

## Research Article

# Three New Species and One New Record of Genus *Chimarra* Stephens (Trichoptera: Philopotamoidea: Philopotamidae) from Indian Himalaya

Manpreet Singh Pandher<sup>1</sup> and Simarjit Kaur<sup>2</sup>

<sup>1</sup> Department of Zoology, Desh Bhagat University, Mandi Gobindgarh, Punjab 147301, India

<sup>2</sup> Department of Zoology & Environment Sciences, Punjabi University, Patiala 147002, India

Correspondence should be addressed to Manpreet Singh Pandher; [mpandher.iari@gmail.com](mailto:mpandher.iari@gmail.com)

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Three new species and one new record are added to the philopotamid fauna of India from the Indian Himalaya. The newly described species under the genus *Chimarra* Stephens include *Chimarra butticulata* sp.n. and *C. gangotriensis* sp.n. both from Uttarakhand and *C. sangtami* sp.n. from Nagaland. The record of *C. nigra* Kimmins (from Sikkim) constitutes the first record of that species from India, although it was previously known from Nepal. It is redescribed here from India as there are minor differences in the male genitalia from previously described species (in original paper of Kimmins only lateral view of the phallus was illustrated and in the redescribed species the ventral view of phallus is illustrated along with the lateral view). The four species belong to two different species groups and one species is unplaced in the species group. These species are distinguishable from each other as well as from the previously known allied species by consistent taxonomic features of the inferior appendages, tergite X, and the phallic apparatus of males.

## 1. Introduction

With more than 800 species known for the world, about 400 species of the genus *Chimarra* Stephens are recorded from the Oriental Region [1]. The genus is the second largest caddisfly genus in terms of species diversity, second only to *Rhyacophila* [2] (Rhyacophilidae), and is known from all biogeographical regions except Antarctica [3]. About 2/3rd of the species in the genus *Chimarra* are restricted to the Oriental and Neotropical Regions and the lowest diversity (less than 3% of the species) is in the Palearctic Region.

The genus *Chimarra* is divided into 4 subgenera: *Chimarra* Stephens, *Chimarrita* Blahnik, *Curgia* Walker, and *Otarra* Blahnik [4]. The last 3 subgenera occur only in the Neotropical Region, whereas subgenus *Chimarra* occurs worldwide and is especially abundant in tropical regions, being the only subgenus of the subfamily Chimarrinae distributed in India.

Most of the oriental species of *Chimarra* were described in the past 22 years. Malicky [5–18] described 162 species

from Nepal, China, Cambodia, Thailand, Indonesia (Ambon, Bali, Irian Jaya, Java, Kalimantan, Lombok, Sulawesi, and Sumatra), Vietnam, Bhutan, Malaysia (Sabah), Pakistan, Philippines, Sri Lanka, and India (Andaman Islands, Great Nicobar Island, and South Andaman Island). In addition to those works coauthored by Malicky and others, in which many new species were described and first national species records made include those of Sun and Malicky [19], Malicky and Chantaramongkol [20–23] and Malicky et al. [24], other works describing Oriental species of *Chimarra* include those of Banks [25–27], Blahnik et al. [3, 28], Ghosh and Chaudhury [29], Hagen [30, 31], Hwang [32], Jacquemart [33], Kimmins [34–36], Martynov [37], Melnitsky [38], Mey [39–44], Mosely [45], Navás [46–48], Oláh [49], Oláh and Malicky [50], Saini et al. [51–53], Johanson and Oláh [54], Pandher and Saini [55, 56], Schmid [57, 58], Sun [59], Ulmer [60–65], Yang et al. [66], and Wang et al. [67].

Until now, 36 species of this genus have been recorded from India. Among these previously described species, 27

have been reported only from the Himalayan region. Contributors to these species include Kimmins [35] (5 species), Martynov [37] (4 species), Ghosh and Chaudhary [29] (2 species), Saini et al. [51–53] (8 species), and Pandher and Saini [55, 56] (8 species), respectively. Four species were described from mountain springs of the Western Ghats (Maharashtra and Karnataka) by Navás [47] (3 species) and Kimmins [35] (1 species) and 4 species are reported from tropical rain forests of Andaman and Nicobar Island by Malicky [5, 10] (2 species; 2 species). *Chimarra aberrans* Martynov occurs in all regions of India and one species has been recorded from Mount Abu (Rajasthan) by Pandher and Saini [56].

