

**Three new species of the genus *Chimarra* STEPHENS, 1829
(Trichoptera: Philopotamidae) from the Indian Himalayas**

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ABSTRACT. Three new species are described in the genus *Chimarra* STEPHENS. They are *Chimarra icar*, *C. pupi* (both from Sikkim) and *C. maneriensis* from Uttarakhand. These species are distinguishable from each other and from previously known species by the structure of the male genitalia.

KEY WORDS: Trichoptera, Philopotamidae, *Chimarra*, Oriental, Himalayan region, Sikkim, Uttarakhand.

INTRODUCTION

Chimarra STEPHENS, 1829 is the second largest caddisfly genus in terms of species diversity, outshined only by *Rhyacophila* PICTET, 1834 (Rhyacophilidae), and is known from all biogeographical regions except Antarctica. The Genus *Chimarra* is divided into four subgenera: *Chimarra*, *Chimarrita* BLAHLNIK, *Curgia* WALKER and *Otarra* BLAHLNIK (BLAHLNIK 1998). The last three of these subgenera are confined to the Neotropical Region, whereas the subgenus *Chimarra* occurs in all biogeographical regions except Antarctica; it is the only genus of Chimarrinae RAMBUR, 1842 in India. Though a cosmopolitan genus, it is especially abundant in tropical regions. Currently *Chimarra* is represented by 735 species at world level, some 592 of which belong to the subgenus *Chimarra* (*Chimarra*). Of the 592 described species about half (308 species) are found in the Oriental Region alone.

Neotropical species and the phylogeny of this genus were discussed by BLAHLNIK (1998). BLAHLNIK et al. (2009) described 30 new species of *Chimarra* from Borneo. WICHARD (2007) described a new fossil species of this genus in Dominican amber.

Immature stages of this genus were described by HOANG & BAE (2008) from Vietnam. CARTWRIGHT (2002) described Australian species of *Chimarra*. As far as the Oriental Region is concerned, MALICKY (1979, 1989, 1993, 1994, 1995, 1997, 1998, 2000, 2006, 2007, 2008, 2009, 2010, 2011) is the main contributor, with approximately 130 species to his credit from Nepal, China, Thailand, Indonesia (Bali, Java, Kalimantan, Sulawesi, Sumatra), Vietnam, Bhutan, Myanmar, Malaysia, Philippines, Borneo and India. Some of his joint works on this genus in which many new and first records are made include those of SUN & MALICKY (2002), MALICKY & CHANTARAMONGKOL (1989, 1993a, 1993b, 2003) and MALICKY & PROMMI (2004). Many other workers like SCHMID (1958, 1960), KIMMINS (1957, 1964), MEY (1990, 1995, 1998a, 1998b, 2003, 2006), HWANG (1957), OLAH (1993), HSU & CHEN (1996) have also contributed to the systematics of this genus from the Oriental Region.

So far 23 species of this genus have been recorded from India, 16 from the Himalayan region alone. The authors reporting these 19 species include KIMMINS (1957, 5 species), MARTYNOV (1935, 4 species), GHOSH & CHAUDHURY, (1999, 2 species) and SAINI et al. (2010, 2011a,b, 8 species). The adult males of this genus are remarkable for their extreme variation in genital morphology, particularly in the structure of the inferior appendages, tergite X and phallic apparatus.

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MATERIALS AND METHODS

Adult caddisflies belonging to this genus were collected during 1-4 hours after dusk in 2009 (April-October) with light traps, either 135W, ultra-violet, mercury-vapour bulbs (with alternating current) or 22W Circline fluorescent BL tubes (Bioquip, with 12V rechargeable batteries). The insects were collected near the banks of the small streams,

tributaries and main rivers originating from glaciers of the Indian belt of the Himalayas, with water depths varying from shallow to deep and flow rates from slow to swift. Genitalia were cleared in 10% KOH solution overnight, then observed and preserved with the remainder of the specimen in 80% ethyl alcohol and a drop of glycerol. Additional specimens were cleared using the lactic acid method as proposed by BLAHNIK & HOLZENTHAL (2004) and BLAHNIK et al. (2007). The terminology for the genitalia and wings corresponds to that of BLAHNIK (1998, 2009) for *Chimarra*. Types of the new taxa are currently stored at the Museum of the Department of Zoology and Environmental Sciences, Punjabi University, Patiala (PUPM), and will eventually be moved to the Indian Agricultural Research Institute (National Pusa Collection Museum), New Delhi.

