

AMPHIZOIDAE:
Description of *Amphizoa smetanai* sp.n.
and supplementary description of *A. davidi* LUCAS
(Coleoptera)

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Abstract

A new species, *Amphizoa smetanai* (Coleoptera: Amphizoidae), is described from Emei Shan, Sichuan Province, China. The adult female of *Amphizoa davidi* LUCAS is described for the first time in this paper. A revised key to the adults of all six known species (three North American and three Chinese) of *Amphizoa* is provided.

Key words: Coleoptera, Amphizoidae, *Amphizoa davidi*, *Amphizoa smetanai*, new species, China.

Introduction

The family Amphizoidae includes only one genus, *Amphizoa* LECONTE, 1853, and presently it consists of six known species. There are three species in western North America: *A. insolens* LECONTE, 1853, *A. striata* VAN DYKE, 1927, and *A. lecontei* MATTHEWS, 1872, and three in China: *A. davidi* LUCAS, 1882, *A. sinica* YU & STORK, 1991, and *A. smetanai* sp.n. In North America, amphizoids are restricted to the western states and provinces from Alaska south to southern California and east to central Wyoming and Colorado. The Chinese species occur in Jilin and Sichuan.

The family Amphizoidae has been the focus of considerable interest because of its phylogenetic position within the suborder Adephaga and the disjunct distribution of its member species. Two major works have explored these topics. EDWARDS' (1950) pioneering monograph about Amphizoidae formed the basis for all subsequent work on amphizoids. KAVANAUGH'S (1986) review provided much additional information and a key for known world species. Since that time, YU & STORK (1991), YU, XIE & LIN (1993), and JI & JACH (1995) modified KAVANAUGH'S (1986) key for a new Chinese species and provided important information about the bionomics of *Amphizoa*. YU, ROUGHLEY & XIE (1996) reported the rediscovery of *A. davidi* in China.

The systematic position of Amphizoidae has been interpreted in quite different ways by various authors. KAVANAUGH (1986) presented an arrangement of fossil and extant groups of Adephaga and presented Amphizoidae as the sister group to Liadytidae, Dytiscidae, Noteridae, Hygrobiidae, Parahygrobiidae, Coptoclavidae and Gyrinidae. BURMEISTER (1976, 1990), RUHNAU (1986), BEUTEL & ROUGHLEY (1988) placed Amphizoidae as the sister group to Dytiscidae + Hygrobiidae. The different placements of Amphizoidae by these authors suggest that knowledge of amphizoids is seen as a major key to the understanding of adephagan evolution and phylogeny (KAVANAUGH 1986). In terms of biogeography, until recently North America had the majority of species whereas Asia possessed the more plesiomorphic taxa. The isolation of the plesiomorphic member of the genus within Asia raised interesting biogeographic questions (KAVANAUGH 1988). However, for some time there was little evidence that this group was extant in Asia (KAVANAUGH & ROUGHLEY

1981). The unexpected discovery of *A. sinica*, the rediscovery of *A. davidi*, and the discovery of a new species described in the present paper are important evidence for testing a number of hypotheses. This recently acquired information will assist in the understanding of the species of *Amphizoa* in Asia, the phylogenetic relationships among Palaearctic and Nearctic species, and the zoogeographically disjunct distribution of species within the genus. Work currently underway (W. Xie, M.Sc. project) will evaluate the phylogenetic relationships of the known species by incorporating larval and adult features. This should allow for a rigorous biogeographic analysis of the distribution of the species.

Material and methods

The following acronyms are used in the text to refer to collections from which specimens were received for study and in which specimens are deposited.

CASC	Department of Entomology, California Academy of Sciences, San Francisco, California, USA
CNIC	Canadian National Collection, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada
IZAS	Institute of Zoology, Academia Sinica, Beijing, China
JBWM	J.B. Wallis Museum, Department of Entomology, University of Manitoba, Winnipeg, Canada
MHNG	Muséum d'Histoire naturelle, Geneva, Switzerland
NMW	Naturhistorisches Museum Wien, Vienna, Austria
NMCE	Entomology Collection, Invertebrate Zoology Division, National Museum of Natural Sciences, Ottawa, Canada

The methods of KAVANAUGH (1979) for study of adult specimens are followed here. The measurements used in this paper is the standardized body length (SBL) as discussed by KAVANAUGH (1986). SBL is the sum of three measurements: length of head along midline from apical margin of labrum to a point opposite posterior margin of left eye; length of pronotum along midline from anterior to posterior margin; and length of elytron along midline from apex of scutellum to a point opposite apex of longer elytron.

