

FOUR NEW SPECIES OF GENUS *LEPIDOSTOMA* RAMBUR
(TRICHOPTERA: LEPIDOSTOMATIDAE) FROM INDIA

PAREY, S. H. & SAINI, M. S.

Department of Zoology & Environmental Science, Punjabi University, Patiala, India
E-mail: sajadzoo@gmail.com

Four new species of genus *Lepidostoma* RAMBUR belonging to the *Lepidostoma ferox* branch are described and illustrated from the Indian Himalaya. These include *L. garhwalense* sp. n. from Gairsain (Uttarakhand), *L. truncatum* sp. n. from Ahla (Himachal Pradesh), *L. ahlae* sp. n. from Ahla (Himachal Pradesh) and *L. sonmargae* sp. n. from Sonmarg (Jammu & Kashmir). With these new additions, this genus is now represented by 40 species from India.

Key words: systematics, Himachal Pradesh, Uttarakhand, Jammu, Kashmir

INTRODUCTION

The family Lepidostomatidae is widely distributed throughout the northern Hemisphere, and extends southwards to Panama, New Guinea, and the Afro-tropical Region. It was originally described by ULMER (1903) as a subfamily of Sericostomatidae. Sexual dimorphism prevails throughout the Lepidostomatidae with characteristics so bizarre that MCLACHLAN (1876) referred to this group as the ‘curiosity shop’ of Trichoptera. It is divided into 2 subfamilies: Lepidostomatinae ULMER, 1903, and Theliopsychinae WEAVER, 1993. Subfamily Lepidostomatinae is represented by 2 genera in India, *Lepidostoma* RAMBUR, 1842 (36 species), and *Paraphlegopteryx* ULMER, 1907 (14 species), whereas, subfamily Theliopsychinae contains a single genus *Zephyropsyche* WEAVER, 1993 (1 species), from this region. ROSS (1944) synonymized nearly all of the Nearctic lepidostomatid genera with *Lepidostoma*. WEAVER (1988) provided a synopsis of the North American species and, in a review of the world species, WEAVER (2002) synonymized most Lepidostomatinae genera with *Lepidostoma*, formerly separated by secondary sexual characters of the male.

This genus is represented by more than 400 species from the world and about 200 species from the Oriental region (MORSE, 2011). From India, 17 species of *Lepidostoma* have been described by MOSELY (1939, 1941, 1949a, 1949b, 1949c); 5 species by MARTYNOV (1936); 2 species each by MALICKY (1979, 2003), MCLACHLAN (1871, 1878), ULMER (1905, 1906) and WEAVER (1989, 2002) and 1 species by NAVÁS (1932). One species originally described from Thailand also has been reported from India (Assam) (NUNTAKWANG *et al.* 2007). SAINI and PAREY

(2011) described 4 new species of this genus in India. All the species of *Lepidostoma* known from India are members of either the *L. ferox* branch (33 species) or the *L. hirtum* branch (7 species).

MATERIAL AND METHODS

Specimens examined in this study were primarily collected by using a 22-watt UV (ultraviolet or “black” light), powered by a sealed rechargeable 12-volt battery. Traps were placed near the edges of some high altitude streams for 1–3 hours beginning at dusk. The caddisfly material so collected was killed and preserved in 70% ethyl alcohol with a drop of glycerin. To make detailed morphological studies, the male genitalia were removed with the help of fine-tipped forceps and were treated with the lactic acid procedure of BLAHNIK *et al.* (2007). The genitalic terminology corresponds with that of WEAVER (1988). The types and paratypes are deposited in the Museum of the Department of Zoology Environmental Sciences, Punjabi University, Patiala, India (MDZPUP).

