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Revision of the Chinese *Broscosoma* ROSENHAUER, 1846, with descriptions of two new species (Coleoptera: Carabidae, Broscinae)

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Abstract

Two new species of the genus *Broscosoma* ROSENHAUER, 1846 are described from China: *B. stefani* sp.n. (Sichuan) and *B. farkaci* sp.n. (Tibet). A key is provided to include all Chinese species of *Broscosoma* and the habitus and male genitalia of the new taxa and related species are illustrated.

Key words: Coleoptera, *Broscosoma*, new species, China, Tibet, Sichuan.

Introduction

The recent explorations of montane habitats in China continue to provide new and interesting data on the systematics and biogeography of Carabid beetles. The genus *Broscosoma* ROSENHAUER, 1846, with relic, scattered distribution from the Alps to Japan, previously included only eighteen species. During recent explorations, two new species have been discovered; descriptions of these new species and their relationships with the previously described ones are the main purposes of this work.

Material and methods

The material examined is preserved in the following collections, each of which is coded by an acronym used in this publication.

CF	Coll. Facchini, Piacenza (Italy)
CFa	Coll. Farkač, Prague (Czech Republic)
CJ	Coll. Janata, Prague (Czech Republic)
CS	Coll. Sciaky, Milan (Italy)
CW	Coll. Wrase, Berlin (Germany)
NHMB	Naturhistorisches Museum, Basel (Switzerland)

Measurements were made with an ocular micrometer in a Leica MZ 12.5 stereoscopic microscope. The total length was measured from the apex of the mandibles (closed) to the apex of the elytra. Measurements of body parts and abbreviations used for them in the text are:

El	length of elytra from base of scutellum to apex
Ew	maximum width of elytra
Pl	length of pronotum along median line
Pw	maximum width of pronotum

Indices used in this publication are Pw/Pl and El/Ew.

Photographs were made with a Minolta camera attached to a Leica MZ 12.5 stereoscopic microscope.

Key to the Chinese species of *Broscosoma*

1 Shoulders clearly indicated; colour bright green with golden hue on elytra; eyes convex; elytra with stria 1 deep (except at basal fifth), the following indicated by rows of punctures. Habitus as in Fig. 2, aedeagus Fig. 11. Yunnan..... *ribbei rougeriei* DEUVE & TIAN, 2002

– Shoulders largely rounded; combination of characters not as above. Sichuan, Tibet 2

2 Total length very small (7.5 mm); elytra with stria 1 deep and impunctate, other striae almost indistinct; eyes twice as long as tempora, frontal grooves linear and impunctate, pronotum more convex; umbilicate series composed by one humeral and three apical setigerous punctures; colour dark brown. Habitus as in Fig. 3. Sichuan..... *moriturum* SEMENOV, 1900

– Total length larger than 7.6 mm; elytra with stria 1 punctate (rarely indistinctly punctate, in this case with elytra green); eyes nearly as long as tempora, frontal grooves irregular and punctate or sometimes impunctate, pronotum less convex; umbilicate series composed by one humeral (sometimes missing) and two apical setigerous punctures; colour dark brown, black, greenish or bluish 3

3 Colour green, green-bluish or black with bluish or greenish hue 4

– Colour black or dark brown, without greenish or bluish hue 5

4 Colour green or green-bluish; head with collar constriction impunctate or sparsely punctate. Habitus as in Fig. 4, aedeagus as in Fig. 12. Sichuan..... *sichuanum* DEUVE, 1990

– Colour black with bluish or greenish hue; head with collar constriction deep and punctate. Habitus as in Fig. 5, aedeagus as in Fig. 13. Sichuan ..... *stefani* sp.n.

5 Pronotum with sides more distinctly rounded; umbilicate series without humeral setigerous punctures (rarely on one side only) and with two apical setigerous punctures; head with collar constriction with very few punctures or impunctate; frontal grooves very slightly punctate; antennae short, uniformly brown. Habitus as in Fig. 6, aedeagus as in Fig. 14. Sichuan..... ..... *kalabi* DEUVE, 1992

– Pronotum with sides less distinctly rounded; umbilicate series with one humeral setigerous puncture (very rarely missing) and two apical setigerous punctures. Tibet 6

6 Head with collar constriction impunctate or with very few punctures, frontal grooves impunctate; basal setigerous puncture between the base of striae 2 and 3. Habitus as in Fig. 7, aedeagus as in Fig. 15. Tibet ..... *farkaci* sp.n.

– Head with collar constriction punctate, frontal grooves moderately or markedly punctate; basal setigerous puncture near the base of stria 2 7

7 Elytra slenderer, less convex, with striae more distinct, microsculpture completely effaced; aedeagus slenderer, with apex more markedly bent downwards in lateral view. Habitus as in Fig. 8, aedeagus as in Fig. 16. Tibet ..... *tibetanum* FACCHINI, 2002

– Elytra shorter, more convex, with striae less distinct (often effaced), microsculpture present on elytra (very shallow and incomplete); aedeagus stouter, with apex less markedly bent downwards in lateral view. Habitus as in Fig. 9, aedeagus as in Fig. 17. Tibet..... *businskae* DVOŘÁK, 1998

Broscosoma stefani sp.n.

