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## *Tipula (Vestiplex) carolae* sp. n., a high alpine species of the *excisa* group (Diptera, Tipulidae)

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*Tipula (Vestiplex) carolae* sp. n. which belongs to the *excisa* group is described after a large material from high alpine habitats in Switzerland, Italy and Austria. The new species resembles most *Tipula (Vestiplex) montana* CURTIS from which it can be separated only uneasily by genitalia characters. Colour patterns and biometrical measurements of antennae and L. wing/L. abdomen ratio provide reliable means of discrimination.

Unlike *Tipula (V.) strobliana* MANNHEIMS, mainly subalpine, or *Tipula (V.) excisa* SCHUMMEL and *Tipula (V.) montana* CURTIS which are most common in the lower alpine meadows, *Tipula (V.) carolae* sp. n. inhabits only steep slopes at high alpine level, where vegetation becomes discontinuous and much rock crops out.

In 1953, MANNHEIMS still considered *Tipula (Vestiplex) excisa* SCHUMMEL as a most variable but unique species. Since then, detailed studies based on large series of specimens have enabled to recognize 8 taxa belonging to 3 species (ERHAN & THEOWALD, 1961; THEOWALD & MANNHEIMS, 1962; THEOWALD, 1968):

*Tipula (V.) e. excisa* SCHUMMEL 1833: N. Eurasia, Alps, Balkans

*Tipula (V.) e. carpathica* ERHAN & THEOWALD 1961: Carpathians

*Tipula (V.) montana montana* CURTIS 1834: Alps, SW Balkans, Pyrenees, Great Britain

*Tipula (V.) montana excisoides* ALEXANDER 1833: Northern Palaearctic East of Jenissei; Kamschatka

*Tipula (V.) montana verbeneae* MANNHEIMS & THEOWALD 1959: Northern Palaearctic West of Jenissei

*Tipula (V.) s. strobliana* MANNHEIMS 1966: Alps

*Tipula (V.) s. hemiptera* MANNHEIMS 1959: Carpathians

*Tipula (V.) s. pyrenaei* THEOWALD 1968: Pyrenees

During the many alpine excursions made necessary to prepare a Swiss Tipulidae fauna (the author's doctorate at the University of Neuchâtel) a clear vertical distribution of the alpine species listed above was noted. *Tipula (V.) s. strobliana* MANNHEIMS is mainly restricted to the subalpine level and seldom occurs higher than the forest limit if the latter has not been lowered artificially by human activity or avalanche. *Tipula (V.) m. montana* CURTIS and *e. excisa* SCHUMMEL are typical alpine species, most abundant from tree limit up to the highest continuous meadows. At the higher alpine level, vegetation becomes patchy, bare rock becoming more frequent. In this inhospitable habitat, where the collector begins to abandon hope for a good discovery, a slightly smaller *montana* looking Tipulid was caught, the females of which normally winged were very discrete and only seen walking on the ground. The specimens looked slightly more reddish than *montana*, and collected in sufficient numbers and numerous localities, could

be recognized as belonging to a new species. *Tipula (Vestiplex) carolae* sp. n. is dedicated to my wife Carole for whom the study of Tipulidae might not always have been a great improvement of life.

