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Lasius platythorax SEIFERT, 1991 as a host of several *Chthonolasius* species, with remarks on the colony foundation of the parasites (Hymenoptera: Formicidae)

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Abstract

Evidence indicating that *Lasius platythorax* SEIFERT, 1991 can act as a temporary host of several *Chthonolasius* species is presented. Observations on the socially parasitic colony foundation of several *Chthonolasius* species in typical *L. platythorax* habitats in the Netherlands, Belgium and Slovakia are discussed. Two possible colony foundation strategies to take over *L. platythorax*-colonies are put forward.

Key words: temporary social parasitism, host species, colony foundation, *Lasius platythorax*, *Chthonolasius*

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Introduction

Gynes of the subgenus *Chthonolasius* depend on an allospecific host colony, mostly from the subgenus *Lasius* s.str., for their own colony foundation (SEIFERT 1988). This parasitic relationship is in general not very species-specific: each parasitic species has one or more favoured hosts, i.e. the species occurring in the same habitats as the parasites. Life history data and observations on the colony foundation behaviour of *Chthonolasius* species are scarce, because the temporary mixed nests are only rarely observed. Especially the potential as a host species of recently described *Lasius* s.str. species, such as *Lasius paralienus* SEIFERT, 1992, *Lasius psammophilus* SEIFERT, 1992 and *Lasius platythorax* are poorly understood. According to STEINER & al. (2002) one of them, *L. platythorax*, a highly aggressive ant species, can, in spite of its aggressiveness, act as host species for the temporary social parasitic species *Lasius (Chthonolasius) distinguendus* (EMERY, 1916). One case of a mixed colony of both species in Austria has been described (STEINER & al. 2002). It is also argued that *L. distinguendus* has a low host specificity and that nests of *L. platythorax* are only rarely overtaken by social parasitic ants.

Recent results from pitfall-campaigns and direct observations of mixed colonies show that the "aggressive" *L. platythorax* can also act as a suitable host species for other *Chthonolasius* species. Hereafter we describe these observations and evaluate different possible strategies that socially parasitic *Lasius* gynes may use to invade *L. platythorax* colonies.

Material and methods

Besides the rather laborious nest-collections, which give direct observations of mixed colonies, also sampling with pitfalls can give important information on colony foundation of *Chthonolasius* species. Using pitfalls during a complete year cycle can be informative about the period of mating flights, year-round worker-activity and ecological preferences of several *Chthonolasius* species and their *Lasius* s.str. hosts (DEKONINCK & VANKERKHOVEN 2001). In Belgium and the Netherlands, pitfall trapping is nowadays frequently used to make inventories of the ant fauna of particular areas and regions.

From 1993 to 2003 many projects were devoted to the inventory of the ant-fauna in Belgium (DEKONINCK & al. 2003) and the Netherlands (BOER & al. 2003). Several mixed *Lasius* s.str.-*Chthonolasius* nests were observed (LEHOUCK & al. 2004) and many *Chthonolasius* gynes were collected with pitfall sampling. All species were morphometrically investigated and identified using SEIFERT (1988) and (1996). Specimens (at least one of each species involved) were inspected by Bernhard Seifert and one gyne is deposited in the collection at the Staatliches Museum für Naturkunde Görlitz. All other voucher specimens are deposited in the personal collections of the first two authors.

Results and discussion

Lasius platythorax as a temporary host of *Chthonolasius*-species

In Belgium and the Netherlands, *L. platythorax* is a common ant-species in woodlands, dunes, moist grasslands, humid heaths, bogs and fens where its nests are mostly constructed in dead wood, turf and humus (BOER 1999, DEKONINCK & VANKERKHOVEN 2001, DEKONINCK & al. 2003). Three mixed nests of *Lasius* (*Chthonolasius*) *umbratus* (NYLANDER, 1846) and *L. platythorax* were found in the Netherlands and one in Slovakia (Tab. 1), giving direct evidence that *L. platythorax* can act as a host for *L. umbratus*. On 12 July 1999, we additionally observed three *L. umbratus* gynes with dying *L. platythorax* workers between their mandibles, ready to try to enter a suitable host nest, in the coastal sand dunes of Bergen, The Netherlands. These observations show that *L. platythorax* nests in Europe can be entered and taken over by at least two *Chthonolasius* species: *L. distinguendus* (see STEINER & al. 2002) and *L. umbratus*.

