

Contribution to the knowledge of the subgenus *Scymnus* (*Parapullus*) Yang, 1978 (Coleoptera, Coccinellidae), with description of eight new species

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Abstract

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Eight new species of the subgenus *Scymnus* (*Parapullus*) Yang, 1978 from China are described and illustrated: *S. (P.) hastatus* sp. n., *S. (P.) baxianshanensis* sp. n., *S. (P.) laojielingensis* sp. n., *S. (P.) annuliformis* sp. n., *S. (P.) papillatus* sp. n., *S. (P.) dichotomus* sp. n., *S. (P.) shenmuensis* sp. n. and *S. (P.) yanzigouensis* sp. n. Diagnoses and distributions are provided for each species. An updated key to the Chinese species of the subgenus *Parapullus* is given. A catalogue to all known species of this subgenus is also presented.

Introduction

The subgenus *Scymnus* (*Parapullus*) was created by Yang (1978), with type species *Scymnus* (*Parapullus*) *secula* Yang, 1978 described from Taiwan. The distinguished characters includes: abdominal postcoxal lines distinctly incomplete laterally, antennae composed of ten antennomeres, parameres of the tegmen usually with two groups of long setae inserted in different directions.

Parapullus is a small subgenus of *Scymnus*, currently comprising of 12 described species worldwide and mainly distributed in the Old World (Yang 1978, Pang and Yu 1993, Yu et al. 2000, Chen et al. 2012). In China, eight species have been documented prior to the present work (Chen et al. 2012). In present study examination of ladybird specimens newly collected from various parts of China was done together with coccinellid collection of South

China Agricultural University revealing eight new species belonging to subgenus *Parapullus* and reported herein.

In this paper, eight new species are described and illustrated in detail, and a key to the Chinese species of the subgenus *Parapullus* is updated. Maps of the distribution of the species occurring in China are given. A catalogue to the worldwide species of this subgenus is also presented.

Material and methods

Measurements were made using a micrometer attached to a dissecting microscope as follows: total length (TL), from apical margin of clypeus to apex of elytra; total width (TW), across both elytra at widest part; total height (TH), at highest part of elytra; elytral length (EL), along

suture from base to apex including scutellum; elytral width (EW), equal to TW; pronotal length (PL), from the middle of anterior margin to the base of pronotum; pronotal width (PW), at widest part; head width (HW), at widest part including eyes.

External morphology was observed with a dissecting stereoscope (SteREO Discovery V20). Male and female genitalia were dissected, cleared in 10% solution of NaOH by boiling for several minutes, and examined on slides with an Olympus BX51 compound microscope. After examination, the genitalia were transferred to a small card covered with neutral balsam and pinned beneath the specimen. Photographs of the whole beetles and their genitalia were executed on digital cameras (Coolsnap-Procf & CRI Micro*Color and AxioCam HRc) and composite images generated with IMAGE-PRO PLUS 5.1 and AXIO VISION REL. 4.8 softwares. The final plates were prepared using ADOBE PHOTOSHOP CS 8.0.

Morphological terminology use in this paper follows Ślipiński (2007) and Ślipiński and Tomaszewska (2010). Type specimens designated in the present paper are deposited in the Department of Entomology, South China Agricultural University, Guangzhou, China (SCAU).

Taxonomy

Scymnus (*Parapullus*) *hastatus* sp. n.

<http://zoobank.org/E974785F-794F-4A8F-B996-22ED5BC0BF27>

Figs 1, 9

Diagnosis. This species is easily confused with several species having unicolourous reddish brown body in this subgenus, but can be recognized by the stout penis guide with a hook-like appendage at apex in lateral view (Fig. 1h).

Description. TL: 2.31–2.43 mm, TW: 1.53–1.67 mm, TH: 0.98–1.04 mm, TL/TW: 1.46–1.51, PL/PW: 0.56–0.57, EL/EW: 1.13–1.16, HW/PW: 0.59–0.62, PW/EW: 0.73–0.74.

Body elongate oval, moderately convex, entirely reddish brown, dorsum covered with white pubescence (Fig. 1a–c).

Head with fine frontal punctures, as large as eye facets, 1.0–2.0 diameters apart. Eyes densely faceted, interocular distance 0.51 times head width. Pronotal punctures as large as those on frons, 2.0–3.0 diameters apart. Surface of elytra with punctures larger than those on pronotum, separated by 2.5–3.0 diameters. Prosternal process trapezoidal, 2 times as long as its width at base; with lateral carinae distinct, extending to anterior margin of prosternum, distinctly convergent anteriorly. Abdominal postcoxal lines weakly recurved and distinctly incomplete laterally (Fig. 1d), reaching 6/7 length of abdominal ventrite 1, area enclosed by lines coarsely punctate, broadly smooth along line. Abdominal ventrite 5 in male with apex truncate.

Male genitalia: penis stout, unevenly sinuated (Fig. 1e). Penis capsule highly sclerotized with small inner arm and

large outer arm (Fig. 1e). Apex of penis strongly curved with distinctly membranous appendage (Fig. 1f). Tegmen extremely stout (Fig. 1g–h) with penis guide narrowest at base, gradually expanding to a spade-like apex bearing with a digitations in ventral view (Fig. 1g); in lateral view, penis guide strongly raised at middle with a hook-like appendage at apex (Fig. 1h). Parameres slender with rounded apex, slightly longer than penis guide, densely covered with two groups of long setae at apices (Fig. 1h).

Female unknown.

Type materials. **Holotype:** male, No. SCAU (E) 11346, **China:** **Gansu:** Dongshan, Xinglongshan National Nature Reserve, Yuzhong County, Lanzhou City, 35°47.83'N, 104°3.93'E, ca 2300 m, 3. VIII. 2007, Liang JB leg. **Paratypes (3):** 3♂ with same data as holotype.

Distribution. China (Gansu).

Etymology. The species name is derived from the Latin adjective *hastatus* referring to its penis guide with halberd-like apex in ventral view.

Scymnus (*Parapullus*) *baxianshanensis* sp. n.

<http://zoobank.org/33254854-37B7-4933-8555-241DB7137AAA>

Figs 2, 9

Diagnosis. This species is most similar to *Scymnus* (*Parapullus*) *alishanensis* Pang & Yu, 1993 in general appearance and male genitalia, but can be distinguished from it by having parameres as long as half length of penis guide (Fig. 2h) and penis guide constricted at middle part in ventral view (Fig. 2g). In *S. (P.) alishanensis*, its parameres are longer than half length of penis guide and penis guide constricted near middle part in ventral view.

Description. TL: 2.20–2.48 mm, TW: 1.60–1.71 mm, TH: 1.06–1.18 mm, TL/TW: 1.38–1.45, PL/PW: 0.54–0.55, EL/EW: 1.06–1.09, HW/PW: 0.59–0.60, PW/EW: 0.70–0.75.

Body elongate oval, moderately convex, entirely reddish brown, dorsum covered with white pubescence (Fig. 2a–c).

Head with fine frontal punctures, slightly smaller than eye facets, 0.5–1.0 diameter apart. Eyes densely faceted, interocular distance 0.49 times head width. Pronotal punctures larger than those on frons, 1.0–2.0 diameters apart. Surface of elytra with punctures much larger than those on pronotum, separated by 1.0–2.0 diameters. Prosternal process trapezoidal, 2 times as long as its width at base; with lateral carinae distinct, extending to anterior margin of prosternum, slightly convergent anteriorly. Abdominal postcoxal lines weakly recurved and distinctly incomplete laterally (Fig. 2d), reaching 6/7 length of abdominal ventrite 1, area enclosed by lines finely punctate, narrowly smooth along line. Abdominal ventrite 5 in both sexes with apex truncate.

