A NEW SPECIES OF *CAILLOMA* ROSS & KING, 1952 FROM BOLIVIA [TRICHOPTERA, HYDROBIOSIDAE]

BY

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RÉSUMÉ

Nous décrivons Cailloma rubemarini *n. sp. de la Cordillère royale (Bolivie). Des caractères sont donnés et illustrés pour l'identification des mâles, des femelles, des nymphes et des larves. Le dimorphisme sexuel est important car la taille des ailes de la femelle est réduite. Cette espèce a été récoltée à des altitudes variant de 3800 à 4600 mètres. Avec* Antarctoecia nordenskioeldi *(Ulmer, 1905) (Trichoptera, Limnephilidae), c'est l'une des espèces de la faune benthique bolivienne dont la limite supérieure de distribution altitudinale est la plus haute.*

The Hydrobiosidae have a Gondwanan origin and are distributed in America, Australia, New Zealand, New Caledonia, oriental Asia and Iran. In South America, most of the genera are recorded from the South-western area (Argentina and Chile). Elsewhere on this continent, only three genera are present: *Atopsyche* Banks, 1905, *Iguazu* Ross & King, 1952 and *Cailloma* Ross & King, 1952. *Atopsyche* is widely distributed from southern United States of America to northern Argentina. *Iguazu* is known from north-eastern Argentina and Patagonia. *Cailloma* is widely distributed in the Andes from Ecuador to Patagonia (FLINT, 1974). *Cailloma* contains 3 previously described species: *C. pumida* Ross, 1956 reported from central Chile to neighbouring areas in Argentina, *C. rotunda* Flint, 1967 from Tierra del Fuego to central Chile and *C. lucidula* (Ulmer, 1909) from central Chile to Peru (including Bolivia). The male genitalia of *Cailloma lucidula* and *C. pumida* are similar, but those of *C. rotunda* are quite different from those of the two other species. Recent research on the small torrents appearing downstream the glaciers of Cordillera Real (MOLINA, 2004) resulted in the discovery of high altitude populations of *Cailloma,* all with the females characterized by a strong wing reduction. The larvae and pupae are distinguishable from those of *C. lucidula* on morphological characters. In addition, there are subtile, but constant differences between the male genitalia of these Cordillera populations and those of *C. lucidula*. Accordingly, we describe below the male and female imago of *Cailloma rubemarini* n. sp. Moreover, we give morphological characters which make possible the identification of the larvae and the pupae. The morphological interpretation of the genitalia follows the one presented by SCHMID (1989).

Cailloma rubemarini n. sp.

(Figs. 1-16)

Type material. **Male holotype** : BOLIVIA, Kullu Kachi River (16°17'48"S, 68°27'17"W, few kilometers from Batalla, E Titicaca Lake), 15-IV-2003. — Paratypes: 2 ♀ and 1 ♂, same data as the holotype. The holotype is deposited at the Laboratoire d'Entomologie (MNHN, Paris) and the paratypes at the Instituto de Ecología, Universidad Mayor de San-Andrés, La Paz, Bolivia.

Other examined material. Río San-Juan (crossing with Potosi-Uyuni road), 18-V-2004: 9 ♂ and 1 ♀; Río Turco (10 kilometers S Turco, Cordillera Oriental), 8-XI-2003: 2 ♂; Río Kullu Kachi (Batalla), 15-IV-2003: 5 ♀ and 3 ♀; Río Choquecota (crossing with La Paz-Palca road), 29-X-2002 and 16-IV-2003: 2 ♂, many pupae and larvae. The material is deposited at the Instituto de Ecología, Universidad Mayor de San-Andrés, La Paz, Bolivia.

Male (Figs. 1-2, 5-9).

Spurs: 2/4/4. Forewing length: 9.5 mm, width: 2.4 mm, hindwing length: 8 mm, width: 2.8 mm. Forewing, vein R2+3 forked well beyond anastomosis, R4+5 at anastomosis level, M1+2 and M3+4 about midway to wing margin. Hindwing, R2+3 arising from R4. M1+2 forked at about midway to wing margin; furca 4 absent. Intercubital area large. Abdomen: long and thin; segment V without finger-shaped glandular device (lateral processes); sternite VI with one weakly marked posterior point; sternite VII with a conical button bearing setae; sternite IX developed distally but reduced dorsally, distal edge convex, strongly curved in lateral view. Proctiger broad, long, weakly sclerotized, widens regularly from base to apex in lateral view. Dorsal edge of parapods rounded, ventral edge almost right-angled. Filipods finger-shaped, equally thick along their length. Preanal appendages small, button-shaped. Lower appendages stout, one-segmented; distal part of internal face bearing one line of short thick setae. Phallic apparatus short, curved ventrally with beak-shaped apex.