Moreover, in the Netherlands and Belgium we often found nests of *L. umbratus* in habitats where *L. platythorax* is the only potential suitable host species. These records indicate that *L. umbratus* must have used *L. platythorax* during colony foundation, i.e. that mixed nests must have existed during the temporary parasitic period of its life cycle. Also numerous pitfall-catches of *L. umbratus* gynes in typical *L. platythorax* habitats suggest this host possibility (Tab. 2). Probably the gynes were foraging in these sites looking for a suitable host nest to settle. In Table 2 we present the species composition of *Chthonolasius* gynes versus *Lasius* s.str. species in different habitats in Belgium and the Netherlands as revealed by pitfall captures.

There are hints that *L. platythorax* can also act as a temporary host of *Lasius* (*Chthonolasius*) *sabularum* (BONDROIT, 1918) (BOER in press). We found gynes of this latter species in *L. platythorax* habitats where other suitable host species were lacking (Tab. 2). Also gynes of *Lasius* (*Chthonolasius*) *meridionalis* (BONDROIT, 1918) were found in typical *L. platythorax*-sites but mostly these gynes also had the possibility to use their usual host species *L. psammophilus.* Although nest densities and pitfall trapping numbers can not provide 100 % reliable information on the host species, we believe these observations can allow assumptions on putative hosts.

How to penetrate an "aggressive" host nest?

The direct and indirect evidence given above of *Chthonolasius* species parasitizing the nest of *Lasius* s.str. species, raises the question of the mechanism that these parasites use to colonize the nest of their often quite aggressive host species. There seem to exist two different strategies.

The first strategy is based on chemical camouflage. Two parasites of *L. platythorax*, i.e. *L. umbratus* and *L. distinguendus*, have their nuptial flight in the same period of the year as their host, respectively June - September and July - September (SEIFERT 1996, DEKONINCK & al. 2003). We observed nuptial flights of *L. umbratus* and *L. platythorax* on the same day and winged gynes of both species are found in the same period of the year. Just before the nuptial flight, the workers of *L. platythorax* are aggressive to their own winged sexuals. They chase them away from the nest and at this moment the colony is vulnerable. While the workers focus on the exodus of their sexuals, the *L. umbratus* gynes may take their chance. It may happen especially during this hectic moment that the parasite gyne tries to enter the nest as follows. By clasping a – sometimes already dead – host worker between its mandibles, the gyne becomes sprinkled by colony-odours and can enter the host colony as it is no longer recognised as a stranger. Similar observations of *L. meridionalis* gynes taking *L. psammophilus* workers between the mandibles and entering the *L. psammophilus* nest are often made in the Dutch and Belgian dunes. Perhaps also *L. distinguendus* penetrates the nest of *L. platythorax* in the same way. So, *Chthonolasius* species that have flights during or just before the nuptial flight of *L. platythorax* probably use this entering behaviour, which we can call the "chemical camouflage strategy" (a slip-in strategy). This entering strategy is not without risk. We observed that gynes of *L. umbratus* which tried to penetrate colonies of *L. niger* without nuptial flight activity were grasped by the workers. The next day we found *L. umbratus* as well as *L. meridionalis* gynes on the rubbish dumps of the *L. niger* nest, cut into pieces.

A second strategy is needed when the nuptial flights of parasite and host take place at different times of the year. The nuptial flight of *L. sabularum* is late, from the end of August till the middle of October (Belgium: DEKONINCK & al. 2003, the Netherlands: BOER in press). The chance that a parasite gyne can enter a *L. platythorax* nest using the "chemical camouflage strategy" is therefore much smaller, because the *L. platythorax* workers will most likely recognize and reject parasite gynes with host workers between their mandibles when they are not distracted by their own nuptial flight activities. Instead, we propose that parasite gynes exploit the fact that colony-activities and aggression of host-workers are decreasing with the falling temperatures late in the summer season. This "low temperature strategy" is known to be used by the close relative of *L. sabularum*, namely *Lasius* (*Chthonolasius*) *mixtus* (NYLANDER, 1846). After the late nup-

Tab. 1: Observations of mixed *L. platythorax* - *L. umbratus* colonies (NL = The Netherlands; SK = Slovakia).