Male genitalia: penis stout (Fig. 2e). Penis capsule deeply emarginated medially with small inner arm and large outer arm. Apex of penis slender, forming a hook-

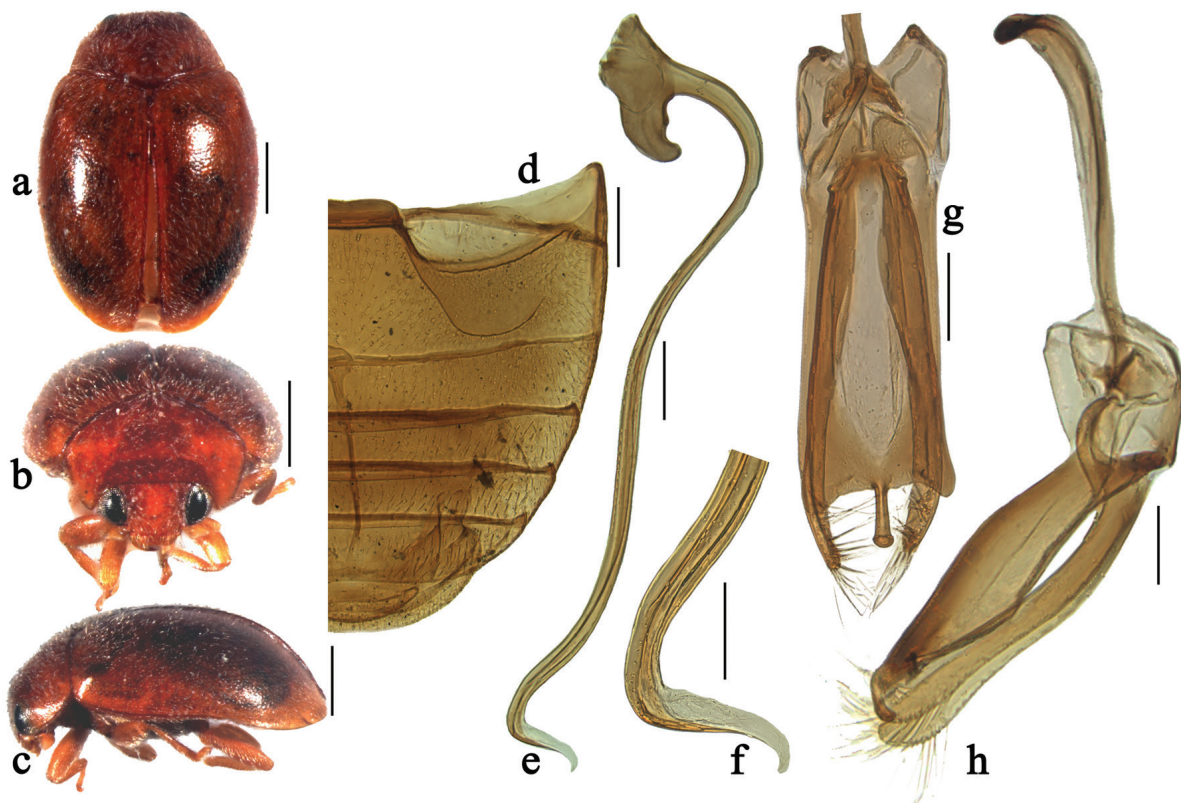


Figure 1. *Scymnus (Parapullus) hastatus* sp. n.: **a** dorsal view; **b** anterior view; **c** lateral view; **d** abdomen; **e** penis; **f** apex of penis; **g** tegmen, ventral view; **h** tegmen, lateral view. Scale bars: **a–c** 0.5 mm, **d** 0.2 mm, **e–h** 0.1 mm.

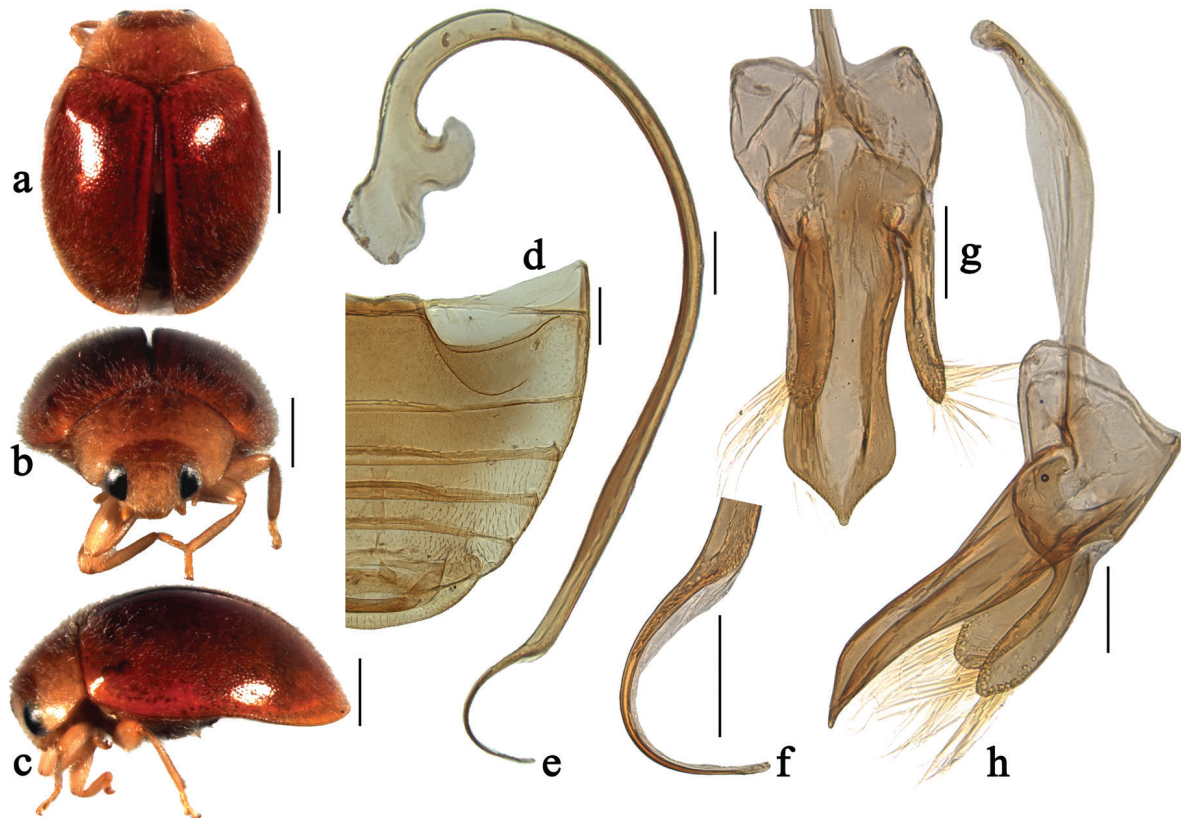


Figure 2. *Scymnus (Parapullus) baxianshanensis* sp. n.: **a** dorsal view; **b** anterior view; **c** lateral view; **d** abdomen; **e** penis; **f** apex of penis; **g** tegmen, ventral view; **h** tegmen, lateral view. Scale bars: **a–c** 0.5 mm, **d** 0.2 mm, **e–h** 0.1 mm.

shaped (Fig. 2f). Tegmen stout (Figs 2g–h) with penis guide slightly constricted at middle part, expanding toward apex, then tapering abruptly to blunt apex in ventral view (Fig. 2g). Parameres narrow, as long as half length of penis guide, densely covered with two groups of long setae at apices (Fig. 2h).

Female similar to male except for sexual characters.

Type materials. Holotype: male, No. SCAU (E) 11532, **China: Tianjin:** Baxianshan National Nature Reserve, Ji County, 40°11.27'N, 117°33.19'E, ca 500 m, 14. VII. 2011, Chen XS leg. **Paratypes (3):** 1♂2♀ with same data as holotype.

Distribution. China (Tianjin).

Etymology. The specific epithet refers to its type locality, Baxianshan National Nature Reserve, Tianjin.

Scymnus (*Parapullus*) *laojielingensis* sp. n.

<http://zoobank.org/6457D29C-A8B3-440B-B5E6-24B57BA824B4>
Figs 3, 10

Diagnosis. This species is similar to *Scymnus* (*Parapullus*) *parallelicus* Chen, Ren & Wang, 2012 in general appearance and male genitalia, but can be distinguished from it by having strongly sinuated apex of penis with membranous appendage (Fig. 3f), the apical 1/4 length of parameres covered with several long setae at inner sides in lateral view (Fig. 3h), and the area enclosed by the abdominal postcoxal lines with coarse punctures (Fig. 3d).

Description. TL: 2.21–2.38 mm, TW: 1.58–1.71 mm, TH: 1.01–1.16 mm, TL/TW: 1.39–1.40, PL/PW: 0.51–0.52, EL/EW: 1.08–1.12, HW/PW: 0.56, PW/EW: 0.72.

Body elongate oval, moderately convex, entirely reddish brown, dorsum covered with white pubescence (Fig. 3a–c).

Head with fine frontal punctures, as large as eye facets, 0.5–1.0 diameter apart. Eyes densely faceted, interocular distance 0.47 times head width. Pronotal punctures similar to those on frons, 1.0–2.0 diameters apart. Surface of elytra with punctures larger than those on pronotum, separated by 2.0–3.0 diameters. Prosternal process trapezoidal, 2.5 times as long as its width at base; with lateral carinae distinct, extending to anterior margin of prosternum, distinctly convergent anteriorly. Abdominal postcoxal lines weakly recurved and distinctly incomplete laterally (Fig. 3d), reaching 5/6 length of abdominal ventrite 1, area enclosed by lines coarsely punctate, narrowly smooth along line. Abdominal ventrite 5 in male with apex rounded.

Male genitalia: penis stout (Fig. 3e). Penis capsule with small inner arm and large outer arm. Apex of penis strongly sinuated with membranous appendage (Fig. 3f). Tegmen stout (Fig. 3g–h) with penis guide with parallel sides from base to 3/4 length, then tapering gradually to blunt apex in ventral view (Fig. 3g) and its apex slightly curved outwardly in lateral view (Fig. 3h). Parameres longer than half length of penis guide, densely covered with a group of

long setae at apices, and its apical 1/4 length covered with several stout setae at inner sides (Fig. 3h).