SYSTEMATICS

Lepidostomatidae ULMER, 1903

Lepidostoma RAMBUR, 1842

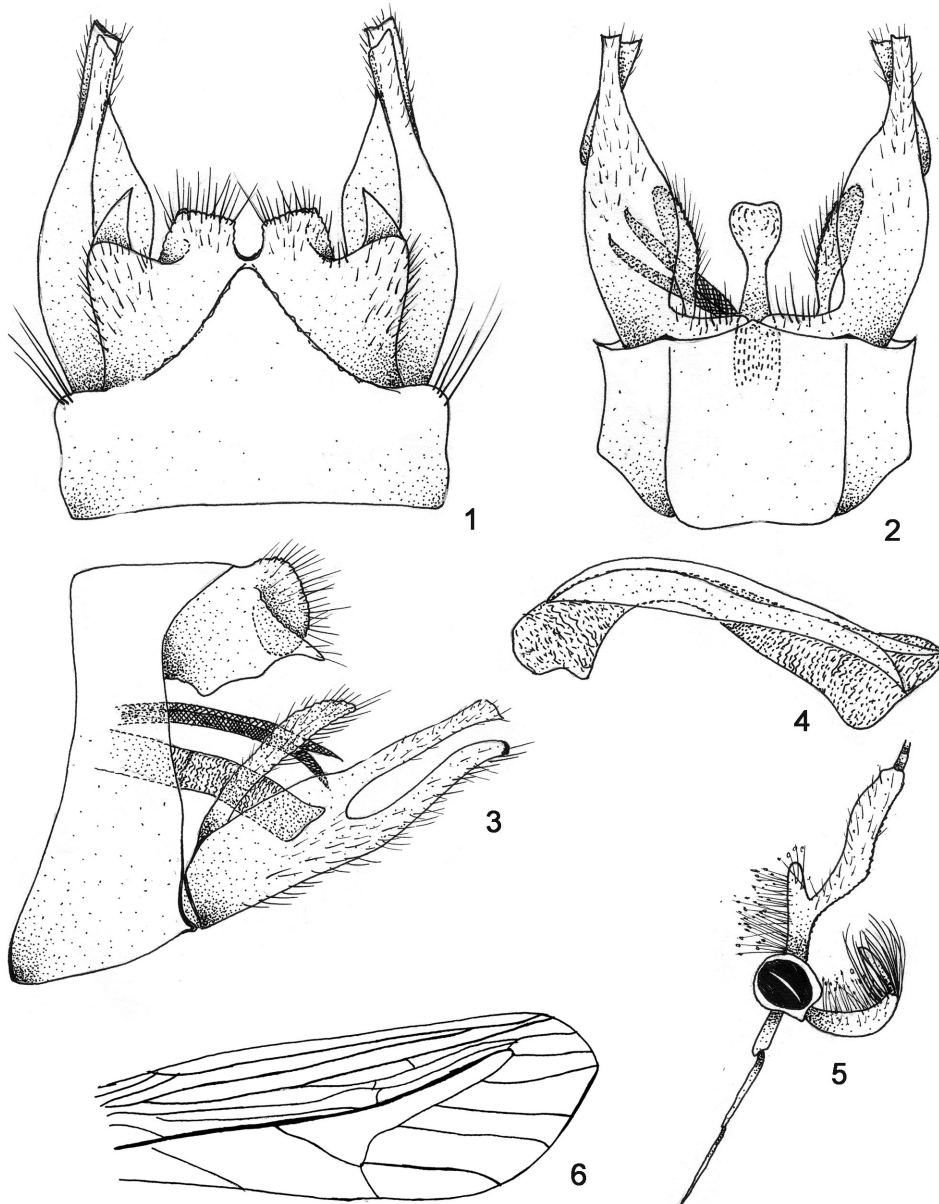
***Lepidostoma garhwalense* sp. n.**

(Figs 1–6)

Description: Colour dark brown. Scapes (Fig. 5) each 1.0 mm, short and slightly curved at middle, with single subbasal process dorsally. Maxillary palps (Fig. 5) each 0.97 mm, two-segmented, 1st segment broad, 2nd segment slender and densely covered with hair, both segments curved dorsad. Length of each forewing 6.9 mm. Wing venation as in fig. 6

Male genitalia (Figs 1–4): Segment IX apicodorsally produced into triangular process. Distal margin of segment X produced into paired dorsolateral and mesal processes: Dorsolateral processes broad at base and apically triangular, mesal processes simple and with truncate and serrate apices, separated from each other by narrow, U-shaped excision nearly reaching tergum IX; when seen laterally mesal processes each appearing as rounded structure having serrated upper edge and non-serrated lower edge. Inferior appendages each 1-segmented, apically branched, branches of subequal length, lateral branch apically rounded, inner one truncate; basodorsal process slender, cylindrical, with serrated dorsal and ventral edges, half as long as inferior appendage. Phallus with phallobase round, phallicata broader and truncate apically.

