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

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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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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.

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