Female externally similar to male but with abdominal ventrite 5 truncate apically.

Type materials. Holotype: male, No. SCAU (E) 11534, **China: Henan:** Laojieling National Nature Reserve, Xixia County, Nanyang City, 33°37.63'N, 111°45.85'E, ca 1400 m, 9. VII. 2009, Chen XS leg.

Paratypes (3): 1♂2♀ with same data as holotype.

Distribution. China (Henan).

Etymology. The specific epithet refers to its type locality, Laojieling National Nature Reserve, Henan Province.

Scymnus (*Parapullus*) *annuliformis* sp. n.

<http://zoobank.org/0F93276E-3C30-4E20-A485-8705A4B5F300>
Figs 4, 10

Diagnosis. This species is similar to *Scymnus* (*Parapullus*) *parallelicus* Chen, Ren & Wang, 2012 in general appearance and male genitalia, but can be separated from it by having slender, ring shaped apex of penis (Fig. 4f) and the abdominal postcoxal lines strongly recurved toward base of ventrite (Fig. 4d). It also resembles *Scymnus* (*Parapullus*) *malleatus* Chen, Ren & Wang, 2012, particularly the ring shaped apex of penis, but can be recognized from it by having narrow and short parameres (Fig. 4h) and the different shape of penis capsule.

Description. TL: 2.28–2.34 mm, TW: 1.58–1.71 mm, TH: 1.06–1.15 mm, TL/TW: 1.37–1.44, PL/PW: 0.51–0.53, EL/EW: 1.07–1.13, HW/PW: 0.60–0.61, PW/EW: 0.67–0.71.

Body oval, moderately convex, entirely reddish brown, dorsum covered with white pubescence (Fig. 4a–c).

Head with fine frontal punctures, as large as eye facets, 1.0–2.0 diameters apart. Eyes densely faceted, interocular distance 0.49 times head width. Pronotal punctures larger than those on frons, 1.0–2.0 diameters apart. Surface of elytra with punctures larger than those on pronotum, separated by 2.0–3.0 diameters. Prosternal process trapezoidal, 2.5 times as long as its width at base; with lateral carinae distinct, extending to anterior margin of prosternum, slightly convergent anteriorly. Abdominal postcoxal lines strongly recurved and distinctly incomplete laterally (Fig. 4d), reaching 5/6 length of abdominal ventrite 1, area enclosed by lines finely punctate, broadly smooth along line. Abdominal ventrite 5 in both sexes with apex truncate.

Male genitalia: penis moderately stout (Fig. 4e). Penis capsule with small inner arm and large outer arm. Apex of penis slender, ring shaped (Fig. 4f). Tegmen stout (Fig. 4g–h) with penis guide parallel sided from base to 3/4 length, then tapering gradually to blunt apex in ventral view (Fig. 4g). Parameres stout with obliquely truncate apex, longer than half length of penis guide, densely covered with two groups of long setae at apices (Fig. 4h).

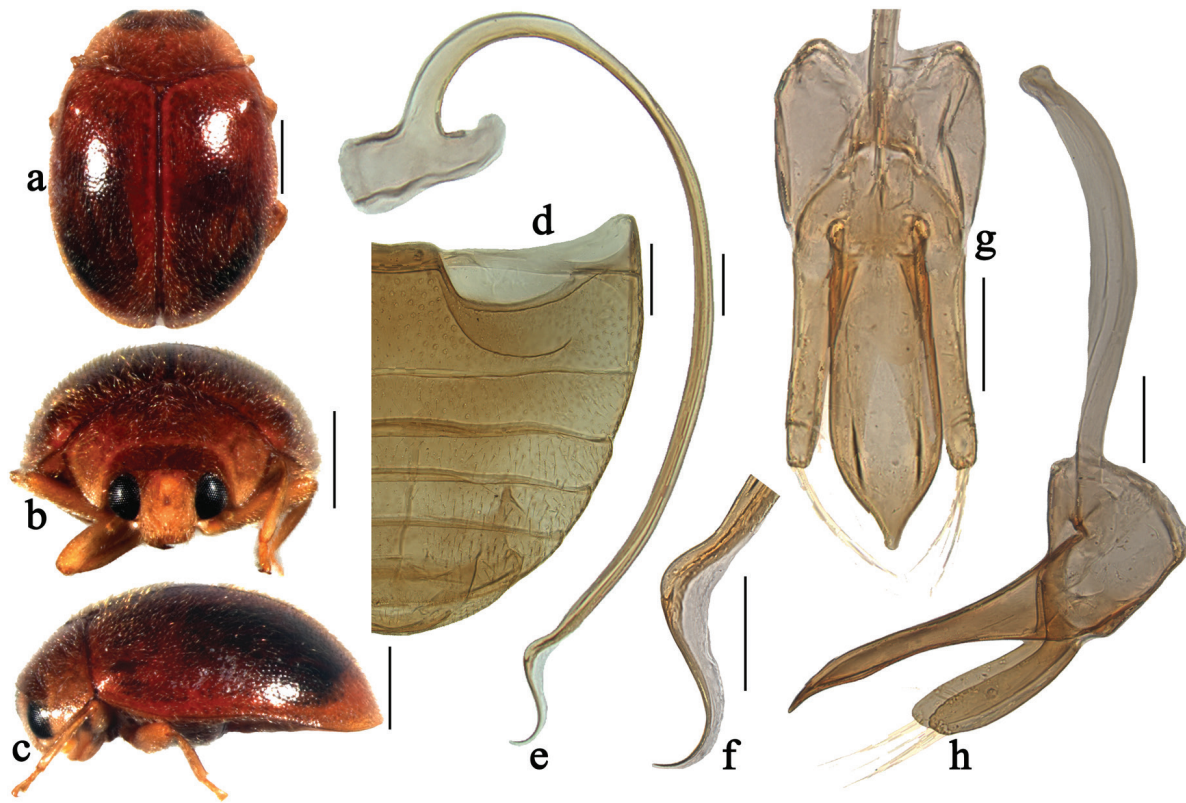


Figure 3. *Scymnus (Parapullus) laojielingensis* sp. n.: **a** dorsal view; **b** anterior view; **c** lateral view; **d** abdomen; **e** penis; **f** apex of penis; **g** tegmen, ventral view; **h** tegmen, lateral view. Scale bars: **a–c** 0.5 mm, **d** 0.2 mm, **e–h** 0.1 mm.

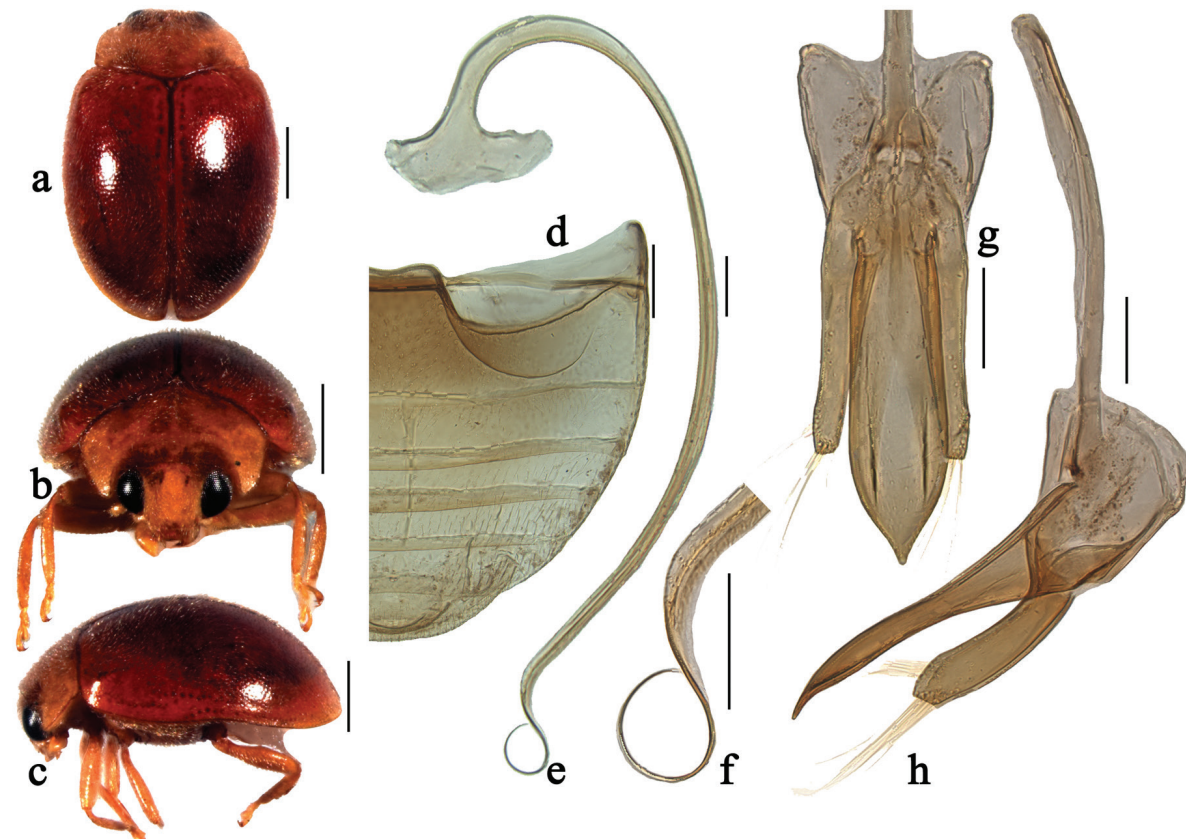


Figure 4. *Scymnus (Parapullus) annuliformis* sp. n.: **a** dorsal view; **b** anterior view; **c** lateral view; **d** abdomen; **e** penis; **f** apex of penis; **g** tegmen, ventral view; **h** tegmen, lateral view. Scale bars: **a–c** 0.5 mm, **d** 0.2 mm, **e–h** 0.1 mm.

