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► To cite this version:

Andreas Müller. A scientific note on *Bombus inexpectatus* (Tkalcù, 1963): evidence for a social parasitic mode of life. *Apidologie*, 2006, 37 (3), pp.408-409. hal-00892189

HAL Id: hal-00892189

<https://hal.science/hal-00892189>

Submitted on 11 May 2020

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A scientific note on *Bombus inexpectatus* (Tkalčů, 1963): evidence for a social parasitic mode of life¹

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Received 18 August 2005 – Accepted 10 November 2005

bumblebee / social parasitism / *Bombus inexpectatus* / *Bombus ruderarius*

The European bumblebee species *Bombus* (*Thoracobombus*) *inexpectatus* has been described as recently as 1963. This late discovery is most likely attributable to its close morphological resemblance to *B. (Thoracobombus) sylvarum* (Linnaeus, 1761) and *B. (Thoracobombus) ruderarius* (Müller, 1776) as well as to its exceptional rarity. Its geographic range covers a rather narrow belt from 1200 m to 2100 m in altitude in the alpine bow from France eastwards to the Dolomites and in the Cantabrian mountains in northwestern Spain (Tkalčů, 1963, 1965; Yarrow, 1970; Amiet, 1996). Across its range, *B. inexpectatus* is always recorded in very low densities.

B. inexpectatus is characterized by a number of peculiar biological and morphological traits, suggesting that this species might be an obligate social parasite in the nests of other bumblebees like the cuckoo bumblebees of the subgenus *Psithyrus* (Yarrow, 1970). These traits include: (i) absence of a worker caste (the two individuals originally considered as workers by Tkalčů (1963) were later classified as small overwintered females (Yarrow, 1970)); (ii) probable inability to produce wax; (iii) reduction of both the auricle and the corresponding hair brush at the apex of the hind basitarsus which probably makes the compression of collected pollen within the receptaculum and its transport to the corbiculae impossible; and (iv) lack of pollen harvesting activities as indicated by the absence of pollen loads in the corbiculae of all females known so far. Though these peculiarities clearly point to a parasitic habit of *B. inexpectatus*, there is still no direct evidence for such a behaviour (Williams, 1998).

On 21 July 2005, we detected by chance a nest of *Bombus ruderarius* on a south-facing slope at 1750 m near Splügen (Grisons, Switzerland). We uncovered the nest which was hidden in the leaf litter of fallow ground and collected the inhabitants. The nest consisted of eight empty cocoons of the first

worker generation, 15 empty cocoons of succeeding broods and four cocoons still closed. The absence of egg and larval cells as well as of filled honey pots indicated that the cycle of this colony already had come to an end. In addition to two workers, two males and one newly emerged queen all belonging to *B. ruderarius*, one female of *B. inexpectatus* was found inhabiting the nest. Four queens of *B. ruderarius* later hatched from the closed cocoons. No old females were among the collected individuals. With a forewing length of roughly 12 mm the female of *B. inexpectatus* was similar in size to the freshly emerged *ruderarius* queens. She undoubtedly had hatched within the *ruderarius* colony shortly before we detected the nest as her hair coat was fresh, the microtrichia on the wing surface unworn and the wing margins nearly intact.

Our finding is the first record of *B. inexpectatus* in a host bumblebee colony, corroborating the supposed habit of this species as a social parasite. *B. ruderarius* was already assumed to be a likely host by Yarrow (1970) who found this species to abound wherever he recorded *B. inexpectatus*. Both species are near relatives and, together with *B. sylvarum*, probably form a clade within the subgenus *Thoracobombus* (Tkalčů, 1963; Yarrow, 1970; Pedersen, 2002; Terzo et al., 2005). Close relatedness seems to be an important precondition for the successful invasion of foreign nests by bumblebee species which otherwise establish their own colonies. Such facultative interspecific social parasitism, which has been repeatedly observed in bumblebees (Hobbs, 1967; Wilson, 1971), is confined to members of the same subgenus (Hobbs, 1967; Michener, 1974). Similarly, *B. (Alpinobombus) hyperboreus* which is an obligate social parasite in most of its circumpolar area invades colonies of two closely related species of the same subgenus, viz *B. polaris* and *B. alpinus* (Milliron and Oliver, 1966; Richards, 1973; Pape,

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¹ Manuscript editor: Jean-Noël Tasei

1983; Stenström and Bergman, 1998), but also of *B. (Pyrobombus) jonellus* (Bergwall, 1970).

The simultaneous occurrence of freshly hatched sexuals of both *B. ruderarius* and *B. inexpectatus* in the same nest indicates that the females of both the host and the parasite must have coexisted for some time within the colony. Obviously, the invasion of the nest by *B. inexpectatus* did not completely stop the production of sexuals in *B. ruderarius*. Coexistence of host queen and social parasite and rearing of host sexuals also in the presence of the parasite, though often in reduced numbers, have repeatedly been observed in bumblebee colonies invaded by *Psithyrus* (Fisher, 1987, 1988).