## 2. Materials and Methods

The specimens were collected with light traps for 1–4 hours after dusk in 2009–2010 (April–October), using either 135 W, ultraviolet, mercury-vapour bulbs (with alternating current), or 22 W Circline fluorescent BL tubes (Bioquip, with 12-volt, rechargeable batteries). The collection was made near the banks of the small streams, tributaries, and the main rivers originating from glaciers of the Indian belt of the Himalaya, with water quantity varying from shallow to deep and with slow to swiftly flowing waters. Genitalia were cleared in 10% KOH solution overnight, then observed, and preserved with the remainder of the specimen in 80% ethyl alcohol with a drop of glycerol. Additional specimens were cleared using lactic acid method as proposed by Blahnik and Holzenthal [68] and Blahnik et al. [69]. Terminology for genitalia and wings corresponds to that of Blahnik [4] and Blahnik et al. [28] for *Chimarra*. Types of the new taxa are deposited in National Pusa Collection Museum (NPC), Indian Agricultural Research Institute New Delhi.

### 2.1. *Tsudai* Group

#### 2.1.1. *Chimarra nigra* Kimmins

*Chimarra nigra* Kimmins 1964: 42 (Figure 1 (1)–(5))

**Material Examined.** India, Sikkim, Sangkalang, 1500 m, 13-v-2009 1♂; 1♀, Pandher and Parey, (NPC).

**Description.** Adult ♂; body transparent light brown (in alcohol). Length of antenna—4 mm; length from tip of head to apex of folded forewing 5 mm.

**Male Genitalia** (Figure 1 (1)–(5)). Segment IX short; tergum IX short, anterodorsally produced, anterior margin concave, anteroventrally produced, posterolateral margin almost straight; posteroventral process well developed. Preanal appendages, each globular, obliquely placed in lateral view; setose and semi-circular in dorsal view. Inferior appendages each directed posteriorly, as long as tergum X, narrow basally, widened apicomesally in lateral view; in ventral view, broad basally, tapering apically, with pointed apex, slightly curved outward. Tergum X with sclerotized lateral lobe and obsolete membranous mesal lobes; each lateral lobe wedge-shaped mesoventrally

pointed and bears multiple sensilla in lateral view; divergent, clavate, in dorsal view; each mesal lobe digitate, directed posterodorsally in lateral view; convergent, digitate in dorsal view. Phallosome tubular, expanded basodorsally, and sclerotized; endothea tubular, constricted mesodorsally in lateral view, bearing granular area at apex, length not discernable, and no endotheal spine and phallosomal sclerite complex visible in either views.

**Distribution.** Nepal. India: Sikkim.

**Diagnosis.** This species is allied to *Chimarra berenike* Malicky [11] and *C. argeia* Malicky and Chantaramongkol [70] in the shape of segment IX in lateral view. However, narrow and small lateral lobe of tergum X and the inferior appendage with rounded apex in lateral view set this species aside from allied species.

#### *Chimarra butticulata* sp.n. (Figure 1 (6)–(10))

**Material Type.** Holotype. India. ♂: Uttarakhand, Maneri, 1200 m, 5-vi-2009, Pandher and Parey, (NPC). Paratype. 2♂♂, 1♀, collection data the same as that of holotype (NPC).

**Etymology.** This species name is derived from Latin word “*butticula*” which means bottle or pitcher, based on the bottle like lateral lobes of tergum X in dorsal view.

**Description.** Adult ♂; color in alcohol dark brown, dorsum of head dark brown, antenna dark brown, maxillary palp brownish. Length from tip of head to apex of folded forewing about 5.75 mm; maxillary palp—1.25 mm long; 3rd segment longer than 2nd but subequal to 5th; labial palp—0.75 mm long. Length of each forewing 5 mm; Rs thickened, curved; cross vein *m* in close proximity of *s* and *r-m* cross veins; 2A obsolete apically, looped to 1A at cross vein *a*; hind wing about 3.50 mm long.

