 April 1957, Borchsenius leg.

Distribution. China (Yunnan).

Host plants. Poaceae.

Biology. Living under the leaf sheath of its host.

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References

- Ben-Dov, Y. 1994. *A Systematic Catalogue of the Mealybugs of the World (Insecta: Homoptera: Coccoidea: Pseudococcidae and Putoidae) With Data on Geographical Distribution, Host Plants, Biology and Economic Importance*. Intercept Limited, Andover, UK. 686 pp.
- Borchsenius, N.S. 1948. New mealybugs of the family Pseudococcidae from Central Asia. *Doklady Akademii Nauk SSSR (n.s.)*, 63: 581–584.
- Borchsenius, N.S. 1949. Insects Homoptera. suborders mealybugs and scales (Coccoidea). Family mealybugs (Pseudococcidae). Vol. VII. *Fauna SSSR. Zoologicheskii Institut Akademii Nauk SSSR. N.S.*, 38: 1–382.
- Borchsenius, N.S. 1950. Mealybugs and Scale Insects of USSR (Coccoidea). *Akademii Nauk SSSR, Zoological Institute, Moscow*, 32: 1–250.
- Borchsenius, N.S. 1958. Notes on the Coccoidea of China. 2. Descriptions of some new species of Pseudococcidae, Acleridae and Diaspididae (Homoptera, Coccoidea). *Entomologicheskoe Obozrenye*, 37: 156–173.
- Borchsenius, N.S. 1960. Coccid fauna of China. 9. New soft scales of the families Margarodidae, Eriococcidae and Pseudococcidae (Homoptera, Coccoidea). *Entomologicheskoe Obozrenye*, 39: 914–938.

- Borchsenius, N.S., Kozarshevskaya, E.F. 1966. Three new species of Pseudococcidae (Homoptera, Coccoidea) from the USSR. *Trudy Zoologicheskogo Instituta Akademii Nauk SSSR*, 37: 36–40.
- Danzig, E.M. 1980. *Coccoids of the Far East USSR (Homoptera, Coccinea) With Phylogenetic Analysis of Scale Insects Fauna of the World*. Nauka, Leningrad. 367 pp.
- Danzig, E.M. 1998. *Kiritshenkella* and related genera of mealybugs from Russia and neighbouring countries (Homoptera, Coccinea: Pseudococcidae). *Zoosystematica Rossica*, 7(1): 153–161.
- Danzig, E.M., Gavrilov-Zimin I.A. 2015. *Palaeartic Mealybugs (Homoptera: Coccinea: Pseudococcidae), Part 2: Subfamily Pseudococcinae*. Zoological Institute, Russian Academy of Sciences, St. Petersburg. 678 pp.
- Hadzibejli, Z.K. 1960. New species of coccids (Homoptera, Coccoidea) from Georgia. *Trudy Akademii Nauk Gruzinskoy SSR Instituta Zashchiti Rastenii*, 13: 299–321.
- Kiritshenko, A.N. 1932. Description of some new Coccidae (Hemiptera) from Turkestan and Ukraine. *Trudy Zoologicheskogo Instituta Akademii Nauk SSSR*, 1932: 135–142.
- Kozár, F. 1983. New and little-known scale-insect species from Yugoslavia (Homoptera: Coccoidea). *Acta Zoologica Academiae Scientiarum Hungaricae*, 29: 139–149.
- Tang, F.D. 1992. *The Pseudococcidae of China*. Chinese Agricultural Science Technology Press, Beijing. 768 pp.
- Tang, F.D., Li, J. 1988. *Observations on the Coccoidea of Inner Mongolia in China*. Inner Mongolia University Press, Inner Mongolia. 227 pp.
- Tao, C.C. 1999. *List of Coccoidea (Homoptera) of China*. Taiwan Agricultural Research Institute, Taichung. 176pp.
- Ter-Grigorian, M.A. 1973. *Fauna of the Armenian SSR: Scale Insects (Coccoidea, Pseudococcidae)*. Akademii Nauk Armiansky SSR, Erevan, Armenia. 246 pp.
- Williams, D.J. 2004. *Mealybugs of Southern Asia*. The Natural History Museum, Kuala Lumpur. 896 pp.
- Wu, S.A. 1999. Homoptera: Coccoidea. In: Shen, X.C., Pei, H.C. (eds.), *The Fauna and Taxonomy of Insects in Henan. Vol. 4. Insects of the Mountains Funiu and Dabie Regions*. Chinese Agricultural Science Technology Press, Beijing. pp. 231–235.
- Yang, P.L. 1982. *General Classification of Scale Insects in China*. Shanghai Scientific and Technical Publishers, Shanghai. 425 pp.