Specimens were studied using a conventional light microscope equipped with a diffracted light source. Line drawings were made with the aid of a camera lucida attached to a Wild M5 stereoscopic microscope.

Key to species of *Amphizoa*

- | | | |
|----|--|-----------------|
| 1 | Elytron with distinct carina on fifth interval; North America, Rocky Mountains to Pacific Coast | <i>lecontei</i> |
| 1' | Elytron without carina on fifth interval | 2 |
| 2 | Pronotum with lateral margin without lateral bead | 3 |
| 2' | Pronotum with lateral margin with lateral bead | 4 |
| 3 | Smaller specimens (SBL = 10.64 - 11.72 mm); metasternal process round at apex (Fig. 1a); mentum with lobe broad (Fig. 8b); China, Sichuan, Baoxing | <i>davidi</i> |
| 3' | Larger specimens (SBL = 12 mm); metasternal process slightly truncate at apex (Fig. 1b); mentum with lobe narrow (Fig. 8a); China, Sichuan, Emei Shan | <i>smetanai</i> |
| 4 | Metasternal process depressed, with lateral margin raised (Fig. 2a); China, Jilin | <i>sinica</i> |
| 4' | Metasternal process flattened, without lateral margin raised (Fig. 2b) | 5 |
| 5 | Larger specimens (SBL over 13 mm); front tarsi with well developed groove on posterior surface, grooves bearing a fringe of long, natatory setae (Fig. 3a); North America, Pacific Northwest | <i>striata</i> |
| 5' | Smaller specimens (SBL under 13 mm); front tarsi without well developed grooves, natatory setae absent (Fig. 3b); North America, Alaska to southern California and east to Montana | <i>insolens</i> |

