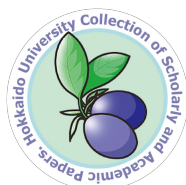




HOKKAIDO UNIVERSITY

Title	Redescription of <i>Symbiopsocus hastatus</i> Mockford (Psocodea: "Psocoptera": Psocidae), with first description of female and comments on the genus.
Author(s)	Yoshizawa, Kazunori; Mockford, Edward L.; Yoshizawa, Kazunori et al.
Citation	Insecta matsumurana. New series : journal of the Faculty of Agriculture Hokkaido University, series entomology., 68, 133-141
Issue Date	2012-10
Doc URL	https://hdl.handle.net/2115/51711
Type	departmental bulletin paper
File Information	04 Yoshizawa.pdf



**REDESCRIPTION OF SYMBIOPSOCUS HASTATUS MOCKFORD
(PSOCODEA: “PSOCOPTERA”: PSOCIDAE), WITH FIRST DESCRIPTION OF
FEMALE AND COMMENTS ON THE GENUS**

By KAZUNORI YOSHIZAWA and EDWARD L. MOCKFORD

Abstract

YOSHIZAWA, K. and MOCKFORD, E. L. 2012. Redescription of *Symbiopsocus hastatus* Mockford (Psocodea: “Psocoptera”: Psocidae), with first description of female and comments on the genus. *Ins. matsum. n. s.* 68: 133–141, 3 figs.

Symbiopsocus hastatus was described based only on two males from Kunashiri Island. Here we redescribe the species based on the specimens collected throughout the Japanese Archipelago, with first description of females. Morphological examinations showed that the species is closely related to *Mecampsis multimacularis* Li from China. The type species of *Mecampsis* is endemic to Chile and, except for 10 Chinese species described recently, distributional ranges of all the species are restricted to South America and the Greater Antilles. These distributional areas of *Mecampsis* are widely disjunct and thus assignments of the Chinese species to this genus are highly questionable. Rather, judging from the phallosomal and hypandrial apomorphies, closer relationship between the Chinese *Mecampsis* with *Symbiopsocus* is likely. Therefore, all the Chinese species of *Mecampsis* are here transferred to *Symbiopsocus*. *Symbiopsocus sturmi* (Badonnel) is transferred back to its original genus, *Psocomesites*.

Authors' address. Yoshizawa, K. (corresponding author): Systematic Entomology, Graduate School of Agriculture, Hokkaido University, Sapporo 060-8589, Japan (psocid@res.agr.hokudai.ac.jp). Mockford, E. L.: Department of Biological Science, Illinois State University, Normal, IL 61790, USA.

INTRODUCTION

The genus *Symbiopsocus* was described by Li (1997) based on a single species, *S. leptocladus* Li, from China. Later, Li (2002), Mockford (2003), Li (2005), Yoshizawa (2008) and Liu et al. (2011) added species to this genus. As a result, a total of 13 species are recognized to date from Japan, Taiwan, China and Colombia (reviewed and keyed by Liu et al., 2011). The genus was placed under the tribe Oreopsocini by Li (2002) or Ptyctini by Lienhard & Smithers (2002) and Mockford (2003). However, by subsequent morphological and molecular examinations, Oreopsocini was synonymized with Ptyctini (Yoshizawa & Johnson, 2008).

The only Japanese species, *S. hastatus* Mockford, 2003, was described based only on two male specimens from Kunashiri Island. Yoshizawa's collection in Hokkaido University (SEHU) includes numerous specimens of this species collected throughout the Japanese Archipelago. The first purpose of this paper is therefore to redescribe the species, including the intraspecific variation of the forewings and first description of females, based on this material.

During the course of our examinations, some systematic problems have also become apparent. First, *S. hastatus* is most closely related to the Chinese species of a different genus, *Mecampsis multimacularis* Li. This shows that the systematic placement of one of these species is inappropriate. Second, judging from the descriptions, *Symbiopsocus* apparently includes a few species that do not fit. Therefore, in addition to the redescription of *S. hastatus*, we provide detailed discussion on the systematics of *Symbiopsocus*.