Female (Figs. 3-4, 10-11).

Forewing length: 5.9 mm, width: 1.9 mm; hindwing length: 4.2 mm, width: 2.2 mm. Wings shorter than abdomen, by comparison with the male, female forewing length reduced to 2/3 and width to the 3/4. Forewing, furca R2+3/R4+5 originating distinctly before anastomosis. Hindwing, extremity of R2+3 fused with Sc. Genitalia: tergite VIII and sternite VIII developed, tangential.

Diagnosis.

The main morphological characteristic of *Cailloma rubemarini* is the marked reduction of the female wings size. This reduction makes them relatively broad. This is interesting as, in comparison with the others Hydrobiosidae, *Cailloma* is characterized by the narrowness of the wings (SCHMID, 1989). *C. rubemarini* is most closely related to *C. lucidula*. In the male wing venation, F1 of hind wings is petiolate in *C. rubemarini,* whereas sessile in *C. lucidula*. Moreover, a detailed comparison of the male genitalia offers light but constant differences. In lateral view, the proctiger widens regularly from the base to the apex, more strongly than in *C. pumida,* whereas in *C. lucidula* thickness is constant. The filipods are finger-shaped, whereas in *C. lucidula* they are club-shaped like in *C. pumida*. The dorsal edge of the parapod is regularly curved, whereas the distal part is gradually straight up in *C. lucidula* and abruptly bent ventrad in *C. pumida*. In dorsal view, the inferior appendages appear intermediate between those of *C. pumida* and those of *C. lucidula*. The phallic apparatus is almost identical to that of *C. lucidula,* except slightly longer and with slightly less curved apex. The female genitalia are similar but can be distinguished in lateral view by the shape of sternite VIII (compare Figure 10 with figure 12 in FLINT, 1974).