DIAGNOSIS: A *Broscosoma* of 8.7–9.7 mm, body black with evident bluish or greenish hue, shiny, femora dark brown, tibiae and tarsi brown or dark brown, palpi and antennae brown, with antennomeres 1–2 paler and 3–4 darker, labrum dark brown; ventral side black, brown in part; shoulders largely rounded, elytra with stria 1 deep and punctate, striae 2–5 very shallow but visible, 6–8 indistinct, head with frontal grooves irregular and punctate, collar constriction deep and punctate, pronotum markedly rounded at sides. It is distinguished from *B. sichuanum* by its

colour, which is black with bluish or greenish hue instead of green or green-bluish and head with collar constriction punctate (impunctate or sparsely punctate in *B. sichuanum*).

TYPE LOCALITY: China, C Sichuan, Xiling Snow Mts.

TYPE MATERIAL: **Holotype**, ♂: China, C Sichuan, Xiling Snow Mts, 2100–3100 m, 1–3.viii.1996 (CS). **Paratypes:** same data as holotype, 1 ♀ (CS); China, C-Sichuan, Jintang, Jiajin Shan, 3400 m, 30°22'451"N, 102°16'644"E, 15.6.2002, 3 ♂♂, 1 ♀ (CJ, CF).

DERIVATIO NOMINIS: This species is dedicated to our colleague Stefan Schödl, who's early death has shocked us.

DESCRIPTION: Length 8.7–9.7 mm (9.6 mm in holotype); habitus as in Fig. 5; body slender, convex, micropterous; body black with an evident bluish or greenish hue, shiny, femora dark brown, tibiae and tarsi brown or dark brown, palpi and antennae brown, with antennomeres 1–2 paler and 3–4 darker, labrum dark brown; ventral side black, brown in part. Microsculpture effaced on head, pronotum and elytra.

Head convex, sparsely punctate, narrower than pronotum, frontal grooves irregular and punctate. Labrum almost straight at anterior margin, clypeus with one seta on each side; mandibles long, slender, pointed at tip; mentum with a blunt tooth. Eyes slightly convex, tempora slightly rounded, almost as long as eyes; collar constriction deep and punctate. Antennae short, with antennomere 2 short, 3 moderately long, 1 and 4–11 medium-sized; antennomeres 1–4 glabrous, 5–11 densely pubescent.

Pronotum markedly convex, evidently longer than wide (index Pw/Pl = 0.89 in holotype); sides markedly rounded, surface smooth, only at basal pedunculate area markedly punctate, sometimes with very few punctures near anterior margin; maximum width slightly anterior middle, almost equally constricted at anterior margin and at base. Lateral seta slightly anterior to middle. Median longitudinal impression deep, anterior transverse impression shallow. Pro-, meso-, metasternum and episterna smooth; prosternum unbordered at apex.