MATERIALS AND METHODS

Specimens stored in 80% ethanol or 50% glycerol were used for examination. For methods of dissection and illustration, see Yoshizawa (2002). For abbreviations of wing venation, see Yoshizawa (2005). An Olympus SZX16 stereoscopic microscope and a Zeiss Axiphot compound light microscope were used for observations. Photographs were taken using an Olympus E-330 attached to the SZX16. All specimens are stored in Hokkaido University Insect Collection, Sapporo (SEHU) unless specified. The paratype of *S. hastatus* and some specimens noted below under "specimens examined" are in the E. L. Mockford collection (ELM), Illinois State University, Normal, IL. The collector's name was omitted for the specimens collected by Yoshizawa.

REDESCRIPTION

Symbiopsocus hastatus Mockford (Figs 1–3)

Symbiopsocus hastatus Mockford, 2003: 225; Yoshizawa & Johnson, 2008: 550, 552; Yoshizawa, Bess & Johnson, 2011: 87.
Ptyctini sp. KY180: Yoshizawa, 2004: 384, 386–389.
Ptyctini Gen. sp.: Johnson et al., 2004: 1774.

Redescription of male terminalia. Anterodorsal margin of clunium deeply concave;

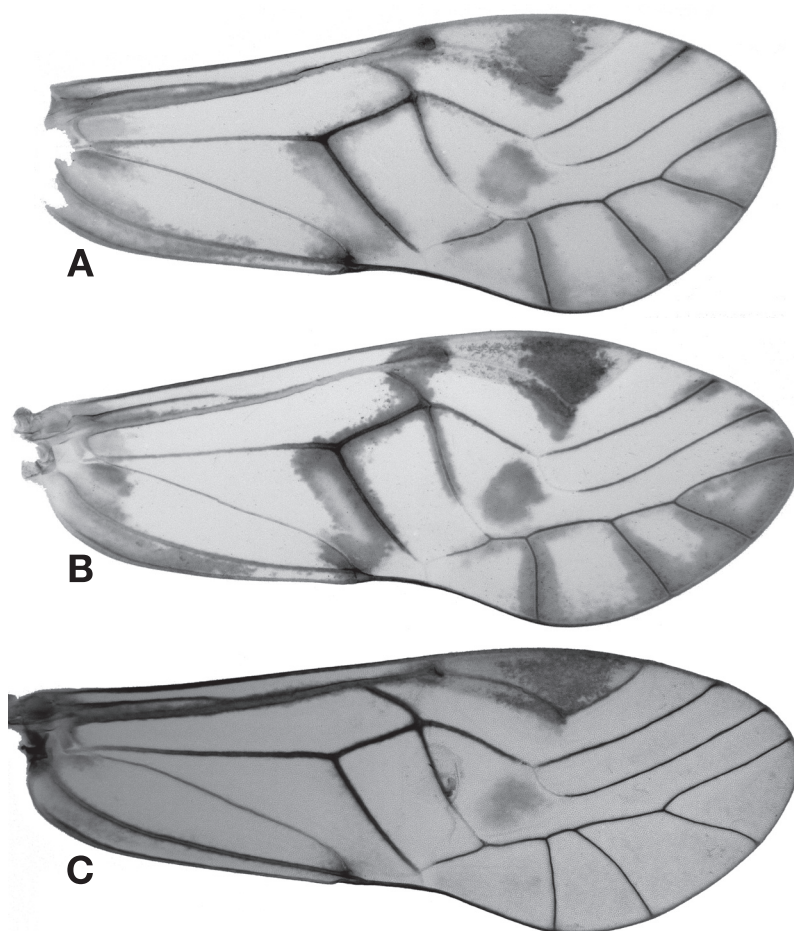


Fig. 1. Forewings of *Symbiopsocus hastatus*. Male (A) and female (B) from Moshiri, Hokkaido, and male (C) from Saga, Kyushu. Note that variations as shown in A–C can sometimes also be seen in the same sex from the same locality.