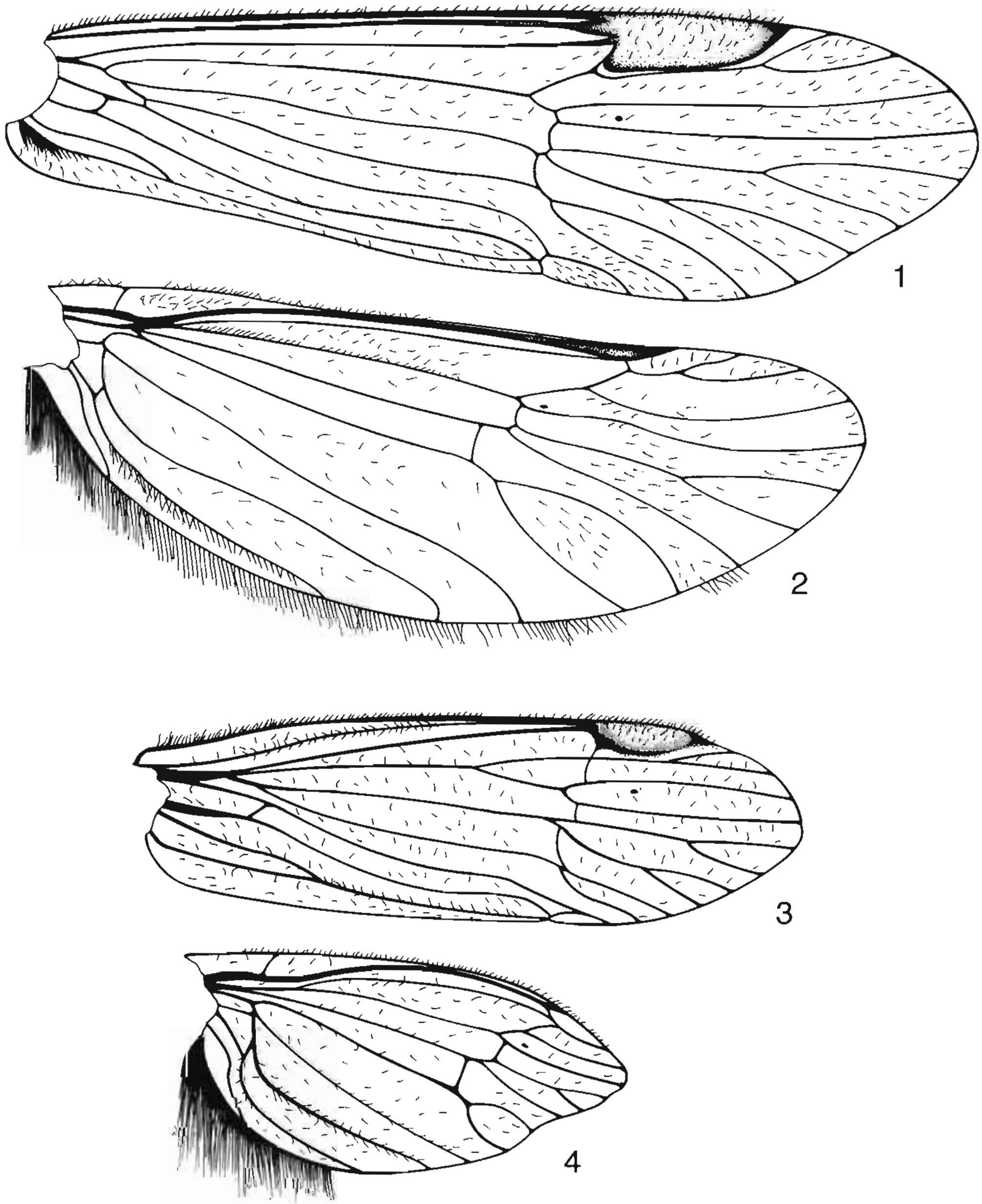

Fig. 1-4, ***Cailloma rubemarini* sp. n.**, wing venation. — 1, male anterior wing. — 2, male posterior wing. — 3, female anterior wing. — 4, female posterior wing.

Larvae and pupae.

FLINT, who described them (1974), notes « the females, larvae, and pupae seem to be identical in the two species (*Cailloma lucidula* and *C. pumida*) ». We were able to rear some old larvae until their emergence in an aquarium. The characters of the larva and the nymph were compared with the descriptions and figures given by Flint. In the larvae, the colour pattern of the head and the pronotum (Fig. 12) distinguishes *C. rubemarini* from *C. lucidula*. The spots are more marked and rounder. The edge of the frontoclypeus is particularly distinct: *C. rubemarini* has two patches linked by a dark line, whereas *C. lucidula* and *C. pumida* both have a broad dark