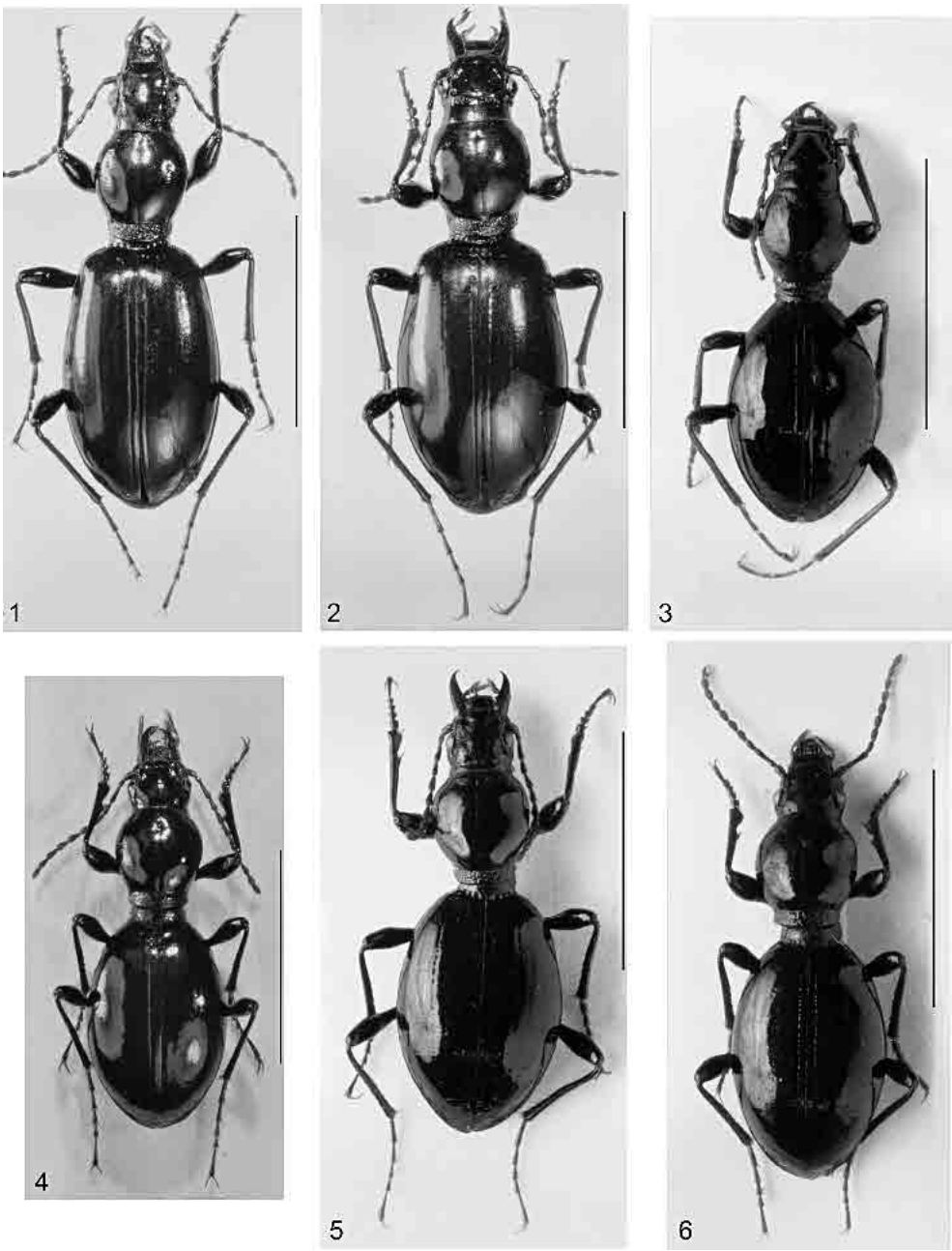
Elytra convex, wide (index El/Ew = 1.46 in holotype), glabrous, without microsculpture, rounded at sides, with maximum width at middle. Shoulders effaced, striae punctate, stria 1 deep, striae 2–5 very shallow but visible, 6–8 indistinct. Intervals impunctate. Basal setigerous puncture present at base of stria 2, discal setigerous punctures absent. Umbilicate series composed by one humeral and two apical setigerous punctures. Abdomen smooth, last visible sternite with one (rarely two) seta on each side.

Legs moderately short, tarsi narrow, tarsomeres glabrous dorsally, onychium with few thin setae ventrally. Protarsomeres 1–3 of male dilated, mesotarsomeres 1–2 of male slightly dilated.

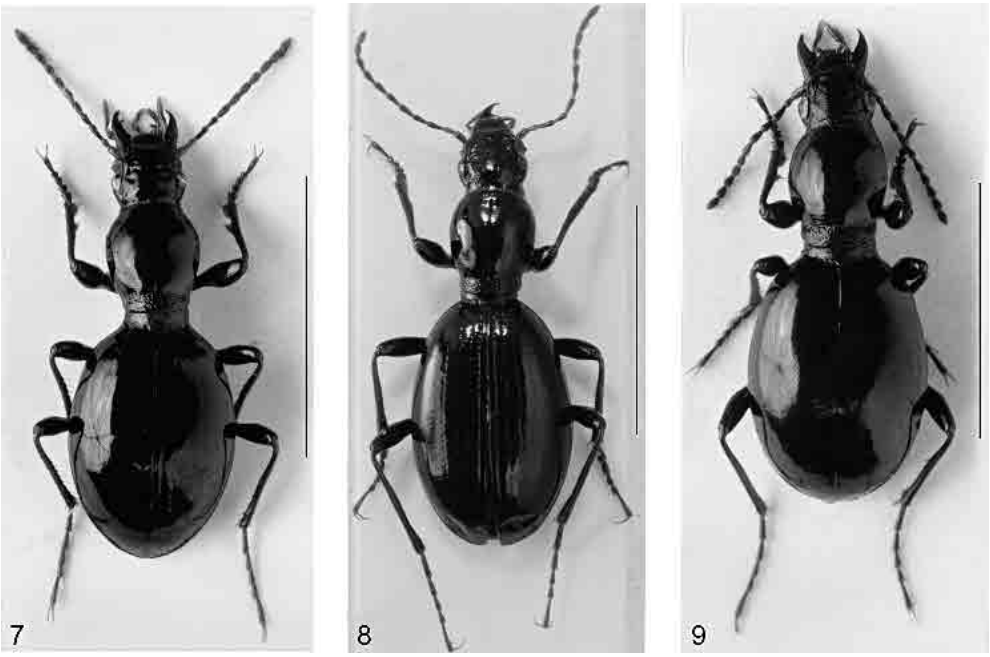
Aedeagus (Fig. 13) of medium size, median lobe with dorsal ostium. Apex in lateral view bent downwards.

DISTRIBUTION: Known only from China, C Sichuan (Xiling Snow Mts and Jintang, Jiajin Shan).

