The cockroaches of Balta Tepper from China, with the description of four new species (Blattodea, Ectobiidae, Pseudophyllodromiinae)

Zhi-Wei Qiu1, Yan-Li Che1, Yu-Hong Zheng1, Zong-Qing Wang1

1 Institute of Entomology, College of Plant Protection, Southwest University, Beibei, Chongqing 400715, China

Corresponding author: Zong-Qing Wang (zqwang2006@126.com)

Academic editor: D. Evangelista | Received 8 June 2017 | Accepted 3 October 2017 | Published 6 November 2017

http://zoobank.org/BD6F82D9-CA6F-4633-8BA8-C132E5AE35BC

Citation: Qiu Z-W, Che Y-L, Zheng Y-H, Wang Z-Q (2017) The cockroaches of Balta Tepper from China, with the description of four new species (Blattodea, Ectobiidae, Pseudophyllodromiinae). ZooKeys 714: 13–32. https://doi.org/10.3897/zookeys.714.14041

Abstract
Four new species of cockroach genus Balta Tepper, 1893 are described and illustrated: B. crena sp. n., B. maculata sp. n., B. tangi sp. n., and B. yaoi sp. n. Balta picea (Bey-Bienko, 1958) is now regarded as a new synonym of Balta hwangorum (Bey-Bienko, 1958), which is redescribed and illustrated. Two new combinations are proposed: B. nodigera (Bey-Bienko, 1958), comb. n. and B. valida (Bey-Bienko, 1958), comb. n., and both species are redescribed and illustrated. A key to all species from China is provided.

Keywords
Dictyoptera, distribution, key, new combination, new synonym

Introduction
Balta Tepper, 1893 is a large genus comprising 98 species, 40 of which are distributed in Australia, and 14 in Mainland China and Taiwan. The others are distributed in Pacific islands, Africa, and India. Bey-Bienko (1958) described three species of Lupparia Walker, 1868 and two species of Balta from China. Roth (1991) thought that Balta and Lupparia are quite similar. The genera Balta and Lupparia are distinguished by the size of the apical triangle of the hind wing (Balta spp. with smaller apical triangle). Che et al.
(2010) briefly reviewed the research history of the genus; they also mentioned the relationship between *Balta* and *Lupparia* and some difficulty existing in discriminating these two genera. From then on, no one reported new species of the genus *Lupparia*. Recently, many cockroach specimens were received from Prof. Shuqiang Li (IOZCAS, Institute of Zoology, The Chinese Academy of Sciences), which were collected by means of canopy spraying conducted mainly in Yunnan and Hainan Provinces from 2009 to 2012. Material was also received from Prof. Shunxiang Ren and Zaifu Xu (SCAU, South China Agricultural University) that was collected from Guangdong Province.

After examining the specimens and comparing them with the original descriptions of Bey-Bienko (1958) and Asahina (1965), descriptions of four new species are appropriate, and are included here. Additionally, *Balta picea* (Bey-Bienko, 1958) is placed as a junior synonym of *Balta hwangorum* (Bey-Bienko, 1958), and two new combinations are proposed.

**Materials and methods**

The terminology mainly follows Roth (2003). The terms for wing-veins are according to Li and Wang (2015). Morphological terms referring to spines are as follows: spines on the antero-ventral margin of the front femur with one or more proximal stout spines succeeded by a row of spinules of uniform length, terminating in two (B₂) or three (B₃) large spines (Type B); while the proximal stout spines absent (Type C) (Roth 2003). Genital segments of the examined specimens were macerated in 10% NaOH and observed in glycerin jelly using a Motic K400 stereomicroscope. All drawings were made with the aid of a Motic K400 stereomicroscope. Photographs of the specimens were taken using a Canon 50D plus a Canon EF 100mm f/2.8L IS USM Macro lens with the aid of Helicon Focus software. Material examined, including types of new species, is deposited in the Institute of Entomology, Southwest University (IESWU) in Beibei, Chongqing, China.

**Taxonomy**

*Balta Tepper, 1893*

*Balta* Tepper, 1893: 39. Type species: *Balta epilamproides* Tepper, 1893: 39. Kirby 1904: 106; Shelford 1908: 19; Hebard 1943: 37; Princis 1951: 68; 1969: 968; Roth 1991: 967; Che et al. 2010: 56.

*Mareta* Bolívar, 1895: 371. Type species: *Mareta conspicienda* Bolívar; by monotype. Kirby 1904: 97; Shelford 1908: 10 (under *Phyllodromia* synonymy); Rehn 1922: 14; Hebard 1929: 18; Rehn 1931: 300. Synonymized with *Balta* by Princis 1969: 968.

*Eoblatta* Shelford, 1911: 155 ( nec *Eoblatta* Handlirsch, 1906). Type species: *Blatta notulata* Stål, 1860; by monotype. Hebard 1917: 26. As a synonym of *Balta* in Beccaloni 2014.
The cockroaches of Balta Tepper from China, with the description of four new species...