*Tipula (Vestiplex) carolae* sp. n. fig. 1a, 2a

*Type material:* Holotype ♂: Furka, Blau Berg, 2500 m, (CH, Valais), Swiss coordinates 675/258, 4.8.1980, sweep-net, DUFOUR leg. Musée d'histoire naturelle de Neuchâtel (MHNN). Paratypes: 2 ♂, Albula, 2200 m (CH-GR), 7.7.1979, DUFOUR leg. (MHNN); 2 ♀, Arolla (CH-VS), 9.7.1979, SIEGENTHALER leg. Musée Zoologique de Lausanne (MZL), alcohol; 1 ♀, Bourg-St-Pierre, 2100 m (CH-VS), 25.7.1977, DUFOUR leg. (MHNN); 1 ♂ 1 ♀, Bretolet Col de (CH-VS), 5.7.1977, DUFOUR leg. (MHNN); 8 ♂, Chercrouit Col (Courmayeur, I.), 25.7.1962, (Instituut voor Taxonomische Zoölogie (Zoölogisch Museum) Amsterdam (ZMA)); 4 ♂, Chercrouit Col (Courmayeur, I.), 29.7.1962, (ZMA); 1 ♂, Duan Pass (CH-GR), 3.7.1950, SUTTER leg. (ZMA); 1 ♂, Flüela, 2400 m (CH-GR), 21.8.1978, DUFOUR leg. (MHNN); 1 ♂, Flüela, 2500–2700 m (CH-GR), 21.8.1978, DUFOUR leg. (MHNN); 5 ♂, Furka, 2450 m (CH-VS), 4.8.1980, DUFOUR leg. (MHNN); 1 ♂, Furka (route de la) (CH-VS), 4.8.1980, DUFOUR leg. (MHNN); 3 ♂, Furka, Blau Berg, 2500 m (CH-VS), 16.8.1978, DUFOUR leg. (MHNN); 26 ♂ 9 ♀, Furka, Blau Berg, 2500 m (CH-VS), 4.8.1980, DUFOUR leg. (MHNN); 2 ♀, Gotthard Hospiz (CH-TI), 23.7.1953 (ZMA); 1 ♂, Grand-St-Bernard (CH-VS), 23.7.1948, SCHMID (MZL); 1 ♂, Grand-St-Bernard (CH-VS), 5.9.1978, DUFOUR leg. (MHNN); 1 ♂, Grand-St-Bernard (CH-VS), 30.7.1980, DUFOUR leg. (MHNN); 2 ♀, Leuk, 2350 m (CH-VS), 4.8.1980, RUEDI leg. (MHNN); 3 ♂ 1 ♀, Leuk, 2400 m (CH-VS), 4.8.1980, RUEDI leg. (MHNN); 6 ♂, Nufenen, Pt. 2339 (CH-TI), 16.7.1979, DUFOUR leg. (MHNN); 13 ♂ 3 ♀, Nufenen, Pt. 2428 (CH-VS), 16.7.1979, DUFOUR leg. (MHNN); 4 ♂, Nufenen, Pt. 2428 (CH-VS), 29.7.1979, RUEDI leg. (MHNN); 1 ♂, Rechy val, 2100–2400 m (CH-VS), 25.9.1980, DUFOUR leg. (MHNN); 1 ♂, Rifelalp (CH-VS), 28.7.1980, REZBANYAI, Natur-Museum Luzern (NML); 3 ♂ 2 ♀, St Luc, Forcletta, 2600–2700 m (CH-VS), 3.8.1980, DUFOUR leg. (MHNN); 1 ♂, St Luc, Forcletta, 2876 m (CH-VS), 3.8.1980, DUFOUR leg. (MHNN); 4 ♂ 1 ♀, St Luc, Hotel Weiss-horn (CH-VS), 3.8.1980, DUFOUR leg. (MHNN); 9 ♂ 1 ♀, St Luc, Lac du Tounot (CH-VS), 3.8.1980, DUFOUR leg. (MHNN); 2 ♂, St Luc, Montagne de Tounot (CH-VS), 2.8.1980, DUFOUR leg. (MHNN); 1 ♂, Susten, 2300 m (CH-BE), 5.8.1980, DUFOUR leg. (MHNN); 1 ♀, Umbrail (I), 7.7.1968 (ZMA); 1 ♂, Umbrail (I), 19.8.1978, DUFOUR leg. (MHNN).