posterodorsal margin with pair of posterior expansions articulated with paraproct (Fig. 1AB). Epiproct (Fig. 1AB) slightly extended anterodorsally over clunium, anterior and lateral regions well sclerotized, median and posterior regions membranous, anteromedially with cone-shaped projection directed posteriorly. Paraproct (Fig. 1A) with distal process nearly straight and directed posteriorly. Hypandrium (Fig. 2ACD) distally with two tiers of bilateral lobes; dorsal lobes weakly sclerotized, each with strongly sclerotized strap medially, its distal end forming free projection with denticles; ventral lobes strongly sclerotized, ventral and lateral surfaces covered with denticles; median tongue-like structure extending from between ventral lobes, divided bilaterally with narrow notch posteriorly, with pair of processes extending from dorsal surface near base of tongue directed posterolaterally. Phallosome (Fig. 2E) pointed posteriorly, narrowing anteriorly; endophallus with pair of weakly sclerotized portions.

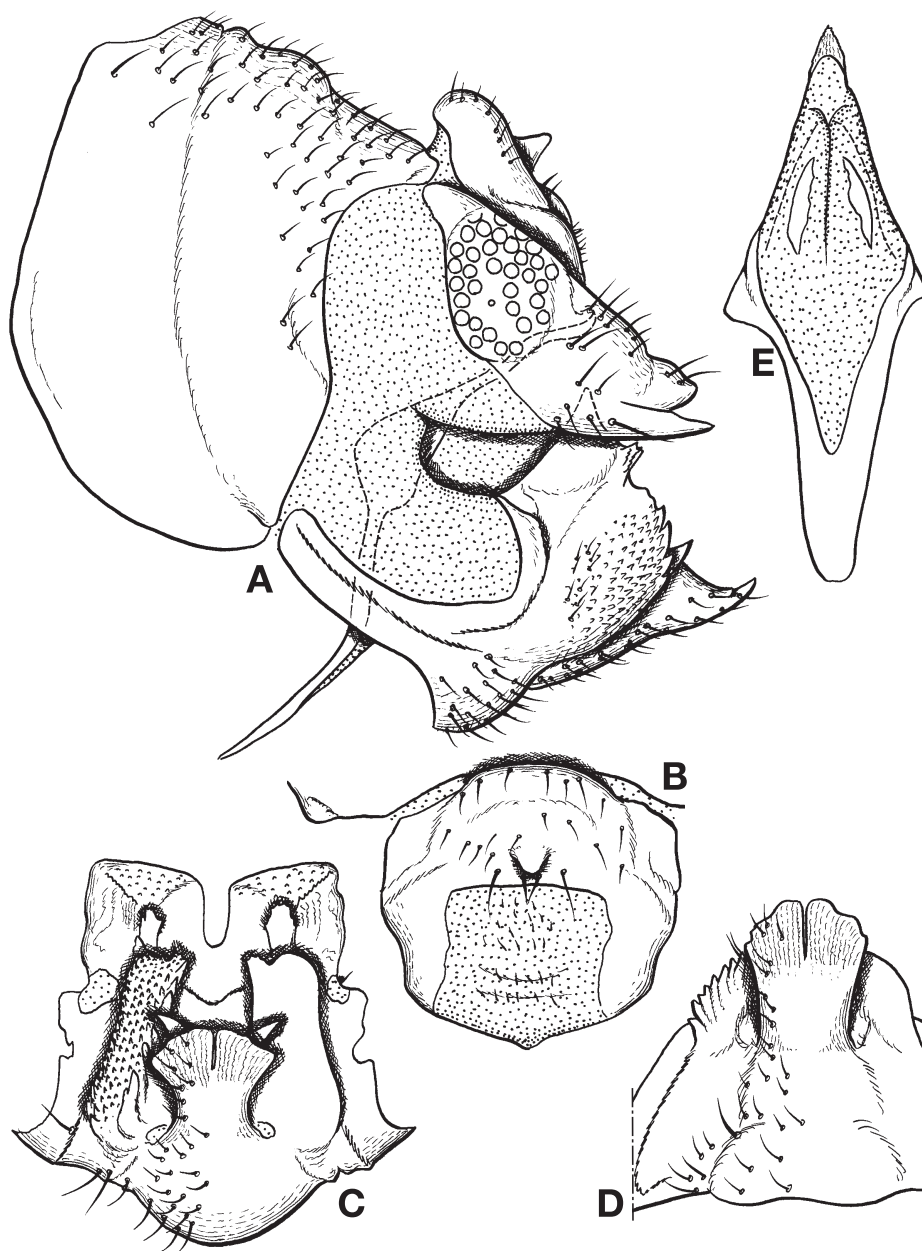


Fig. 2. Male terminalia of *Symbiopsocus hastatus*. A. Terminalia, lateral view; B. Epiproct and posterodorsal margin of clunium, dorsal view; C. Hypandrium, posterior view (denticles and setae omitted from right half); D. Hypandrium, ventral view; E. Phallosome, posteroventral view.

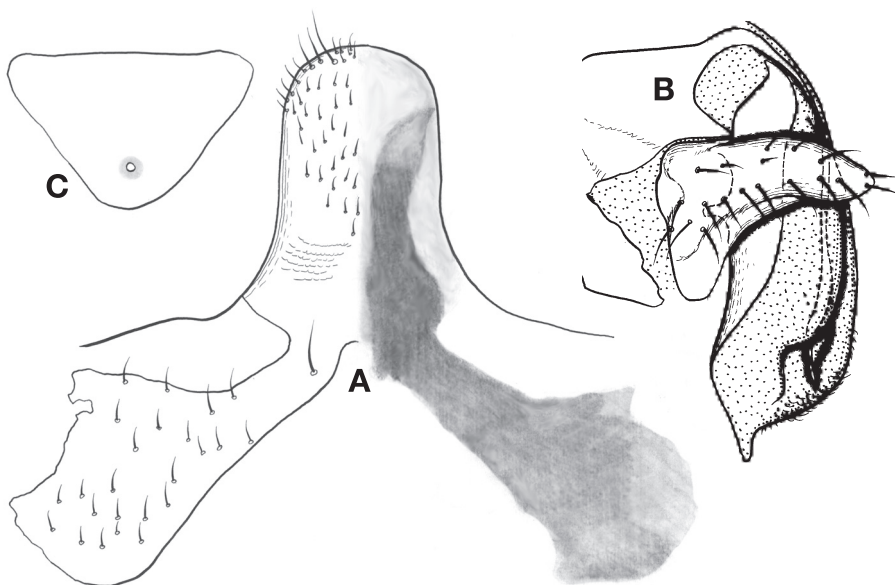