AFFINITIES: *Broscosoma stefani* sp.n. is similar to *B. sichuanum* but it can be easily distinguished from it by its head with collar constriction punctate (impunctate or sparsely punctate in *B. sichuanum*) and by its colour, which is black with bluish or greenish hue instead of green or green-bluish.



Figs. 1–6: Habitus of 1) *Broscosoma ribbei ribbei* from Nepal, Dhaulagiri; 2) *B. ribbei rougeriei* from Yunnan, Dali, Diancang Shan; 3) *B. moriturum*, type; 4) *B. sichuanum*, from Sichuan, Luding Co., Moxi; 5) *B. stefani* sp.n., holotype; 6) *B. kalabi*, from Sichuan, Zhegushan pass. Scale: 5 mm.



Figs. 7–9: Habitus of 7) *Broscosoma farkaci* sp.n., holotype; 8) *B. tibetanum*, holotype; 9) *B. businskae*, paratype from Tibet, mountains N of Nyingchi. Scale: 5 mm.

***Broscosoma farkaci* sp.n.**

DIAGNOSIS: A *Broscosoma* of 7.7–9.0 mm, body dark brown, almost black, shiny, with legs, labrum, palpi and antennae brown, rarely antennomeres 3–4 slightly darkened; ventral side dark brown; shoulders largely rounded, elytral stria 1 punctate, moderately deep, striae 2–3 very shallow but visible, 4–8 indistinct, head with frontal grooves irregular and impunctate, collar constriction moderately deep, smooth or with very few punctures, elytra with basal setigerous puncture between the base of striae 2 and 3. It is distinguished from the other Tibetan species (*B. businskae* and *B. tibetanum*) by its head with collar constriction impunctate or with very few punctures (instead of distinctly punctate), frontal grooves impunctate (instead of punctate) and basal setigerous puncture between the base of striae 2 and 3 (near the base of stria 2 in *B. businskae* and *B. tibetanum*).

TYPE LOCALITY: SE Tibet, Mt. Namchawarwa.

TYPE MATERIAL: **Holotype**, ♂: SE Tibet, Mt. Namchawarwa, 4400 m, VI.1998 (CFa). **Paratypes**: same data as holotype, 3 ♂♂, 2 ♀♀ (CFa, CS, CF).

DERIVATIO NOMINIS: Dedicated to our friend Dr. Jan Farkač, who, with his usual kindness, presented to us the specimens of this species.

DESCRIPTION: Length 7.7–9.0 mm (7.7 mm in holotype); habitus as in Fig. 7; body slender, convex, micropterous; body dark brown, almost black, shiny, with legs, labrum, palpi and

antennae brown, rarely antennomeres 3–4 slightly darkened; ventral side dark brown. Microsculpture effaced on head, pronotum and elytra.

Head convex, smooth or with very few punctures, narrower than pronotum, frontal grooves irregular and impunctate. Labrum almost straight at anterior margin, clypeus with one seta on each side. Mandibles long, slender, pointed at tip, mentum with tooth. Eyes rather flat or very slightly convex, tempora almost as long as eyes; collar constriction moderately deep, smooth or with very few punctures. Antennae short, with antennomere 2 short, 3 moderately long, 1 and 4–11 medium-sized; antennomeres 1–4 glabrous, 5–11 densely pubescent.

Pronotum clearly convex, markedly longer than wide (index Pw/Pl = 0.84 in holotype); sides moderately rounded, surface smooth, only at basal pedunculate area markedly punctate; maximum width slightly anterior middle, almost equally constricted at anterior margin and at base. One or two lateral setae, slightly anterior to middle. Median longitudinal impression moderately deep, anterior transverse impression very shallow. Pro-, meso-, metasternum and episterna smooth; prosternum unbordered at apex.

Elytra convex, wide (index El/Ew = 1.51 in holotype), glabrous, sides rounded, maximum width at middle. Shoulders effaced, striae punctate, stria 1 moderately deep, striae 2–3 very shallow but visible, 4–8 indistinct. Intervals impunctate, without microsculpture. Basal setigerous puncture between the base of striae 2 and 3, discal setigerous punctures absent. Umbilicate series composed by one humeral and two apical setigerous punctures. Abdomen smooth, last visible sternite with one seta on each side in both sexes.

Legs moderately short, tarsi narrow, tarsomeres glabrous dorsally, onychium with few thin setae ventrally. Protarsomeres 1–3 of male dilated, mesotarsomeres 1–2 of male slightly dilated.

Aedeagus (Fig. 15) medium sized, median lobe with dorsal ostium. Apex in lateral view slightly bent downwards.