Diagnosis: The male of this species closely resembles that of *Lepidostoma tesarum* MOSELY, but differs from the latter by having segment IX more triangular apicodorsally, not rounded. Segment X dorsolateral processes are broad basally, not narrow, and they are apically triangular, not pointed; mesal processes are truncate with serrated dorsal edges, not rounded and without any serration. The phalli-



Figs 1–6. *Lepidostoma garhwalense* sp. n.: 1 = male genitalia, dorsal view; 2 = male genitalia, ventral view; 3 = male genitalia, left lateral view; 4 = phallic apparatus, left lateral view; 5 = head, scape, and palps, right lateral view; 6 = right forewing, dorsal view. BDP = basodorsal process; IF = inferior appendage; IX = segment IX; MP = maxillary palp; P = phallus; PCF = postcubital fold; PM = parameres; S = scape; X = segment X

cata is apically truncate, not rounded. The basal process of each scape is very prominent, not reduced. Both segments of the maxillary palps are curved dorsad and C-shaped, not almost upright as in *L. tesarum*. The wings of this species resemble those of *Lepidostoma destructum* ULMER.

Material: Holotype male, India: Uttrakhand, Gairsain, 2500 m, 16-vi-2009 (MDZPUP).

Female and immature stages: Unknown.

Etymology: This species is named after the Garhwal Hills in which its type locality is situated.

***Lepidostoma truncatum* sp. n.**

(Figs 7–12)

Description: Body brown, middle and hind legs dark brownish. Scapes (Fig. 10) each 2.91 mm, with two subequal subbasodorsal processes curved toward each other. Maxillary palps (Fig. 10) each 0.98 mm, two-segmented, basal segment three times longer than apical one. Length of each forewing 7.7 mm. Wing venation of this species is similar to that of *L. ferox* and is given in Fig. 12.

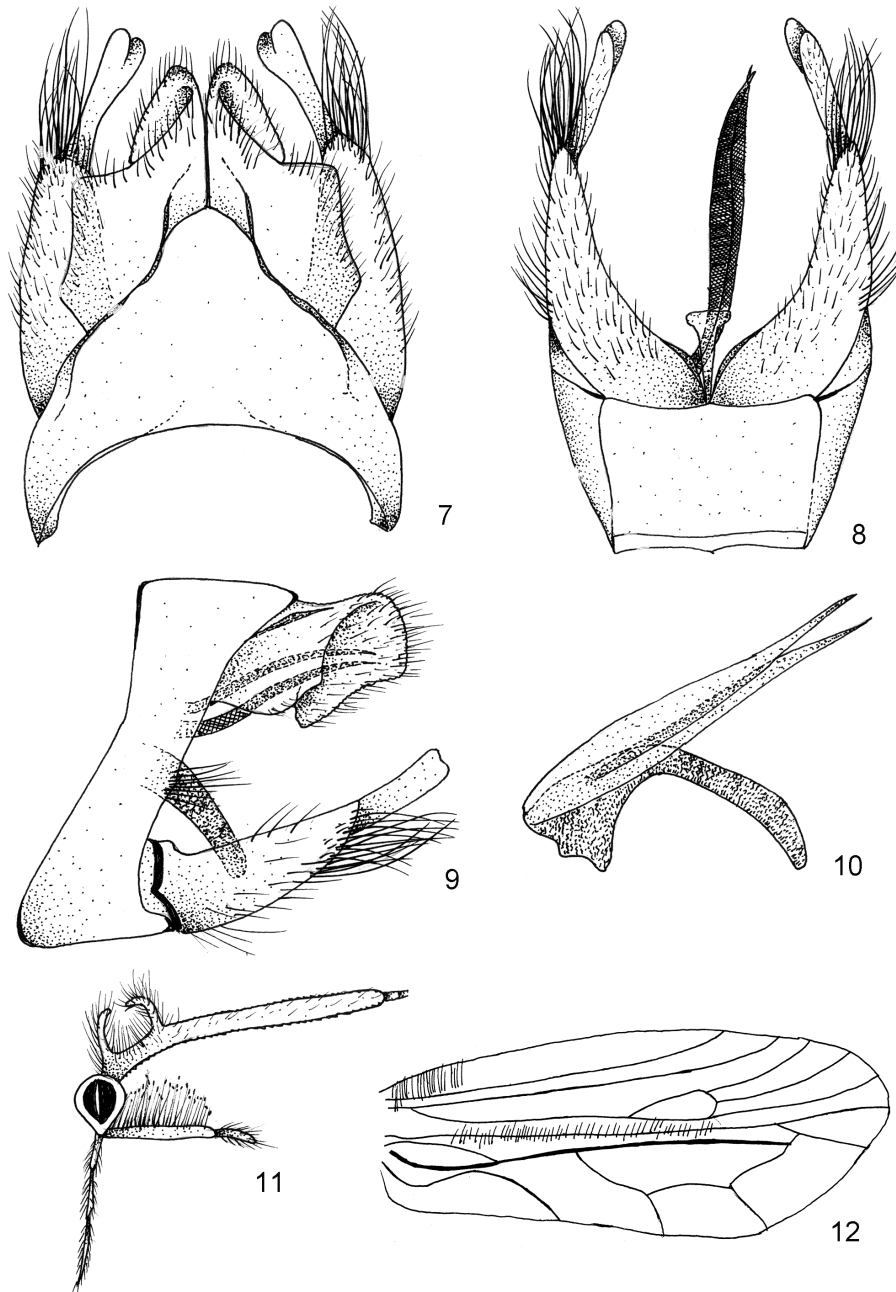
Male genitalia (Figs 7–10): Apicodorsal margin of segment IX bluntly pointed. Segment X divided by deep and narrow incision reaching to its base; each half bearing dorsolateral and mesal processes: in lateral view dorsolateral processes broad at base, mesal processes rounded and serrated apically; segment X appearing as bilobed structure. Inferior appendages each two-segmented, 1st segment triangular in outline with broadened base, 2nd segment broadened apically with slight apical excision; basodorsal processes absent. Phallobase with small dent at its centre, phallicata slender and cylindrical; parameres much longer than phallus.