**Male Genitalia** (Figure 1 (6)–(10)). Tergum IX very short, anterodorsally produced; anterior margin concave; anteroventrally produced; posterolaterally mesally produced; posteroventral process poorly developed. Preanal appendages, each small, setose, semi-circular in lateral view, rounded in dorsal view. Inferior appendages, each longer than tergum X, directed posterad, narrow at base, wide mesally tapering apically and rounded at apex in lateral view; in ventral view uniformly wide at base, tapering to apex, with pointed, dark, mesally curved apex. Tergum X with sclerotized lateral and mesolateral lobes and obsolete mesal membranous lobes; each lateral lobe long, wide, curved downward, pointed at apex and lobe bearing multiple sensilla in lateral view; in dorsal view wide basally up to middle, gradually narrowing towards apex; each mesolateral lobes digitate almost half the length of lateral lobes in dorsal view, curved upward in lateral view.

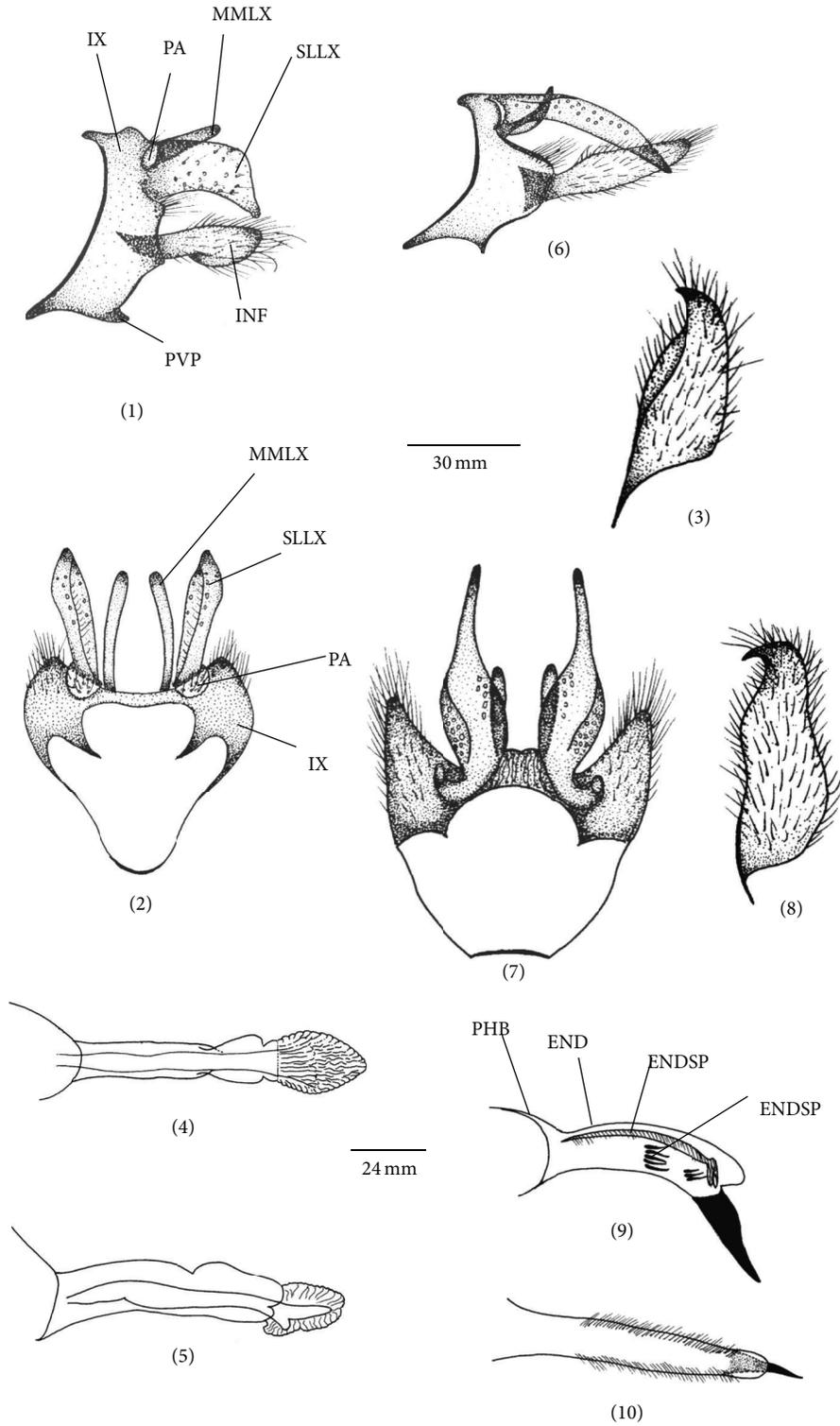


FIGURE 1: *Chimarra* spp. (1)–(5) *Chimarra nigra* Kimmins ♂ genitalia: (1) left lateral view; (2) dorsal view; (3) inferior appendage ventral view; (4) phallus ventral view; (5) phallus lateral view. (6)–(10) *C. butticulata* sp. nov. ♂ genitalia: (6) left lateral view; (7) dorsal view; (8) inferior appendage ventral view; (9) phallus lateral view; (10) phallus ventral view.

Phallosome tubular, expanded basodorsally, and sclerotized. Endotheca with basodorsal projection, length not discernable, apically with ventral, large spine-like projection, strongly sclerotized (maybe

of phallosome) in lateral view; a row of comb-like spines laterally visible in ventral view, phallosomal complex not visible, two rows of asymmetrical, small spines visible preapically.

*Diagnosis.* *C. butticulata* sp.n. is allied to *C. nepalensis* Kimmins [36], *C. nahesson* Malicky and Chantaramongkol [21], and *C. fenestrata* Kimmins [36] due to presence of long pointed apically sclerotized lateral lobe of tergum X in lateral view. Comparatively *C. butticulata* sp.n. is very close to *C. fenestrata*. However, the shape of segment IX in lateral view; inferior appendages constricted near base and slightly pointed apically as viewed laterally and the mesal lobes of tergum X rounded apically as viewed dorsally make *C. butticulata* a distinct species. There are marked differences in the shape and number of endothecal spines as well.