Allactina Hebard, 1929: 18 (nec Allactina Curran, 1924). Type species: Allactina jacobsoni Hebard, 1929. Synonymized with Balta by Princis 1969: 968.

Graptoblatta Hebard, 1929: 23. Type species: Blatta notulata Stål, 1860. Princis 1969: 957 (as a synonym of Lupparia). Synonymized with Balta by Princis 1969: 968.

Diagnosis. See Che et al. (2010).

Discussion. The characters of L. nodigera Bey-Bienko and L. valida Bey-Bienko were compared with the generic diagnosis of Lupparia: the hind wing of the two species with the apical triangle small or not distinct differs from the main generic characters of Lupparia, and are consistent with Balta. The two species also share the following characters: 1) abdominal tergites unspecialized, tarsal claws strongly asymmetrical and unspecialized; 2) median phallomere appendage present and with brush-like structure; 3) front femur type B or C, which are also consistent with Balta. Therefore the two species are transferred to the genus Balta.

Checklist of Balta species from China.

B. barbellata Che & Chen, 2010 China (Hainan)
B. curvirostris Che & Chen, 2010 China (Hainan)
B. crena sp. n. China (Yunnan)
B. dissecta Che & Wang, 2010 China (Fujian)
B. hwangorum Bey-Bienko, 1958 China (Yunnan)
B. jinlinorum Che & Wang, 2010 South China
B. maculata sp. n. China (Yunnan)
B. nodigera (Bey-Bienko, 1958), comb. n. China (Yunnan)
B. notulata Stål, 1860 (Oriental region islands, Indian Ocean islands, Korean Peninsula, Australasian islands)
B. spinea Che & Chen, 2010 China (Hainan)
B. spinescens Che & Wang, 2010 (Southeast China)
B. tangi sp. n. China (Yunnan)
B. valida Bey-Bienko, 1958, comb. n. China (Yunnan)
B. vilis Brunner von Wattenwyl, 1865 (Southeast Asia, East Asia)
B. yaoi sp. n. China (Yunnan)

Key to species of Balta from China (males).

1  Tegmina with round black spots (Figs 3, 7) .................................................. 2
–  Tegmina without black spots (Figs 1, 5, 9, 11, 13) ...................................... 3
2  Median phallomere appendage simple, arched, and without brush-like structure (Fig. 62) ................................................................. B. yaoi sp. n.
–  Median phallomere appendage with brush-like structure (Fig. 38) ............
  ........................................................................................................... B. maculata sp. n.
| 3 | Vertex with dark stripes or bands | 4 |
|---|----------------------------------|---|
|   | Vertex unicolored, without stripes (Figs 64, 76, 88) |   |
| 4 | Styli triangular, median phallomere long, sticklike, with blunt base, and bifurcated near apex, one arched appendage present | B. spinea |
|   | Styli elliptical, with scattered fine spines, median phallomere long, sticklike and curved with base blunt and apex brush-like, one arched appendage with apex and base brush-like | B. spinescens |
| 5 | Styli globular | B. notulata |
|   | Styli finger-like or conical (Figs 23, 48, 72, 84, 96) |   |
| 6 | Face black (Fig. 10) | B. hwangorum |
|   | Face brownish yellow (Figs 2, 6, 12, 14), or with brown stripes (Figs 40) |   |
| 7 | Styli arising on the inner side of lateral lobes of subgenital plate (Fig. 96) | B. hwangorum |
|   | Styli arising on the apex of lateral lobes of subgenital plate (Figs 24, 48, 84) |   |
| 8 | Front femur type B₂ or B₃ (Fig. 93) | B. jinlinorum |
|   | Front femur type C₂ or C₃ (Figs 45, 81) |   |
| 9 | Front femur type B₂ |   |
|   | Face without stripes (Fig. 76), front femur type C₂ (Fig. 81) | B. valida comb. n. |
|   | Face with stripes (Fig. 40), front femur type C₃ (Fig. 43) | B. tangi sp. n. |
| 12 | Subgenital plate with spines (Figs 23, 24) | B. nodigera comb. n. |
| 13 | Subgenital plate without spines |   |
| 14 | Hind margin of supra-anal plate with U-shape concavity medially (Fig. 22), the apex of median phallomere with some long setae (Fig. 26) | B. crena sp. n. |
| 15 | Hind margin of supra-anal plate broady rounded, the apex of median phallomere with some long setae | B. dissecta |
|   | Pronotum length 3.0–3.8mm | B. curvirostris |
|   | Pronotum length 1.9–2.0mm | B. vilis |

---

**Balta crena sp. n.**

http://zoobank.org/8E6159A0-9A4C-4CF7-BBF3-D3243E37B559

Figs 1, 2, 15–27

**Type material. Holotype:** China, Yunnan: male (IESWU), Xishuangbanna, Menglun Botanical Garden, Lvshilin, 640 m, 21°54.600’N, 101°17.084’E, 17 November 2009, coll. Guo Tang and Zhiyuan Yao. **Paratypes:** 1 male, same collection event as holotype; 10 males and 14 females, Xishuangbanna, Menglun, G213 (National road) secondary forest, 644 m, 21°54.439’N, 101°17.755’E, 20 November 2009, coll. Guo Tang and
The cockroaches of Balta Tepper from China, with the description of four new species...