Fig. 3. Female genitalia of *Symbiopsocus hastatus*. A. Subgenital plate, showing structure (left) and coloration (right); B. Gonapophyses; C. Gonopore plate.

Description of female genitalia. Subgenital plate (Fig. 3A) with long egg guide, its posterior margin rounded. Gonapophyses (Fig. 3B): ventral valve long; dorsal valve distally broadened and setose, distal process short, ventral membranous region enveloping distal half of ventral valve; external valve narrow, with well developed posterior lobe. Gonopore plate (Fig. 3C) almost clear except area around gonopore opening brownish.

Variation of forewing characters. In most specimens, the forewings are clear, with blackish brown markings as shown in Fig. 1AB (Mockford, 2003). In some cases, the forewings are uniformly pale brown and lack distinct markings except for the pterostigma and below the Rs fork (Fig. 1C). The forewing venation is also highly variable: e.g., spur vein of pterostigma present (Fig. 1C) or obscure (Fig. 1AB); Rs and M touching at a point (Fig. 1BC) or connected by a very short crossvein (Fig. 1A; Mockford, 2003); first section of CuA1 (much) longer than (Fig. 1AB) or as long as (Fig. 1C) the second section. The wing shape is also variable (Fig. 1). These variations can sometimes be seen in both sexes at the same locality. However, no distinctive genitalic difference can be identified among the specimens here examined and thus these variations are considered to be intraspecific ones.

