Ousting of the Common Redstart (Aves: Turdidae: *Phoenicurus phoenicurus*) from its nests by the bumblebee *Bombus niveatus vorticosus* (Hymenoptera: Apidae)

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Abstract. During a study of bird nesting in SW. Anatolia, 125 man-made nest boxes have been installed, 3 m high, in the trees. These nest boxes have been occupied by several bird species (*Phoenicurus phoenicurus*, *Parus major*, *Parus ater*, *Sitta krueperi*, *Certhia brachydactyla*). Of the 48 Redstart nests, 19 (40 %) had been successfully invaded by the bumblebee *Bombus niveatus vorticosus*. This invasion occurred at different times in the nest building cycle: - during the building of the nest, - during the incubation or - after the hatching of the young. Once installed in the nest of the Redstart, the bumblebee does not directly attack the bird, but disturbs it by continuously rearranging the nesting material and by covering the bird's brood. Eventually, the bird deserts its nest and brood. The Redstart does not display any agonistic behaviour towards the bumblebee. Nests of other bird species are never invaded.

Résumé. Expulsion du Rouge-queue à front blanc (Aves : Turdidae : *Phoenicurus phoenicurus*) hors de son nid par le bourdon *Bombus niveatus vorticosus* (Hymenoptera : Apidae). Au cours d'une étude sur la nidification des oiseaux au sud-ouest de l'Anatolie, 125 nichoirs artificiels ont été installés à 3 m de hauteur dans les arbres. Ces nichoirs ont été occupés par plusieurs espèces d'oiseaux (*Phoenicurus phoenicurus*, *Parus major*, *Parus ater*, *Sitta krueperi*, *Certhia brachydactyla*). Sur 48 nids de rouge-queue, 19 (40 %) ont été envahis avec succès par le bourdon *Bombus niveatus vorticosus*. Cette invasion s'est déroulée à plusieurs stades : - pendant la construction du nid ; - pendant l'incubation ; - après l'éclosion. Une fois installé dans le nid du rouge-queue, le bourdon n'attaque pas directement l'oiseau mais il le dérange continuellement en réarrangeant les matériaux du nid pour recouvrir à la fois son propre couvain et celui de l'oiseau. L'oiseau finit par abandonner son nid et sa couvée. Le rouge-queue ne manifeste aucun comportement agressif envers le bourdon. Les nids des autres espèces d'oiseaux observées ne sont jamais envahis.

Keywords: Common red-tail, bumblebee, nesting behaviour, inquilinism, invasion, usurpation.

It has been long known that bumblebees settle into abandoned or even occupied mammal's nests. This has been observed in many species, as *Bombus alpinus* (L.), *B. distinguendus* Morawitz, *B. gerstaeckeri* Morawitz, *B. hortorum* (L.), *B. lucorum* (L.), *B. mesomelas* Gerstaecker, *B. mucidus* Gerstaecker, *B. pascuorum* (Scopoli), *B. pomorum* (Panzer), *B. pratorum* (L.), *B. veteranus* (Fabricius), *B. wurflenii* Radoszkowski (Freygessner 1899; Sladen 1912; May 1937, 1938; den Boer & Vleugel 1949; Løken 1973; Hagen 1986–1994; Amiet 1996; Goulson 2003). Sladen (1912) describes a *Bombus ruderatus* (Fabricius) nest established in in an abandoned vole nest. Aichhorn (1976) notes that *Bombus mendax* Gerstaecker often nests in abandoned rodent's nests, probably of *Pitymys subterraneus* (de Sélys Longchamp). Less frequently, bumblebees have been observed establishing in abandoned squirrels (*Sciurus vulgaris* L.) nests: *Bombus muscorum* (L.) (Hoffer 1884) and *Bombus jonellus* (Kirby) (Sladen, 1912). In most cases, this reuse of abandoned rodent nests is, apparently, only an occasional phenomenon.