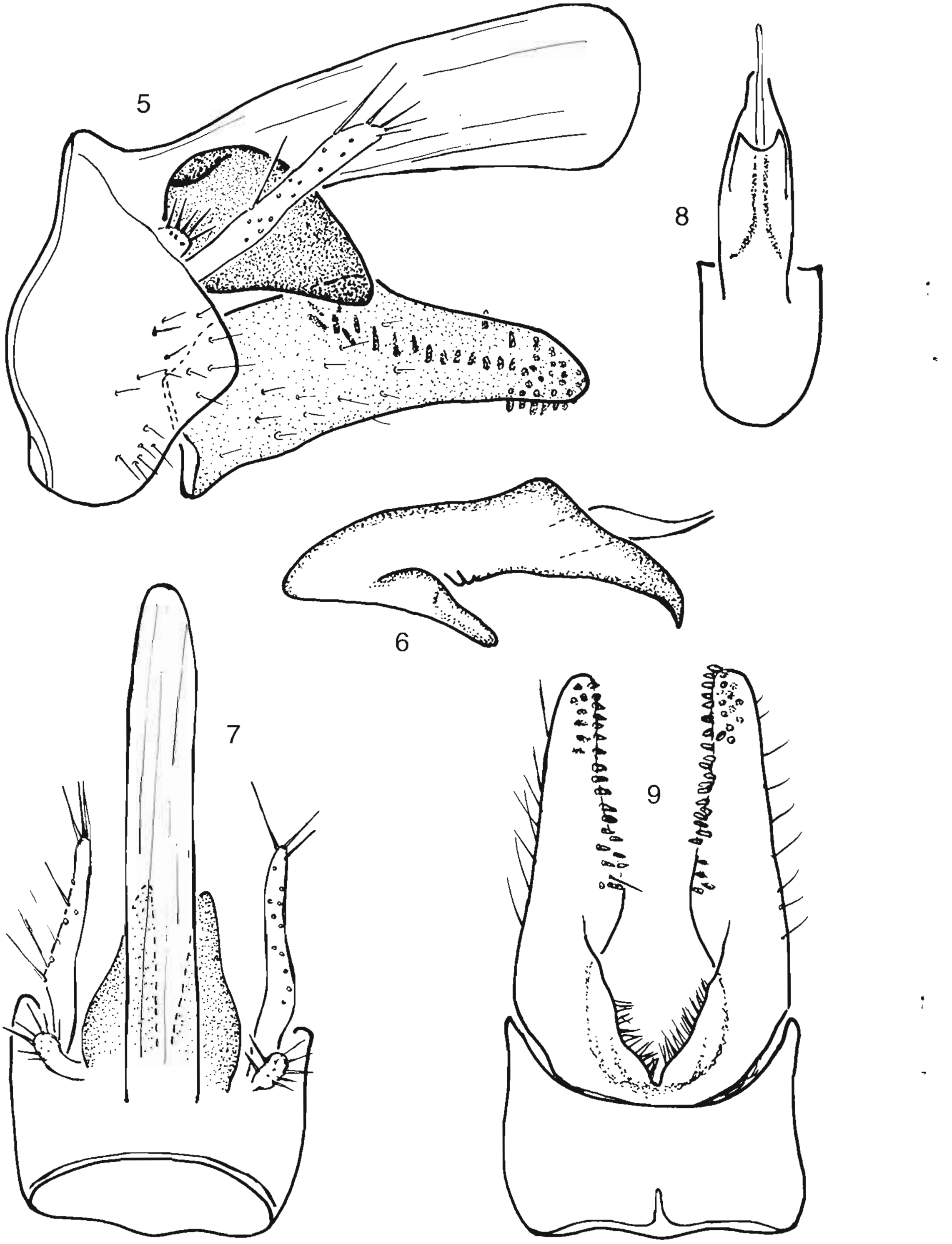

Fig. 5-9, ***Cailloma rubemarini* sp. n.**, male genitalia. — 5, male genitalia (phallic apparatus omitted), lateral view. — 6, phallic apparatus, lateral view. — 7, ninth and tenth abdominal segments, dorsal view. — 8, phallic apparatus, dorsal view. — 9, ninth abdominal segment and inferior appendages, ventral view.

