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High altitude crane flies (Tipuloidea) and their importance as food for birds

Douglas R. Hardy¹, Christophe Dufour² & Pjotr Oosterbroek³

¹ Senior Research Fellow, Department of Geosciences, University of Massachusetts Amherst, Massachusetts, USA; dhardy@geo.umass.edu

² Former director, Muséum d'histoire naturelle, 14 rue des Terreaux, CH-2000 Neuchâtel, Switzerland, Christophe.Dufour@unine.ch

³ Senior Staff Member, Naturalis Biodiversity Center, Leiden, The Netherlands, p.oosterbroek@chello.nl, ccw.naturalis.nl

It is well known that larvae and adults of Arctic crane flies are important as food for birds, especially during the breeding season (McKinnon et al. 2012, Machin et al. 2017, Leung et al. 2018; a chapter on the importance of Arctic crane flies in the nutrition of birds during their breeding season is found in Lantsov & Chernov 1987). Although less known, this is also the case for some high altitude bird species, in the Alps and the Caucasus, and as we discuss here, also in the Andes. The data presented here for the Swiss Alps and the Caucasus refer to crane flies of the family Tipulidae, for North America to Tipulidae and Pediciidae, and for the Andes to limoniid crane flies.

The Swiss Alps

The highest known crane fly altitudes in the Swiss Alps are 3.100 m for *Tipula (Pterelachisus)* glacialis (Pokorny) and *T. (Vestiplex) montana* Curtis (Dufour 1992). Among the 154 species of crane flies found in Switzerland, 39 reach altitudes above 2.000 m, but only eight (5.2%) are truly alpine, with the following median elevation ranges (all above 2.000 m): *Tipula (Pterelachisus)* glacialis Pokorny (2.200 m), *Tipula (Pterelachisus) irregularis* Pokorny (2.370 m), *Tipula (Pterelachisus) sauteri* Dufour (2.423 m), *Tipula (Pterelachisus) subglacialis* Theowald (2.180 m), *Tipula (Savtshenkia) goriziensis* Strobl (2.175 m), *Tipula (Vestiplex) crolina* Dufour (2.428 m), *Tipula (Vestiplex) excisa* Schummel (2.050 m) and *Tipula (Vestiplex) montana* Curtis (2.150 m).

In the Swiss Alps, White-winged Snowfinches (*Montifringilla nivalis nivalis* (Linnaeus)) in late spring and early summer forage preferentially next to invertebrate-rich, melting snow patches where Tipulidae larvae abound. They feed primarily on these larvae, which are also important in the diet of their nestlings, as studied by Heiniger (1991) and Resano-Mayor et al. (2019). The Heininger 1991 study is summarized by Schneider 2017 as follows: While outside of the breeding season the snowfinches eat almost exclusively seeds from alpine plants, their main nourishment during the breeding season is thought to be arthropods (larvae, Lepidoptera, Arachnida, etc.), which they collect from the ground. The main component of the nestling food is larvae from Tipulidae, because they are especially nutritious. The Tipulidae larvae live in the cavern between the snow blanket and the ground. In the evening they freeze in the melt water and are released when the snow melts on the following day. That is why there are many Tipulidae larvae at the edge of snow patches, which are easily accessible for the Snowfinches (Fig. 1).

Alexander (1962) suggests that certain crane flies found at high altitudes are blown up by the wind. This is a common phenomenon for some insects such as butterflies and has also been observed with crane flies. In Switzerland, a male of *Nephrotoma cornicina* (Linnaeus), a lowland colline (foothill) species (median altitude 550 m) was observed in August 1978, above the Flüelapass, on snow, at 2.600 m (Dufour 1986).



Fig 1. White-winged Snowfinch at the edge of a patch of snow, where they prefer to feed (after Heiniger 1991).

Allochthonous, wind transport or migrating insects can play a significant role in high altitude ecosystems. In the frame of a large scale research program in alpine ecology on an alpine meadow (*Caricetum firmae*) situated on the top of Munt la Schera (2.540 m) in the Swiss National Park, Dethier (1984) concludes that "In the soil, detritivorous species clearly dominate the arthropod community, whereas, in the herbaceous layer, predators are remarkably abundant in comparison with the indigenous potential

prey. Moreover, a non-negligible part of their food consists of wind transport, erratic or migrating insects, especially at the beginning of the season. This ecosystem, therefore, can be considered to be somehow *subsidized* by other ecosystems found at lower altitude".