Specimens examined. Paratype male (ELM collection) from Kunashiri (see Mockford, 2003 for detailed data). Other material: many males and females were collected throughout the Japanese archipelago, with the following dates and localities. [Hokkaido] Experimental Forest of Hokkaido University, Moshiri, Horokanai Town, 5–6. viii. 1994 (SEHU and ELM); Mt. Asahidake, 500–1100m alt., 9–11. viii. 1994; [Honshu] Omori Park, Akita City, 4. vii. 1993, 1. vii. 1997; Hayachine, Iwate Pref., 5. vii. 1993;

Yachiho-kogen near Shirokoma-ike, Sakuho Town, Nagano Pref., 13. viii. 1992; Ashinoko, Hakone Town, Kanagawa Pref., 24. vi. 1997; Kofu Town, near Daisen Ski Slope, Shimane Pref., 12. vii. 1994; Mt. Ungetsu, Geihoku Town, Hiroshima Pref., 4–5. ix. 1992, 10–11. vii. 1994; [Shikoku] Tsuchigoya, Ehime Pref., 23. vii. 1996; Shirasa, Kochi Pref., 24. vi. 1996; Mt. Shiraga, Kochi Pref., 25. vi. 1996; [Kyushu] Kashii-gu, Fukuoka City, 10. vi. 1992; Yamaingiri, Fukuoka City, 27. vi. 1992; Mt. Sefuri, Fukuoka Pref., 17. vi. 1994 (SEHU and ELM); Kyushu Univ. Hikosan Biological Laboratory, 8. vi. 1993; Ideno–Shiibaru, Saga Pref., 21. vi. 1994, N. Takahashi leg.

Distribution. Japan (Kunashiri, Hokkaido, Honshu, Shikoku, Kyushu).

DISCUSSION

Mockford (2003) noted that the species lacks the median tongue-like structure of hypandrium. However, the present re-examination of the paratype specimen, from which the figures in the original description were made, clearly shows that the hypandrium of this species possesses the median tongue-like structure. The edges of the median tongue are obscured by surrounding structures in the paratype preparation. Although we did not examine the holotype of this species for the present study, conspecificity between the holotype and paratype was established by Mockford (2003). The median tongue is unknown for the other species of *Symbiopsocus* but is known for the Chinese species of *Mecampsis* (Li, 2002). Especially, the male genitalic structures of *S. hastatus* are very similar to those of *Mecampsis multimaculatus* Li, 2002 in many apomorphic conditions, such as presence of the cone-like process on the anteromedian region of the epiproct and arrangements of the hypandrial apophyses. These similarities apparently show their close relatedness. However, they are classified under different genera (furthermore, according to Li, 2002, they are different even at tribal level: Oreopsocini and Ptyctini) so that the generic-level classification also must be revised.

The distributional range of the genus *Mecampsis* was restricted to South America and the Greater Antilles until Li (2002) assigned 10 Chinese species to the genus (Lienhard & Smithers, 2002). As discussed in Smithers (1983), *Mecampsis* can be defined only by a set of wing venational characters (i.e., short Rs-M cross vein, presence of pterostigma spurvein, first section of CuA1 longer than second, and triangular areola postica) because of the absence of genitalic information of the genus. These venational characters are highly homoplasious (furthermore, the condition of CuA1 is even variable within *S. hastatus*: Fig. 1) and are not informative enough to assign a species to this genus confidently, especially the one from a geographically disjunct place.

In contrast, judging from the present examination and published information, monophyly of *Symbiopsocus* plus the Chinese species now assigned to *Mecampsis* can be warranted based on the following apomorphies: hypandrial distal lobes composed of two tiers; phallosome slender, with both ends pointed. The triangular areola postica may also be included in the list of their synapomorphies as supplementary, although it is highly homoplasious, observed in many different genera (e.g., *Trichadenotecnum*, *Loensia*, *Psocidus* s. str.), and does not provide strong evidence by itself. Therefore, the Chinese species of *Mecampsis* are here transferred to *Symbiopsocus* as new combinations (see Appendix).

Within *Symbiopsocus*, *S. hastatus* and the Chinese species previously assigned to *Mecampsis* share some apomorphic conditions, i.e., Rs-M touching at a point or

connected by a short cross vein in forewing (both sexes) and possession of a median tongue-like structure in the hypandrium (not applicable for the species known only from females). These are apparently apomorphic states of characters (although more or less homoplasious), suggesting that the species compose a sub-clade within *Symbiopsocus*. The species known only from females are placed here on the basis of similarity of the subgenital plate, gonapophyses, and wing venation (including the apomorphies mentioned above) with females of species known from both sexes.