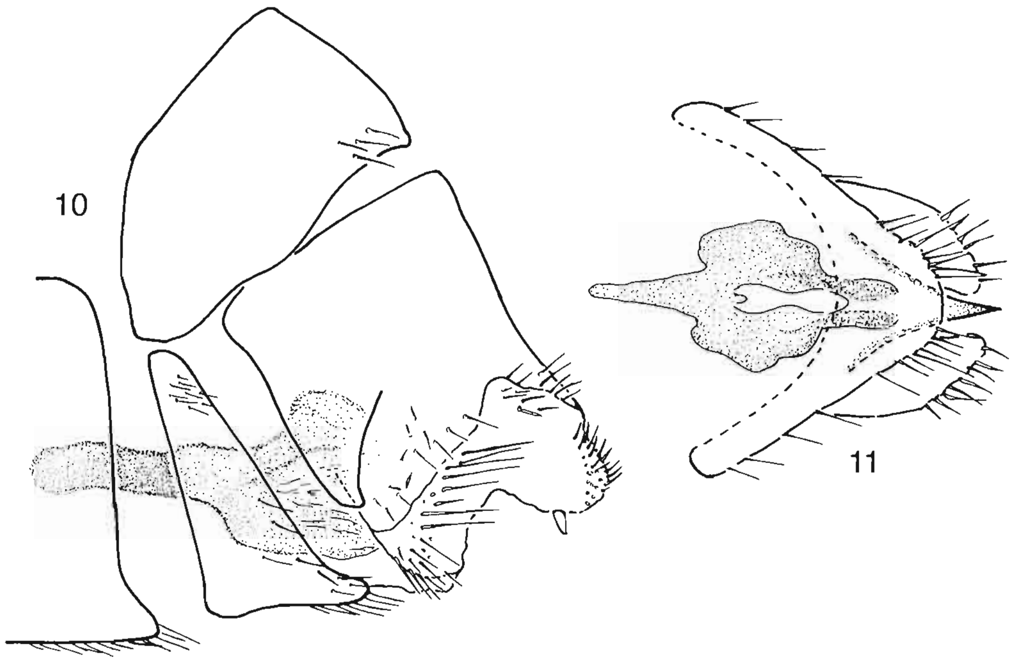

Fig. 10-11. ***Cailloma rubemarini* sp. n.**, female genitalia. — 10, lateral view. — 11, dorsal view.

rectangular patch (cf. fig. 19 of Flint). In *C. rotunda*, the edge of the frontoclypeus has no pattern or patch. The main difference is the shape of the profemurs (in the Hydrobiosidae they are characterized by the presence of an apicoventral projection opposite to the tibia and the tarsus which constitutes a grip facilitating the predatory behaviour of the larvae). The femur is only slightly curved in *C. rubemarini* (Fig. 13), whereas in *C. lucidula* and *C. pumida* it is strongly bent (cf. fig. 22 of FLINT, 1974). There are also slight differences of the colour pattern of the anal proleg (Fig. 14). In the pupae, the mandibles of *C. lucidula* and *C. rubemarini* are similar (Fig. 15), but the size and shape of some pupal hook plates, i. e. the anterior one of segment II, the anterior of segment III and the posterior of segment V, are good diagnostic characters (fig. 16 and fig. 18 of FLINT, 1974).

Etymology. We are pleased to dedicate this work to Ruben Marin, one of the pioneers of Bolivian hydrobiological research.

Ecology and biogeography

We collected *Cailloma rubemarini* at several sites in the Cordillera Real from two rivers located on the eastern border of the Altiplano : Río Khullu Cachi, a tributary of the Titikaka, and Río Choquecota, a tributary of Río La Paz (Amazon basin). We also found it in a small stream of the Cordillera Oriental on the western border of the Altiplano (Río Turco) and on the Río San-Juan between Potosi and Uyuni. These two rivers belong to the Popoo endorheic basin. All these sites are located at more than 3800 m above sea level. Downstream, on the Altiplano, there are very different ecological conditions involving regular periods of dryness, erosion and turbidity, reduction of slope and current. The human use of these waters is intensive and the pollution of the residual ones may be strong, often reducing the benthic fauna to a few dipteran families. Consequently, the ecological distribution of *C. rubemarini* is restricted to a limited altitudinal zone between glaciers or high-mountain marshes and the Altiplano. This species is thus geographically and ecologically isolated from *C. lucidula,* as the only known Bolivian locality of that species is near Cochabamba at 2570 m above sea level (FLINT, 1974). This isolation is reinforced by the loss of flight capacity.