SYSTEMATICS

Genus: *Chimarra* STEPHENS, 1829

Type species: *Phryganea marginata* LINNAEUS, 1767 (monobasic)

Diagnosis

The most important diagnostic characteristics of the genus *Chimarra* STEPHENS include: foretibial spur formula 1, 4, 4; occipital portion of head well developed and extended in a wide curve behind eyes; ocelli present; maxillary palp 5-segmented with 2nd segment twice as long as 1st and 4th segment almost half as long as annulated and flexible 5th segment; forewing with apical forks I-III and V, lacking fork IV (fork of M3+4); costal and anal margins nearly parallel and vein R₅ strongly sinuous before discoidal cell. Hind wing only slightly wider than fore wing; with vein R₁ narrowly parallel to subcosta, sometimes apparently fused; forks I-III and V present; anal vein A₂ narrowly looped to join A₁ (BLAHNIK 1998, 2009). Inferior appendages in male genitalia, 1-segmented (2-segmented in males of other species of Philopotamidae).

Chimarra icar sp. n.

(Figs 1-5)

Type material

Holotype. Male, India, Sikkim, Rongli, 27^o13'0"N; 88^o42'0"E, 900 m, 1 V 2009, Pandher and Parey (PUPM). **Paratypes:** data as for holotype, 9 males, 3 females (PUPM).

Diagnosis

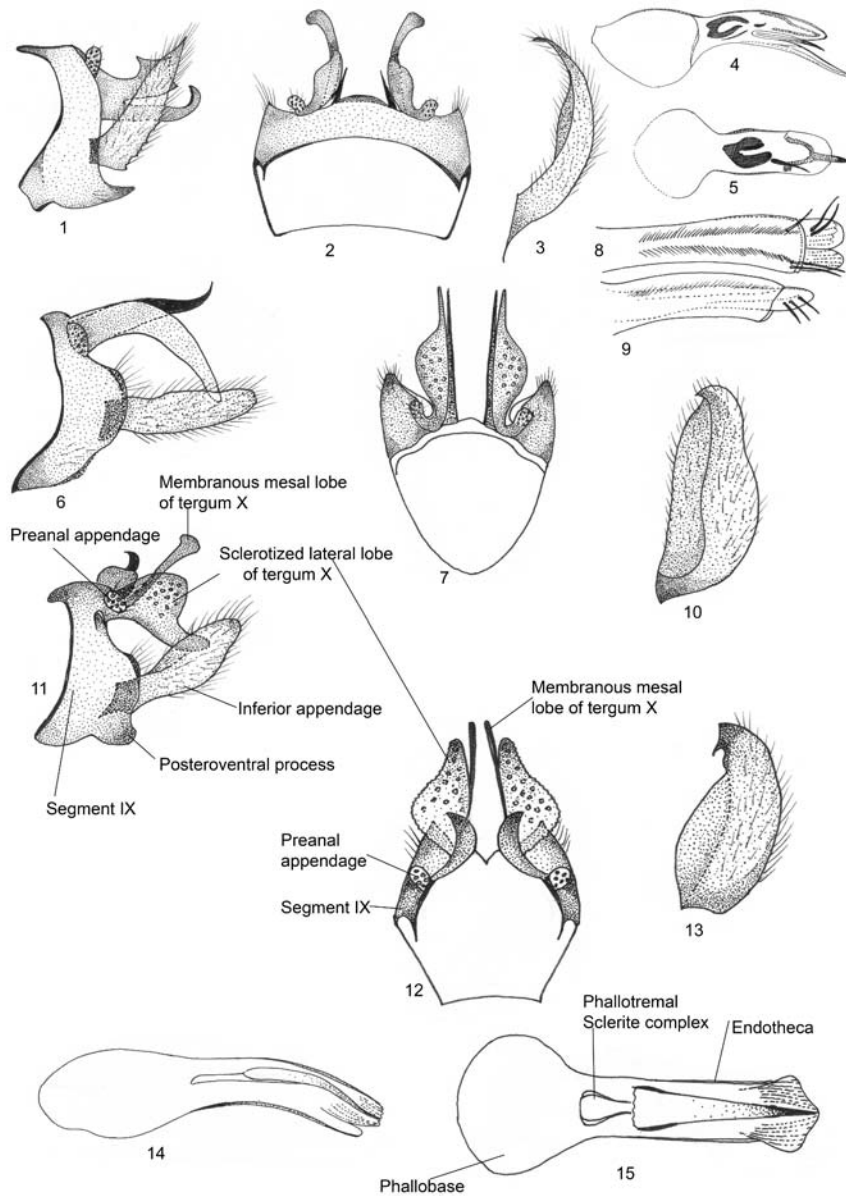
In possession of a well-developed post ventral process, *Chimarra icar* sp. n. is allied to *C. gether* MALICKY, 2009, *C. tawitawi* MALICKY, 1994, *C. demeter* MALICKY, 2000 and many other similar species of this genus. It is more closely related to *C. gether* MALICKY,