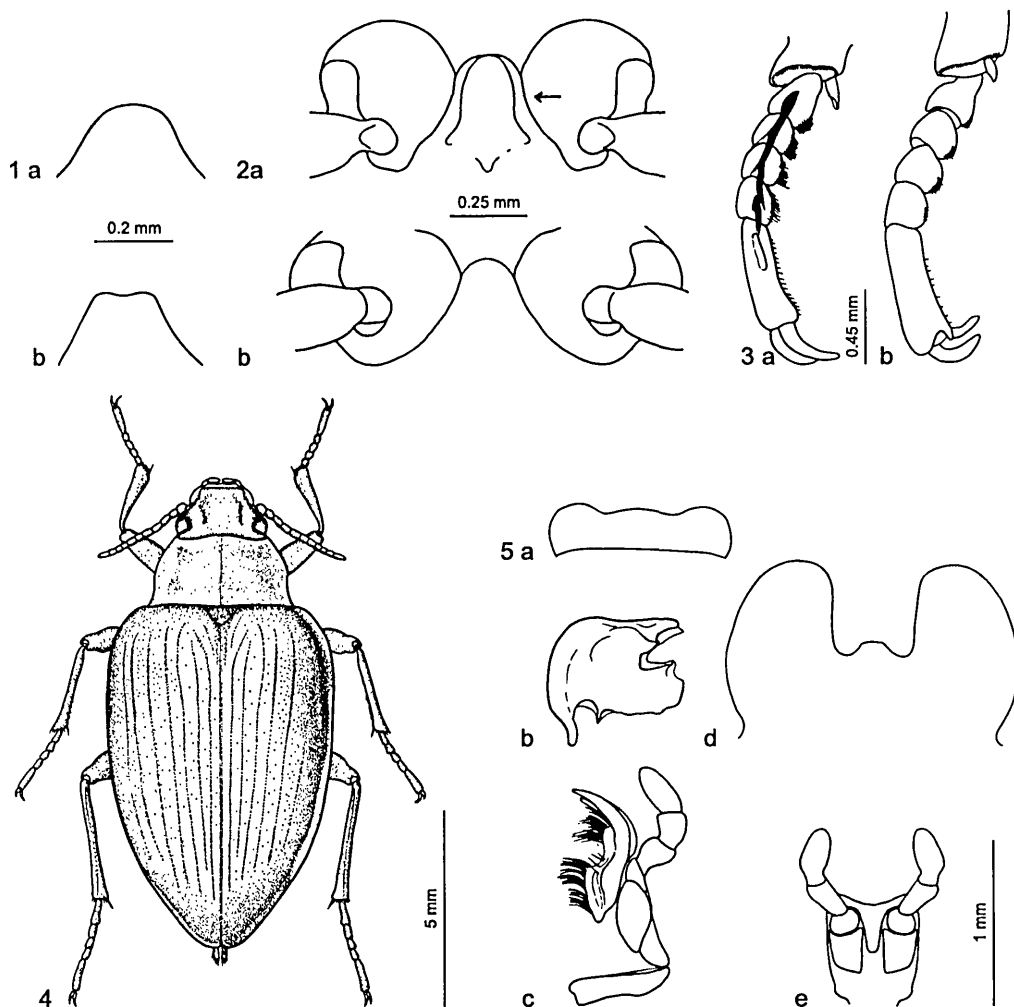


Fig. 1: Outline of shape of metasternal process, a) *Amphizoa davidi*; b) *A. smetanai*.

Fig. 2: Metasternal process, a) *Amphizoa sinica*, the arrow indicates the raised lateral margin; b) *A. insolens*.

Fig. 3: Protarsus, lateral aspect, a) *Amphizoa striata*; b) *A. insolens*.

Fig. 4: Habitus, adult female, *Amphizoa davidi*.

Fig. 5: Mouthparts of *Amphizoa davidi*, a) labrum; b) mandible (prostheda not illustrated); c) maxilla; d) mentum; e) labium.

Amphizoa smetanai sp.n.

Material examined: Holotype ♀, China, Sichuan, Emei Shan, 29°32'N, 103°21'E, 3000 m a.s.l., 17.VII.1996, leg. A. Smetana, J. Farkač & P. Kabátek. The holotype will be deposited in MHNG at the request of Dr. Smetana.

Description: Size medium, SBL = 12.00 mm; body form moderately wide; head piccous, pronotum, elytra, and legs dark brown, with antennae tip, maxillary and labial palpi, front- and mid-coxa, trochanter, basal femur and distal part of tarsomere 5 rufopiccous; ventral surface of