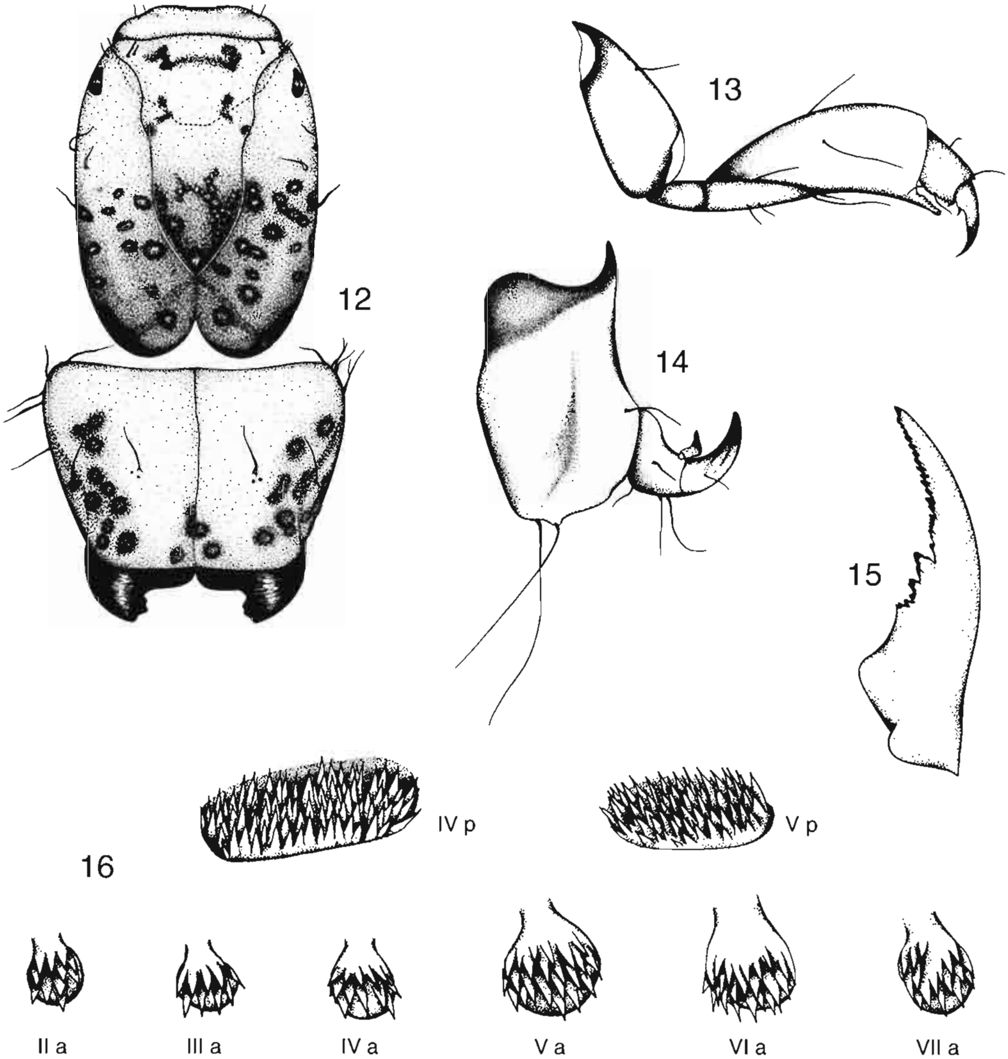

Fig. 12-14. ***Cailloma rubemarini* sp. n.**, larva. — 12, head and prothorax. — 13, prothoracic leg. — 14, anal claw.
Fig. 15-16. ***Cailloma rubemarini* sp. n.**, pupa. — 15, mandible. — 16, hooks plates (II = 2nd abdominal segment, III = 3rd abdominal segment, IV = 4th abdominal segment, V = 5th abdominal segment, VI = 6th abdominal segment, VII = 7th abdominal segment, a = anterior, p = posterior).

This new species is restricted to a cold (the air temperature decreases substantially before sunset) and variable environment, where winds are violent, particularly at the end of the day. The effect of the wind is strengthened by the low developpment of the vegetation.. These meteorological conditions affect severely the flight activities of all insects and light-traps are not an effective collecting method. The males of *C. rubemarini* fly, but with difficulty. Most of the time, we collected them as they crawled towards the light-trap. The females remain immobile on the stones in or at the edge of the stream, probably near the place where they emerged. We assume that this difficulty of flight is related to wings reduction.

The benthic fauna associated with *C. rubemarini* is moderately diverse at higher taxonomic level but the species diversity is poor. At the altitude of the glaciers, 3 orders (Ephemeroptera, Plecoptera and Trichoptera) are often represented by only 5 species belonging to 5 families – Ephemeroptera : *Massartellopsis irrazavali* Demoulin, 1955 (Leptophlebiidae), *Andesiops* *peruvianus* (Ulmer, 1920) (Baetidae); Plecoptera: *Claudioperla tigrina* (Klapalek, 1903) (Grypopterigydae); Trichoptera: *Cailloma rubemarini* n. sp. (Hydrobiosidae), *Antarctoecia nordenskioeldi* (Ulmer, 1905) (Limnephilidae).

CONCLUSION

The present recession of the Bolivian glaciers, related to global climatic change (FRANCOU *et al.* 2000), is going to modify, considerably, the hydrological regime of these mountain streams. Because precipitation is low and unequally distributed during the year, the permanence of annual flow is now threatened and many streams will become temporary. Their temperature, hydrological variability and sediment charge will increase. These aquatic communities, located, isolated and highly specialized to extreme ecological conditions, are thus among the most threatened in South America and their study deserves more attention.

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