Diagnosis: The male of this species closely resembles that of *Lepidostoma ferox* MCLACHLAN, but differs from the latter by having segment IX apicodorsally produced into round lobes, not semicircular lobes; ventrally tergum IX is quadrate, not rectangular. Segment X has an excision only in its apical 1/3rd, not to the middle as in *L. ferox*. The scapes each have two basal processes, not a single basal process. Maxillary palps are straight, not curved; the 1st segment is straight, not bent, the 2nd segment is cylindrical, not slender.

Material: Holotype male, India: Himachal Pradesh, Ahla, 2000 m, 11-vii-2010 (MDZPUP).

Female and immature stages: Unknown.

Etymology: The name of the species is based on truncate structure of the lateral processes of segment X.



Figs 7–12. *Lepidostoma truncatum* sp. n.: 7 = male genitalia, dorsal view; 8 = male genitalia ventral view; 9 = male genitalia, left lateral view; 10 = phallic apparatus, left lateral view; 11 = head, scape and palps, right lateral view; 12 = right forewing, dorsal view

Lepidostoma sonmargae sp. n.

(Figs 13–18)

Description: Golden brown. Scapes (Fig. 13) each 3.88 mm, with two small subbasal processes dorsally, more distal process slightly curved. Maxillary palps (Fig. 17) each 0.97 mm, two-segmented, 1st segment slightly thicker and longer than apical segment, covered with mixed hairs and scales. Length of each forewing 7.9 mm. Wing venation as in Figure 18.

Male genitalia (Figs 13–16): Tergum IX apicodorsally produced into triangular projection. Segment X with narrow excision at its centre reaching to its base. Both dorsolateral and mesal processes well developed: dorsolateral processes triangular in dorsal view, mesal processes rounded and serrate in lateral view both pairs of processes appearing subquadrate. Inferior appendages each two-segmented, 1st segment apically rounded, 2nd segment apically excised in dorsal view; basodorsal processes absent. Phallus shorter than parameres, phallobase with anteroventral flange; paramere spines apically pointed and diverging from one another. Wing venation of this species is similar to that of *L. nagana* and is given in Figure 18.