These invasions, however, may be usual in the life cycle of some bumblebee species. In the province of Belgorod (Russia), Grinfeld (1978) noticed that nests of *Bombus fragrans* (Pallas) were installed in empty Souslik nests (*Spermophilus citellus* (L); Sciuridae, which live in populous colonies). In Anatolia, *Bombus fragrans* is most often encountered in places where Sousliks are common (pers. obs.). In the Arctic, Lemming (*Lemmus* spp.) nests are frequently occupied by *Bombus polaris* Ross, and *B. hyperboreus* Schönherr (Richards 1973) and by *Bombus glacialis* Friese (Berezin 1990, 1994a, 1994b, 1995). Djegham *et al.* (1994) note that colony foundation and egg laying by *B. terrestris* (L.) are clearly facilitated by the odours of the Common Vole (*Microtus arvalis* (Pallas)).

The invasion of bird's nests by bumblebees is less well documented. Aichhorn (1976) notes that *Bombus*

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Table 1. Birds nesting in the nest boxes in Elmalı Sedir Araştırma Ormanı (ESAO).

Bird species	1999	2000
Common Redstart, *Phoenicurus phoenicurus* (L.)	15	19
Great Tit, *Parus major* (L.)	17	13
Coal Tit, *Parus ater* (L.)	4	3
Krüper's Nuthatch, *Sitta krueperi* Pelzeln	3	2
Short-toed Treecreeper, *Certhia brachydactyla* Brehm	7	5
Abandoned nests	18	20
Unused	58	55
Total	122	117

mendax, may occasionally occupy the nests of Snow Finches, *Montifringilla nivalis* (L.). Most nests of *Bombus hypnorum* (L.) are located in tree holes, in abandoned bird's nests (Hasselrot 1960; Haas 1961, 1962, 1965). Wagner (1937) ascribes the secular expansion of this bumblebee species to the increasing habit of fixing man-made bird's nest boxes in gardens. *Bombus jonellus*, *B. pratorum*, *B. hortorum*, *B. distinguendus* and *B. pascuorum* may also occasionally settle in abandoned bird's nest, e.g. those of the great tit *Parus major* L. (Sladen 1912; Postner 1951; Løken 1973; Alford 1975; Hagen 1994).

Nesting behaviour of the subgenus *Sibiricobombus* is unknown, except for the note of Özbek (1983) signalling that *Bombus niveatus* Kriechbaumer often nests in holes in buildings.

The distribution of *Bombus niveatus* includes, from west to east: Albania, Montenegro, Serbia, Bulgaria, Greece, Crete, Cyprus, Rhodes, Crimea, Turkey, Lebanon, Syria, Georgia, Armenia, Dagestan, Iran and Turkmenistan (Rasmont *et al.* 2005). Its altitudinal distribution is wide: from the sea level in Greece up to 3000 m in N. Iran (Reinig 1972; Baker 1996; Rasmont *et al*. 2005). *Bombus niveatus* Kriechbaumer ssp. *vorticosus* Gerstaecker is particularly common in the oro-Mediterranean stage, with coniferous forests (*Pinus* spp., *Cedrus libani*, *Juniperus* spp.) and woody milk-vetch (*Astragalus* spp.) steppes. The present paper gives a first indication on the nesting behaviour of this bumblebee.

Table 2. Numbers of successful invasions of the nests of *Phoenicurus phoenicurus* by *Bombus niveatus vorticosus*.

	1999	2000
Total number of Redstarts nests	23	25
Successfull Redstarts nests	13	16
Redstart nests invaded by *Bombus niveatus*		
During nest preparation	7	6
During clutch incubation	1	0
During hatching	2	3
Total number of invaded nests	10 (43%)	9 (36%)