Figures 1–14. 1–2 Balta crena sp. n., male: holotype dorsal view 2 ventral view 3–4 Balta maculata sp. n., male: holotype 3 dorsal view 4 ventral view 5–6 Balta tangi sp. n., male: holotype 5 dorsal view 6 ventral view 7–8 Balta yaoi sp. n., male: holotype 7 dorsal view 8 ventral view 9–10 Balta hwangorum Bey-Bienko, 1958, male 9 dorsal view 10 ventral view 11–12 Balta nigerina (Bey-Bienko, 1958) comb. n., male 11 dorsal view 12 ventral view 13–14 Balta valida (Bey-Bienko, 1958), comb. n., male 13 dorsal view 14 ventral view.
Zhiyuan Yao; 4 males and 1 female, Mengla County, Bubeng monsoon forest, 690 m, 21.61379°N, 101.58079°E, 10 August 2012, coll. Guo Zheng, Xue Li and Wenyue Zhu.

**Differential diagnosis.** This species resembles *Balta notulata* (Stål, 1860) in appearance, but can be distinguished from the latter by the following characters: 1) hind
margin of subgenital plate concave and without produced medial lobe (Fig. 24) while that in *B. notulata* with produced medial lobes; 2) some fine spines present on either apex of lateral lobes of subgenital plate (Fig. 24), which are lacking in *B. notulata*.

**Description. Male.** Body brownish yellow (Figs 1, 2). Third and fourth maxillary palpomeres almost the same length, both distinctly longer than the fifth (Fig. 16). Tegmen with M and CuA oblique (Fig. 18); hind wing with M simple; CuA with three or four complete branches and without incomplete ones (Fig. 19). Front femur type C₂ (Fig. 20), tarsal claws strongly asymmetrical and unspecialized (Fig. 21). Abdominal tergites unspecialized.

**Male genitalia.** Supra-anal plate with posterior margin distinctly produced and concave in U-shape in the middle, right and left paraprocts simple (Fig. 22). Subgenital plate with hind margin strongly concave medially; two lateral lobes with styli on either apex direct dorsally and with fine spines (Figs 23, 24). Hook-like phallomere on right side and with preapical concavity (Fig. 27). Median phallomere with base acuminate, apex blunt with some long setae, median phallomere appendage with some fine spines (Fig. 26). Left phallomere complex, consisted of several irregular sclerites (Fig. 27).

**Female.** Both tegmina and hind wings slightly beyond the end of abdomen. Subgenital plate with hind margin rounded.

**Measurements (mm).** Overall length: male 13.5–14.0, female 9.5–10.0; tegmen length male 11.0–12.0, female 7.9–8.2; pronotum length × width male 2.5–2.7 × 3.5–3.8, female 2.5–2.7 × 3.4–3.7.

**Etymology.** Latin word *crena* means “nick”, referring to subgenital plate with its hind margin strongly concave medially.

**Distribution.** China (Yunnan).

*Balta maculata* sp. n.

http://zoobank.org/AD8E7309-BB79-4AF2-915D-9FECA65EAB6E

Figs 3, 4, 28–39

**Type material.** **Holotype:** China, Yunnan: male (IESWU), Xishuangbanna, Menglun, 21 November 2009, coll. Guo Tang. **Paratypes:** 5 males and 5 females, Xishuangbanna, Menglun, 21 November 2009, coll. Guo Tang; 35 males and 63 females, Xishuangbanna, Menglun, G213 (National road) bamboo forest, 581 m, 21°53.622′N, 101°16.955′E, 26 November 2009, coll. Guo Tang and Zhiyuan Yao; 14 males and 50 females, Xishuangbanna, Menglun, G213 (National road) bamboo forest, 2–26 November 2009, coll. Guo Tang and Zhiyuan Yao; 9 males and 12 females, Xishuangbanna, Menglun Botanical Garden, Lvshilin, 652 m, 21°54.710′N, 101°16.941′E, 16 November 2009, coll. Guo Tang and Zhiyuan Yao.

**Differential diagnosis.** This species resembles *Balta yaoi* sp. n. in appearance, but can be distinguished from the latter by the following characters: 1) tegmen with more obvious black spots, cells slightly more hyaline and without yellowish brown spots (Fig. 31); while in the latter species, the tegmen has fewer and less obvious black spots,
Figures 28–39. *Balta maculata* sp. n. 28 head 29 maxillary palps 30 pronotum 31 tegmen 32 hind wing 33 front femur 34 tarsal claws and arolium 35 supra-anal plate and paraprocts, ventral view 36 subgenital plate, dorsal view 37 right phallomere 38 median phallomere 39 left phallomere. Scale bars: 0.5 mm (28–30, 33–39), 2.0 mm (31, 32).

cell with yellowish brown spots; 2) median phallomere complex, the appendage base with brush-like structure (Fig. 38); while the latter with median phallomere simple, the appendage arched and without brush-like structure.