Systematic placement of *Symbiopsocus sturmi* (Badonnel) from Colombia, originally described under *Psocomesites* Roesler, 1943 and transferred to *Symbiopsocus* by Li (2002), is questionable because of its significantly disjunct distribution. The genitalic structure of *S. sturmi* is more similar to “typical” *Psocomesites* described from South America in some respects: i.e., shape of the phallosome, and sclerotization and setose patterns of the subgenital plate are closely similar between *S. sturmi* and *P. continuatus* (Roesler, 1943), type species of the genus; *S. sturmi* and *P. spinosus* (New & Thornton, 1975) share an apparently apomorphic bilobed epiproct (the character not described for *P. continuatus*). Therefore, *S. sturmi* should be returned to its original genus, *Psocomesites*. The figure plates given in Li (2002) for *Symbiopsocus bicurris* are cited incorrectly and thus the species also seems to be heterogeneous. However, the original description and figure plate of this species (Li, 1990: fig. 6) clearly show that the species shares apomorphies with the other species of *Symbiopsocus*.

By these treatments, *Symbiopsocus* can be regarded as a natural group, containing 22 species, with its distributional range restricted to eastern Asia (Liu et al., 2011).

ACKNOWLEDGMENTS

We thank Charles Lienhard for peer-review of the paper, whose comments were valuable in revising the ms. We also thank N. Takahashi for giving us valuable specimens.

REFERENCES

- Badonnel, A. 1986. Psocoptères de Colombie (Insecta, Psocoptera). Spixiana 9: 179–223.
- Johnson, K. P., Yoshizawa, K. & Smith, V. S. 2004. Multiple origins of parasitism in lice. Proceedings of the Royal Society of London (B) 271: 1771–1776.
- Li, F. S. 1990. Eleven new species of psocids from Guizhou, China (Psocoptera, Psocomorpha, Psocidae). I. Guizhou Science 8: 4–11.
- Li, F. S. 1992. Psocoptera. Pp. 306–330, in Peng J.W. et al. (eds). Iconography of Forest Insects in Hunan China. Hunan Science and Technology Press, Hunan.
- Li, F. S. 1995. Psocoptera. Pp. 142–210, in Wu, H. (ed.). Insects of Baishanzu Mountain, Eastern China. Forestry Publishing House, Beijing.
- Li, F. S. 1997. Psocoptera: Psyllipsocidae, Amphientomidae, Pachytroctidae, Caeciliusidae, Stenopsocidae, Amphipsocidae, Dasydemellidae, Lachesillidae, Ectopsocidae, Peripsocidae, Pseudocaeciliidae, Philotarsidae, Elipsocidae, Hemipsocidae, and Psocidae. Pp. 385–530, in Yang X. K. (ed). Insects of the Three Gorge Reservoir area of Yangtze river. Vol 2. Chongqing Publishing House, Chongqing.
- Li, F. S. 2002. Psocoptera of China. Science Press, Beijing.
- Li, F. S. 2005. Psocoptera: Caeciliusidae, Stenopsocidae, Amphipsocidae, Dasydemellidae,