Material and methods

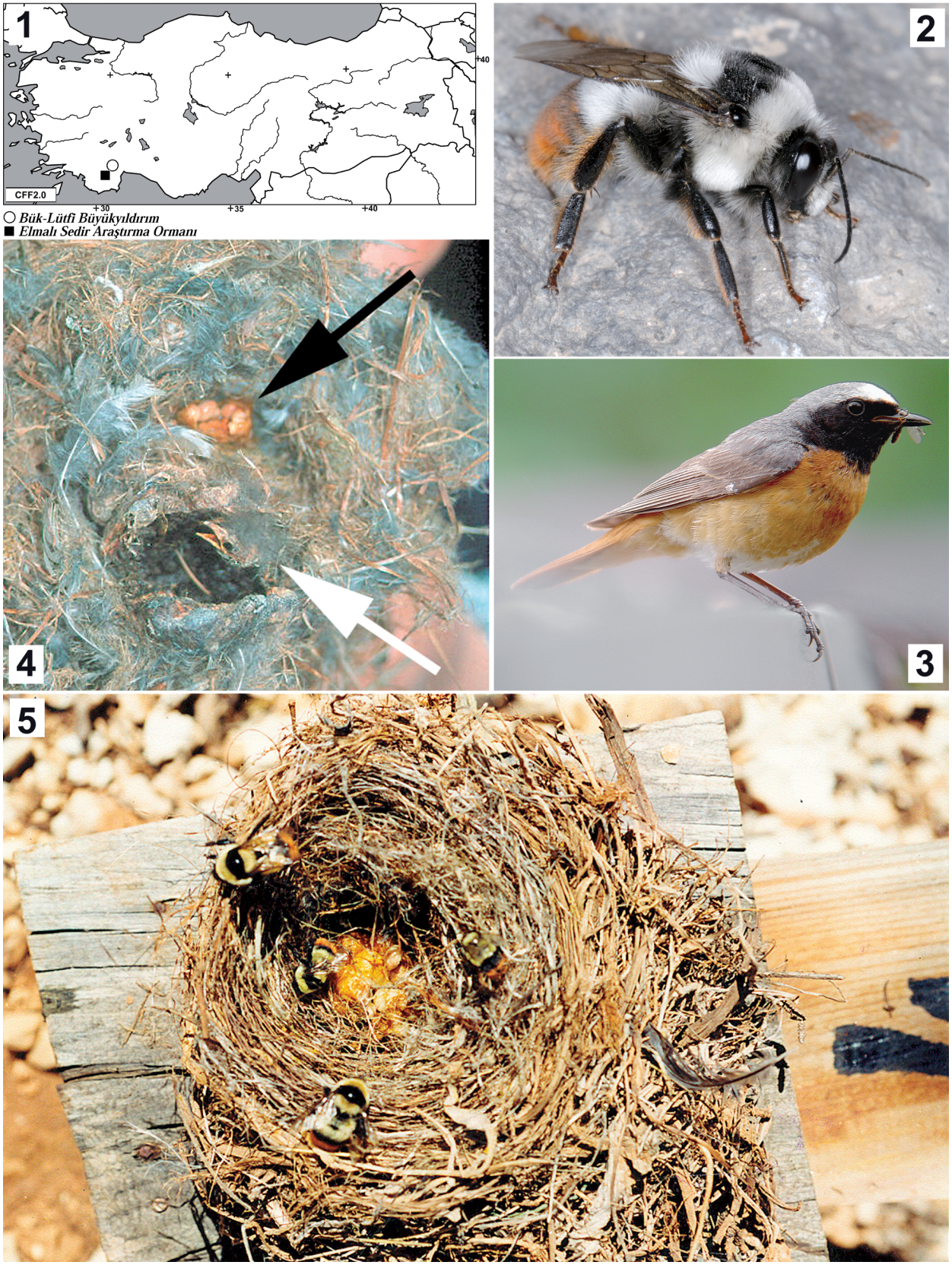
One of the authors (M.S. Kaçar) was involved in a survey of the Common Redstart (*Phoenicurus phoenicurus* L., Aves: Turdidae), specially regarding its breeding and feeding behaviour. This study was carried out in two research forests under the administration of Forest Research Institute based in Antalya-Turkey (SW-Turkey) during the years 1998-2000. The research forests were the Bük-Lütfi Büyükyıldırım (BLBY) and Elmalı Sedir Araştırma Ormanı (ESAO) (Elmalı Sedir Research Forest).