body piceous; head and pronotum coarsely and densely punctate; elytron finely and densely punctate, with more fine punctures than those of *A. davidi*, not granulate in appearance; head quadrate, with a moderately deep furrow on inner side of eye; clypeus not separated from the frons; antenna 11-segmented, filiform, antennomeres 1 - 5 bare with coarse sparse punctures, antennomeres 6 - 11 globular, with sparse fine punctures; antennomere 1 thickened, antennomere 3 nearly twice as long as antennomere 2; labrum transverse (Fig. 11a), with anterior margin three lobed, the middle lobe about the same length as lateral lobes; mandible short and stout (Fig. 11b), covered by the labrum at rest; anterodorsal surface of mandible with a shallow distal impression, and covered with fine punctures; apex of mandible truncate, with two teeth; lacinia and galea of maxilla (Fig. 11c) curved, with pointed apices; inner margin of lacinia with dense, strong hairs; maxillary palp 4-segmented, palpomere 1 short, nearly half the length of palpomere 2, palpomere 2, and 3 nearly equal in length, palpomere 4 longest, twice as long as palpomere 3; palpifer elongate, well sclerotized, not distinctly thickened in the middle; basistipes stout, slightly shorter than palpifer; cardo elongate; mentum with tooth broad (Fig. 11d), lateral lobe of mentum moderately prominent laterally at the base; labial palpus 3-segmented, palpomere 1 much shorter than others; palpiger stout; ligula present and distinct, not narrowed posteriorly, with apex angulate (Fig. 11e); lateral lobe of mentum (Fig. 8) slightly narrow; pronotum broadest at base, with lateral margin arcuate at middle and without lateral bead, slightly sinuate anterior to basal angle; median longitudinal impression present, deeply impressed at middle; basal impression deep; ventral side of body finely punctate, with indistinct microsculpture; prosternal intercoxal process slightly elongated, with longitudinal concave impression on the surface; metasternal process (Fig. 1b) truncated at apex, and without lateral carinae on the margin of anterior process; seven abdominal segments visible; elytra evenly convex; elytral striae complete, moderately impressed; femur thick, with distinct transverse sculpture anteriorly and posteriorly; tibia with a groove along outer rear edge bearing fringe of setae; each tibia having two strong distal spines; tarsus 5-segmented, pro- and mesotarsomeres 1 - 4 nearly equal in length, with two clusters of hairs ventrally, metatarsomeres 2 - 4 nearly equal in length, tarsomere 1 slightly longer than tarsomeres 2 - 4; tarsomere 5 longest, as long as tarsomeres 2 - 4, with two rows of longitudinal tiny spines ventrally; claws slender; genital appendages composed of a pair of coxites and a pair of valvifers encircling coxites laterally; coxite long, covered with tiny hairs, narrow at base (Fig. 9a); distal part of coxite with a tuft of bristles; valvifer indistinctly sclerotized.

Remarks: Adult specimens of *Amphizoa smetanai* are similar to those of *A. davidi* but distinguishable mainly by the following differences: coxites of female genitalia slender, and narrow at base (Fig. 9); prosternal process slightly elongate (Fig. 10); metasternal process truncate at apex (Fig. 1b); body size larger than in *A. davidi*; mentum with lobe narrower.

Collecting notes: The habitat of *A. smetanai* is unknown. The only known specimen was found on the pathway leading to the religious outlook at the top of the mountain. It had been stepped on and slightly damaged by one of the trail users (Smetana, pers. comm.). A search of the surrounding area for suitable habitat yielded no appropriate habitat although there was a dry watercourse near where the type specimen had been found which would have surface flow during heavy rain or other times of higher water flow. The summit has an impounded spring source which is used for human consumption. Other than this, Mount Emei has no running water habitats typically used by amphizoids.

It was suggested by Dr. A. Smetana that *A. smetanai* may live on Mt. Emei in a different kind of habitat. On this mountain, there are seepage areas which occur sporadically throughout the coniferous forest zone of the summit portion. Some of these seepage areas are in the form of vertical cliffs with a thin layer of water running down the face and accumulating in pools at the base. If *A. smetanai* does occur in such a habitat, which would be unusual for any species of *Amphizoa*, it would help to explain why this species has so far eluded the attention of collectors.

The initial speculation of the senior author was that this was a specimen of *A. davidi* which had