Female similar to male except for sexual characters.

Type materials. Holotype: male, No. SCAU (E) 11527, **China: Anhui:** Hongshan, Yaoluoping National Nature Reserve, Yuexi County, 31°0.85'N, 116°8.67'E, ca 800 m, 30. IX. 2010, Wang XM leg. **Paratypes (9): Anhui:** 1♂ with same data as holotype. 1♂, Yaoluoping National Nature Reserve, Yuexi County, 30°58.95'N, 116°4.83'E, ca 1000 m, 28. IX. 2010, Li WJ leg. **Tibet:** 1♀, Cibagou National Nature Reserve, Chayu County, 28°33.69'N, 97°5.10'E, ca 2000 m, 13. X. 2007, Chen XS leg. 2♀, Xiachayu Town, Chayu County, 28°30.04'N, 97°0.84'E, ca 1800 m, 14. X. 2007, Chen XS leg. 1♂, Xiayadong Village, Yadong County, 28°29.29'N, 97°1.36'E, ca 2800 m, 29-30. IX. 2009, Chen XS leg. 1♀, Motuo County, Linzhi City, 29°19.30'N, 95°18.33'E, ca 760 m, 17. X. 2009, Chen XS leg. 1♀, Lebu Village, Cuona County, 27°48.63'N, 91°44.98'E, ca 2400 m, 24. X. 2011, Li WJ leg. 1♂, Mama Village, Cuona County, 27°47.44'N, 91°46.56'E, ca 2800 m, 25. X. 2011, Huo LZ leg.

Distribution. China (Anhui, Tibet).

Etymology. The specific epithet refers to its penis with ring shaped apex.

Scymnus (*Parapullus*) *papillatus* sp. n.

<http://zoobank.org/54FE83B5-3AD8-4D2A-8373-E5B0180B5615>

Figs 5, 11

Diagnosis. This species is similar to *Scymnus* (*Parapullus*) *solus* Chen, Ren & Wang, 2012 in general appearance and male genitalia, but can be separated from it by having a papilla bearing a stout seta at the apical 1/3 length of paramere (Fig. 5h).

Description. TL: 1.98–2.36 mm, TW: 1.39–1.66 mm, TH: 0.92–1.09 mm, TL/TW: 1.42, PL/PW: 0.50–0.55, EL/EW: 1.09–1.12, HW/PW: 0.59–0.60, PW/EW: 0.70–0.73.

Body elongate oval, moderately convex, dorsum covered with white pubescence (Fig. 5a–c). Head, antennae and mouthparts brown. Pronotum dark brown. Scutellum black. Elytra black with apical 1/4 brown. Prothoracic hypomeron and prosternum brown. Mesoventrite, metaventrite and elytral epipleura black. Legs brown.

Head with fine frontal punctures, as large as eye facets, 0.5–1.0 diameter apart. Eyes densely faceted, interocular distance 0.50 times head width. Pronotal punctures larger than those on frons, 1.5–3.0 diameters apart. Surface of elytra with punctures as large as those on pronotum, separated by 1.0–2.0 diameters. Prosternal process trapezoidal, 2.3 times as long as its width at base; with lateral carinae distinct, extending to anterior margin of prosternum, distinctly convergent anteriorly. Abdominal postcoxal lines weakly recurved and distinctly incomplete laterally (Fig. 5d), nearly extending to posterior margins of abdominal ventrite 1, area enclosed by lines finely punctate, narrowly smooth along line. Abdominal ventrite 5 in male with apex truncate.

Male genitalia: penis stout and long (Fig. 5e). Penis capsule with outer arm large and inner arm strongly

curved. Apex of penis unevenly curved, forming a large hook (Fig. 5f). Tegmen stout (Fig. 5g–h) with penis guide narrowest at base, expanding toward apex, then tapering abruptly to blunt apex in ventral view (Fig. 5g). Parameres obliquely truncated apically, longer than half length of penis guide, densely covered with a group of long setae at apices, and its apical 1/3 length with a papilla bearing a stout seta on inner side (Fig. 5h).

Female externally similar to male but with abdominal ventrite 5 rounded apically.

Type materials. Holotype: male, No. 20050319043, **China: Guangdong:** Xiaohuangshan, Nanling National Nature Reserve, Shaoguan City, 24°54.76'N, 113°2.83'E, ca 800 m, 1. X. 2004, Ren SX leg. **Paratypes (12): Guangdong:** 1♂ with same data as holotype except “Chen JJ leg”. **Hunan:** 1♂, Mangshan National Nature Reserve, Yizhang County, 24°58.83'N, 112°53.14'E, ca 700 m, 2. X. 2004, Ren SX leg. **Tianjin:** 3♂6♀, Baxianshan National Nature Reserve, Ji County, 40°11.27'N, 117°33.19'E, ca 500 m, 14. VII. 2011, Chen XS leg. **Shanxi:** 1♂, Lishan National Nature Reserve, Yuanqu County, 35°28.39'N, 112°9.45'E, ca 1200 m, 3. VIII. 2011, Chen XS leg.

Distribution. China (Shanxi, Tianjin, Hunan, Guangdong).

Etymology. The specific epithet refers to its paramere with a papilla on the inner side of the apical 1/3 length.

Scymnus (*Parapullus*) *dichotomus* sp. n.

<http://zoobank.org/8D650875-A228-462F-9A0A-FAC4133A1697>

Figs 6, 11

Diagnosis. This species is similar to *Scymnus* (*Parapullus*) *aduncatus* Chen, Ren & Wang, 2012 in general appearance, but can be distinguished from it by having robust basal part of penis guide in lateral view (Fig. 6h) and the blunt apex in lateral view (Fig. 6g).

Description. TL: 2.16 mm, TW: 1.46 mm, TH: 0.97 mm, TL/TW: 1.48, PL/PW: 0.52, EL/EW: 1.14, HW/PW: 0.63, PW/EW: 0.71.

Body elongate oval, moderately convex, dorsum covered with white pubescence (Figs 6a–c). Head, antennae and mouthparts brown. Pronotum yellowish brown. Scutellum black. Elytra black with apical 1/6 yellowish brown. Prothoracic hypomeron and prosternum yellowish brown. Mesoventrite, metaventrite and elytral epipleura black. Legs brown.

Head with fine frontal punctures, as large as eye facets, 1.0–2.0 diameters apart. Eyes densely faceted, interocular distance 0.49 times head width. Pronotal punctures larger than those on frons, 1.0–2.0 diameters apart. Surface of elytra with punctures similar to those on pronotum, separated by 2.0–3.0 diameters. Prosternal process trapezoidal, 2 times as long as its width at base; with lateral carinae distinct, extending to anterior margin of prosternum, slightly convergent anteriorly. Abdominal postcoxal lines weakly recurved and distinctly incomplete laterally (Fig.



Figure 5. *Scymnus (Parapullus) papillatus* sp. n.: a dorsal view; b anterior view; c lateral view; d abdomen; e penis; f apex of penis; g tegmen, ventral view; h tegmen, lateral view. Scale bars: a–c 0.5 mm, d 0.2 mm, e–h 0.1 mm.



Figure 6. *Scymnus (Parapullus) dichotomus* sp. n.: a dorsal view; b anterior view; c lateral view; d abdomen; e penis; f apex of penis; g tegmen, ventral view; h tegmen, lateral view. Scale bars: a–c 0.5 mm, d 0.2 mm, e–h 0.1 mm.

6d), reaching 4/5 length of abdominal ventrite 1, area enclosed by lines finely punctate, broadly smooth along line. Abdominal ventrite 5 in male with apex truncate.

Male genitalia: penis slender (Fig. 6e). Penis capsule stout with outer arm large and inner arm strongly curved upwardly. Apex of penis simple (Fig. 6f). Tegmen stout (Figs 6g–h) with penis guide narrowest at base, expanding toward apex, then tapering abruptly to blunt apex in ventral view (Fig. 6g) and strongly curved outwardly in lateral view (Fig. 6h). Parameres slightly constricted at base, distinctly shorter than penis guide, densely covered with two groups of long setae at apices (Fig. 6h).

Female unknown.