BLBY is located between the coordinates of 36°01'06" N and 30°23'15"-30°27'14" E, 35 km N of Antalya within boundaries of Korkuteli town, with a total area of 1822,7 ha. It is in the western vicinity of Termessos National Park and in the upper part of Mecene Canyon. Its altitude varies between 465 and 1264 m. It is a forest characterised by *Pinus brutia* Ten. *Cedrus libani* A. Richard, *Pinus ponderosa* Douglas ex. Lawson, *Pinus pinea* L., *Juniperus excelsa* Bieb., *J. oxycedrus* L., *J. virginiana* L., *Cupressus arizonica* Greene, *Platanus orientalis* L. (Anonymous 1998) can also be observed in the area.

The Elmalı Sedir Research Forest is located [36°33'26"-36°36'18"N and 29°57'03"-30°04'13"E] 130 km SW of Antalya within the boundaries of Elmalı town (fig. 1). with a total area of 2616.9 ha. This forest rises from the shores of Lake Avlan (now dried), at 1030 m up to 2611 m on Gökyamaç Hill. Its flora includes *Juniperus excelsa*, *J. foetidissima* Willd., *J. oxycedrus*, *Acer monspessulanum* L., *A. hyrcanum* Fischer & Meyer, *Quercus cerris* L., *Q. infectoria* Olivier, *Q. coccifera* L., *Fraxinus ornus* L. (Çetik 1977).

Observations were made on 125 standard artificial pinewood (*Pinus brutia*) nest boxes. They were painted in various colours (25 yellow, 25 orange, 25 blue, 25 green and 25 non-painted). The boxes measured 14 × 20 × 22 cm and the entrance hole had a diameter of 3.5 cm. They were hung 2.80–3.50 m high on trees, beside rods or on riverbanks, humid areas and recreation grounds. The observations were made between the hours 06:00–12:00 and 14:00–18:00. In 1999, 3 boxes were lost (122 remaining) and in 2000 only 117 boxes were used.

Figure 1–5
1, location in Turkey of Bük-Lütfi Büyükyıldırım (BLBY) and Elmalı Sedir Araştırma Ormanı (ESAO); **2,** *Bombus niveatus* Kriechbaumer 1870, here, the male of the white banded ssp. *niveatus,* while the ssp. *vorticosus* Gerstaecker 1872 is gold-banded (photo P. Rasmont); **3,** the Common Redstart *Phoenicurus phoenicurus* (L.), a specimen from Finland (photo K. Korhonen)*;* **4,** a nest of the Common Redstart (*Phoenicurus phoenicurus*) succeedingly invaded by *Bombus niveatus vorticosus* (photo M.S. Kaçar). A hatch is nearly covered by the material disturbed by the bumblebees. The black arrow shows the bumblebee brood, the white arrow shows the abandoned Redstart hatch; **5,** a nest occupied by the Common Redstart (*Phoenicurus phoenicurus*) the year before and invaded now by *Bombus niveatus vorticosus*; the brood of the bumblebee is installed in the center of the bird's nest, here without cover (photo M.S. Kaçar).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Results and discussion

The Common Redstart, *Phoenicurus phoenicurus* (L.), is a summer migrant species in Turkey. It spends the winter in south Arabia and north Africa. The male comes first, starts nesting and waits for the females. For its nest, it uses a mixture of different materials such as soft parts of trees, hairs, feathers and moss.

In the nesting boxes of ESAO, in 1999, the Redstarts established 23 nests (of which 15 with brood); in 2000, 25 nests (19 with brood). Not all the nest boxes were used by this species: some others were used by other bird species, mostly tits, *Parus major* (L.) and *Parus ater* (L.) (Table 1).

These nests were continuously surveyed by one of us (MSK) throughout the whole season.