2009, *C. monorum* CHANTARAMONGKOL & MALICKY, 1989, *C. tawitawi* MALICKY, 1994, *C. demeter* MALICKY, 2000, *C. skaidan* MALICKY, 1989 and *C. argax* MALICKY, 1989 in the shape of segment IX and the dorsolaterally directed inferior appendages. But in its general structure *C. icar* sp.n. is closer to *C. gether* MALICKY, reported from Vietnam. However, *C. icar* is a distinct species as the lateral lobes of tergum X are produced apically, roundly outward in the dorsal view, the mesal lobes of tergum X are pointed apically and very small, about less than half the length of the lateral lobes, the lateral lobes of tergum X are produced ventrally, long and curved dorsally, whereas in *C. gether* MALICKY the lateral lobes of tergum X are outwardly pointed apically in the dorsal view, the mesal lobes of tergum X are blunt apically, about half the length of lateral lobes of tergum X, and the lateral lobes, though produced ventrally, are smaller and curved. Similarly, there are clear differences in the structure of the phallus and phallic spines of these two species. In *C. icar* the phallotremal sclerite complex is horseshoe-shaped, and the endotheca has a single long apical spine and one small median spine, but in *C. gether* MALICKY no phallotremal sclerite complex is visible, only a single long apical spine.

Description

Adult male. Colour in alcohol, black-brown except head blackish and femora yellowish grey, antenna yellowish, wings paler and maxillary and labial palpi pale yellowish. Body covered with inconspicuous and fuscous pubescence. Antenna shorter than forewing. Maxillary palps elongate, 1.5 mm long, segment 3 subequal to 2 and 5; labial palpi short, 1 mm long. Average length of forewing 5 mm; forewing venation; Rs curved; discoidal cell elongate, length almost 3 or more times than width; crossvein m usually proximal to s and r-m crossveins; 2A obsolete apically and looped to 1A.

Male genitalia (Figs 1-5). Tergum IX very short; anterodorsally produced; anteroventral margin somewhat produced, angular; posterolateral margin nearly straight; postventral process prominent with broad base and pointed apically. Preanal appendage short, setose, rounded and wart-like. Inferior appendage directed postero-dorsally, broad basally, narrow acutely towards pointed apex in lateral view with serrated inferior margin; in ventral view mesally curved, basomesal margin uniform, curved and pointed apically. Tergum X with sclerotized lateral lobes and separate mesal lobes; each lateral lobe long, wide, quadrate, ventrally much produced in lateral view; with pointed upper apex which is curved outwardly and ventral lobe much produced, divergent and apically curved outwards in dorsal view; mesal lobe digitate, shorter than lateral lobe. Phallobase globular, sclerotized. Endotheca tubular, with granular texture, not discernible, 2 endothecal spines visible in lateral view; one long spine, probably an apical one, and one small median spine, endotheca much produced ventrally; phallotremal sclerite complex visible in lateral as well as ventral view, horseshoe-shaped in ventral view.