**Description. Male.** Body tawny. Face between eyes brown, between ocelli and antenna sockets with a light brown stripe, under antennal sockets also with a light brown.
The cockroaches of Balta Tepper from China, with the description of four new species...

The cockroaches of Balta Tepper from China, with the description of four new species...

stripe (Fig. 28). Pronotum with some small scattered and symmetrical spots or inconspicuous stripes, with tawny disk, lateral borders hyaline (Fig. 30). Tegmen and hind wing tawny, tegmen with black spots (most distributed on veins) (Fig. 31). The middle of anterior margin of abdominal tergites blackish brown. Third and fourth maxillary palpiomers appear same length, both distinctly longer than the fifth (Fig. 29). Tegmen with M and CuA oblique (Fig. 31). CuA of hind wing with three complete branches and without incomplete ones (Fig. 32). Front femur of type C, (Fig. 33), tarsal claws strongly asymmetrical and unspecialized (Fig. 34). Abdominal tergites unspecialized.

Male genitalia. Supra-anal plate short, hind margin rounded; right and left paraprocts similar (Fig. 35). Subgenital plate with hind margin strongly concaved; styli conical, arising on apexes of lateral lobes and slightly curved laterally (Fig. 36). Hook-like phallomere on the right side and with preapical concavity (Fig. 37). Median phallomere stick-like, curved near acuminated apex, median phallomere appendage present and with brush-like structure (Fig. 38). Left phallomere complex (Fig. 39).

Female. Supra-anal plate longer than subgenital plate, hind margin of the former with triangular process in the middle. Subgenital plate simple with hind margin rounded.

Measurements (mm). Overall length male 14.0–15.0, female 9.8–10.2; tegmen length male 12.1–12.5, female 8.0–8.5; pronotum length × width male 2.4–2.9 × 3.4–3.8, female 2.5–3.0 × 3.6–4.0.

Etymology. Latin word *maculata* meaning “with dots”, referring to the tegmina with dots.

Distribution. China (Yunnan).

**Balta tangi** sp. n. http://zoobank.org/511EDAE2-8FC8-48CC-8A94-FAE64D43E411

Figs 5, 6, 40–51

Type material. Holotype: China, Yunnan: male (IESWU), Xishuangbanna, Menglun Botanical Garden, Lvshilin, 652 m, 21°54.710′N, 101°16.941′E, 16 November 2009, coll. Guo Tang and Zhiyuan Yao. Paratypes: 25 males and 16 females, same collection event as holotype; 8 males and 8 females, Xishuangbanna, Menglun, G213 (National Road) bamboo forest, 21–26 November 2009, coll. Guo Tang and Zhiyuan Yao; 11 males and 21 females, Xishuangbanna, Menglun Botanical Garden, Lvshilin, 656 m, 21°54.705′N, 101°16.898′E, 13 November 2009, coll. Guo Tang and Zhiyuan Yao.

Differential diagnosis. *Balta tangi* species resembles *B. spinea* in appearance, but can be distinguished from the latter by the following characters: 1) face with transversal stripes between interocular space (Fig. 40) while face of *B. spinea* without transversal stripes but having two longitudinal stripes, each of them with one small rounded white spot; 2) subgenital plate in ventral view between the styli slightly emarginated and with a protrusion in the middle (Fig. 48) but in *B. spinea* without the protrusion.

Description. Male. Body yellowish brown. Vertex brownish yellow. Face with three stripes (Fig. 40). Disk of pronotum yellowish brown and with some small scat-
Figures 40–51. *Balta tangi* sp. n. 40 head 41 maxillary palps 42 pronotum 43 tegmen 44 hind wing 45 front femur; 46 tarsal claws and arorium 47 supra-anal plate and paraprocts, ventral view 48 subgenital plate, dorsal view 49 right phallomere 50 median phallomere 51 left phallomere; Scale bars: 0.5 mm (40–42, 45–51), 2.0 mm (43, 44).

...tered and symmetrical blackish brown spots, lateral borders of pronotum hyaline (Fig. 42). Lateral border of abdomen sterna with round blackish brown spots (Fig. 6). Third and fourth maxillary palpmere nearly the same length, distinctly longer than the fifth (Fig. 41). Hind wing with triangle apical, near apex of R with posterior branches, CuA with three complete branches (Fig. 44). Front femur type $C_3$ (Fig. 45); tarsal claws strongly asymmetrical and unspecialized (Fig. 46). Abdominal tergites unspecialized.
Male genitalia. Supra-anal plate symmetrical with hind margin slightly concave in the middle, paraprocts simple (Fig. 47). Subgenital plate with hind margin slightly emarginated and with process in the middle, conical styli located on the apex of either lateral lobes respectively, ventral side of subgenital plate with some fine spines near the stylus (Fig. 48). Hook-like phallosome on right side and with preapical concavity (Fig. 49). Median phallosome sticklike, base thick and strong, apex gradually becomes sharp-pointed, near the middle part of median phallosome with an arc-shaped appendage, base, and apex with short setae (Fig. 50). Left phallosome complex, apex with spinous structure (Fig. 51).