The invasion by *B. niveatus* occurred at two different periods: during the building of the nest or later, when it contained eggs or hatchlings. In ESAO, in 1999, 7 nests were invaded during the nesting period; in 2000, this number was 6. In BLBY, no invasions by bumblebees were observed but one nest was taken over by *Dolichovespula* sp. in 1999. During the brooding period, in ESAO, one nest (with eggs) and two nests (with hatchlings) were invaded in 1999 and three nests (with hatchlings) in 2000 were invaded by *B. niveatus*.

When the bumblebee queen invades a nest occupied by the Redstart, she continuously rearranges the nesting material covering so the bird's clutch or even the young birds (fig. 2).

We never observed any fight or agonistic behaviour, nor did we see an invading bumblebee being killed by the Redstart. However, the bird seems to be considerably disturbed by the presence and the activity of the bumblebees. The disturbance generally culminated with the bird abandoning its nest after some time. Some birds left their nest, even with hatchlings, shortly after the installation of the bumblebees. We found several nests with the mummies or bones of starved young birds.

Bombus niveatus vorticosus also happened to occupy Redstart's nests abandoned by the birds the year before. In these cases, the bumblebee's brood was installed in the centre of the nesting box, while the bumblebee seems not to cover its nest with nesting material with the same obstinacy, laying it sometimes uncovered (fig. 3).

The only victims of this behaviour seem to be the Redstarts. We have never found a nest of Tits (*Parus* spp.), Nuthatch (*Sitta krueperi* Pelzeln) or Short-toed Treecreeper (*Certhia brachydactyla* Brehm) invaded by a bumblebee. We have, as yet, no knowledge as to how the bumblebee recognises a Redstart nest. We also ignore whether the bumblebee enters the nest when the bird is present, or only during its absence. We never observed any attempt of the Redstart to resist the *B. niveatus* queen invasion by fighting back.

Although the bumblebees often nest in abandoned rodent nests (see op.cit. in the introduction) this behaviour becomes usual, if not compulsory in a few species only. The association of *Bombus fragrans* with *Spermophilus citellus* (Grinfel'd 1978) is a good example of this. Most cases occur in the Arctic regions, where *B. polaris*, *B. hyperboreus* and *B. glacialis* nest readily in the Lemming (*Lemmus* spp.) nests, where they coexist with the mammal (Richards 1973; Berezin 1990, 1994a, 1994b, 1995).

The fact that the odours of Vole (*Microtus arvalis*) nesting material facilitate the nesting and egg laying of *Bombus terrestris* (Djegham *et al.* 1994) indicates that in some situations, the bumblebee's behaviour could be triggered by allomones. It could be a further step in a symbiotic interaction.

Up to now, only *Bombus hypnorum* has been found currently in bird's nests (Wagner 1937; Hasselrot 1960; Haas 1961, 1962, 1965; Hagen 1994). As opposed to what we report here, this bumblebee was not known to invade active bird's nest. However, R. De Jonghe (com. pers.) observed some very isolated cases where the invading *B. hypnorum* queen ousted a tit (*Parus* sp.). It could be suggested that the same stimulus, here the cavity, plays the same role for the bird and for the bumblebee, leading to a competitive use of this resource.

The case of *Bombus niveatus vorticosus* is a completely new one. The birds are swiftly ousted from their nest by the bumblebee. This seems to be due to the intense and lasting disturbance of the nest, without any manifest aggression, as far as we were able to observe. The most curious aspect of this is the apparent absence of reaction from the Redstart. This may explain why Redstarts are the only victims of this ousting behaviour. It is worth noticing that when *B. niveatus* settles in an abandoned Redstart's nest, it does not rearrange the nesting material in the same way. This suggests that the dogged rearranging could be an active, *ad hoc* technique to get rid of the bird.

Within social insects, inquilinism is a common phenomenon, and is also often called social parasitism. It is not sure if the present ousting behaviour can be related or not to the inquilinism concept. However, as a further research direction, we can hypothesise that the same behavioural process could be involved either when a bumblebee queen supersedes an existing bumblebees colony or when it invades a Redstart nest.

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