*Distribution.* India: Uttarakhand.

## 2.2. Digitata Group

### *Chimarra sangtami* sp.n. (Figure 2 (11)–(15))

*Type material.* Holotype. INDIA. ♂: Nagaland, Kiphrie, 1200 m, 16-v-2010, Pandher and Parey, (NPC). Paratype 2♂♂, 3♀♀, collection data the same as that of holotype, (NPC).

*Etymology.* This species is named after Naga tribe “Sangtam” which inhabits the type district “Kiphire” of Nagaland.

*Description.* Adult ♂; color in alcohol fuscous, antenna, brownish yellow, wing hyaline, maxillary, and labial palpi pale yellow. Body covered with fuscous pubescence. Length from tip of head to apex of folded forewing 6 mm; antenna shorter than forewing, about—4 mm long; maxillary palp 1.50 mm, third segment more than 1.5 times longer than second segment; labial palp 0.90 mm long. Length of each forewing 5 mm, discoidal cell twice as long as its width; Rs curved, cross vein *m* proximal to cross veins *s* and *r-m*; 2A obsolete and looped to 1A; hind wing about 3.25 mm long.

*Male Genitalia* (Figure 2 (11)–(15)). Tergum IX short, anterodorsally produced; anterior margin concave, ventrolaterally produced; posterolateral margin almost straight; posteroventral process prominent, wide at base, with acute apex. Preanal appendages each short, oblong, setose, in lateral view; globose in dorsal view. Inferior appendages each dorsally inflected basoventrally, wider at base, constricted mesally, with pointed apex in lateral view; in ventral view, sickle-shaped, curved mesally, pointed apically. Tergum X with sclerotized lateral lobes (with sclerotized dorsal and ventral margins) and separate projecting membranous mesal lobes; each lateral lobe long, dorsally with broad and wedge shaped margin and ventral margin digitate which is curved anterodorsally in lateral view, longer than dorsal margin; each mesal lobe digitate, convergent, bifid at apex in dorsal view. Phallosome tubular and sclerotized. Endotheca slender, long; length not discernable; one long preapical spine visible in lateral

and ventral views; phallosomal complex composed of rod and ring structure, in lateral view C shaped, dorsally with granular area.