Diagnosis: The male of this species appears close to that of *Lepidostoma nagana* MOSELY, but differs from the latter by having segment IX triangular apicodorsally, not truncate. Segment X of this species has its dorsolateral processes triangular, not rounded; when seen laterally, both dorsolateral and mesal processes are of the same length, not of unequal length. The scape of each antenna is relatively shorter than in *L. nagana*, the basal process of the scape is straight, not angled. The basal segment of each maxillary palp is relatively shorter than in *L. nagana*.

Material: India: Holotype: male, (MDZ), Jammu & Kashmir, Sonmarg, 2900 m, 11-viii-2008.

Female and immature stages: Unknown.

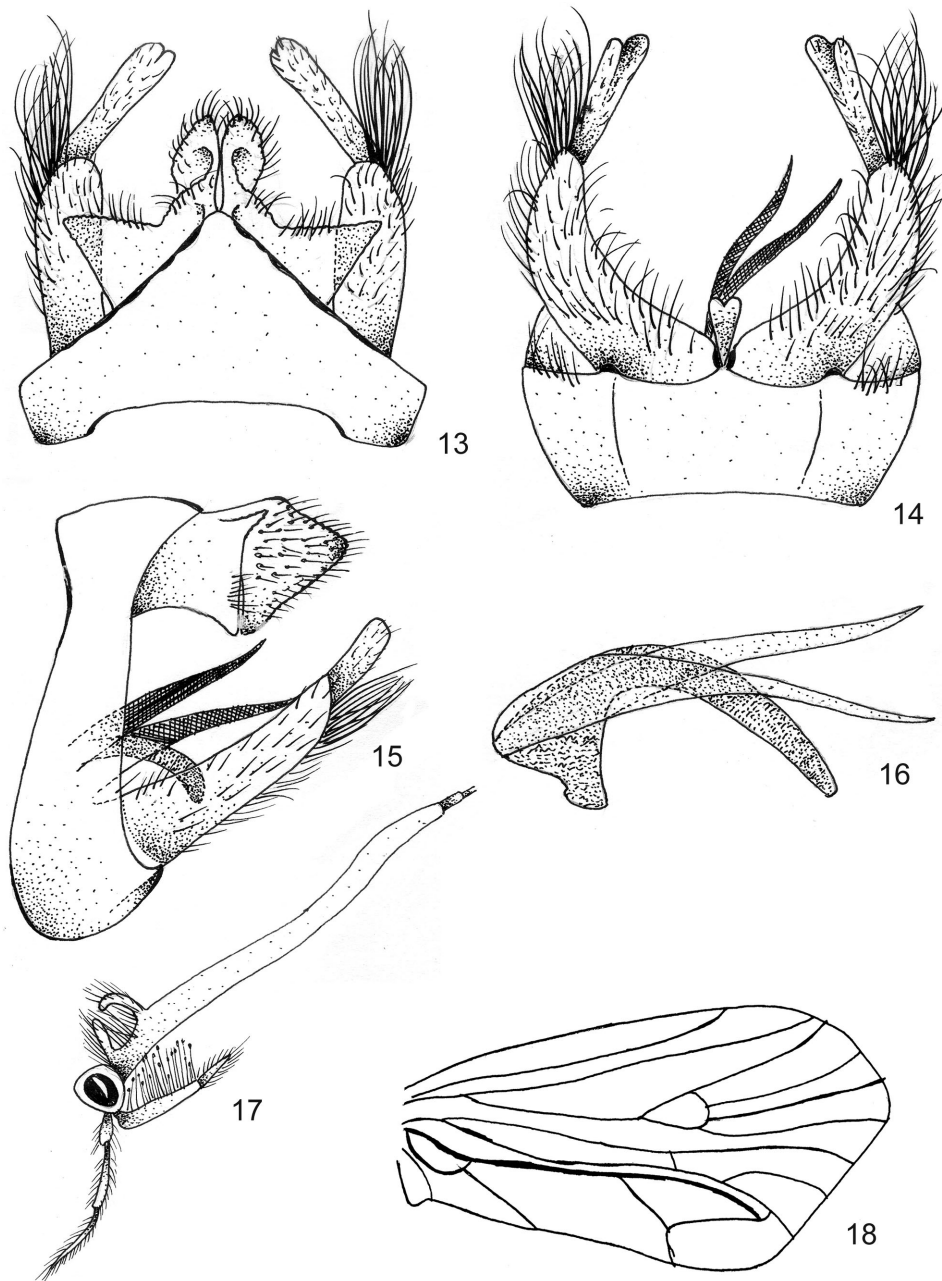
Etymology: The name of the species is based on the locality from where the type specimen was collected.