Female. Sexual dimorphism, female body thicker and stronger than male, both tegmina and hind wings degraded, just extending to supra-anal plate, RA with one or two branches.

Measurements (mm). Overall length male 14.5–16.0, female 12.0–13.5; tegmen length male 13.5–14.0, female 9.4–9.6; pronotum length × width male 2.9–3.0 × 3.9–4.1, female 2.8–3.0 × 3.9–4.2.

Etymology. This species is named in honor of Mr. Guo Tang, who collected the holotype of the species.

Distribution. China (Yunnan).

Balta yaoi sp. n.
http://zoobank.org/AA25257D-4E10-4C22-99EA-4808E7FF794A
Figs 7–8, 52–63

Type material. Holotype: China, Yunnan: male (IESWU), Xishuangbanna, Menglun, 2010, coll. Zhiyuan Yao. Paratypes: 4 males, same collection event as holotype; 14 males and 22 females, Xishuangbanna, Menglun, garbage dump, 627 m, 21°54.380′N, 101°16.815′E, 23 November 2009, coll. Guo Tang and Zhiyuan Yao; 3 males, Xishuangbanna, Menglun, 2010, coll. unknown;

Differential diagnosis. This species is similar to B. valida comb. n. in appearance, but can be distinguished in the following characteristics: 1) For the former, median phallosome appendage without brush-like structure (Fig. 62), while in the latter with brush-like structure; 2) subgenital plate with hind margin curved concave (Fig. 60), while in the latter not concaved medially.

Description male. Body yellowish brown (Figs 7, 8). Vertex slightly yellow, between eyes with a slightly brown stripe, under the stripe with a slightly brown triangular spot, under antennal sockets with or without a stripe (Fig. 52). Disk of pronotum yellowish brown, with some small scattered and symmetrical blackish brown spots, two lateral border hyaline (Fig. 54). Tegmen yellowish brown, with a few small round black spots, cell with yellowish brown spots. The lateral border of abdomen with round blackish brown spots. Third and fourth maxillary palpmers nearly same length, longer than the fifth (Fig. 53). Tegmen with M and CuA oblique (Fig. 55). Hind wing with M simple, without branches, CuA with three complete branches and
without incomplete ones, hind wing with small apical triangle (Fig. 56). Front femur Type C2 (Fig. 57), tarsal claws strongly asymmetrical and unspecialized (Fig. 58). Abdominal tergites unspecialized.

**Male genitalia.** Supra-anal plate short, hind margin finely rounded, right and left paraprocts slightly unsymmetrical (Fig. 59). Subgenital plate with hind margin strongly emarginated, styli located on the apex of each lateral lobe respectively and slightly
The cockroaches of Balta Tepper from China, with the description of four new species...

curved laterally (Fig. 60). Hook-like phallosome on the right side and with preapical concavity (Fig. 61). Median phallosome sticklike, slightly curved, apex acuminate, median phallosome appendage arched (Fig. 62). Left phallosome complex, without brush-like structure (Fig. 63).

**Female.** Both tegmina and hind wings slightly beyond the end of abdomen. The end of abdomen rounded.

**Measurements (mm).** Overall length of male 12.0–13.0, female 10.0–10.3; tegmen length male 10.0–11.0, female 7.9–8.0; pronotum length × width male 2.3–2.6 × 3.4–3.6, female 2.2–2.5 × 2.8–3.0.