Type material. Holotype: male, No. SCAU (E) 11388, **China: Yunnan:** Xujiaba, Ailaoshan National Nature Reserve, Jingdong County, 24°32.77'N, 101°01.69'E, ca 2500 m, 17. VIII. 2013, Chen XS leg.

Distribution. China (Yunnan).

Etymology. The specific epithet refers to its apex of paramere densely covered with two groups of long setae.

Scymnus (*Parapullus*) *shenmuensis* sp. n.

<http://zoobank.org/99B80354-E9DD-4153-930A-27AB9F692328>

Figs 7, 12

Diagnosis. This species is similar to *Scymnus* (*Parapullus*) *secula* Yang, 1978 in general appearance and male genitalia, but can be separated from it by the brown pronotum with a large black marking (Fig. 7a–b) and the apex of penis stout, hook-shaped (Fig. 7f).

Description. TL: 2.18 mm, TW: 1.46 mm, TH: 0.98 mm, TL/TW: 1.49, PL/PW: 0.46, EL/EW: 1.20, HW/PW: 0.57, PW/EW: 0.77.

Body elongate oval, slightly convex, dorsum covered with white pubescence (Figs 7a–c). Head, antennae and mouthparts dark brown. Pronotum brown with a large black marking. Scutellum black. Elytra black with apical 1/6 yellowish brown. Prothoracic hypomeron and prosternum brown. Mesoventrite, metaventrite and elytral epipleura black. Legs brown.

Head with fine frontal punctures, slightly larger than eye facets, 0.5–1.0 diameter apart. Eyes densely faceted, interocular distance 0.50 times head width. Pronotal punctures as large as those on frons, 1.0–2.0 diameters apart. Surface of elytra with punctures larger than those on pronotum, separated by 2.0–3.0 diameters. Prosternal process trapezoidal, 2 times as long as its width at base; with lateral carinae distinct, extending to anterior margin of prosternum, slightly convergent anteriorly. Abdominal postcoxal lines strongly recurved and distinctly incomplete laterally (Fig. 7d), reaching 5/6 length of abdominal ventrite 1, area enclosed by lines irregularly punctate, narrowly smooth along line. Abdominal ventrite 5 in male with apical margin shallowly emarginated medially.

Male genitalia: penis stout (Fig. 7e). Penis capsule with small inner arm and large outer arm. Apex of penis stout with membranous appendage, hook-shaped (Fig. 7f). Teg-

men stout (Figs 7g–h) with penis guide narrowest at base, expanding toward apex, then tapering abruptly to blunt apex in ventral view (Fig. 7g) and its apex slightly curved outwardly in lateral view (Fig. 7h). Parameres slightly curved at base, distinctly shorter than penis guide, densely covered with two groups of long setae at apices (Fig. 7h).

Female unknown.

Type material. Holotype: male, No. SCAU (E) 11455, **China: Taiwan:** Shenmu Railway Station, Alishan Mountains, Jiayi County, 23°31.12'N, 120°48.37'E, ca 2200 m, 23. X. 2012, Chen XS leg.

Distribution. China (Taiwan).

Etymology. The specific epithet refers to its type locality, Shenmu Railway Station in Alishan Mountains, Taiwan.

Scymnus (*Parapullus*) *yanzigouensis* sp. n.

<http://zoobank.org/1CC0B157-15A9-4F86-85AA-29FB14857F92>

Figs 8, 12

Diagnosis. This species is similar to *Scymnus* (*Parapullus*) *nanlingicus* Chen, Ren & Wang, 2012 in general appearance and male genitalia, but can be separated from it by having broad area enclosed by abdominal postcoxal lines (Fig. 8d) and the parameres narrowest at base, expanding toward apex in lateral view (Fig. 8h).

Description. TL: 2.20–2.42 mm, TW: 1.52–1.67 mm, TH: 0.99–1.05 mm, TL/TW: 1.45, PL/PW: 0.51, EL/EW: 1.13–1.14, HW/PW: 0.56–0.58, PW/EW: 0.73–0.74.

Body oval, moderately convex, dorsum covered with white pubescence (Fig. 8a–c). Head, antennae and mouthparts brown. Pronotum yellowish brown. Scutellum dark brown. Elytra black with apical 1/4 yellowish brown. Prothoracic hypomeron and prosternum yellowish brown. Mesoventrite, metaventrite and elytral epipleura black. Legs brown.

Head with fine frontal punctures, as large as eye facets, 0.5–1.0 diameters apart. Eyes densely faceted, interocular distance 0.47 times head width. Pronotal punctures similar to those on frons, 1.0–2.0 diameters apart. Surface of elytra with punctures larger than those on pronotum, separated by 2.0–3.0 diameters. Prosternal process rectangular, 2 times as long as its width at base; with lateral carinae distinct, parallel, extending to anterior margin of prosternum. Abdominal postcoxal lines strongly recurved and distinctly incomplete laterally (Fig. 8d), reaching 7/8 length of abdominal ventrite 1, area enclosed by lines irregularly punctate, broadly smooth along line. Abdominal ventrite 5 in male with apex truncate.

Male genitalia: penis stout (Fig. 8e). Penis capsule with outer arm stout and inner arm strongly curved, hook-shaped. Apex of penis simple (Fig. 8f). Tegmen stout (Fig. 8g–h) with penis guide parallel sided from base to 4/5 length, then tapering abruptly to blunt apex in ventral view (Fig. 8g). Parameres narrowest at base, expanding toward apex, distinctly shorter than penis guide, densely covered with two groups of long setae at apices (Fig. 8h).

Female unknown.

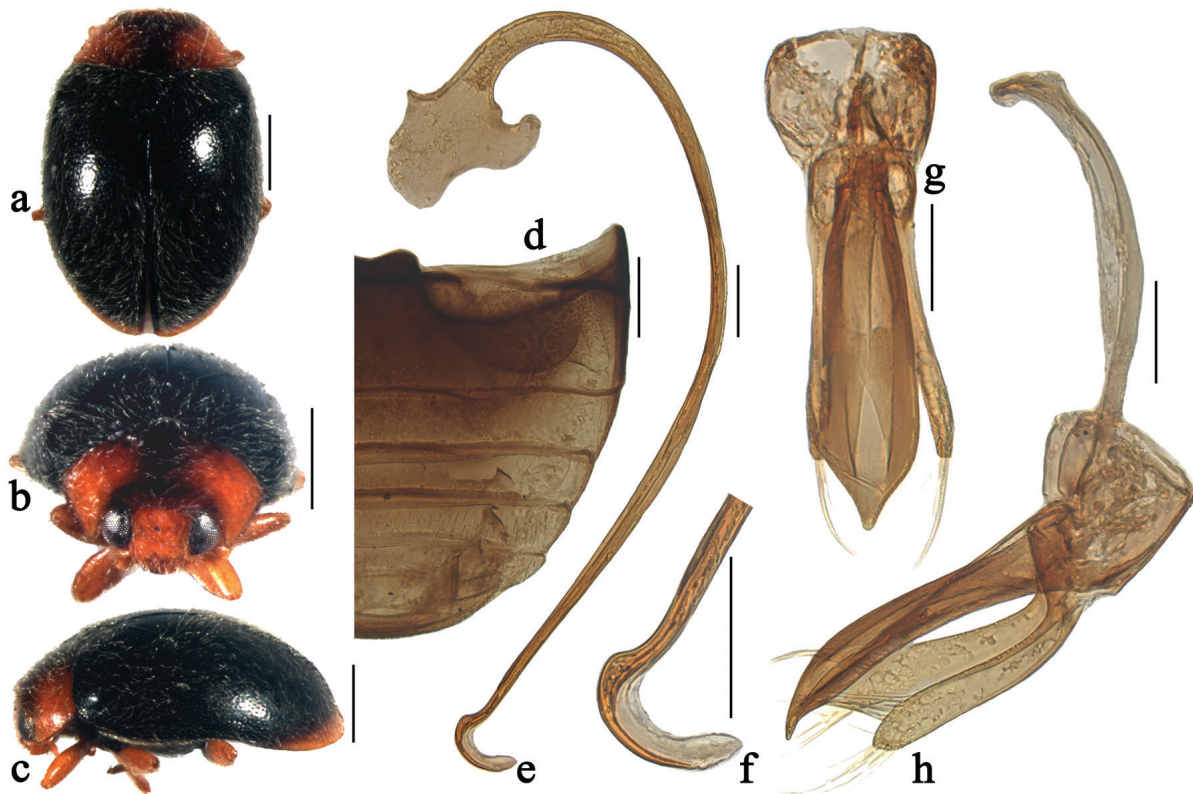


Figure 7. *Scymnus (Parapullus) shenmuensis* sp. n.: **a** dorsal view; **b** anterior view; **c** lateral view; **d** abdomen; **e** penis; **f** apex of penis; **g** tegmen, ventral view; **h** tegmen, lateral view. Scale bars: **a–c** 0.5 mm, **d** 0.2 mm, **e–h** 0.1 mm.