The Andes

The highest crane fly altitudes are found in the Andes, namely 5.600 m for *Dicranomyia* (*Dicranomyia*) perexcelsior (Alexander) from Bolivia (Alexander 1962) and (so far the highest) 5.680 m for what has been identified by Dmitry Gavryushin as "quite certain" being *D*. (*D*.) hirsutissima (Alexander) from Peru (Fig 2). Adults of the last-mentioned species were observed by DRH at several altitudes while ascending the Quelccaya Ice Cap in Peru. For example, at 5.520 m a pair of White-winged Diuca Finches (*Idiopsar speculifera*) were observed feeding on these crane flies, which is one of several bird species using crane flies as a food resource in the area, another species being the White-fronted Ground Tyrant (*Muscisaxicola albifrons* (von Tschudi)) (Fig. 3). In DRH's experience, these limoniid crane flies are active in the area during April and October, bracketing the colder, winter dry season (June–August). In April 2014, crane flies were abundant (and entering our tents) at our 5.200 m camp, indicating they were living at that elevation and not blown up from a lower elevation. Considerable biological activity is present in this area (Fig. 4), right



- Fig. 2 (top). *Dicranomyia* (*Dicranomyia*) *hirsutissima* female, identification by Dmitry Gavryushin as "quite certain".
- Fig. 3 (right). White-fronted Ground Tyrant in the vicinity of its nest beneath the glacier, carrying crane fly adults and perhaps larvae or caterpillars.



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up to the glacier margin, ranging from insects to lizards to frogs to mammals and birds. Crane flies appear to be important as food during the austral autumn and spring, for at least the birds. During DRH's years visiting Quelccaya (2003–2018), adults of D. (D.) *hirsutissima* were also observed at the summit automated weather station at 5.680 m (Fig. 5).



Fig 4. Lake and bofedal (wetland) adjacent to DRH camp at Quelccaya Ice Cap, April 2016 (5.200 m). The ice cap margin where nesting White-winged Diuca Finches and White-fronted Ground Tyrants have been studied is currently ~600 m to the right of the photo; another part of the glacier is visible ~5 km in the background.



Fig 5. Weather station on the Quelccaya Ice Cap summit, Peru, 5.680 m, 4 April 2014.

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Upon each visit, 1-2 m excavations were made into the snow until reaching the enclosures for dataloggers; along the vertical aluminum tubing, dozens of the adult crane flies were often found, and sometimes in mating pairs. It cannot be said with confidence whether they were alive or not upon the encounters, yet the regularity of their discovery suggests that in the Andes crane flies regularly fly – or are transported by wind – to at least about 5.700 m.

D. (*D*) *hirsutissima* was originally described from the Chacaltaya glacier in the Cordillera Real in Bolivia, from an altitude of 5.000 m (Alexander 1962). It is at this type locality where Diuca Finches were first associated with glaciers (Niethammer 1953), which are now known from research at Quelccaya to be the only bird species in the world which nests on glaciers (Hardy et al. 2018). Unfortunately, the Chacaltaya glacier disappeared by 2009.

North America

High altitude records for North American mountains include *Tipula (Pterelachisus) simondsi* Alexander, described from a single brachypterous female, collected in the Sierra Nevada, on a snowfield along the Mount Whitney Trail, at 3.810 m (Alexander, 1965). Other alpine records from California are *Tricyphona subaptera* (Pediciidae) from the East Donohue Pass in the Ansel Adams Wilderness at 3.241 m (Medeiros & Schoville 2017; altitude kindly provided by Matthew Medeiros) and *Tipula (Eremotipula) leiocantha* Alexander from Mount Barcroft in the White Mountains at 3.810 m (Gelhaus 2005). In the Rocky Mountains of Colorado, a species of *Tipula (Beringotipula)* was collected at the Loveland Pass at 3.658 m (Gelhaus pers. comm.). At the lower elevation of 2.100 m in the high desert of Nevada, heavy predation was observed of *Tipula (Eremotipula) spaldingi* Dietz by Brewers Blackbirds (*Euphagus cyanocephalus* Wagler) (Gelhaus 2005).