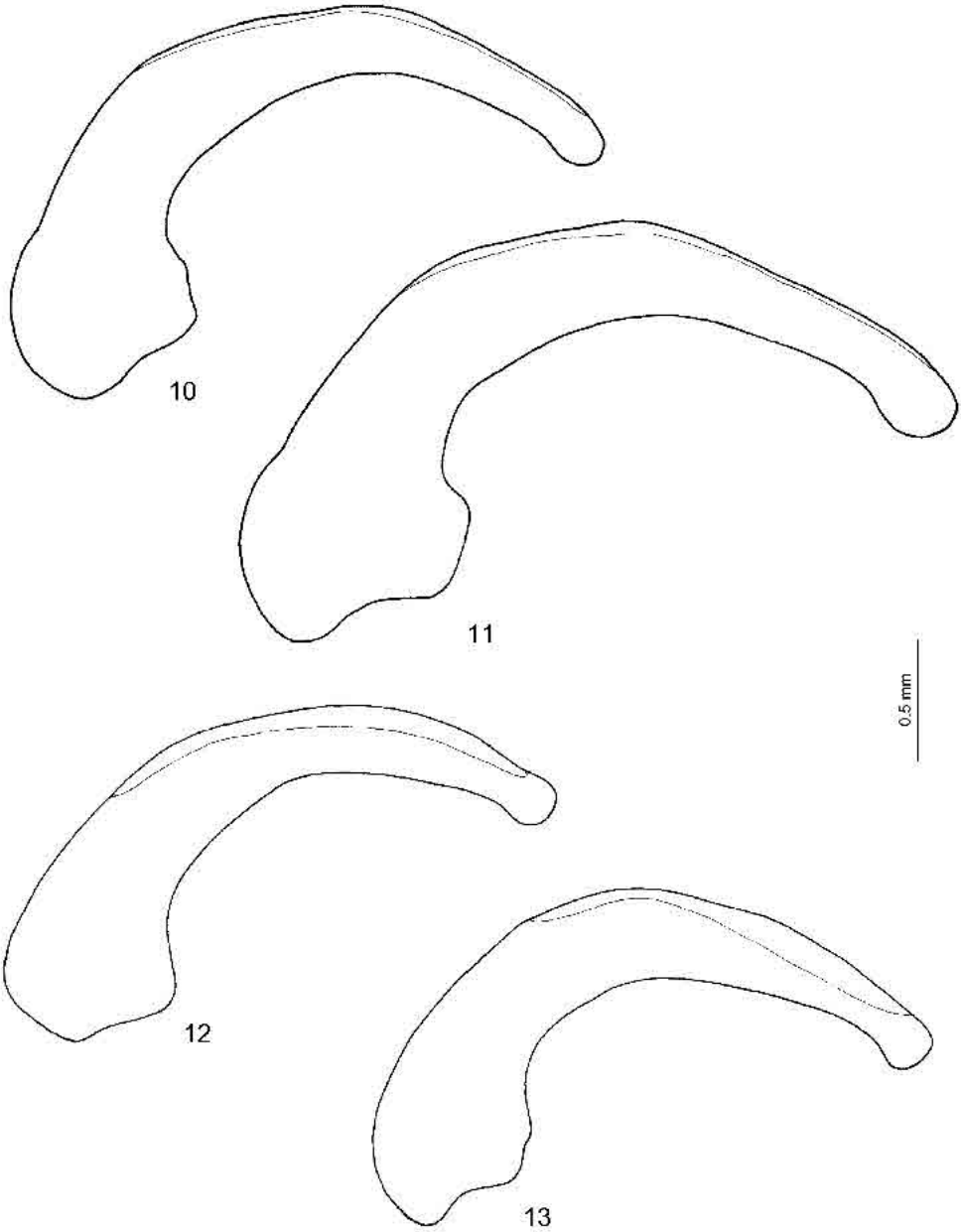
DISTRIBUTION: Known only from China, SE Tibet, Mt. Namchawarwa.

AFFINITIES: *Broscosoma farkaci* sp.n. is distinguished from the two other species known from Tibet (*B. businskae* and *B. tibetanum*) by its head with collar constriction impunctate or with very few punctures (instead of distinctly punctate), frontal grooves impunctate (instead of punctate) and basal setigerous puncture between the base of striae 2 and 3 (near the base of stria 2 in *B. businskae* and *B. tibetanum*). It is distinguished, moreover, from *B. tibetanum* by its elytra less elongate, elytral striae less distinctly impressed, last visible sternite of male with one instead of two seta on each side and the different shape of the aedeagus (Figs. 15, 16).