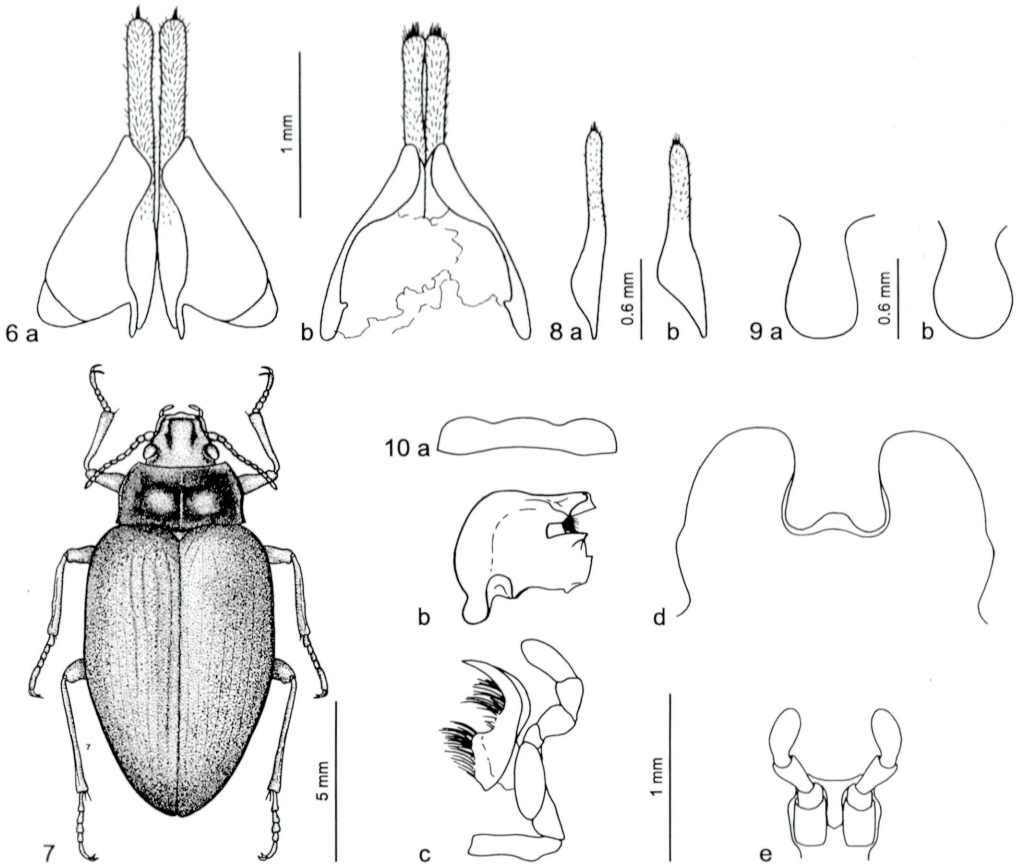


Fig. 6: Coxites and valvifers of *Amphizoa davidi*, a) ventral aspect; b) same, dorsal aspect.

Fig. 7: Habitus, adult female, *Amphizoa smetanai*. Reconstructed from partly damaged holotype.

Fig. 8: Female coxites, lateral aspect, a) *Amphizoa smetanai*; b) *A. davidi*.

Fig. 9: Outline of form of prosternal process, a) *Amphizoa smetanai*; b) *A. davidi*.

Fig. 10: Mouthparts of *Amphizoa smetanai*, a) labrum; b) mandible; c) maxilla; d) mentum; e) labium.

flown to Emei Shan. Several aspects mitigate against this interpretation. 1) This specimen is distinct structurally from *A. davidi*, and sufficiently so that it appears to warrant being described as a separate taxon. 2) Amphizoids are known to disperse by flight but records are quite rare (EDWARDS 1950, KAVANAUGH 1986). 3) Mount Emei is well known to collectors for its highly endemic fauna. It is a relatively isolated monolith surrounded by a low elevation plain and it is separated from other suitable amphizoid habitat.

Etymology: The species epithet is patronymic and is derived from the name of the collector of the holotype, Dr. Aleš Smetana. It is in honour of his skill as a collector and his mentorship of the senior author during the early years of his career. Naming this species in your honour is a small way to say thank-you, friend.

Amphizoa davidi LUCAS

Female specimens of *A. davidi* were not known previously. The following description follows the format used by KAVANAUGH (1986).

Material examined: 1 ♂, China, Sichuan, Baoxing County, 30°30'N, 102°30'E, 1850 m a.s.l., 16.VIII.1995, leg. R.E. Roughley, P. Yu & W. Xie (IZAS); 1 ♀, same locality, 1900 m a.s.l., 19.IV.1996, leg. W. Xie & H. He (JBWM); 2 ♀♀, same locality, 2600 m a.s.l., 25.IV.1996, leg. W. Xie, H. Zhai & H. He (JBWM); 1 ♀, same locality, 2700 m a.s.l., 25.IV.1996, leg. W. Xie, H. Zhai & H. He (JBWM). Various males and females to be deposited in CASC, CNIC, NMW, MHNG, and NMCE.