Lepidostoma ahlae sp. n.

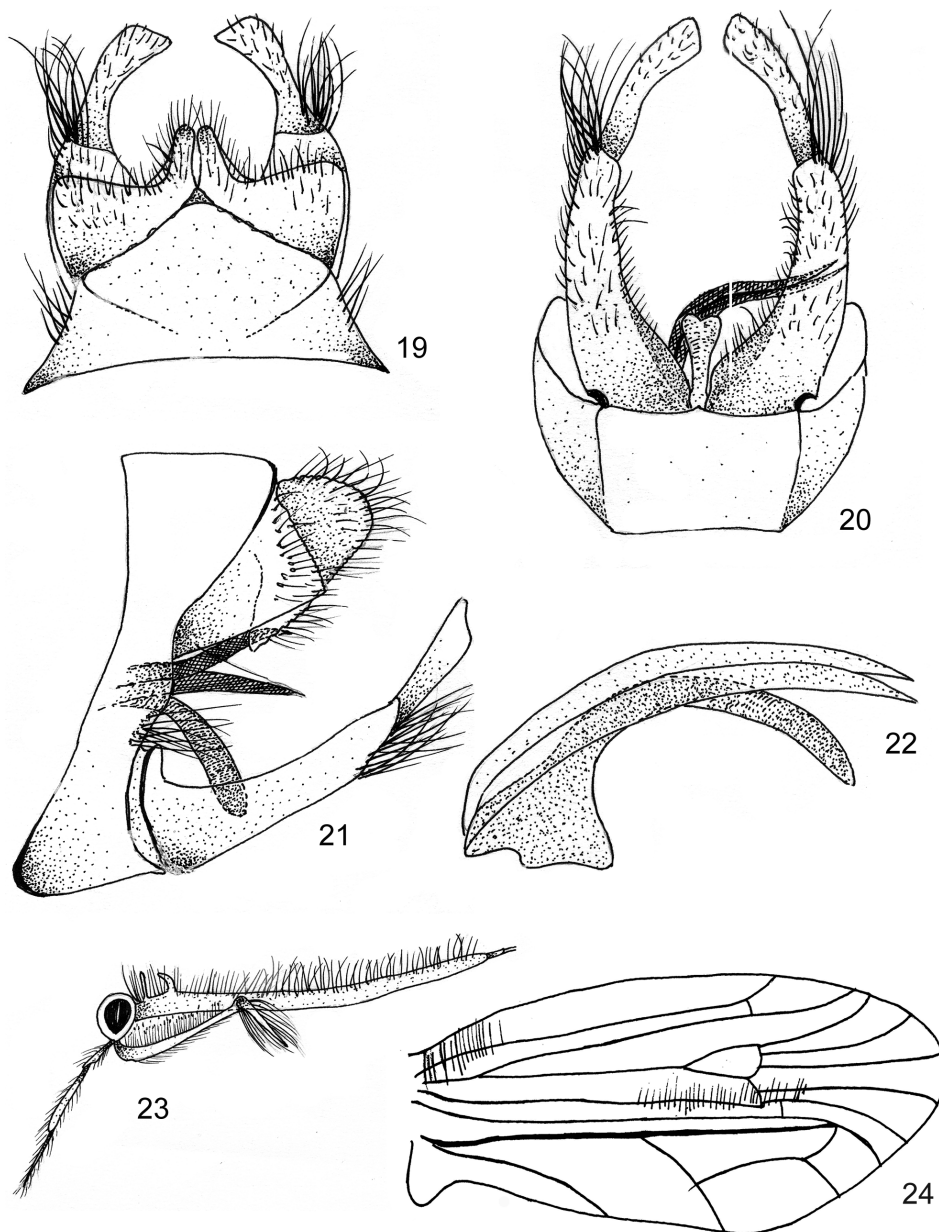
(Figs 19–24)

Description: Colour dark brown. Scapes (Fig. 19) each 4.85 mm in length, with two small subbasal processes dorsally. Maxillary palps (Fig. 23) each 1.94 mm, two-segmented, basal segment much longer, apical one with pointed apex, both segments covered with dense setae. Average length of each forewing 7.7 mm. Wing venation as in Figure 24.