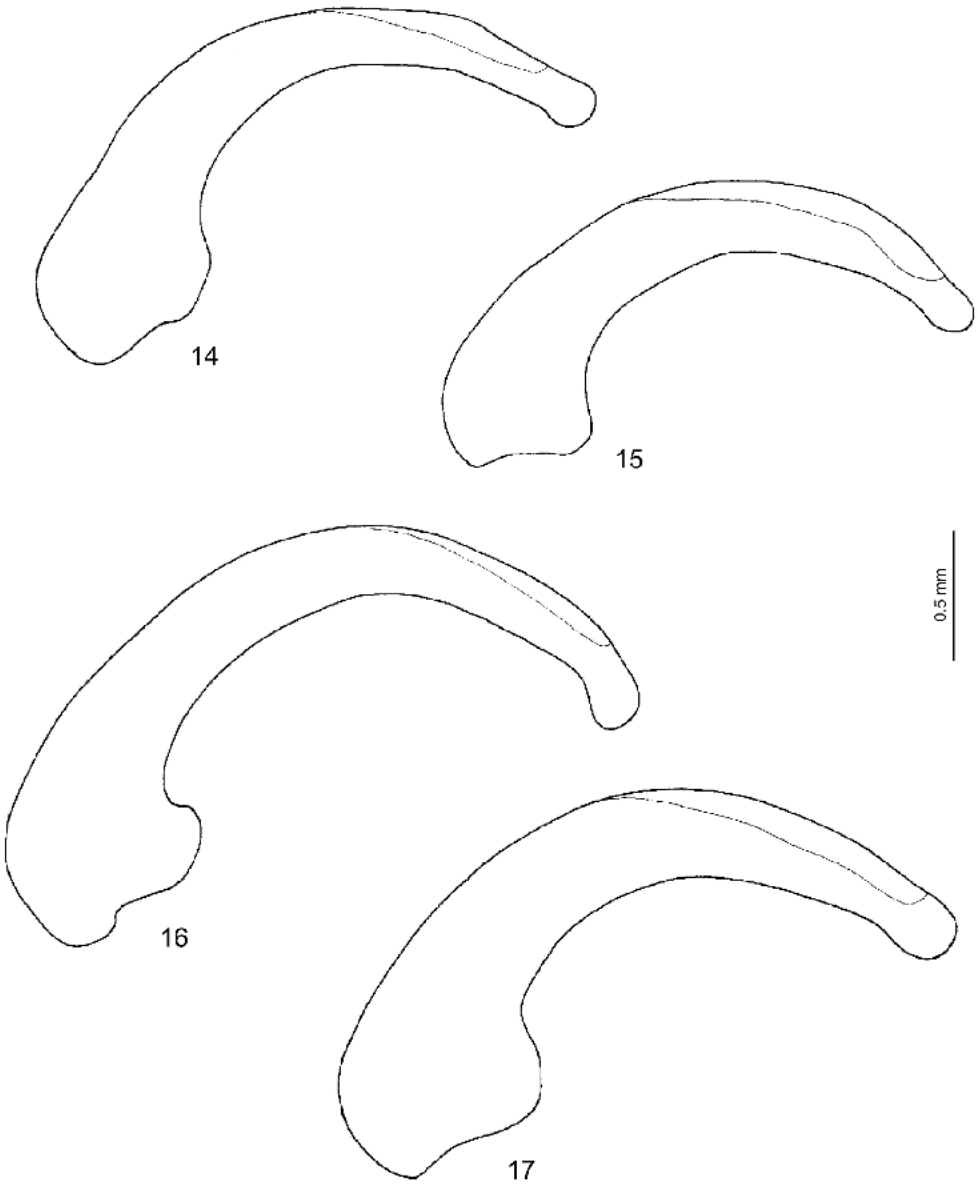
Notes on the other Chinese taxa of the genus *Broscosoma*

Broscosoma ribbei ssp. *rougeriei* DEUVE & TIAN, 2002

This subspecies (Fig. 2) was described upon a single female from Yunnan, Ailao Shan, Jinping Xian, Fengshuiling. We have examined several additional specimens: 1 ♀ from Yunnan, Dali, Cangshan mts., 2700 m (NHMB), 4 ♂♂ and 6 ♀♀ from Yunnan, Dali Bai Nat. Aut. Pref., Diancang Shan, 3 km W Dali old town, creek valley at "Cloud Road", right upper chairlift station, under stones, 25°41.1'N 100°06.8'E, 2650–2750 m, 29.VIII.–1.IX.2003, leg. D. Wrase (CW) and 2 ♀♀ from Yunnan, Dali Bai Nat. Aut. Pref., Diancang Shan, 4 km W Dali old town, E slope, under stones, 25°41.4'N 100°06.7'E, 2900–3000 m, 31.VIII.2003, leg. D. Wrase (CW). The specimens examined perfectly correspond to the original description.



Figs. 10–13: Median lobe of the aedeagus in left view of 10) *Broscosoma ribbei ribbei* from Nepal, Dhaulagiri; 11) *B. ribbei rougeriei* from Yunnan, Dali, Diancang Shan; 12) *B. sichuanum*, from Sichuan, Luding Co., Moxi; 13) *B. stefani* sp.n., holotype.



Figs. 14–17: Median lobe of the aedeagus in left view of 14) *Broscosoma kalabi*, from Sichuan, Shuajingsi; 15) *B. farkaci* sp.n., holotype; 16) *B. tibetanum*, holotype; 17) *B. businskae*, paratype from Tibet, mountains N of Nyingchi.

The nominotypical form, *B. ribbei* ssp. *ribbei* PUTZEYS, 1877 (Fig. 1), lives in Nepal and Sikkim. It is mainly distinguished from *B. ribbei* ssp. *rougeriei* by its dark green colour instead of bright

green with golden hue on elytra, eyes slightly smaller and more convex and pronotum on the average more slender.