The Caucasus

For the Caucasus, Lantsov (2007) mentions 22 species of Tipulidae that reach altitudes above 2.000 m but none from above 3.000 m, although crane flies are without doubt to be found above that limit (Lantsov pers. comm.). Altitudes up to or above 2.500 m are recorded for: *Nephrotoma cornicina* (Linnaeus) (up to 2.700 m), *Nephrotoma pratensis* (Linnaeus) (3.000 m), *Nephrotoma tenuipes* (Riedel) (2.500 m), *Tipula (Emodotipula) obscuriventris* Strobl (2.500 m), *Tipula (Lunatipula) theowaldi* Savchenko (2.500 m), *Tipula (Pterelachisus) luteobasalis* Savchenko (3.000 m), *Tipula (Pterelachisus) varipennis* Meigen (2.500 m), *Tipula (Savtshenkia) gimmerthali* Lackschewitz (2.650 m), *Tipula (Savtshenkia) nivalis* Savchenko (3.000 m), *Tipula (Vestiplex) pallidicosta pullata* Savchenko (2.700 m) and *Tipula (Vestiplex) semivittata* Savchenko (2.700 m).

In the Caucasus, tipuloid dipterans are regarded essential components of food for certain bird species, such as the Tree Pipit (*Anthus trivialis* (Linnaeus)) and the Caucasian Water Pipit (*A. spinoletta coutelli* Audouin) (Polivanov & Polivanova 1998). For these and other insectivorous birds of high mountains it can be assumed with a high degree of probability that this refers to the adults and larvae of the high mountain crane flies *T.* (*V.*) *semivittata*, *T.* (*V.*) *pallidicosta pullata* and *T.* (*S.*) *nivalis* (Lantsov 2003, Lantsov pers. comm.). Especially *T.* (*V.*) *semivittata* shows high abundance in high mountain communities (Lantsov 2003). The Tree Pipit inhabits forest edges and the Caucasian Water Pipit the alpine and subalpine meadows. Tipulids constitute up to 52–69% of the Caucasian Water Pipit diet during the nesting period (Polivanov & Polivanova 1998). *T.* (*S.*) *nivalis* is endemic to the Central Caucasus and dominates the highlands in the range of 2.300–3.000 m. The species is active at the edge of snowfields and mating is observed on the snow. The species is considered an essential food component for birds living at these altitudes (Lantsov pers. comm.).

The Himalayas

High altitudes in the Himalayas are 4.877 m for *Tipula (Pterelachisus) scandens* Edwards (Starkevich et al. 2020) and 5.182 m for *T. (Sinotipula) hypsistos* Alexander and *T. (S.) exquisita* Alexander (Alexander 1962).

The genus Chionea

Not mentioned above are high altitude records for members of the limoniid genus *Chionea*. It seems unlikely that they can play a role as important food for birds. *Chionea*'s are small (3–5 mm, rarely up to 8 mm), flightless, winter-active crane flies, frequently found on the snow, in small numbers. It is a Holarctic genus with 38 species and subspecies (de Jong and Ciliberti 2014, Oosterbroek 2020). Some species are typically found at lower altitudes, others in more mountainous habitats. There are several records up to 2.500 m but as far as we know only four from above 3.000 m. The species *C. alpina* Bezzi and *C. araneoides* Dalman are recorded from 3.035 m in Austria (Thaler & Knoflach 2001) and for North America, Byers (1983) mentions 3.200 m for *C. durbini* Byers in the Sierra Nevada of California and 3.500 m for *C. nigra* Byers in the Rocky Mountains of Central Colorado.

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Erratum – The article title of the Hardy, Dufour & Oosterbroek (2020) paper in *Fly Times* issue 65 (Fall 2020) was mistyped by me on pages iv and 15.

The full and correct title is:

High altitude crane flies (Tipuloidea) and their importance as food for birds

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