*Diagnosis.* In possession of broad segment IX, long postventral process and upright directed inferior appendage, *Chimarra sangtami* sp.n. is allied to *C. gether* Malicky [16], *C. demeter* Malicky [12], and *C. tawitawi* Malicky [8]. However, while in *C. sangtami* the sclerotized lateral lobes of tergum X are broad mesally, notched preapically, curved outward, and pointed apically as viewed dorsally whereas in the allied species lateral lobe of tergum X is very different in shape. Moreover, there is considerable difference in the phallus structure like number and size of endothecal spines and phallosomal sclerite complex.

*Distribution.* India: Nagaland.

*Unplaced Species.* This species described below is though very similar to species belonging to *tsudai* Group (due to presence of multiple sensilla on mesal lobe of tergum X and mesal lobe forming upright digitate projection); however, the presence of well developed ventral process on segment IX in *C. gangotriensis* sp. n. is an exception as the ventral process is more or less obsolete in the species belonging to *tsudai* Group.

### *Chimarra gangotriensis* sp.n. (Figure 2 (16)–(20))

*Holotype.* India. ♂: Uttarakhand, Maneri, 1200 m, 5-vi-2009, Pandher and Parey, (NPC). Paratype. 1♀, collection data the same as that of holotype (NPC).

*Etymology.* This species is named for the Hindu pilgrim Gangotri on the road through Maneri.

*Description.* Adult ♂; color: alcohol dark brown; dorsum of head, black; thorax, black; legs, pale brown; wing hyaline, light yellow. Length from tip of head to apex of folded forewing about—7.50 mm; maxillary palp—1.50 mm, third segment about twice the second and subequal to the 5th; labial palp long, about—1 mm. Length of each forewing—6.25 mm; Rs curved; cross vein *m* in close proximity with *s* and *r-m* cross veins; 2A with obsolete apex, looped to 1A at cross vein *a*; discoidal cell elongates, more than, 1.75 its width.

*Male Genitalia* (Figure 2 (16)–(20)). Segment IX short; with reduced tergum, obsolete dorsally, anterodorsally not produced; anteroventrally produced; posterolateral margin almost straight; posteroventral process well developed, wide basally, and pointed at apex. Preanal appendages, each obliquely placed, rounded, setose, globose in dorsal view. Inferior appendages each slightly longer than tergum X, directed posterad, constricted near base, wide and inferior margin tapering towards rounded apex in lateral view; in ventral view broad basally, constricted on outer surface, apically pointed and bears long tuft of setae. Tergum X with sclerotized