**Etymology.** This species is named in honor of Mr. Zhiyuan Yao, who collected the holotype of the species.

**Distribution.** China (Yunnan).

---

**Balta hwangorum** Bey-Bienko, 1958

Figs 9, 10, 64–75

**Balta hwangorum** Bey-Bienko, 1958: 676, 688 (Type locality: Yunnan, China); Princis 1969: 978.

**Balta picea** Bey-Bienko, 1958: 677 (Holotype, female) (Type locality: Yunnan, China).

**Syn. n.**

**Material examined.** Deposited in IESWU. **China,** Yunnan Prov.: 3 males, Xishuangbanna, Damenglong, 650 m, 13 April 1958, coll. Zhizi Chen; 5 males, Xishuangbanna, Menghun, 650–750 m, 9 June 1958, coll. Xuwu Meng; 1 male and 1 female, Xishuangbanna, Jinghong, 650 m, 6–24 July 1958, coll. Junhua He; 1 male, Xishuangbanna, Menghun, 650–750 m, 1 June 1958, coll. Leyi Zheng; 1 male, Xishuangbanna, Menghun, 650–1080 m, 7 June 1958, coll. Chunpei Hong and Shuyong Wang; 1 male, Xishuangbanna, Damenglong, 650 m, 14 April 1958, coll. Chunpei Hong; 1 male, Xishuangbanna, Menghun, 650–750 m, 3 February 1958, coll. Shuyong Wang; 2 males, Xishuangbanna, Menga, 1050–1080 m, 20 May 1958, coll. Fuji Pu; 1 male, Xishuangbanna, Menghun, 650–750 m, 13 June 1958, coll. Yiran Zhang; 1 male, Xishuangbanna, Menghun, 650–750 m, 18 April 1958, coll. Leyi Zheng; 1 male, Xishuangbanna, Xiaomengyang, 850 m, 13 June 1958, coll. Lingchao Zang; 2 males and 1 female, Xishuangbanna, Menglun, G213 (National road) bamboo forest, 627 m, 21°54.380′N, 101°16.815′E, 21–26 November 2009, coll. Guo Tang and Zhiyuan Yao; 2 males and 2 females, Xishuangbanna, Menglun, G213 (National road) bamboo forest, 627 m, 21°54.380′N, 101°16.815′E, 22 November 2009, coll. Guo Tang and Zhiyuan Yao; 2 males and 2 females, Xishuangbanna, Menglun, G213 (National road) secondary forest, 644 m, 21°54.439′N, 101°16.755′E, 20 November 2009, coll. Guo Tang and Zhiyuan Yao; 1 male, Mojiang, 1 May 2013, coll. Zongqing Wang. China: Guangxi: 1 female, Pingxiang, 850 m, 11 May 1963, coll. Sikong Liu.
Figures 64–75. *Balta hwangorum* Bey-Bienko, 1958. 64 head 65 maxillary palps 66 pronotum; 67 tegmen 68 hind wing 69 front femur 70 tarsal claws and arolium 71 supra-anal plate and paraprocts, ventral view 72 subgenital plate, dorsal view 73 right phallomere 74 median phallomere 75 left phallomere. Scale bars: 0.5 mm (64–66, 69–75), 2.0 mm (67, 68).

**Redescription. Male.** Body yellowish brown (Figs 9, 10). Vertex to anterior margin of antennal sockets reddish brown, face yellowish brown to blackish brown (Figs 9, 10). Pronotum with inconspicuous black brindle or two oblique and symmetrical stripes, with disk reddish brown to black brown, two lateral borders, anterior and posterior margin yellowish brown and hyaline (Fig. 66). Legs yellowish brown to blackish
brown. Abdomen blackish brown. Apex of subgenital plate with reddish brown spots or without. Fourth and fifth maxillary palpomeres approximately same length, both distinctly shorter than the third (Fig. 65). Tegmen with M and CuA slightly oblique (Fig. 67). Hind wing with M without branches, CuA with five complete branches and without incomplete ones (Fig. 68). Front femur type C₂ (Fig. 69), tarsal claws strongly asymmetrical and unspecialized (Fig. 70). Abdominal tergites unspecialized.

**Male genitalia.** Supra-anal plate in ventral view short, hind margin arched, slightly emarginated in the middle; right and left paraprocts similar (Fig. 71). Subgenital plate symmetrical throughout except at the base, hind margin with deep V-shape emargination, styli similar, conical, arising on lateral lobes (Fig. 72). Hook-like phallomere on right side, hook slender (Fig. 73). Median phallomere sticklike, slightly curved, apex acuminate, near the apex part with a sclerite, base of arc appendage with brush-like structure (Fig. 74). Left phallomere complex, apex with a bifurcate spinous structure and a slender hairs structure (Fig. 75).

**Female.** Slight sexual dimorphism in that the female body is smaller than the male. Supra-anal plate symmetrical, rounded, hind margin divided in the middle. Subgenital plate broad and rounded.

**Measurement (mm).** Overall length male 15.0–18.5, female 14.0–17.1; tegmen length male 13.5–16.0, female 11.2–14.0; pronotum length × width male 2.9–3.5 × 4.1–4.9, female 3.0–3.1 × 5.0–5.1.

**Remarks.** Several specimens were separated as two species by Bey-Bienko, mainly based on the body color (1958). However, after examining a large number of specimens, the results show that body color of *B. hwangorum* varies. Moreover, in Bey-Bienko's records, in *B. hwangorum*, the length of lobes of the subgenital plate is different among the species, but in fact we find no difference.

**Distribution.** China (Yunnan, Guangxi).

---

**Balta nodigera** (Bey-Bienko, 1958), **comb. n.**

Figs 11, 12, 76–87

*Onychostylus nodiger* Bey-Bienko, 1958: 679 (Type locality: Yunnan, China).

*Lupparia nodigera*: Princis 1969: 960.

**Material examined.** Deposited in IESWU. **China,** Fujian Prov.: 1 male, Putian, 7 June 1979, coll. Jingying Liu; 1 male, Putian, 5 July 1978, coll. Bangkan Huang.