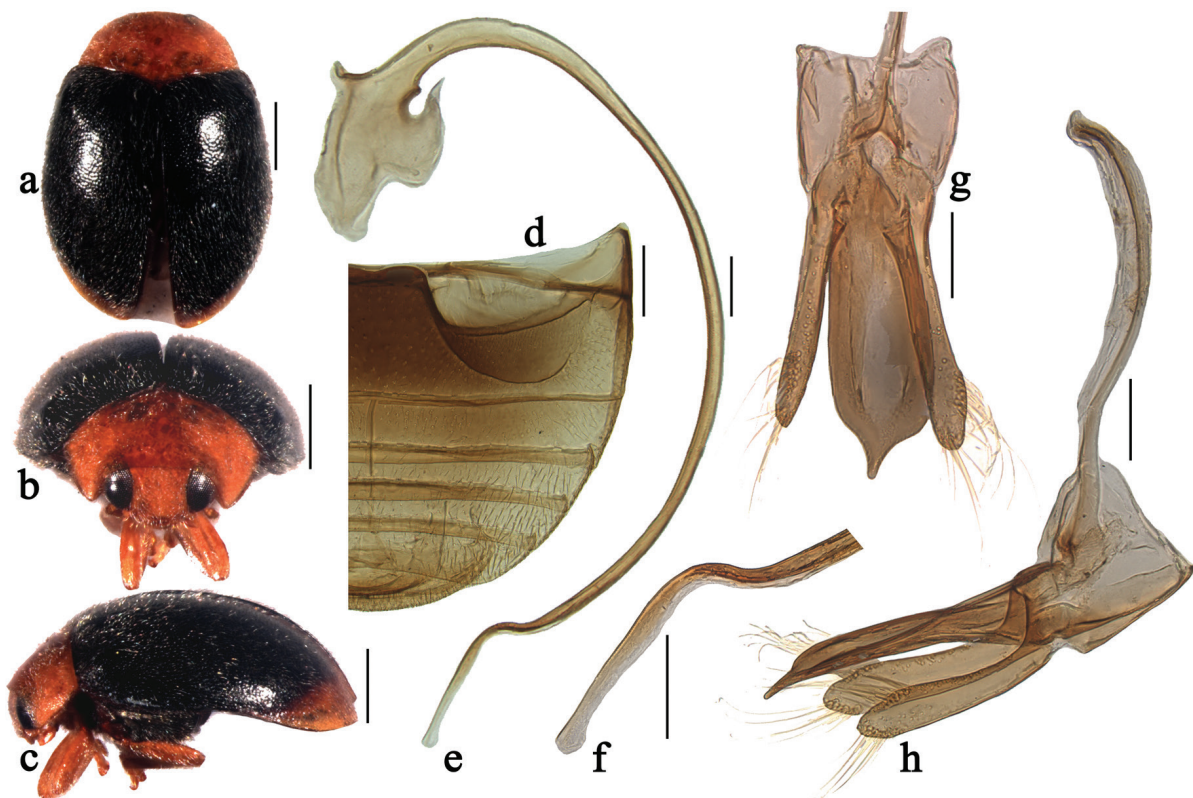


Figure 8. *Scymnus (Parapullus) yanzigouensis* sp. n.: **a** dorsal view; **b** anterior view; **c** lateral view; **d** abdomen; **e** penis; **f** apex of penis; **g** tegmen, ventral view; **h** tegmen, lateral view. Scale bars: **a–c** 0.5 mm, **d** 0.2 mm, **e–h** 0.1 mm.

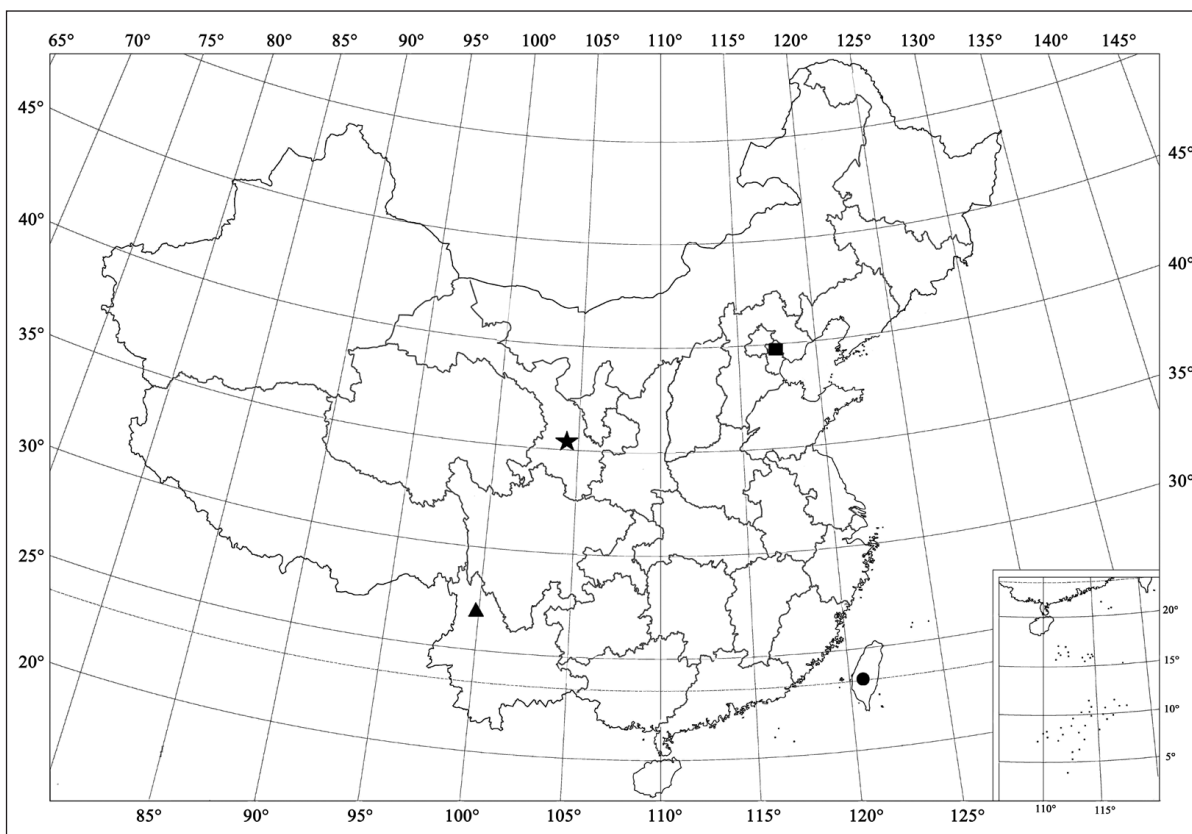


Figure 9. Distribution map. *Scymnus* (*Parapullus*) *hastatus* sp. n. (★); *Scymnus* (*Parapullus*) *tsugae* Yu & Yao (▲); *Scymnus* (*Parapullus*) *alishanensis* Pang & Yu (●); *Scymnus* (*Parapullus*) *baxianshanensis* sp. n. (■).