*Other material:* 1 ♂, Gemmi (CH-VS), 5.7.1887, HUGUENIN, Eidgenössische Technische Hochschule Zürich (ETHZ); 3 ♂, Zermatt, Schwarze (CH-VS), 9.8.1933, KEISER, Naturhistorisches Museum Basel (NHMB); 1 ♂, Zermatt, Stafelalp (CH-VS), 24.6.1959, KEISER (NHMB); 1 ♀, Zuoz (CH-GR), 17.7.1975, SAUTER (ETHZ); 1 ♀, Zuoz (CH-GR), 17.7.1975, SAUTER (ETHZ); 1 ♂, Hintersee, 1300 m (Austria), 11.8.1956, G. VERBENE (ZMA); 1 ♂, Vent, Martin-Busch-Hütte, 2300–2500 m (Austria), 30.7.1967, Ötztal. ent. exp. Zool. Mus. (ZMA); 1 ♂, Vent, 1900–2550 m (Austria), 30.7.1967, idem (ZMA).

*Description*

Body length ♂: 12–14 mm, ♀: 17–20 mm. Wing length ♂: 13–17 mm; ♀: 13–16 mm. Male: head grey; nasus most variable, distinct or lacking; palpi and rostrum dark grey; 13 antennal segments; scape, pedicel and flagellum black; first

flagellar segment distinctly longer than flagellar segment 2 or 3; antennal segments 4–13 with basal nodes; eyes separated below by 3–4 times width of scape. Thorax grey, bearing four grey praescutal stripes limited by a brown margin; the central stripes are fused (not separated by lighter ground colour of thorax); lateral stripes limited on outer margin by a distinct brown line only on posterior half, merging in grey colour of thorax near front of praescutum; wings grey with numerous hyaline markings; neala (squama) without bristles; coxa grey, femora and tibiae darkened apically; tibial spurs 1, 2, 2. Abdomen orange-brown; tergite 1 grey; end of abdomen (segments 6–9) progressively darker with dark lateral stripes on tergites 2–5. Hypopygium: tergite 9 bearing 2 short rounded spines on either side of the dark largely sclerotized cupule-like shiny surface (Fig. 1a). The female is similar to male in general appearance; antennae not nodulous; wings shorter no reaching end of abdomen; abdomen brownish not distinctly darkened apically; cerci with rounded slightly serrate tip (Fig. 2a); hypovalvae rather narrow.

*Distribution:* Austrian, Swiss and Italian Alps.

*Ecology:* high alpine, mostly above 2300 m up to 2876 m.

*Ethology:* males fly actively and conspicuously while females which have only very slightly reduced wings and normal flight muscles, were mainly seen walking. However 2 ♀♀ were caught in a light trap indicating that they are not totally unable to fly.

#### DISCUSSION

*Tipula (V.) carolae* sp. n. males can be separated from *excisa* by totally black antennae and rounded lateral spines of tergite 9 (needlelike in *excisa*); females by slender base of hypovalvae which are like in *montana* (see THEOWALD & MANNHEIMS, 1962; Fig. 20); tips of cerci are somewhat serrate, though not as deeply as in

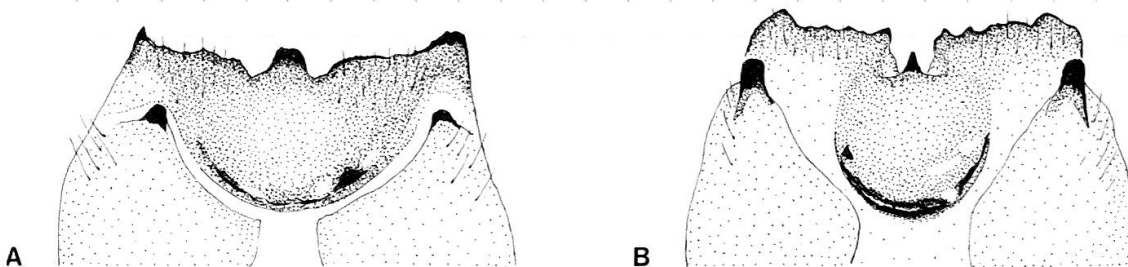


Fig. 1: Tergite 9 of ♂, dorsal view. A, *Tipula (V.) carolae* sp. n.; B, *Tipula (V.) montana* CURTIS.