- Hemipsocidae, Pseudocaeciliidae and Psocidae. Pp. 87–110, 19 figs, in Yang Maofa & Jin Daochao (eds): *Insects from Dashahe Nature Reserve of Guizhou*. Guizhou Peoples Publishing House, Guiyang.
- Lienhard, C. 2003a. Additions and corrections (part2) to Lienhard & Smithers, 2002: “Psocoptera (Insecta) –World Catalogue and Bibliography. *Psocid News* 5: 2–37 (available online at <http://hdl.handle.net/2115/35519>).
- Lienhard, C. 2003b. Nomenclatural amendments concerning Chinese Psocoptera (Insecta), with remarks on species richness. *Revue suisse de Zoologie* 110: 695–721.
- Lienhard, C. & Smithers, C. N. 2002. Psocoptera (Insecta) –World Catalogue and Bibliography. *Instrumenta Biodiversitatis* V, Muséum d’histoire naturelle, Genève.
- Liu, L., Li, F. S. & Liu, Z. 2011. *Symbiopsocus* Li (Psocoptera: Psocidae), with a new species from China. *Zootaxa* 2780: 63–68.
- Mockford, E. L. 2003. New species and records of Psocoptera from the Kuril Islands. *Deutsche Entomologische Zeitschrift* 50: 191–229.
- New, T. R. & Thornton, I. W. B. 1975. Psocomorpha (Psocoptera) collected on recent expeditions to South America. *Journal of Entomology (B)* 44: 27–80.
- Roesler, R. 1943. Über einige Copeognathengenera. *Stettiner Entomologische Zeitung*. 104: 1–14.
- Smithers, C. N. 1983. A reappraisal of *Clematostigma* Enderlein with notes on related genera (Psocoptera: Psocidae). *Australian Entomological Magazine* 9: 71–79.
- Yoshizawa, K. 2002. Phylogeny and higher classification of suborder Psocomorpha (Insecta: Psocodea: “Psocoptera”). *Zoological Journal of the Linnean Society* 136: 371–400.
- Yoshizawa, K. 2004. Molecular phylogeny of major lineages of *Trichadenotecnum* and a review of diagnostic morphological characters (Psocoptera: Psocidae). *Systematic Entomology* 29: 383–394.
- Yoshizawa, K. 2005. Morphology of Psocomorpha (Psocodea: ‘Psocoptera’). *Insecta matsumurana*, new series 62: 1–44.
- Yoshizawa, K. 2008. Systematic positions of the species currently placed under the holding genus *Psocidus* s. l. described by Okamoto (Psocodea: ‘Psocoptera’: Psocidae). *Insecta matsumurana*, new series 64: 23–34.
- Yoshizawa, K., Bess, E. & Johnson, K. P. 2011. Kaindipsocinae is the sister taxon of the rest of Psocidae (Insecta: Psocodea: ‘Psocoptera’). *Invertebrate Systematics* 25: 81–90.
- Yoshizawa, K. & Johnson, K. P. 2008. Molecular systematics of the barklouse family Psocidae (Insecta: Psocodea: ‘Psocoptera’) and implications for morphological and behavioral evolution. *Molecular Phylogenetics and Evolution* 46: 547–559.

APPENDIX. NOMENCLATURAL ACTS PROPOSED IN THIS PAPER.

- Psocomesites sturmi* Badonnel rev. comb.
Psocomesites sturmi Badonnel, 1986: 213.
Symbiopsocus sturmi: Li, 2002: 1408.
Symbiopsocus changbaiensis (Li) n. comb.
Mecampsis changbaiensis Li, 2002: 1427.
Symbiopsocus dolichosus (Li) n. comb.
Mecampsis dolichosus Li, 2002: 1419
Mecampsis dolichosa: Lienhard, 2003a: 33.
Symbiopsocus latus (Li) n. comb.
Mecampsis latus Li, 2002: 1424.

Mecampsis lata: Lienhard, 2003a: 33.
Symbiopsocus magnificus (Li) n. comb.
Mecampsis magnificus Li, 2002: 1425.
Mecampsis magnifica: Lienhard, 2003a: 33.
Symbiopsocus multimacularis (Li) n. comb.
Mecampsis multimacularis Li, 2002: 1417.
Symbiopsocus nanyuensis (Li) n. comb.
Psocidus nanyuensis Li, 1992: 325.
Mecampsis nanyuensis: Li, 2002: 1423.
Symbiopsocus ophiocephalis (Li) n. comb.
Mecampsis ophiocephalis Li, 1995: 188; 2002: 1421 (as *M. ophiocephalus*, incorrect subsequent spelling, see Lienhard, 2003b: 714)
Symbiopsocus septangulatus (Li) n. comb.
Mecampsis septangulatus Li, 2002: 1420.
Mecampsis septangulata: Lienhard, 2003a: 33.
Symbiopsocus undulatus (Li) n. comb.
Mecampsis undulatus Li, 2002: 1422.
Symbiopsocus unitus (Li) n. comb.
Mecampsis unitus Li, 2002: 1426.
Mecampsis unita: Lienhard, 2003a: 33.