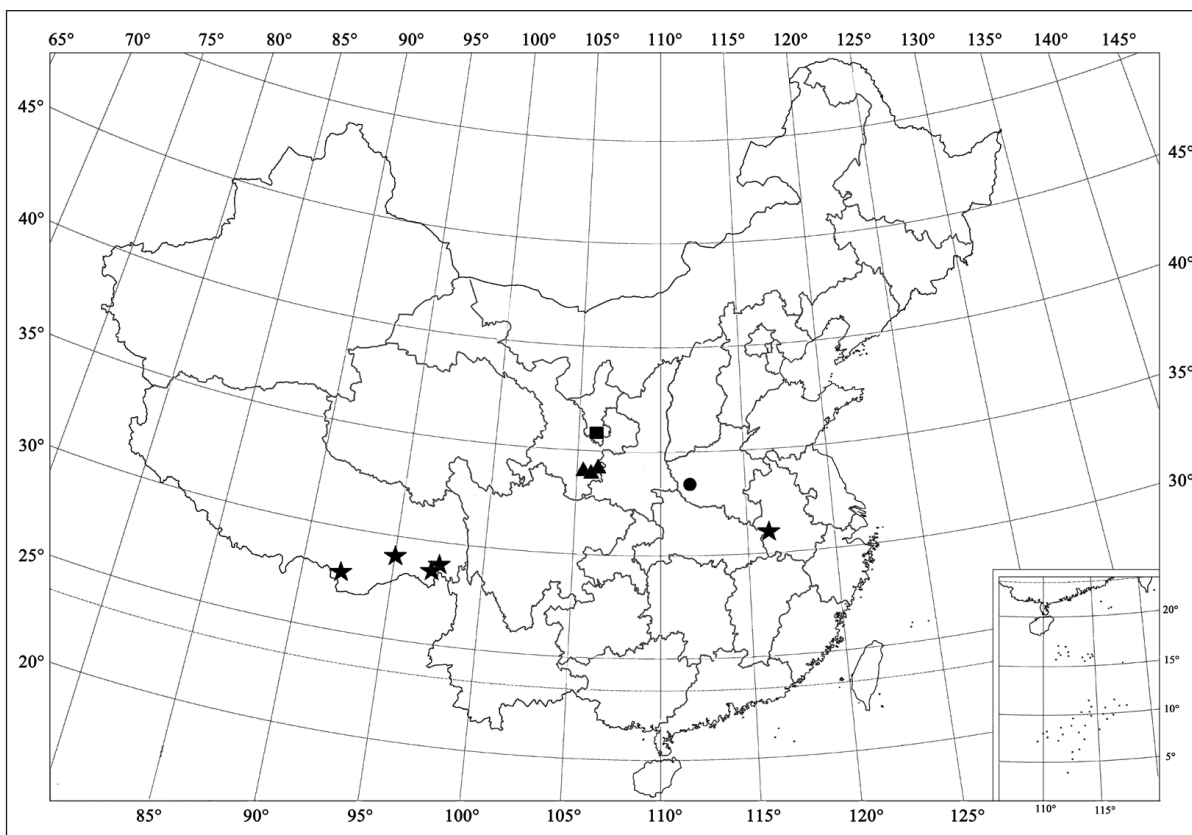


Figure 10. Distribution map. *Scymnus* (*Parapullus*) *laojielingensis* sp. n. (●); *Scymnus* (*Parapullus*) *parallelicus* Chen, Ren & Wang (▲); *Scymnus* (*Parapullus*) *annuliformis* sp. n. (★); *Scymnus* (*Parapullus*) *malleatus* Chen, Ren & Wang (■).

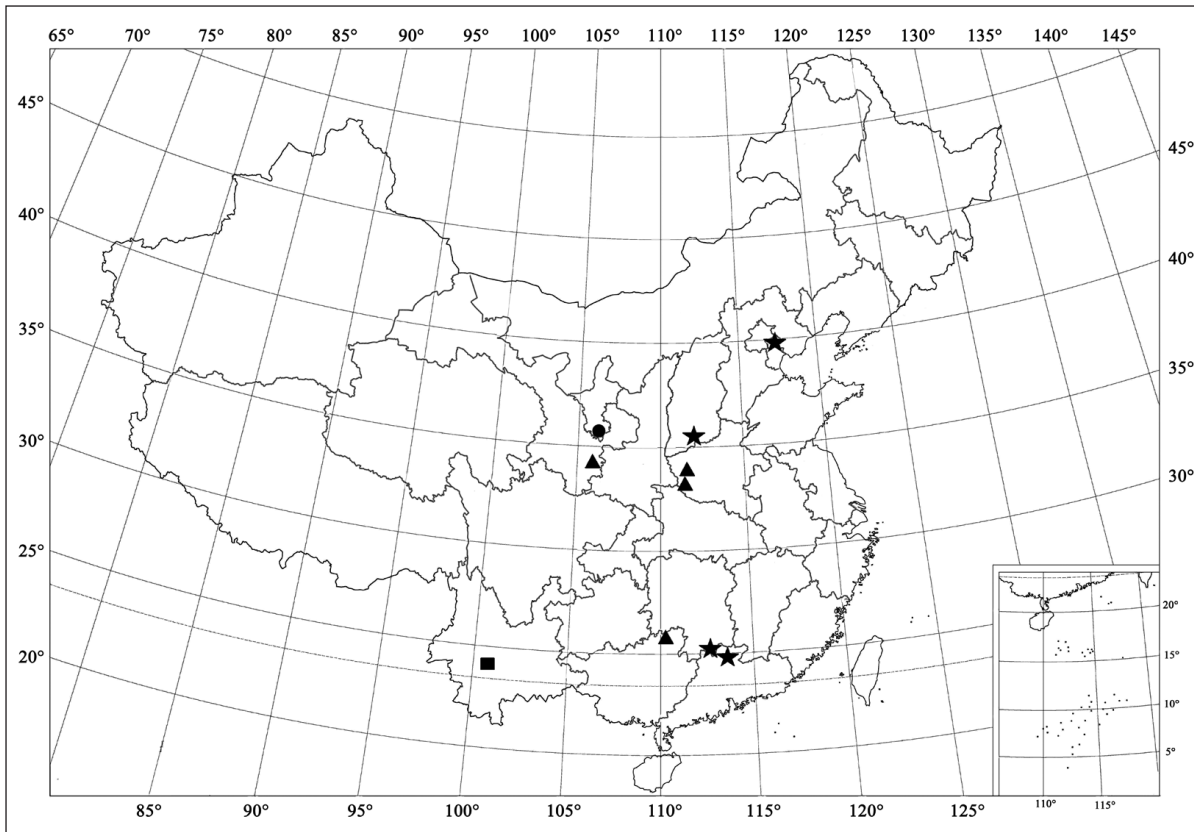


Figure 11. Distribution map. *Scymnus (Parapullus) papillatus* sp. n. (★); *Scymnus (Parapullus) solus* Chen, Ren & Wang (▲); *Scymnus (Parapullus) aduncatus* Chen, Ren & Wang (●); *Scymnus (Parapullus) dichotomus* sp. n. (■).

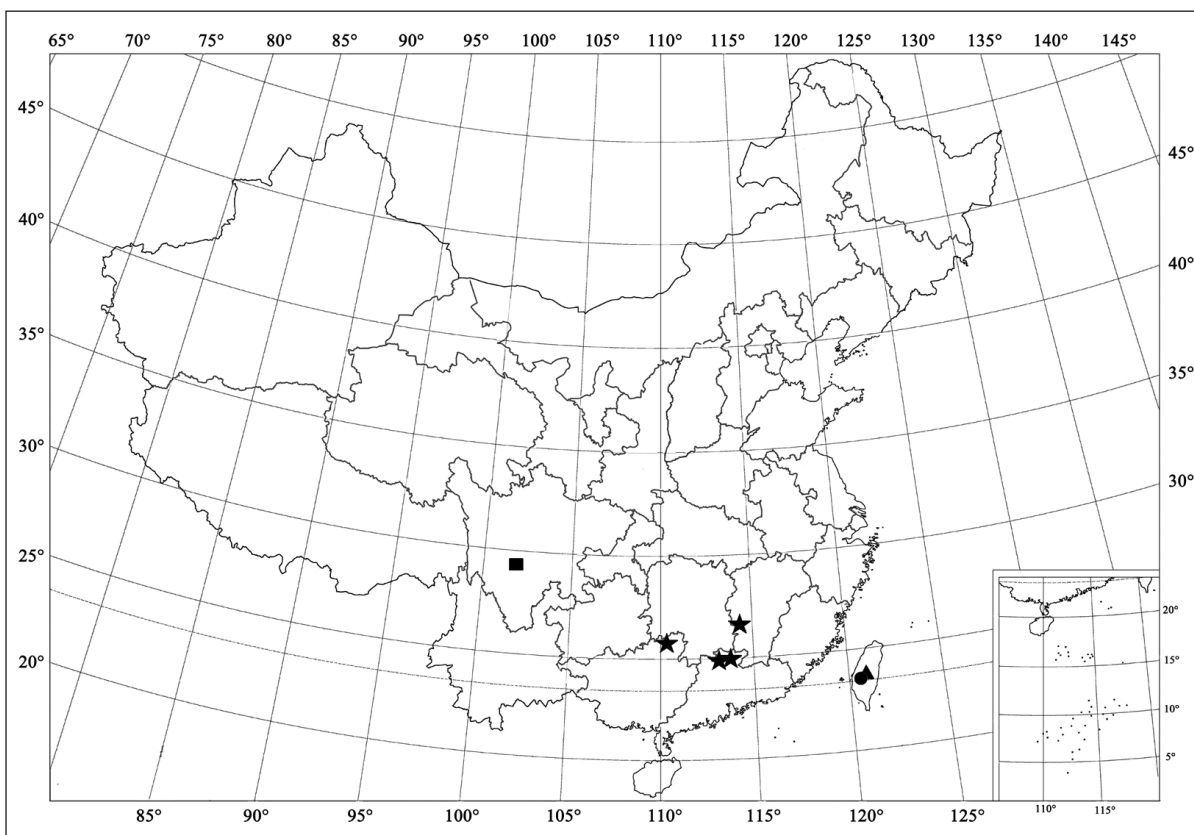


Figure 12. Distribution map. *Scymnus (Parapullus) shenmuensis* sp. n. (●); *Scymnus (Parapullus) secula* Yang (▲); *Scymnus (Parapullus) nanlingicus* Chen, Ren & Wang (★); *Scymnus (Parapullus) yanzigouensis* sp. n. (■).

Type materials. Holotype: male, No. SCAU (E) 11531, **China: Sichuan:** Yanzigou, Gonggashan National Nature Reserve, Luding County, 29°41.92'N, 102°0.22'E, ca 2500 m, 28. IX. 2007, Chen XS leg.
Paratypes (1): 1♂ with same data as holotype.

Distribution. China (Sichuan).

Etymology. The specific epithet refers to its type locality, Yanzigou Scenic Spots, Gonggashan National Nature Reserve, Sichuan Province.