*excisa*. The dark grey *T. (V.) strobliana* will be separated easily by body colour pattern, only faintly spotted wings and very broad base of hypovalvae of ♀♀. *T. (V.) carolae* and *montana* being extremely similar, a secure determination will need using many characters in parallel:

1. *Genitalia*. Rounded sclerotized surface of tergite 9 of ♂ wide, extending near base of lateral spines and to hind margin of tergite in *carolae* (Fig. 1a); smaller and leaving an unsclerotized area near base of spines in *montana* (Fig. 1b). Tip of cerci slightly serrate in *carolae* ♀ (Fig. 2a); not serrate in *montana* (Fig. 2b).

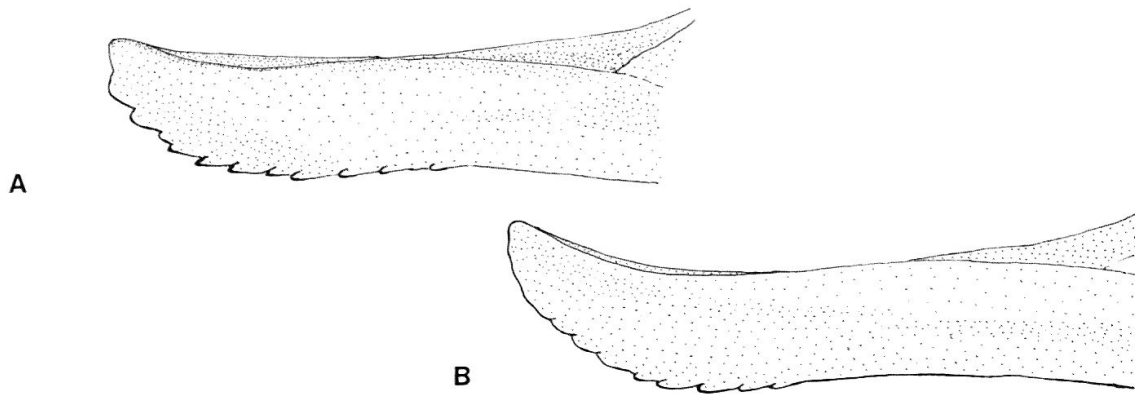


Fig. 2: Cerci of ♀, outside. A, *Tipula (V.) carolae* sp. n.; B, *Tipula (V.) montana* CURTIS.

2. *Colour pattern.* Antennae: scape, pedicel, flagellum all black in *carolae* ♂ and ♀; scape, pedicel yellow; first flagellar segment dark or lightened in *montana* ♂; segments 1–3 most variable in ♀ *montana*, but only very rarely all dark together. Thorax: medium praescutal stripes always fused in *carolae* sp. n., their outer margin merging into grey ground colour of thorax near front of praescutum. Medium praescutal stripes mostly separated by lighter ground colour of thorax (rarely fused) and with outer margin distinct in *montana*. Abdomen: general colour reddish brown; tergite 1 grey in *carolae*; yellowish brown including tergite 1 in *montana*.

3. *Biometrical measurements.* Table 1 provides measurements of length of antennal segments 3–5, wing and abdomen; secondly two discriminating ratios:  $R \frac{3}{4} + 5 = \text{antennal segment 3} / \text{antennal segments 4 + 5}$ .  $R \frac{w}{a} = \text{length of wing} / \text{length of abdomen}$ .

♂♂ of *carolae* are best separated by antennal ratio: the observed  $R \frac{3}{4} + 5$  is  $< 0.57$  in *montana*;  $> 0.62$  in *carolae*. Statistical calculation indicates that  $R \frac{3}{4} + 5$  should also exceed 0.59 in less than 0.25% of *montana* specimens, whilst it should be inferior to 0.61 in less than 0.25% in *carolae*. Being a larger species than *carolae*, *montana* shows larger antennal segments 3–5, longer abdomen and larger wings. In spite of some overlap, table 1 will help finding observed discriminating measurements.

