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**New sites in Poland and notes on the biology of socially parasitic ants
Formicoxenus nitidulus (NYL.) and *Harpagoxenus sublaevis* (NYL.)
(Hymenoptera, Formicidae)**

Abstract. The paper gives new sites of two ant species rarely recorded from Poland, namely *Formicoxenus nitidulus* (NYL.) in Mazovian Lowlands and Podlasie (in the Białowieska Forest) and *Harpagoxenus sublaevis* (NYL.) in Sandomierska Lowlands (in the Sandomierska Forest); occurrence of the latter in the Tatra Mts. is confirmed. Some notes on the biology of these social parasites are given.

Key words: ants, social parasites, xenobiosis, dulosis, *Formicoxenus nitidulus*, *Harpagoxenus sublaevis*, fauna of Poland

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Formicoxenus nitidulus (NYL.) and *Harpagoxenus sublaevis* (NYL.) [subfamily Myrmicinae, tribe Formicoxenini (formerly Leptothoracini, BOLTON 1994); see BUSCHINGER 1981] represent two of the four different forms of social parasitism in ants (BUSCHINGER 1986, 1990): xenobiosis and temporary parasitism with dulosis respectively.

***Formicoxenus nitidulus* (NYLANDER, 1846)**

F. nitidulus, the commonest of the ant species which practise xenobiosis, occurs almost throughout Europe (mainly in North and Central Europe; in the south it reaches Italy), in Siberia and the Caucasus. It co-exists with ants of the genus *Formica* L., mainly with wood ants, by entering into the «compound-nest» relation with them. This dependency is entirely of trophic character; guest ants beg host workers for regurgitated food or they take part in the

latter's food exchange (BUSCHINGER 1986). Colonies of *F. nitidulus* include up to about 150 adults and generally contain a number of intermorphic females; they are functionally monogynous (BUSCHINGER and WINTER 1976, SEIFERT 1996).

In Poland, *F. nitidulus* has been recorded from 50 dispersed sites on the Baltic Coast, in the Pomeranian Lake District, the Masurian Lake District, the Wielkopolsko-Kujawska Lowlands, Lower Silesia, Upper Silesia, the Lubelska Uplands, Roztocze, the Western Beskidy Mts, the Bieszczady Mts, and the Pieniny Mts (PISARSKI 1975, WIŚNIEWSKI 1987). The species probably occurs throughout the country but due to its cryptic mode of life it escapes detection during faunistic studies. By reporting the occurrence of *F. nitidulus* in two more geographical regions, namely in the Mazovian Lowlands and in Podlasie, this paper partly fills gaps in the knowledge of the distribution of the species in Poland (Fig. 1).

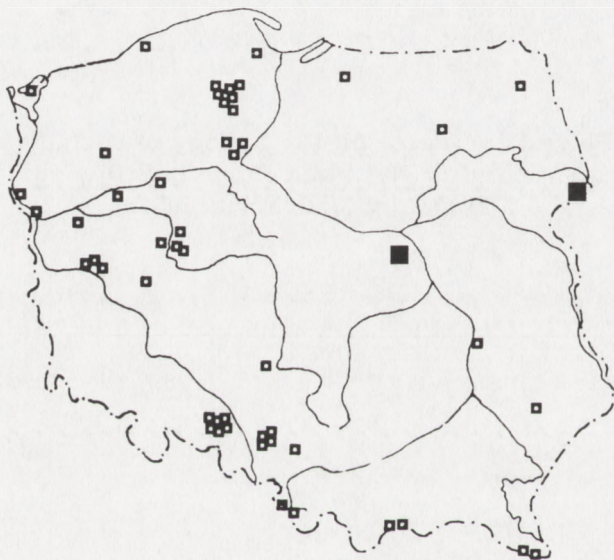


Fig. 1. Localities of *Formicoxenus nitidulus* (NYL.) in Poland (□ – literature data, ■ – new data).

In the course of a recent inspection of the myrmecological collection in the Museum and Institute of Zoology PAS in Warsaw several hitherto unknown sites of the occurrence of rare and (or) little-known species were revealed. For instance, a series of worker specimens of *F. nitidulus* from the Mazovian Lowlands, never mentioned in any paper, was found with a label reading: "Podkowa Leśna near Warsaw, 25.08.1963, leg. B. PISARSKI". The circumstances under which the ants were collected are unknown.

In Podlasie, *F. nitidulus* was discovered thanks to special research carried out in the Białowieska Forest in August 1998. The species was found in a mound of *Formica polyctena* FOERST. in the reserve Starzyna (forest inspectorate Hajnówka) – the mound was one of the eleven ant hills of the latter species from which nest material samples had been collected with a view to fin-

ding the xenobiont. Among the 21 *F. nitidulus* individuals obtained there were 13 true workers (ergatomorphs without ocelli), 5 intermorphs and 3 gynomorphs (leg. W. CZECHOWSKI).

In Poland, the reported host species for *F. nitidulus* have so far been the following: *Formica truncorum* F. (KOEHLER 1951, WIACKOWSKI 1957), *F. pratensis* RETZ. (NOVOTNY 1931, MINKIEWICZ 1935), *F. rufa* L. (NOVOTNY 1931, 1937, GRIEP 1940, KOEHLER 1951, PISARSKI 1953, URBAŃSKI 1956, PEŁAL 1961, WIŚNIEWSKI 1987) and the very *F. polyctena* (WIŚNIEWSKI 1967, 1987). All the above-mentioned species belong to the subgenus *Formica* s.str. PISARSKI (1975) vaguely mentioned *F. pressilabris* NYL. (subgenus *Coptoformica* MÜLL.) as a possible host species; maybe on the basis of his own unpublished data.