Key to the Chinese species of the subgenus *Scymnus* (*Parapullus*) Yang

1	Elytra reddish brown	2
–	Elytra black	9
2	Penis guide not with parallel sided in ventral view	3
–	Penis guide with parallel sided in ventral view	6
3	Parameres slender, slightly longer than penis guide (Fig. 1h); penis guide not constricted medially; apex of penis guide with hook-like appendage in lateral view (Fig. 1h)	<i>S. (P.) hastatus</i> sp. n.
–	Parameres stout, distinctly shorter than penis guide; penis guide constricted medially	4
4	Penis capsule not emarginated medially; parameres broad, distinctly expanding toward apex	<i>S. (P.) tsugae</i> Yu & Yao
–	Penis capsule deeply emarginated medially	5
5	Parameres as long as 3/4 length of penis guide	<i>S. (P.) alishanensis</i> Pang & Yu
–	Parameres as long as 1/2 length of penis guide (Fig. 2h)	<i>S. (P.) baxianshanensis</i> sp. n.
6	Apex of penis stout with membranous appendage (Fig. 3f)	<i>S. (P.) laojielingensis</i> sp. n.
–	Apex of penis slender without membranous appendage	7
7	Prosternal process rectangular	<i>S. (P.) parallelicus</i> Chen, Ren & Wang
–	Prosternal process trapezoidal	8
8	Abdominal postcoxal lines strongly recurved laterally (Fig. 4d); parameres narrow in lateral view (Fig. 4h)	<i>S. (P.) annuliformis</i> sp. n.
–	Abdominal postcoxal lines weakly recurved laterally; parameres broad in lateral view ...	<i>S. (P.) malleatus</i> Chen, Ren & Wang
9	Apex of parameres densely covered with one group of setae	10
–	Apex of parameres densely covered with two groups of setae	11
10	On the inner side of paramere with a papilla bearing a stout seta at apical 1/3 length (Fig. 5h) ...	<i>S. (P.) papillatus</i> sp. n.
–	On the inner side of paramere smooth, not with a papilla appendage	<i>S. (P.) solus</i> Chen, Ren & Wang
11	Penis guide strongly curved in lateral view	12
–	Penis guide straight or with apex slightly curved outwardly	13
12	Prosternal process with lateral carinae parallel	<i>S. (P.) aduncatus</i> Chen, Ren & Wang
–	Prosternal process with lateral carinae convergent anteriorly	<i>S. (P.) dichotomus</i> sp. n.
13	Pronotum brown with a large black marking (Fig. 7a)	<i>S. (P.) shenmuensis</i> sp. n.
–	Pronotum entirely brown	14
14	Penis capsule with outer arm narrow, sub-quadrangle	<i>S. (P.) secula</i> Yang
–	Penis capsule with outer arm broad, truncate	15
15	Area enclosed by abdominal postcoxal lines relatively narrow	<i>S. (P.) nanlingicus</i> Chen, Ren & Wang
–	Area enclosed by abdominal postcoxal lines relatively broad (Fig. 8d)	<i>S. (P.) yanzigouensis</i> sp. n.

Catalogue of the subgenus *Scymnus* (*Parapullus*) Yang, 1978

Scymnus (*Parapullus*) *abietis* (Paykull, 1798)

Coccinella abietis Paykull, 1798: 154.

Scymnus abietis: Mulsant 1850: 975; Weise 1879: 142; Korschevsky 1931: 117; Gourreau 1974: 109.

Scymnus semilimbatus Fleischer, 1927: 260.

Scymnus (*Scymnus*) *abietis*: Bielawski 1968: 22; 1975: 249; Soares et al. 2003: 27.

Scymnus (*Parapullus*) *abietis*: Pang and Yu 1993: 228; Kovář 2007: 584; Coutanceau 2009: 5; Chen et al. 2012: 22; Borowski 2015: 91.

Distribution. Austria, Belgium, Bulgaria, Belarus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, Norway, Poland, Romania, Russia, Slovakia, Sweden, Switzerland, Ukraine, Serbia and Montenegro, Mongolia.

Scymnus (*Parapullus*) *aduncatus* Chen, Ren & Wang, 2012

Scymnus (*Parapullus*) *aduncatus* Chen, Ren & Wang, 2012: 30.

Distribution. China (Ningxia).

***Scymnus (Parapullus) alishanensis* Pang & Yu, 1993**

Scymnus (Parapullus) alishanensis Pang & Yu, 1993: 230; Yu et al. 2000: 168; Pang et al. 2004: 82; Kovář 2007: 584; Ren et al. 2009: 68; Chen et al. 2012: 26.

Distribution. China (Taiwan).

***Scymnus (Parapullus) annuliformis* sp. n.**

Distribution. China (Anhui, Tibet).

***Scymnus (Parapullus) baxianshanensis* sp. n.**

Distribution. China (Tianjin).

***Scymnus (Parapullus) coosi* Hatch, 1961**

Scymnus (Scymnus) coosi Hatch, 1961: 152. Gordon 1976: 20; 1985: 120.

Scymnus (Parapullus) coosi: Pang and Yu 1993: 229; Chen et al. 2012: 22.

Distribution. USA.

***Scymnus (Parapullus) dichotomus* sp. n.**

Distribution. China (Yunnan).

***Scymnus (Parapullus) difficilis* Casey, 1899**

Scymnus (Scymnus) difficilis Casey, 1899: 154; Leng 1920: 214; Korschefsky 1931: 157; Gordon 1976: 19; 1985: 120.

Scymnus (Parapullus) difficilis: Pang and Yu 1993: 229; Chen et al. 22.

Distribution. USA.

***Scymnus (Parapullus) hastatus* sp. n.**

Distribution. China (Gansu).

***Scymnus (Parapullus) laojielingensis* sp. n.**

Distribution. China (Henan).

***Scymnus (Parapullus) malleatus* Chen, Ren & Wang, 2012**

Scymnus (Parapullus) malleatus Chen, Ren & Wang, 2012: 24.

Distribution. China (Ningxia).

***Scymnus (Parapullus) nanlingicus* Chen, Ren & Wang, 2012**

Scymnus (Parapullus) nanlingicus Chen, Ren & Wang, 2012: 32.

Distribution. China (Jiangxi, Guangdong, Guangxi).

***Scymnus (Parapullus) nebulosus* LeConte, 1852**

Scymnus nebulosus LeConte, 1852: 137; Crotch 1874a: 262; Horn 1895: 95; Steinweden 1929: 29.

Scymnus (Scymnus) nebulosus: Casey 1899: 154; Leng 1920: 214; Korschefsky 1931: 163; Chapin 1974: 22; Gordon 1976: 13; 1985: 119.

Scymnus infuscatus Boheman, 1859: 208; Leng 1920: 214; Korschefsky 1931: 160; Gordon 1976: 15; 1985: 119. Synonymized by Gordon 1976: 15.

Scymnus phelpsii Crotch, 1874b: 77; Horn 1895: 96; Gordon 1976: 15; 1985: 120. Synonymized by Gordon 1976: 15.

Scymnus (Scymnus) phelpsii: Casey 1899: 154; Leng 1920: 214; Korschefsky 1931: 165; Malkin 1943: 194; Hatch 1961: 153; Belicek 1976: 302; Gordon 1976: 15; 1985: 120.

Scymnus (Scymnus) harneyi Hatch, 1961: 152; Gordon 1976: 15; 1985: 120. Synonymized by Gordon 1976: 15.

Scymnus (Parapullus) nebulosus: Pang and Yu 1993: 229; Chen et al. 2012: 22.

Distribution. Canada, USA.

***Scymnus (Parapullus) papillatus* sp. n.**

Distribution. China (Shanxi, Tianjin, Hunan, Guangdong).

***Scymnus (Parapullus) parallelicus* Chen, Ren & Wang, 2012**

Scymnus (Parapullus) parallelicus Chen, Ren & Wang, 2012: 24.

Distribution. China (Gansu).

***Scymnus (Parapullus) secula* Yang, 1978**

Scymnus (Parapullus) secula Yang, 1978: 27; Pang and Yu 1993: 229; Yu et al. 2000: 167; Pang et al. 2004: 82; Kovář 2007: 584; Ren et al. 2009: 68; Chen et al. 2012: 32.

Distribution. China (Taiwan).

***Scymnus (Parapullus) shenmuensis* sp. n.**

Distribution. China (Taiwan).

***Scymnus (Parapullus) solus* Chen, Ren & Wang, 2012**

Scymnus (Parapullus) solus Chen, Ren & Wang, 2012: 29.

Distribution. China (Gansu, Henan, Guangxi).

***Scymnus (Parapullus) tsugae* Yu & Yao, 2000**

Scymnus (Parapullus) tsugae Yu & Yao in Yu et al. 2000: 168; Pang et al. 2004: 82; Kovář 2007: 584; Chen et al. 2012: 29.

Distribution. China (Yunnan).

Scymnus* (*Parapullus*) *yanzigouensis* sp. n.*Distribution.** China (Sichuan).**Acknowledgements**

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