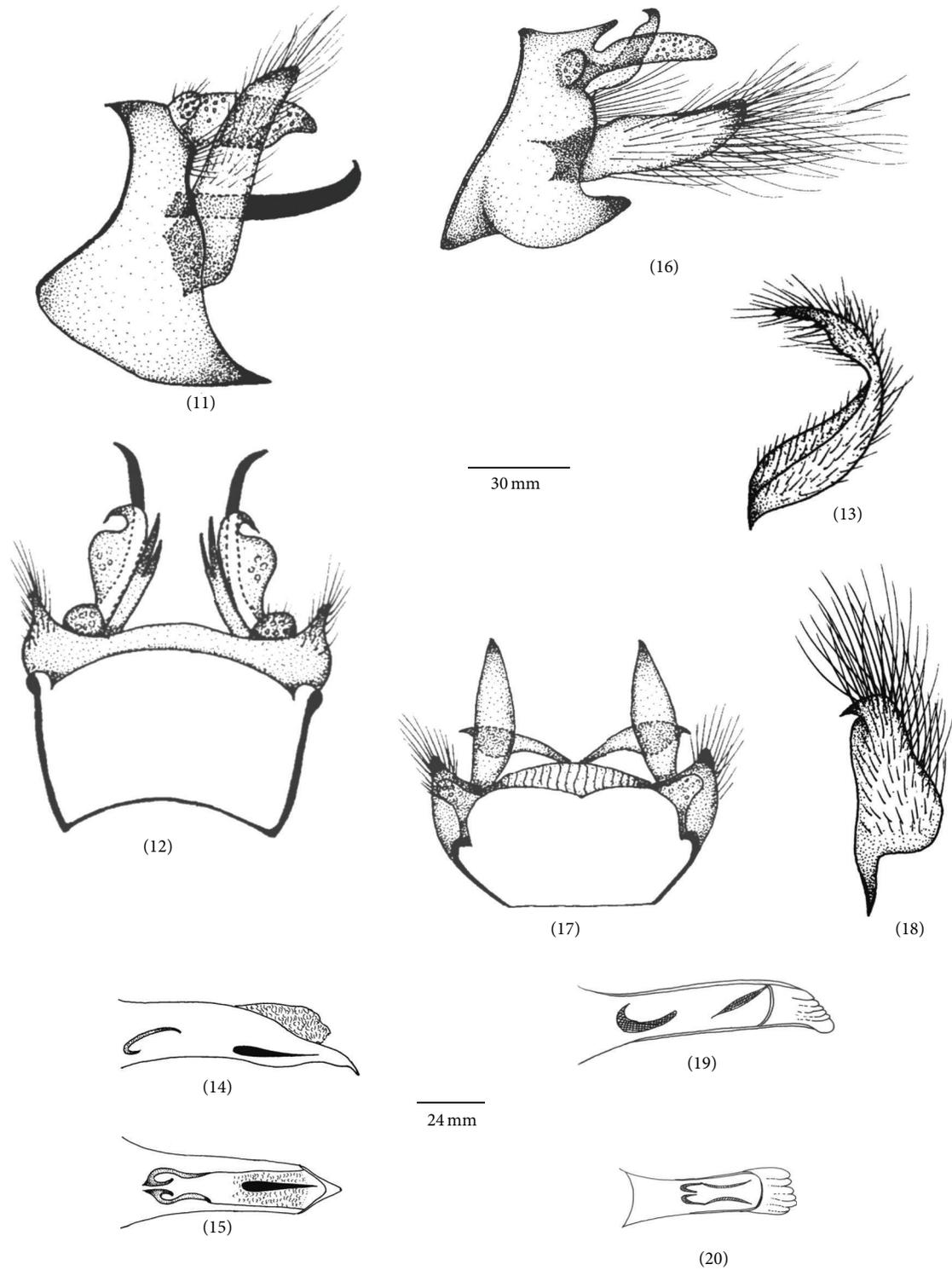


FIGURE 2: *Chimarra* spp. (11)–(15) *Chimarra sangtami* sp. nov. ♂ genitalia: (11) left lateral view; (12) dorsal view; (13) inferior appendage ventral view; (14) phallus lateral view; (15) phallus ventral view. (16)–(20) *C. gangotriensis* sp. nov. ♂ genitalia: (16) left lateral view; (17) dorsal view; (18) inferior appendage ventral view; (19) phallus lateral view; (20) phallus ventral view. (IX: segment 9, PA: preanal appendages, MMLX: membranous mesal lobe of tergum X, SLLX: sclerotized lateral lobe of tergum X, INF: inferior appendage, PVP: posteroventral process, PHB: phallobase, END: endotheca, and ENDSP: endothecal spine).

lateral and mesolateral lobes and obsolete mesal membranous lobes; each lateral lobe being long, wide, rounded apicoventrally, and bearing multiple sensilla in lateral view; in dorsal view wedge-shaped; each mesolateral lobe posterad directed, curved apicodorsally, and pointed in lateral view; in dorsal view enlarged mesoapically, with pointed, divergent apex. Phallobase tubular and sclerotized. Endotheca long, length not-discernable, with c-shaped sclerotized structure probably phallotremal sclerite complex, and apically long spine and endotheca membranous apically.

**Diagnosis.** This species is allied to *C. pontos* Malicky, [14], *C. semiramis* Malicky, [14], and *C. oreithyia* Malicky, [14] due to presence of long hair like setae on inferior appendages. However, IX sternum with long and broad postventral process; sclerotized lateral lobes of tergum X pointed in dorsal view make *C. gangotriensis* distinct from allied species. Moreover, c-shaped phallotremal sclerite complex in lateral view is visible in *C. gangotriensis* whereas no phallotremal sclerite complex is visible in allied species.

**Distribution.** India: Uttarakhand.

## Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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