**Redescription. Male.** Body medium-size, yellowish brown (Figs 11, 12). Third and fourth maxillary palpomeres yellowish brown, the fifth light brown. Pronotum yellowish brown and disk with two unobvious black spots, lateral borders hyaline. Tegmina and hind wings light brown. Abdomen brown. Third and fifth maxillary palpomeres almost same length, distinctly longer (Fig. 77). Tegmen with M and CuA oblique (Fig. 79). Hind wing with small triangle apical, CuA with four complete branches and without incomplete ones (Fig. 80). Front femur type C₂ (Fig. 81),
Figures 76–87. *Balta nodigera* (Bey-Bienko, 1958) comb. n. 76 head 77 maxillary palps 78 pronotum 79 tegmen 80 hind wing 81 front femur 82 tarsal claws and arolium 83 supra-anal plate and paraprocts, ventral view 84 subgenital plate, dorsal view 85 right phallomere 86 median phallomere 87 left phallomere. Scale bars: 0.5 mm (76–78, 81–87), 2.0 mm (Figs 79, 80).

Tarsal claws strongly asymmetrical and unspecialized (Fig. 82). Abdominal tergites unspecialized.

**Male genitalia.** Supra-anal plate posterior margin slightly convex in the middle, paraprocts simple (Fig. 83). Subgenital plate in ventral view with hind margins strong-
The cockroaches of Balta Tepper from China, with the description of four new species...

ly emarginated in the middle, conical styli located on the distal of lateral lobes, ventral side of subgenital plate with some fine spines (Fig. 84). Hook-like phallomere on right side, the hook structure short and thick (Fig. 85). Median phallomere sticklike, thick and strong at base, apex with two different size spines; one associated median phallomere appendage stronger and with setae at apex, (Fig. 86). Left phallomere with left side apex spine-like (Fig. 87).

**Measurements (mm).** Overall length male 14.5; tegmen length male 12.0; pronotum length × width male 3.0 × 4.0.

**Distribution.** China (Fujian, Yunnan).

---

**Balta valida** (Bey-Bienko, 1958), comb. n.
Figs 13, 14, 88–99

*Onychostylus validus* Bey-Bienko, 1958: 589 (Type locality: Yunnan, China).
*Lupparia valida*: Princis 1969: 957.

**Material examined.** Deposited in IESWU. **China,** Yunnan Prov.: 19 males, Xishuangbanna, Menghun, 650 m, 4–9 April 1958, coll. Yiran Zhang and Xuwu Meng; 1 male and 1 female, Xishuangbanna, Dadugang, 22°22.190′N, 100°56.977′E, 29 May 2014, coll. Xinran Li and Hongguang Liu; 5 males and 5 females, Puer, Meizihu park, 20 May 2016, coll. Zhiwei Qiu and Lu Qiu; 2 males and 1 female, Xishuangbanna, Wangaishu, 22 May 2016 coll. Zhiwei Qiu and Lu Qiu. China, Hainan Prov.: 1 male, Wuzhi Mountain, 18°54.290′N, 109°41.081′E, 795 m, 18 May 2014, coll. Shunhua Gui and Xinran Li. 1 male, Limu Mountain, 16 April 2016, coll. Jianyue Qiu.

**Redescription.** Male. Body yellowish brown (Figs 13, 14). Vertex between eyes brick-red, between two ocelli yellow, remainder of face yellowish brown and without stripes (Figs 13, 14). Maxillary palpomeres yellowish brown with either base blackish brown. Base of antenna yellowish brown and the rest blackish brown to black. Pronotum yellowish brown and disc with some black spots, lateral borders hyaline. Legs yellowish brown. Base and two borders of abdominal sternites black (Fig. 14). Third and fourth maxillary palpomeres approximately same length, both distinctly longer than the fifth (Fig. 89). Tegmen with M degeneration and CuA with more branches (Fig. 91). Hind wing with M without branches, near apex of R with short branches, CuA with four to six complete branches and two or three branches of them bifurcated near apex (Fig. 92). Front femur type B3 (Fig. 93), tarsal claws strongly asymmetrical and unspecialized (Fig. 94). Abdominal tergites unspecialized.

**Male genitalia.** Supra-anal plate in ventral view short, hind margin finely rounded, right and left paraprocts unsymmetrical (Fig. 95). The hind margin of subgenital plate concave near lateral sides and with densely setae; styli conical, with densely scattered short setae, located on lateral lobes (Fig. 96). Hook-like phallomere on right side and with preapical concavity (Fig. 97). Median phallomere thick and strong and near apex...
Figures 88–99. *Balta valida* (Bey-Bienko, 1958) comb. n. 88 head 89 maxillary palps 90 pronotum 91 tegmen 92 hind wing 93 front femur; 94 tarsal claws and arolium; 95 supra-anal plate and paraprocts, ventral view 96 subgenital plate, dorsal view 97 right phallomere 98 median phallomere 99 left phallomere. Scale bars: 0.5 mm (88–90, 93–99), 2.0 mm (91, 92).

with a brush-like structure; base of appendage also with long strip brush-like structure (Fig. 98). Left phallomere complex, with brush-like structure (Fig. 99).