Figs 1-15. Male genitalia. 1-5. *Chimarra icar* sp. n.: 1 – left lateral view, 2 – dorsal view, 3 – ventral view of inferior appendage, 4 – lateral view of phallus, 5 – ventral view of phallus. 6-10. *C. pupi* sp. n.: 6 – left lateral view, 7 – dorsal view, 8 – ventral view of phallus, 9 – lateral view of phallus, 10 – ventral view of inferior appendage. 11-15. *C. maneriensis* sp. n.: 11 – left lateral view, 12 – dorsal view, 13 – ventral view of inferior appendage, 14 – lateral view of phallus, 15 – ventral view of phallus.

Etymology

The species name is the acronym of the funding agency Indian Council of Agricultural Research (ICAR).

***Chimarra pupi* sp. n.**

(Figs 6-10)

Type material

Holotype. Male, India, Sikkim, Sangkalang, 27°31'0"N; 88°34'0"E, 1500 m, 13 V 2009 – Pandher and Parey (PUPM). **Paratype:** collection data as for holotype, 1 male, (PUPM).

Diagnosis

Chimarra pupi sp. n. is allied to *C. fenestrata* KIMMINS, 1964, *C. nepalensis* KIMMINS, 1964, *C. podarge* MALICKY & CHANTARAMONGKOL, 1993 in the overall structure of the male genitalia and especially in the shape of the lateral lobes of tergum X, which are curved and very long ventrally in the lateral view. It appears to be closer to *C. fenestrata* KIMMINS and at first glance seems to be its variant. But in *C. pupi* segment IX is comparatively narrow, without any well-developed postventral process, the mesal lobes of tergum X are very long, subequal to the lateral lobes of tergum X in both lateral and dorsal views, whereas in *C. fenestrata* KIMMINS segment IX is broad, with a well-developed postventral process, the mesal lobes of tergum X are small, about half as long as the lateral lobes of tergum X.

Description

Adult male. Colour in alcohol golden yellow, head somewhat darker. Body covered with short pale pubescence. Maxillary palp short, 1 mm long, segment 3 distinctly longer than 2; labial palp very short, 0.5 mm. Average length of forewing 5 mm, forewing venation: stem of Rs curved, enlarged at inflection; fork at base of discoidal cell distinctly thickened, length of discoidal cell about 2 times width; vein 2A intersecting 3A.

Male genitalia (Figs 6-10). Tergum IX short dorsolaterally; almost obsolete dorsomesally; in lateral view anteroventral margin produced; posterolaterally produced medially; posteroventral process absent. Preanal appendage setose, short, club-shaped in dorsal view. Inferior appendage longer than tergum X with incurved spinose outer and inner margins, in lateral view straight, nearly uniformly wide, rounded apically; in ventral view broad uniformly and pointed apically. Tergum X with sclerotized lateral lobes and separate mesal lobes; each lateral lobe long, in lateral view curved ventrad mesally, bears multiple sensilla, in dorsal view pointed apically; each mesal lobe elongate, digitate, dorsoapically curved in lateral view. Phallobase tubular. Endotheca tubular, length not discernible, apically bearing endothecal spines; 2 apical spines and 3 preapical spines in ventral view and two rows of small comb-like spines.

Etymology

The species name is the acronym of the host institute – Punjabi University, Patiala, India (pupi).

***Chimarra maneriensis* sp. n.**

(Figs 11-15)

Type material

Holotype. Male, India, Uttarakhand, Maneri, 30.75°N and 78.5333°E, 1200 m 15 VI 2009. **Paratype:** collection data as for holotype, 1 male, (PUPM).