The median lobe of the aedeagus of both taxa is very similar, with the same internal sac structure. Specimens from Yunnan have the apex of the median lobe more dilated than in specimens from Nepal (Figs. 10, 11). Therefore we agree with the interpretation proposed by DEUVE & TIAN (2002) in the original description of an eastern subspecies of *B. ribbei* with rather small, but stable differences.

***Broscosoma moriturum* SEMENOV, 1900**

Type locality: China, northern Sichuan, "Ta-tzao-pin, supra angustias Cho-dzi-gou" (today Juzhaigou).

This species had been described upon a single female specimen, in ZISP (Zoological Institute, St.-Petersburg). The type, in good condition except for the lack of the right antenna, is labelled: "Ta-tzao-pin, 28.vii - 7.viii.93, Berezovsky" (white handwritten label). It is a species of very small size (7.5 mm, the smallest Chinese *Broscosoma*) and shows a marked resemblance to *B. uenoi* HABU, 1972 from Taiwan. In spite of the frequent recent researches in the area of Juzhaigou, this species, to our knowledge, has never been collected again. The type remains the only known specimen. Although males are unknown, the diagnostic characters known from the female type specimen are numerous and evident, such that it cannot be confused with any other species.

***Broscosoma sichuanum* DEUVE, 1990**

Type locality: China, Sichuan, Songpan.

This species was described upon a single male from an old collection, but we have examined several specimens, some of which were determined by Deuve, from a few other localities. From all these data it seems that the species is distributed from northern Sichuan (Songpan is almost 200 km N of Chengdu) to western Sichuan (all the localities we know are to the west of Kangding). This is an interesting case of rather wide ranging species within a genus where most species have a very limited distribution.

Material examined: China, Sichuan, Road Litang-Yajiang: 3 ♂♂ and 4 ♀♀; China, Sichuan, Gongga Shan massif, Hailuogou Glacier Park: 2 ♂♂ and 5 ♀♀.

***Broscosoma kalabi* DEUVE, 1992**

Type locality: China, northern Sichuan, Shuajingsi.

Of this species, described upon two specimens, we have examined additional material, allowing us to extend the limits of its distribution.

Material examined: China, Sichuan, Shuajingsi: 1 ♂; China, Sichuan, Lixian, Zhegushan pass: 4 ♀♀.

***Broscosoma businskae* DVOŘÁK, 1998**

Type locality: China, Eastern Tibet, Nyingchi.

This species was described upon a long series of specimens collected in eastern Tibet (Nyingchi). Beyond a portion of the type series, we have examined several specimens collected by different individuals and with different locality data, however we surmise that the actual collecting locality is the same. These specimens are labelled: "Tibet (Nyungtri), Serkyim-la (N slope), 4200-4300 m, 27-28.VI.1995". The original description correctly compares this species

with all the other Chinese *Broscosoma* and well illustrates its habitus. We here present a new drawing of the median lobe of the aedeagus (Fig. 17).

***Broscosoma tibetanum* FACCHINI, 2002**

Type locality: China, "E Tibet, C. Nyingchi, Basum Tso Lake".

This species was described upon one male and one female, from a location very close to the type locality of *B. businskae*. *Broscosoma tibetanum* is easily distinguished from *B. businskae* by its slenderer and less convex elytra, elytral striae more distinctly impressed, last visible sternite of male with two setae on each side instead of one, aedeagus more slender, with apex more markedly bent downwards in lateral view (Fig. 16).