Description of female (adult): Size medium, SBL = 11.26 - 11.72 mm; body form narrow; head piceous, pronotum, elytra and legs dark brown to rufopiceous, with antennae tip, maxillary and labial palpi, front- and mid-coxa, trochanter, basal femur and distal part of tarsomere 5 rufopiceous; ventral surface of body piceous to dark brown; head and pronotum coarsely and densely punctate; elytron finely and densely punctate, granulate in appearance; head quadrate, with a deep furrow on inner side of eye; clypeus not separated from the frons; antenna 11-segmented, filiform, antennomeres 1 - 7 bare with coarse, sparse punctures, antennomere 8 - 11 globular with sparse, fine punctures; antennomere 1 thickened, antennomere 3 slightly longer than antennomere 2; labrum transverse (Fig. 5a), with anterior margin three lobed, the middle lobe slightly shorter than lateral lobes; mandible (Fig. 5b) short and stout, covered by the labrum at rest; anterodorsal surface of mandible slightly concave, and covered with coarse punctures laterally; apex of mandible truncate, with two teeth; lacinia and galea of maxillae (Fig. 5c) curved, with pointed apices; inner margin of lacinia with dense, strong hairs; maxillary palp 4-segmented, palpomere 1 short, nearly half the length of palpomere 2, palpomere 2 and 3 nearly equal in length, palpomere 4 longest, twice as long as palpomere 3; palpifer stout, well sclerotized, distinctly thickened in the middle; basistipes stout, slightly shorter than palpifer; cardo elongate; mentum with tooth broad, lateral lobe of mentum (Fig. 5d) moderately narrower; labial palpus (Fig. 5e) 3-segmented, palpomere 1 much shorter than others; palpiger stout; ligula present and distinct, narrowed posteriorly, with apex rounded; pronotum broadest at base, with lateral margin arcuate at middle, and without lateral bead, sinuate anterior to basal angle; median longitudinal impression present but faintly impressed; basal impression moderately deep; ventral side of body finely punctate, with distinct microsculpture; prosternal intercoxal process short, round, with flattened surface (Fig. 10b); posterolateral angle of proepisternum and posteromedial angle of proepipleuron about evenly to form smooth prothoracic margin; metasternal process (Fig. 1a) rounded at apex, and with lateral carinae on the margin of anterior process; seven abdominal segments visible; elytra evenly convex; elytral striae complete but faintly impressed; femur thick, with distinct transverse sculpture anteriorly and posteriorly; tibia with a groove along outer rear edge bearing fringe of setae; each tibia having two strong distal spines; tarsus 5-segmented, pro- and mesotarsomeres 1 - 4 nearly equal in length, with two clusters of hairs ventrally, metatarsomeres 2 - 4 nearly equal in length, tarsomere 1 slightly longer than tarsomeres 2 - 4; tarsomere 5 longest, as long as tarsomeres 2 - 4, with two rows of longitudinal tiny spines ventrally; claws slender; genital appendages (Fig. 6) composed of a pair of coxites and a pair of valvifers encircling coxites laterally; coxite short, strong, covered with tiny hairs, broad at base (Fig. 9b); distal part of coxite with a tuft of bristles; valvifer weakly sclerotized.

Collecting notes: The type locality of *A. davidi* is in Baoxing County, Sichuan Province, China. The members of this species are most often found in clear, cold, fast-flowing streams, clinging to floating debris that had collected in backwater eddies, on branches, or near stones along the margin. The distribution of *A. davidi* is in the range of 1900 to 3100 metres elevation within the Qing Yi River drainage basin. The vegetation types of this region are birch-hemlock-pine, hemlock-fir, spruce-pine, and fir-spruce mixed forest. The upper range, from about 2300 to 3100 metres elevation, represents their permanent distribution, because we found both larvae and adults there. A few adults were found in the region of 1900 metres in the broad river and slow-flowing water at lower elevations. These specimens were likely washed downstream by flooding. The larvae collected in

April were all second instars. Third instar larvae were collected in August, and first instar larvae in October. It is unclear whether or not *A. davidi* overwinters in the first instar (typical of other species of *Amphizoa*) or as second instar larvae. Therefore, work needs to be continued to determine the habitat requirements and life history of this species.

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