While facultative intra- and interspecific social parasitism is quite widespread in bumblebees and occurs in a number of subgenera (Hobbs, 1967; Wilson, 1971; Michener, 1974), obligate social parasitism has evolved only three times. The cuckoo bumblebee species of the subgenus *Psithyrus* are entirely parasitic and the subgenera *Alpinobombus* and *Thoracobombus* each have a social parasite, viz *B. hyperboreus* and *B. inexpectatus*, respectively. In contrast to *Psithyrus* which has completely lost the corbiculae for carrying pollen, the latter two species have normal corbiculae which were even found to contain pollen loads in a very few specimens of *B. hyperboreus* (Yarrow, 1970; Ranta and Lundberg, 1981). In comparison to *B. hyperboreus*, the total absence of pollen loads in all *inexpectatus* females known so far and the reduced armature of the hind basitarsus indicate that *B. inexpectatus* may be a step ahead in the evolution of behavioural and physiological parallelism to *Psithyrus*.

Note scientifique sur *Bombus inexpectatus* (Tkalčů, 1963) : évidence d'un mode de vie sociale parasite.

Eine wissenschaftliche Notiz zu *Bombus inexpectatus* (Tkalčů, 1963): Nachweis einer sozialparasitischen Lebensweise.

REFERENCES

- Amiet F. (1996) Hymenoptera Apidae, 1. Teil: Allgemeiner Teil, Gattungsschlüssel, die Gattungen *Apis*, *Bombus* und *Psithyrus*, Insecta Helvetica Fauna 12, 1–98.
- Bergwall H.-E. (1970) Ekologiska iakttagelser över några humlearter (*Bombus* Latr.) vid Staloluokta inom Padjelanta nationalpark, Lule lappmark, Entomol. Tidskr. 91, 3–23.
- Fisher R.M. (1987) Queen-worker conflict and social parasitism in bumble bees, Anim. Behav. 35, 1026–1036.
- Fisher R.M. (1988) Observations on the behaviours of three European cuckoo bumble bee species (*Psithyrus*), Insectes Soc. 35, 341–354.
- Hobbs G.A. (1967) Ecology of species of *Bombus* in southern Alberta. VI. Subgenus *Pyrobombus*, Can. Entomol. 99, 1271–1292.
- Michener C.D. (1974) The social behavior of the bees, a comparative study, Harvard University Press, Cambridge.
- Milliron H.E., Oliver D.R. (1966) Bumblebees from northern Ellesmere Island, with observations on usurpation by *Megabombus hyperboreus* (Schönh.), Can. Entomol. 98, 207–213.
- Pape T. (1983) Observations on nests of *Bombus polaris* Curtis usurped by *B. hyperboreus* Schönherr in Greenland, Entomol. Medd. 50, 145–150.
- Pedersen B.V. (2002) European bumblebees – phylogenetic relationships inferred from DNA sequences, Insect Syst. Evol. 33, 361–386.
- Ranta E., Lundberg H. (1981) Resource utilization by bumblebee queens, workers and males in a subarctic area, Holarctic Ecol. 4, 145–154.
- Richards K.W. (1973) Biology of *Bombus polaris* Curtis and *B. hyperboreus* Schönherr at Lake Hazen, Northwest Territories, Quaestiones Entomologicae 9, 115–157.
- Stenström M., Bergmann P. (1998) Bumblebees at an alpine site in northern Sweden: temporal development, population size, and plant utilization, Ecography 21, 306–316.
- Terzo M., Urbanova K., Valterova I., Rasmont P. (2005) Intra- and interspecific variability of the cephalic labial glands' secretions in male bumblebees: the case of *Bombus (Thoracobombus) ruderarius* and *B. (Thoracobombus) sylvarum*, Apidologie 36, 85–96.
- Tkalčů B. (1963) Eine neue Hummel-Art der Gattung *Agrobombus* Vogt aus dem Alpengebiet, Cas. Cesk. Spol. Entomol. 60, 183–196.
- Tkalčů B. (1965) Über *Agrobombus inexpectatus* Tkalčů, Reichenbachia 5, 225–230.
- Williams P.H. (1998) An annotated checklist of bumble bees with an analysis of patterns of description, Bull. Nat. Hist. Mus. Lond. Entomol. 67, 79–152.
- Wilson E.O. (1971) The insect societies, Harvard University Press, Cambridge.
- Yarrow I.H.H. (1970) Is *Bombus inexpectatus* (Tkalčů) a workerless obligate parasite? Insectes Soc. 17, 95–112.