**Measurements (mm).** Overall length male 16.3–20.5, female 14.5–17.0; tegmen length male 14.2–17.0, female 12.0–14.1; pronotum length × width male 2.3–4.0 × 3.3–5.3, female 3–4.3 × 3.3–5.1.

**Distribution.** China (Hainan, Yunnan).
Acknowledgements

We are sincerely grateful to Mr. Zhiyuan Yao (IOZCAS), Mr. Guo Tang, Mr. Guo Zheng (Shenyang Normal University), and Ms. Wenyue Zhu (IOZCAS) who collected specimens, and to Prof. Shuqiang Li (IOZCAS), Prof. Shunxiang Ren (SCAU), and Zaifu Xu (SCAU) who provided Balta specimens. We would also like to thank Dr. Phil Barden and Dr. Dominic Evangelista for helping us improve the quality of the paper. This study is supported by the National Natural Science Foundation of China (No. 31472026).

References

Asahina S (1965) Taxonomic notes on Japanese Blattaria, III. On the species of the genus Onychostylus Bolivar. Japanese Journal of Sanitary Zoology 16: 6–15. https://doi.org/10.7601/mez.16.6

Bey-Bienko GYa (1958) Results of the Chinese-Soviet Zoological-Botanical Expeditions of 1955-56 to southwestern China. Blattoidea of Szechuan and Yunnan 2: 582–597.

Brunner von Wattenwyl C (1865) Nouveau Système des Blattaires. G. Braumüller, Vienna, 426 pp. [In French]

Che YL, Chen L, Wang ZQ (2010) Six new species of the genus Balta Tepper (Blattaria, Pseudophyllodromiinae) from China. Zootaxa 2609: 55–67.

Handlirsch A (1906–08) Die Fossilen Insekten und die Phylogenie Der Rezenten Formen. Verlag von Wilhelm Engelmann, Leipzig, 672 pp. [In German]

Hebard M (1917) The Blattidae of North America, north of the Mexican boundary. Memoirs of the American Entomological Society 2: 1–50.

Hebard M (1929) Studies in Malayan Blattidae (Orthoptera). Proceedings of the Academy of Natural Sciences of Philadelphia 81: 1–109.

Hebard M (1943) Australian Blattidae of the subfamilies Chorisoneurinae and Ectobiinae (Orthoptera). Academy of Natural Sciences of Philadelphia 4: 1–81.

Kirby WF (1904) A Synonymic Catalogue of Orthoptea Vol. 1. Orthoptera Euplexoptera Cursoria, et Gressoria 18: 61–209.

Li XR, Wang ZQ (2015) A taxonomic study of the beetle cockroaches (Diploptera Saussure) from China, with notes on the genus and species worldwide (Blattodea: Blaberidae: Di- plopterinae). Zootaxa 4018: 35–56. https://doi.org/10.11646/zootaxa.4018.1.2

McKittrick FA (1964) Evolutionary studies of cockroaches. Cornell University Agricultural Experiment Station Memoir 389: 1–197.

Princis K (1951) Neu e und wenig Bekannte Blattarien aus dem Zoologischen Museum, Kopenhagen. Spolia Zoologica Musei Hauniensis 12: 5–72.

Princis K (1969) Blattariae: subordo Epilamproidea. Fam.: Blattellidae. Orthopterorum Catalogus. Dr. W. Junk N.V., Gravenhage, Uitgeverij, Part 13, 711–1038.

Rehn JAG (1922) Contributions to our knowledge of the Dermaptera and Orthoptera of the Transvaal and Natal. Annals of the Transvaal museum 9: 1–99.
Rehn JAG (1931) On the blattid genera *Abrodiaeta* (=*Allacta* Saussure and Zehntner) and *Margattea* (Orthoptera). Transactions of the American Entomological Society 57: 297–304.

Roth LM (1991) New combinations, synonymies, redescriptions, and new species of cockroaches, mostly Indo-Australian Blattellidae. Invertebrate Taxonomy 5: 953–1021. https://doi.org/10.1071/IT9910953

Roth LM (2003) Systematics and phylogeny of cockroaches (Dictyoptera: Blattaria). Oriental Insects 37: 1–186. https://doi.org/10.1080/00305316.2003.10417344

Shelford R (1908) Orthoptera: Blattidae: Phyllodromiinae. Genera Insectorum 73: 1–29.

Shelford R (1911) Preliminary diagnoses of some new genera of Blattidae. Entomologist’s Monthly Magazine 22: 154–156.

Tepper JGO (1893) The Blattariae of Australia and Polynesia. Transactions of the Royal Society of South Australia 17: 25–126.

Walker F (1871) Supplement to the Catalogue of Blattariae. Catalogue of the specimens of Dermaptera Saltatoria in the collection of the British Museum. British Museum, London, 1–43.