Date	Locality	Country	Habitat	Nest locality
24.08.1999	Bloemendaal	NL	Coastal sand dunes	Trunk of *Quercus robur*
01.08.2001	Betlanovce	SK	Farm yard	Trunk of *Populus nigra*
15.09.2001	Lochem	NL	Heath and pine forest	Trunk of *Pinus nigra*
02.06.2002	Herckenbosch	NL	Forest	Trunk of *Quercus robur*

Tab. 2: Observations of *L. platythorax*-workers and gynes of *Chthonolasius*-species in the same pitfalls over a one year period, with the presence of other *Lasius* s.str. species (workers) (umbr = *L. umbratus*; meri = *L. meridionalis*; sabu = *L. sabularum*, and PLAT = *L. platythorax*; NIGE = *L. niger*; PSAM = *L. psammophilus*).

Number of gynes			Presence of host workers in % of total *Lasius* s.str.			Year	Location	Country	Habitat
umbr	meri	sabu	PLAT	NIGE	PSAM				
4	1	-	100	-	-	2002	Westhoek, De Panne	B	Dunes
1	1	-	100	-	-	2002	Dellebuursterheide-33 (Drenthe)	NL	Heath
-	1	-	100	-	-	2002	Dellebuursterheide-32 (Drenthe)	NL	Heath
6	-	-	100	-	-	2002	Westhoek, De Panne	B	Dunes
1	-	-	100	-	-	2002	Westhoek, De Panne	B	Dunes
1	-	-	100	-	-	1997	Grootbroek Bree, Kinrooi	B	Woodland
1	-	1	100	-	-	2003	Heitrakse Peel (Noord-Brabant)	NL	Moor
-	-	1	100	-	-	2003	De Haere (Gelderland)	NL	Heath
1	-	2	93.5	6.5	-	2000	Rodebos, St-Agatha-Rode	B	Woodland
7	-	-	92	-	8	2003	Caitwickerzand-13 (Gelderland)	NL	Heath
5	3	-	86	-	14	1999	duinen Bergen (Noord-Holland)	NL	Dunes
8	2	-	70	-	30	1999	duinen Bergen (Noord-Holland)	NL	Dunes
1	-	-	73	27	-	1997	Heiderbos, opglabbeek	B	Woodland
17	75	2	45	5	50	1987	Mechelse Heide, Maasmechelen	B	Heath
3	3	-	34	4	60	2003	Caitwickerzand-15 (Gelderland)	NL	Heath
2	7	-	24	0.5	75.5	2002	Westhoek, De Panne	B	Dunes

tial flight the mated gynes of *L. mixtus* hide in sheltered places and wait until the temperature drops. In these cold periods, when all other ants are inactive, these winter active gynes wander around until they encounter a suitable host colony (SEIFERT 1996). In Belgium, most of the *L. mixtus* gynes collected by pitfall sampling are recorded in the months March and April (DEKONINCK & al. 2003). We hypothesize that *L. sabularum* exploits the reduced activity of *L. platythorax* during the end of the autumn, and perhaps too in winter and early spring in the same way as *L. mixtus* does in winter and early spring. We have one record of a gyne of *L. sabularum* collected in the period 1 - 15 March 2003 in pitfalls in the Polygoonbos, a woodland dominated by *Pinus sylvestris*, in Ypres, Belgium (specimen in collection of B. Seifert in the Staatliches Museum für Naturkunde Görlitz).

We conclude that the success of colony foundation of the above mentioned *Chthonolasius* species seems to depend on avoiding aggression by the host workers, either by chemical camouflage when the *L. platythorax* host workers are distracted by their own nuptial flight activities, or by exploiting cold periods of low activity and aggression of host workers in autumn and winter.

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Zusammenfassung

Unsere Beobachtungen deuten darauf hin, dass *Lasius platythorax* SEIFERT, 1991 als temporärer Wirt von mehreren *Chthonolasius* Arten fungiert. Wir diskutieren die sozialparasitische Koloniegründung von einigen *Chthonolasius*-Arten in typischen Lebensräumen von *L. platythorax* in den Niederlanden, in Belgien und in der Slowakei. Zwei mögliche Strategien der Übernahme von *L. platythorax*-Kolonien durch *Chthonolasius* werden formuliert.

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