Diagnosis

This species is similar to *C. cumata* MALICKY & CHANTARAMONGKOL, 1993, *C. berenike* MALICKY, 1998, *C. suadulla* MALICKY & CHANTARAMONGKOL, 1993 in the shape of segment IX in the lateral view. It is closer to *C. suadulla* MALICKY & CHANTARAMONGKOL in the shape of segment IX and tergum X in both lateral and dorsal views. However, in the lateral view the sclerotized lateral lobes of tergum X are more similar in *C. cumata* MALICKY and *C. maneriensis*. But in *C. maneriensis* the inferior appendages are directed upright in the lateral view and without any ventral prominence at the apex; the mesal lobes of tergum X are pinhead-like apically, whereas in *C. cumata* the inferior appendages are not directed upright in the lateral view and with a ventral prominence; the mesal lobes of tergum X are digitate and not pinhead-like apically. Similarly, in *C. maneriensis* the lateral lobe of tergum X is almost wider up to the mid-point and pointed apically; the mesal lobes of tergum X are longer than the lateral lobes of tergum X in the dorsal view; the inferior appendages with a tooth-like projection sub-apically in the ventral view, whereas in *C. suadulla* MALICKY & CHANTARAMONGKOL the lateral lobes of tergum X are uniformly wide though pointed apically, and the mesal lobes of tergum X are about half the length of the lateral lobes of tergum X; inferior appendages pointed apically in the ventral view.

Description

Colour in alcohol yellowish brown, head blackish, antenna yellowish and wing golden yellow; body surface covered with dense, short, brownish pubescence. Maxillary palp 1.75 mm long, segment 3 distinctly longer than 2, 3 subequal to 5; labial palpi small, 1 mm long. Antenna shorter than forewing. Average length of forewing 5.25 mm; forewing venation: stem of Rs curved, with sclerotized node at inflection; fork at base of discoidal cell distinctly thickened, length of discoidal cell about 2.5 times width; crossvein m proximal to crossveins s and r-m, vein; vein 2A intersecting 3A.

Male genitalia (Figs 11-15). Tergum IX short; anterodorsally produced; anteroventral margin with slightly blunt projection; posterolaterally median bulge prominent; postventral process just indicated. Preanal appendages short, setose and globular. Inferior appendages longer than tergum X, directed posterodorsally in lateral view, wider mesally, narrow

apically; in ventral view broad basally, with tooth-like projection subapically. Tergum X with sclerotized lateral lobes and separate mesal lobes; each lateral lobe long, with numerous sensilla, broad and ventrally produced in lateral view, with serrated outer margin in dorsal view; mesal lobe directed postero-dorsally, pinhead-like in lateral view; digitate, convergent in dorsal view. Phallobase rounded, sclerotized. Endotheca tubular, length not discernible, no spines visible in ventral or lateral view; phallotremal sclerite complex with ring and rod structure in ventral view.

Etymology

The species is named after the type locality, Maneri.

DISCUSSION

In 2009 as many as 3 500 adult caddisfly specimens were collected during expeditions to various localities in the Indian Himalayas in the states of Sikkim and Uttarakhand. After sorting, 14 specimens were placed in the genus *Chimarra* as new species. The adult caddisflies were collected mainly from the small streams, tributaries and main rivers originating from glaciers of the Indian belt of the Himalayas with water depths varying from shallow to deep, and flow rates from slow to swift. Besides the water quantity, the temperature and quality of water containing organic matter are the factors underlying the distributions of these species, as these are the conditions that are essentially required by the immature insects. The water temperature is also a major factor affecting the distribution of caddisflies. The altitudinal range varied from 250 m to 3 300 m during the collection expedition to the Indian Himalayas. Meaningful analyses of such aspects as the comparative ecology, phylogeny, historical biogeography and utility for freshwater biomonitoring are premature: they await a more comprehensive understanding of the species diversity of the genus in this part of India.

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