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Shelter usage by males of *Hylaeus nivalis* (MORAWITZ 1867) (Hymenoptera: Apidae) and notes on flower records

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A b s t r a c t : Investigations on *Hylaeus nivalis* were conducted in the Zillertal Alps (A, Tyrol) to observe shelter-usage by males. The observations revealed that males use inflorescences of *Leontodon* as night-shelters and during bad weather. Males became completely trapped inside the inflorescences, remaining tightly constrained. Night-sheltering on other flowers than *Leontodon* was not observed but seems likely. In addition, new flower records are reported, supporting the assertion that the species is polylectic.

K e y w o r d s : Zemmgrund, Zillertaler Alps, *Hylaeus nivalis*, night-sheltering bees.

Introduction

Hylaeus nivalis (MORAWITZ 1867) (Hymenoptera: Apidae) belongs to the *Hylaeus nivalis* group, which in Europe consists of seven closely related species. One characteristic feature of the group is an almost exclusive altimontane to alpine distribution in Europe, leading to a disjunctive dispersal (DATHE 2000). Until now, the morphology (MORAWITZ 1867; DATHE 1977; DATHE 1979; DATHE 1980; WARNCKE 1988; DATHE 2000) and biogeographical distribution of *H. nivalis* has primarily been studied. Collection records and localities have been published by numerous authors (PÉREZ 1890; ENSLIN 1952; DATHE 1977; DATHE 1979; DATHE 1980; SCHEDL 1982; WARNCKE 1988; EBMER 1996; DATHE 2000; EBMER 2003); they reveal that the main areas of distribution are the Pyrenees and primarily the eastern Alps. The closely related sister taxon *Hylaeus nivaliformis* DATHE 1977 occurs in the western Alps (DATHE 1979; KOPF 2008), although its status as a separate species has been criticized (WARNCKE 1988). The ecology of *H. nivalis* is poorly studied, probably due to its great rarity, small size and high-lying habitats. Only four flower records have been reported in the literature: several species of *Sempervivum* (MORAWITZ 1867), *Geranium sylvaticum* L. (MÜLLER 1881; BLÜTHGEN 1961), *Saxifraga aizoides* L. (BEAUMONT 1958) and *Linaria alpina* (L.) MILL. (SCHEDL 1982). *H. nivalis* nests in rock and soil crevices (AMIET, NEUMEYER & MÜLLER 1999), but it is undescribed where males stay overnight and rest during bad weather. The few published observations of night sheltering males of the genus *Hylaeus* in Europe (e.g. FUNK 1864; VERHOEFF 1892; BISCHOFF 1927; GEISER 1988) describe or

show single males or aggregations of males on stems, flowers and in burrows, but information about *H. nivalis* is lacking.

Methods

Observations were conducted in the Zillertal Alps (A, Tyrol, Zemmgrund) near the Berliner Hütte in two periods from July 7-9, 2012, during an alpine student course of the University of Vienna, and from August 6-10, 2013. In the first period, the author observed males of *H. nivalis* using flowers as shelters after the beginning of sudden rainfalls. Four males from two locations were observed and one male from each place was collected for determination. During the second period, males were located at dusk and observed until they were completely immobile. The flowers used for sheltering were marked and revisited before dawn. Two of five observed males were collected for determination. Determinations were conducted using DATHE (1977) and DATHE (1980). The visited plants were collected and determined using ROTHMALER (2009) and FISCHER et al. (2008).

Results

Collected Specimens

Hylaeus (*Hylaeus*) *nivalis* (MORAWITZ 1867)

M a t e r i a l : A: Tyrol, Zillertal Alps, Zemmgrund, 2397 m, N47.036944 E11.829067, 7.7.2012, sitting on *Geum montanum* L., 1♂. 2195 m, N47.031153 E11.821665, 8.7.2012, sheltering in *Leontodon hispidus* L., 1♂. 2311 m, N47.03458 E11.82542, 6.8.2013, sheltering in *L. hispidus*, 1♂. 2159 m, N47.028735 E11.818161, 6.8.2013, sheltering in *Leontodon helveticus* MÉRAT. 1♂. 2159 m, N47.028735 E11.818161, 6.8.2013, visiting *Campanula barbata* L., afterwards *L. helveticus*, 1♀.