Male genitalia (Figs 19–22): Segment IX apicodorsally produced into somewhat rounded tip. Segment X with dorsolateral plates broad at base, apically rounded; mesal processes narrow, situated closely to one another with small space between them; in lateral view dorsolateral plates triangular, apically rounded, with slightly serrate ventral margins, mesal processes somewhat dome-shaped, with very broad bases. Inferior appendages each two-segmented, 1st segment broad at base and narrower towards its apex, 2nd segment short with truncate apex; basodorsal processes absent. Phallus with phallobase and phallicata slender, cylindrical in lateral view. Parameres about as long as phallus



Figs 13–18. *Lepidostoma sonmargae* sp. n.: 13 = male genitalia, dorsal view; 14 = male genitalia ventral view; 15 = male genitalia, left lateral view; 16 = phallic apparatus, left lateral view; 17 = head, scape and palps, right lateral view; 18 = right forewing, dorsal view



Figs 19–24. *Lepidostoma ahlae* sp. n.: 19 = male genitalia, dorsal view; 20 = male genitalia, ventral view; 21 = male left lateral view; 22 = phallic apparatus, left lateral view; 23 = head, scape and palps, right lateral view; 24 = right forewing, dorsal view

and with two paramere spines closely adjacent to one another. Wing venation of this species (Fig. 24) similar to that of *L. inerme*.

Diagnosis: The male of this species resembles that of *Lepidostoma inerme* MCLACHLAN but differs from it by having the dorsolateral processes of segment X in dorsal view rounded, not finger-like, and the mesal processes apically finger-like, not truncate; when seen laterally, each mesal process appears dome-shaped, not pointed, and each lateral process is rounded, not lobed. Scapes of this species each have two small subbasal processes but those of *L. inerme* are without any processes. Maxillary palps of this species have the 2nd segment apically tapering, not apically rounded.

Material: Holotype male, India: Himachal Pradesh, Ahla, 2000 m, 11-vii-2010, S. H. Parey (MDZPUP).

Paratypes, India: Jammu and Kashmir, Pahalgam, 3100 m, 28-viii-2008; Yusmarg, 2800 m, 01-viii-2009, 2 males (MDZPUP).

Female and immature stages: Unknown.

Etymology: The species name is after its type locality Ahla (Himachal Pradesh).

*

Acknowledgements – The authors are thankful to Dr. J. C. MORSE (Clemson University, USA) and the second anonymous reviewer for critically reviewing this manuscript. Thanks are due to University Grants Commission (UGC), New Delhi, for providing financial assistance in accomplishing this work. Laboratory facilities provided by Punjabi University, Patiala, are thankfully recorded. Help rendered by laboratory colleagues VIKRAM SINGH RATHOR, MUZAMIL AHMAD, LAKHVINDER KAUR & MANPREET SINGH is gratefully acknowledged.

REFERENCES

- BLAHNIK, J., HOLZENTHAL, R. W. & PRATHER, L. (2007) The lactic acid method for clearing Trichoptera genitalia. Pp. 9–14. *In*: BUENO-SORIA J., BARBA-ALVAREZ R., ARMITAGE B. J. (eds): *Proceedings of the 12th International Symposium on Trichoptera*. The Caddis Press, Columbus, Ohio.
- MALICKY, H. (1979) Neue Köcherfliegen (Trichoptera) von den Andamanen-Inseln. *Zeitschrift der Arbeitsgemeinschaft Österreichischer Entomologen* **30**: 97–109.
- MALICKY, H. (2003) Köcherfliegenfänge vom Gotthardpassgebiet (2090–2120 m), Kanton Tessin (Trichoptera). *Entomologische Berichte Luzern* **49**: 21–22.
- MARTYNOV, A. V. (1936) On a collection of Trichoptera from the Indian Museum, part II: Integripalpia. *Records of Indian Museum* **38**(3): 239–306.
- MCLACHLAN, R. (1871) On new forms, etc., of extra-European trichopterous insects. *Journal of the Linnean Society of London, Zoology* **11**: 98–141, plates 2–4.
- MCLACHLAN, R. (1876) A monographic revision and synopsis of the Trichoptera of the European fauna. John van Voorst, London. **5**: 221–280