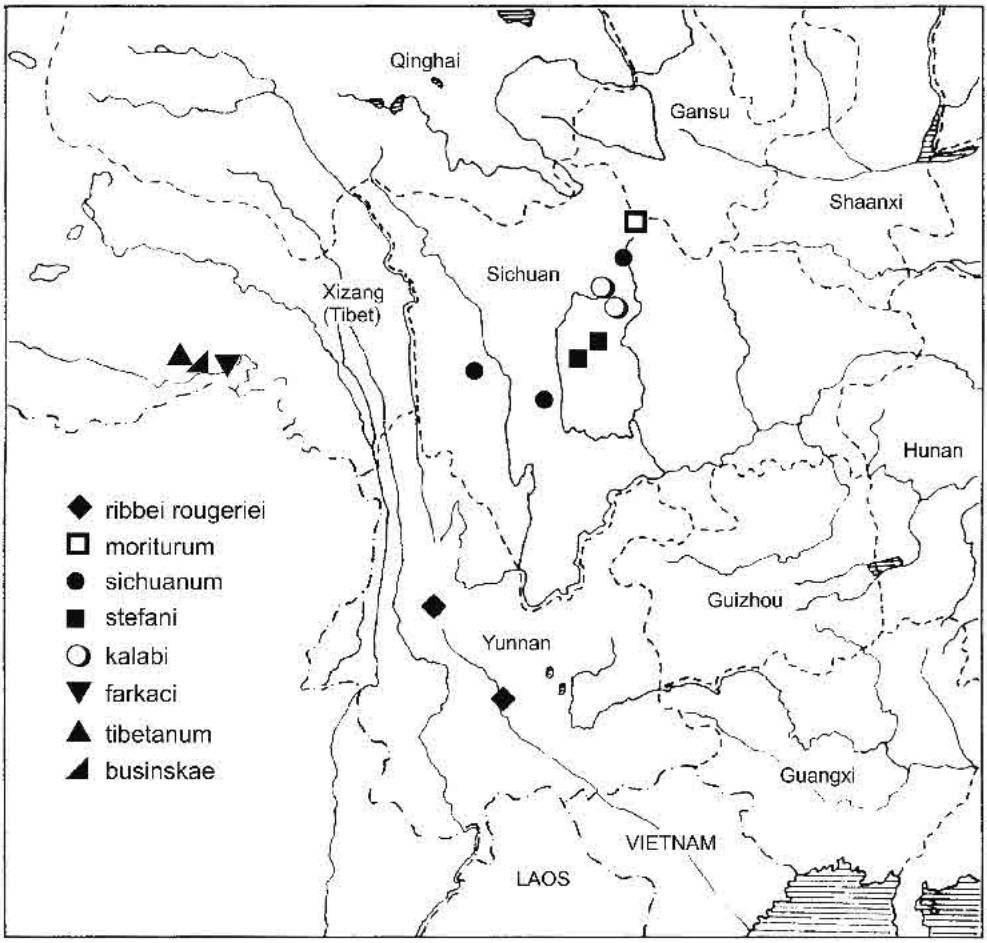


Fig. 18: Distribution map of all known Chinese species of *Broscosoma*.

General remarks

The genus *Broscosoma* is a very interesting instance of an apparent relic distribution, present in the Alps (2 spp.: *B. baldense* ROSENHAUER, 1846 and *B. relictum* WEISSMANDL, 1935), the Caucasus (1 sp.: *B. semenovi* BELOUSOV & KATAEV, 1990), Nepal (7 spp.: *B. ribbei*, *B. monticola* HABU, 1973, *B. deuvei* LASSALLE, 1982, *B. guttuliforme* DEUVE, 1985, *B. schawalleri* DEUVE, 1990, *B. rolex* MORVAN, 1995, *B. convexum* DEUVE, 1983), Sikkim (2 spp.: *B. gracile* ANDREWES, 1927 and *B. ribbei* s.str., that lives also in Nepal), south-western China (8 taxa, including the two here described: *B. ribbei* ssp. *rougeriei* (Yunnan), *B. moriturum*, *B. sichuanum*, *B. kalabi* and *B. stefani* sp.n. (Sichuan), *B. businskae*, *B. tibetanum* and *B. farkaci* sp.n. (Tibet)), Taiwan (1 sp.: *B. uenoi* HABU, 1972) and Japan (1 sp.: *B. doenitzi* HAROLD, 1881). We have shown that this distribution is rather similar to that of the genus *Stomis* (SCIAKY, 1997) and it is conceivable that future explorations in China will result in discovery of further new species.

Checklist of taxa of *Broscosoma* (sorted geographically from west to east)

1. *Broscosoma relictum* WEISSMANDL, 1935	Alps
2. *Broscosoma baldense* ROSENHAUER, 1846	
ssp. *baldense* ROSENHAUER, 1846	Alps
ssp. *pasubianum* WEISSMANDL, 1935	Alps
3. *Broscosoma semenovi* BELOUSOV & KATAEV, 1990	Caucasus
4. *Broscosoma monticola* HABU, 1973	Nepal
5. *Broscosoma deuvei* LASSALLE, 1982	Nepal
6. *Broscosoma convexum* DEUVE, 1983	Nepal
7. *Broscosoma rolex* MORVAN, 1995	Nepal
8. *Broscosoma schawalleri* DEUVE, 1990	Nepal
9. *Broscosoma guttuliforme* DEUVE, 1985	Nepal
10. *Broscosoma gracile* ANDREWES, 1927	Sikkim
11. *Broscosoma ribbei* PUTZEYS, 1877	
ssp. *ribbei* PUTZEYS, 1877	Sikkim, Nepal
ssp. *rougeriei* DEUVE & TIAN, 2002	Yunnan
12. *Broscosoma tibetanum* FACCHINI, 2002	Tibet
13. *Broscosoma businskae* DVOŘÁK, 1998	Tibet
14. *Broscosoma farkaci* sp.n.	Tibet
15. *Broscosoma moriturum* SEMENOV, 1900	Sichuan
16. *Broscosoma sichuanum* DEUVE, 1990	Sichuan
17. *Broscosoma kalabi* DEUVE, 1992	Sichuan
18. *Broscosoma stefani* sp.n.	Sichuan
19. *Broscosoma uenoi* HABU, 1972	Taiwan
20. *Broscosoma doenitzi* (HAROLD, 1881) = *elegans* BATES 1883	Japan

Acknowledgements

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We wish to thank our colleague Dr. K. Will (University of California, Berkeley) for his critical review of the English text.

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