Observations

All five males of *H. nivalis* that were observed in the evening of August 6, 2013, sheltered either in inflorescences of *Leontodon hispidus* or *L. helveticus* and were recovered in the following morning. They were found in the same inflorescences as observed in the previous evening. As in many other Asteraceae, the inflorescences of *Leontodon* close overnight (FRITSCH 1851; PFEFFER 1904) and during rainy weather (pers. obs.; for *L. autumnalis* L. see TOTLAND (1997)). Hence males of *H. nivalis* became completely trapped inside the inflorescences and remained tightly constrained. The petals had to be removed in the morning to check for the presence of the males. A similar observation was made for the male which sheltered in *L. hispidus* during rainfall. The immobile bee was lying in a slightly lateral position and was almost entirely enclosed by the inflorescence. Likewise, the male which was found on *Geum montanum* was motionless; however, it was much more exposed and hence became wet.

H. nivalis was observed to visit four plant species. The observed female visited *Campanula barbata* and *L. hispidus*, while the observed males visited *L. hispidus*, *L. helveticus* and *G. montanum*.

Discussion

It can be safely assumed that males of *H. nivalis* rest or sleep in the inflorescences of *Leontodon* overnight, since it seems impossible for the male bees to escape at night when enclosed in an inflorescence and since the observed specimens were found in the same bodily positions in the morning as in the evening. Probably, the inflorescences of *Leontodon* are not the only shelter. Other Cichorioideae, such as representatives of *Taraxacum*, *Crepis*, *Hieracium*, *Picris* or *Hypochaeris* may be attractive as well, and some of them are highly abundant. In the study area, at least 19 species of the above mentioned genera of plants were detected (NIKLFELD & SCHRATT-EHRENDORFER 2007). Flowers from species of other families are available and might be chosen, too. For example, the umbrella-like flowers of *Campanula*, which are frequently used as shelters by males of other bee species, such as *Dufourea alpina* (MORAWITZ 1865) (pers. obs.). Nonetheless, no observations for *H. nivalis* have been made.

MORAWITZ (1867) collected *H. nivalis* on "different species of *Sempervivum*" but gave no exact species information about the visited plants. If we consider *Sempervivum* to be one flower record, then we know of a total of four flower records for *H. nivalis* from the literature (MORAWITZ 1867; MÜLLER 1881; BEAUMONT 1958; BLÜTHGEN 1961; SCHEDL 1982). Combining this with the information obtained from the present observations, eight plant species from seven families are proven to be visited by individuals of *H. nivalis* for both sexes. Considering the females only, they visit at least six plant species from six families due to the two additional flower records for females resulted from this study. Therefore it can be concluded that *H. nivalis* is a polylectic species. Oligolecty appears to be unlikely, although it is difficult to obtain evidence of foraging-strategies for *Hylaeus* due to the internal method of pollen transport and the related difficulty of accessing the pollen (WESTRICH 1990; MICHENER 2007; AMIET & KREBS 2012). Still, further investigations, such as pollen analysis from the alimentary canal or nests would be useful.

Zusammenfassung

Im Oberen Zemmgrund (Zillertal, Tirol) wurden Beobachtungen und Aufsammlungen der Gebirgsart *Hylaeus nivalis* (MORAWITZ 1867) durchgeführt. Diese konnten zeigen, dass Männchen der Art in den Infloreszenzen von *Leontodon hispidus* und *Leontodon helveticus* übernachten und diese unter anderem bei Schlechtwetter aufgesucht werden. Die Bienen werden dabei über Nacht durch die Schließbewegung der Infloreszenzen vollständig umschlossen. Übernachtungen in den Blüten anderer Pflanzenarten konnten nicht beobachten werden, sind aber wahrscheinlich. Zusätzlich zu den angegebenen Blütenbesuchen aus der Literatur konnten zwei weitere Pflanzenarten für Blütenbesuche von Weibchen notiert werden, welche die vermutete polylektische Lebensweise unterstützen.

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