F. nitidulus is considered an obligatory social parasite, which nests exclusively within the host nest (HÖLDOBLER and WILSON 1990). Therefore STAWARSKI's report (in Polish) is very intriguing. STAWARSKI (1966) has recorded a free-living colony of this species consisting of about 100 individuals and nesting in the stump of a "newly felled pine tree" in a clearing at Szymiszów in Upper Silesia:

"[The nest] was hidden [...] in the thickest layers of bark just a few centimetres from the ground. [It consisted of] 4 rows of chambers contained in concentrically arranged layers of bark. In each row there were 4–6 chambers situated at two levels. Circular chambers, not more than 3–4 cm from one another, were connected with the chambers in the same row and with those in the adjoining ones. The outermost chambers opened on corridors leading to nest entrances, [...] hidden at protrusions of peeling bark. The nest [of about 40 cm²] was covered by a 2–3-cm layer of bark."

It is known that when a wood ant colony changes its nesting place, *F. nitidulus* ants move together with it, following the odour trail of the host ants (FOREL 1928, ELGERT and ROSENGREN 1977). What is more, it happens that *F. nitidulus* is first to let a host mound down when the environmental situation of wood ants becomes worse (DIETRICH 1997). Yet it is conceivable that in certain cases the parasite colony may lose contact with its host colony and, left to fend for itself, it may bivouac in the vicinity for some time (until it dies out?). It should be added here that removals of wood ants are frequent especially in new clearings; STAWARSKI's observation was made just in such a place. On the other hand, however, it follows from the above detailed (yet a little vague) description that the (alleged) independent nest of *F. nitidulus* was not a makeshift shelter but a permanent, well-made construction.

Thus this is a controversial matter. And even more so if *F. nitidulus* were in fact potentially capable of living independently, in such a case what need would there be for a special method of breeding it, in which artificially introduced "slave" *Leptothorax acervorum* (F.) workers were used as nurses (see BUSCHINGER 1976)? But what might *F. nitidulus* be mistaken for?...

***Harpagoxenus sublaevis* (NYLANDER, 1849)**

Harpagoxenus sublaevis is a North European species but it occurs sporadically in Central Europe too. As a social parasite practising slavery it co-exists with *Leptothorax* ants of the subgenus *Leptothorax* s.str.: *L. acervorum* (F.),

L. muscorum (NYL.) and (rarely) *L. gredleri* MAYR¹; the above species also fall victim of its temporary parasitism during colony founding (BUSCHINGER 1968, 1974, 1981, 1990, BUSCHINGER et al. 1980). Mature mixed colonies comprise from a few score to several hundred adults. It is a rule that slaves (not infrequently of two or even three species in one nest; SCHUMANN and BUSCHINGER 1991) greatly predominate; usually they constitute >80%, but sometimes >90%, of the entire society. Host species workers are not the only victims because *H. sublaevis* also enslave females which – deprived of their wings by the slavemakers – act as ordinary slaves in their colonies (BUSCHINGER 1966, BUSCHINGER and WINTER 1978, WINTER 1979).

H. sublaevis is a highly polymorphic species; among its females there are distinguished ergatomorphs (true workers and ergatoid queens, morphologically indistinguishable), apterogynes (originally wingless queens) and gynomorphs (originally alate queens) (BUSCHINGER and WINTER 1975, 1978). Its colonies are strictly monogynous (BUSCHINGER 1966, 1974).

In Poland, *H. sublaevis* is recorded from just a few sites in the southern part of the country: Upper Silesia, the Western Sudeten Mts, the Bieszczady Mts, and the Tatra Mts. (PISARSKI 1975). It has been found in mixed colonies with *L. acervorum* (NOVOTNY 1931, STAWARSKI 1961, PARAPURA and PISARSKI 1971) or with *L. muscorum* (NOVOTNY 1931). The present paper gives a second site of the species in the Tatra Mts. and reports its occurrence in yet another region of Poland, namely in the Sandomierska Lowlands (Fig. 2).



Fig. 2. Localities of *Harpagoxenus sublaevis* (NYL.) in Poland (□ – literature data, ■ – new data).

¹ These species at first were included into the subgenus *Mychothorax* RUZSKY, which have recently been synonymized with *Leptothorax* s.str. (BOLTON 1995).

During the inspection of the myrmecological collection in the Museum and Institute of Zoology PAS, a *H. sublaevis* ergatomorph specimen was found, and the label read: "Tatra Mts., Żar, 13.05.1953, leg. B. PISARSKI". In the Tatra, the species had earlier been recorded from Cyhrla Toporowa, on the basis of a single ergatomorph (ŁOMNICKI 1931).

In the Sandomierska Lowlands, *H. sublaevis* was recorded from the Sandomierska Forest on 25.07.1998 together with seven other ant species new to the region (CZECHOWSKA and CZECHOWSKI 1999). A *H. sublaevis* nest was in a small stump at the heath-covered foot of the dune belt Dąbrowskie Góry (forest district Lipie, forest inspectorate Buda Stalowska). The sample collected included the following: 1 ergatomorph, 1 apterogyne, 2 ergatomorph pupae and 1 larva of *H. sublaevis*; 49 workers, 15 dealated gynes, 6 worker pupae, 2 gyne pupae and 1 male pupa of *L. muscorum*; 11 workers and 1 dealated gyne of *L. acervorum* (leg. W. CZECHOWSKA). The entire mixed colony contained several hundred adult individuals. Its species composition (two host species) indicated that it had been established in a nest of *L. muscorum*. Slaves of this species are known to tolerate *L. acervorum* pupae brought by the slavemakers, but the reverse never happens (SCHUMANN and BUSCHINGER 1991).

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