♀♀ again are best separated by antennal ratios of the first flagellar segments: observed  $R \frac{3}{4} + 5$  is  $< 0.82$  in *montana*;  $> 0.85$  in *carolae*. Statistically  $R \frac{3}{4} + 5$  should be inferior to 0.85 in less than 1.25% *carolae*, whilst it should exceed 0.82 in less than 1.25% *montana*.

Abdomen lengths are almost identical in both species, but wing lengths show only very little overlap. Finally the wing/abdomen ratios enable a good discrimination:  $\leq 1.04$  in *carolae*;  $\geq 1.03$  in *montana*. Furthermore  $R \frac{w}{a}$  should statistically be with a 95% security higher than 1.05 in *montana* and lower than 1.05 in *carolae*.

The ecology of *T. (V.) carolae*, characterized by extremely cold and steep alpine habitat suggests that the species might have stood the glacial period inside the Alps. Furthermore *carolae* might not have been able to extend its range out of the alpine region during the ice times, as other boreo-alpine species probably did, the surrounding tundra building possibly for *carolae* an ecological barrier.

Table 1: Comparison of lengths of antennal segments 3-5 and wing/abdomen ratio in *Tipula (Vestiplex) carolae* sp. n. and *Tipula (Vestiplex) montana* CURTIS (mean and SD with range in paranthese; measurements in mm).

	<u>Tipula(V.) carolae</u> sp.n.	<u>Tipula(V.) montana</u> <u>Curtis</u>
	♂♂	♂♂
Antennal segments 3+4+5	1,54 ± 0,12 (1,2 - 1,85) N = 104	2,05 ± 0,18 (1,7 - 2,44) N = 43
Antennal segments 3/4+5	0,74 ± 0,05 (0,62 - 0,84) N = 104	0,50 ± 0,03 (0,45 - 0,57) N = 43
L. wing	14,8 ± 0,97 (13 - 17 ) N = 109	17,5 ± 1 (15,5 - 20 ) N = 43
L. abdomen	9 ± 0,85 ( 6 - 10,5) N = 107	10,7 ± 0,74 ( 9 - 12 ) N = 43
L.wing / L. abdomen	1,64 ± 0,13 (1,4 - 2,17) N = 107	1,64 ± 0,11 (1,4 - 1,8 ) N = 43
	♀♀	♀♀
Antennal segments 3+4+5	0,85 ± 0,05 (0,75 - 0,96) N = 25	0,89 ± 0,09 (0,77 - 1,05) N = 32
Antennal segments 3/4+5	0,97 ± 0,06 (0,85 - 1,06) N = 25	0,72 ± 0,05 (0,64 - 0,82) N = 32
L. wing	15 ± 0,83 (13 - 16 ) N = 26	17,9 ± 1,2 (15 - 21 ) N = 33
L. abdomen	15 ± 0,98 (12,5 - 17 ) N = 26	15,7 ± 1,13 (13 - 18 ) N = 33
L. wing / L. abdomen	1 ± 0,04 (0,87 - 1,04) N = 26	1,14 ± 0,07 (1,03 - 1,29) N = 33

## RÉSUMÉ

*Tipula (Vestiplex) carolae* sp. n., espèce nouvelle du groupe *excisa* de l'étage alpin supérieur (Diptera, Tipulidae) - *Tipula (Vestiplex) carolae* sp. n., qui appartient au groupe *excisa*, est décrite de Suisse, d'Italie et d'Autriche où elle fréquente l'étage alpin supérieur. Elle ressemble le plus à *Tipula (Vestiplex) montana* CURTIS dont elle peut n'être que difficilement séparée par l'observation des genitalia; de manière certaine, au contraire, par des caractères de coloration et des mesures biométriques sur les antennes et les rapports aile/abdomen. Contrairement à *Tipula (V.) strobliana* MANNHEIMS qui fré-

quente principalement l'étage subalpin, et *Tipula (V.) excisa* SCHUMMEL ou *T. (V.) montana* CURTIS de l'étage alpin inférieur, *T. (V.) carolae* sp. n. habite des pentes raides de l'étage alpin supérieur qui se caractérisent par une végétation discontinue mêlée d'affleurements rocheux.

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