- MCLACHLAN, R. (1878) Neuroptera. *Scientific Results of the Second Yarkland Mission, Based upon the Collections and Notes of the Late F. Stoliczka*. Government of India, Calcutta, 6 pp.
- MORSE, J. C. (2011) Trichoptera World Checklist. Available from <http://entweb.clemson.edu/database/trichopt/index.htm> (accessed 21 September, 2011)
- MOSELY, M. E. (1939) The Indian caddis-flies (Trichoptera) VII: Sericostomatidae (Cont.). *Journal of the Bombay Natural History Society* **41**: 332–339.
- MOSELY, M. E. (1941) The Indian caddis flies (Trichoptera) VIII. Sericostomatidae (Cont.). *Journal of the Bombay Natural History Society* **42**: 772–781.
- MOSELY, M. E. (1949a) The Indian caddis flies (Trichoptera), part IX. *Journal of the Bombay Natural History Society* **48**: 236–245.
- MOSELY, M. E. (1949b) The Indian caddis flies (Trichoptera), part X. *Journal of the Bombay Natural History Society* **48**: 412–422.
- MOSELY, M. E. (1949c) The Indian caddis flies (Trichoptera), part XI. *Journal of the Bombay Natural History Society* **48**: 782–791.
- NAVÁS, L. (1932) Insectos de la India. *Revista de la Academia de Ciencias* **15**: 11–41.
- NUNTAKWANG, A., CHANTARAMONGKOL, P., COURTNEY, GW. (2007) Biodiversity and biogeographic connections of Trichoptera from mountain streams of northern Thailand. Pp. 257–262. In: BUENO-SORIA, J., BARBA-ÁLVAREZ, R., ARMITAGE, B. J. (eds): *Proceedings of the 12th International Symposium on Trichoptera*. The Caddis Press, Columbus, Ohio.
- RAMBUR, J. P. (1842) Histoire naturelle des insectes Névroptères. *Librairie Encyclopédique de Roret's suite à Buffon*, Paris, xviii + 534 pp.
- ROSS, H. H. (1944) The caddisflies, or Trichoptera, of Illinois. *Bulletin of the Illinois Natural History Survey* **23**(1): 1–326.
- SAINI, M. S & PAREY, S. H. (2011) Four new species of genus *Lepidostoma* Rambur (Trichoptera: Lepidostomatidae) from the Indian Himalayas, with a checklist to its Indian species. *Zootaxa* **3062**: 25–36.
- ULMER, G. (1903) Über des Metamorphose der Trichopteren. *Abhandlungen des Naturwissenschaftlichen Vereins in Hamburg* **18**: 1–154.
- ULMER, G. (1905) Über die geographische Verbreitung der Trichopteren. *Zeitschrift für Wissenschaftliche Insektenbiologie* **1**: 16–32, 68–80, 119–126.
- ULMER, G. (1906) Neuer Beitrag zur kenntnis aussereuropäischer Trichopteren. *Notes from the Leyden Museum* **28**: 1–116.
- ULMER, G. (1907) Neue Trichopteren. *Notes from the Leyden Museum* **29**: 1–53.
- WEAVER, J. S. III. (1988) A synopsis of the North American Lepidostomatidae (Trichoptera). *Contributions of the American Entomological Institute* **24**: 1–141.
- WEAVER, J. S. III. (1989) Indonesian Lepidostomatidae (Trichoptera) collected by Dr. E. W. Diehl. *Aquatic Insects* **11**: 47–63.
- WEAVER, J. S. III. (1993) Theliopsychninae, a new subfamily, and Zephyropsyche, a new genus of Lepidostomatidae (Trichoptera). Pp. 133–138. In: OTTO, C. (ed.): *Proceedings of the 7th International Symposium on Trichoptera*, Umeå, Sweden, 3–8 August 1992, Backhuys Publishers, Leiden.
- WEAVER, J. S. III. (2002) A synonymy of the caddisfly genus *Lepidostoma* Rambur (Trichoptera: Lepidostomatidae), including a species checklist. *Tijdschrift voor Entomologie* **14**: 173–192.
- YANG, L. & WEAVER, J. S. III. (2002) The Chinese Lepidostomatidae (Trichoptera). *Tijdschrift voor Entomologie* **415**: 267–352.

Revised version received October 25, 2011, accepted December 17, 2011, published May 10, 2012