**Lasius**

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**Synonyms**

Donisthorpea (Morice and Durrant, 1915) and Tylolasius (Zhang, 1989) are junior synonyms, not in use anymore. The former genus *Acanthomyops* is now a subgenus included in *Lasius*.

Introduction

*Lasius* (Fabricius, 1804) is an ant genus (Family: Formicidae, Subfamily: Formicinae,Tribe: Lasiini) including 115 extant species, 1 extant subspecies, 22 fossil species and 1 fossil subspecies [1].

The genus name stems from the Greek λάσιος (lasios), meaning “hairy”. Morphologically, *Lasius* speciesare characterized by the following attributes. The antennae are made of 12 segments and are filiform or broaden gradually towards apex but do not form a well-differentiated club. The maxillary and labial palps have respectively six and four segments. Depending on the species, there are six to ten teeth on the masticatory margin and zero to one on the basal one. The mesotibia and metatibia have both one simple spur. Eyes are visible. Scrobes and sting are absent from this genus. The difference in size between workers and queens excepted, the caste-polymorphism is not very marked in *Lasius* species. [2]

If you live in North America or Europe, you are very likely to have already encountered ants from the genus Lasius, and on more than one occasion. Perhaps driven by this conspicuousness, species of the genus *Lasius* have been extensively studied since the 18th century, leading to a good knowledge of their taxonomy and biology. These studies relate to very different fields: from the evolution of social parasitism, to mutualistic relationships (with aphids and lepidopteran), to the invasion of the species *L. neglectus* in Europe, to soil ecology (*e.g.* Lasius flavus). Finally, *L. niger*, the type species of the genus, is used in various experiments aiming at understanding the mechanisms of aging.

Extensively studied for their trace pheromones [3].

Geographic distribution and habitat

From southeastern Alaska to southern Himalaya, and from northern Scandinavia to northern Africa, *Lasius* is a widespread genus in the northern hemisphere. Although the repartition area is limited to the Holarctic biogeographic realm, *Lasius* species face diverse habitat and climates: *e.g.* high altitude grasslands, woodlands, meadows, fields, sidewalks. *L. niger* is the most commonly found ant species in urban areas [4]. In more tropical climate, they limit their distribution to temperate vegetation at higher elevation [5].

Species from the *Lasius* genus are known to cope greatly with open habitats. For instance, *L. neoniger* is pervasive in golf greens where it builds little unpopular mounds [6]. From a less anthropocentric point of view, it must be acknowledged that ants benefit the soil ecology by modifying the composition, the texture and fostering infiltration [7]. Within the *Lasius* genus, *L. niger* and *L. flavus* are described as pioneer species, able to face unstable and disturbed habitat [8, 9]. By digging the anthill and carting food inside and outside, they modify carbon, nitrogen and phosphorus cycles [10, 11], as well as cadmium concentration [12]. ants: ecological roles

Nesting habits

Where to establish the colony?

Depending on the species, nests can be wood-based (*e.g. L. bruneus*, *L. fuliginosus)* or directly in the ground (*e.g. L. niger,* *L. neoniger*, *L. flavus*). While jet black ants (*L. fuliginosus*) and *L. spathepus* build an elaborate nest in old hollow trees with a mixture of saliva, chewed wood and honeydew [13], *L. neglectus* ants merely nest in the topsoil under leaf litter or stones [14]. Some colonies have even been found inside electrical devices [15].

Who will establish the colony?

The number of queens (also called gynes) varies between species. Almost all *Lasius* mature colonies have only one queen (strictly monogynous). Depending on the species, queens can be fertilized by one (monoandrous colony) or many (polyandrous colony) males. New queens store enough amounts of nutrients in their native colony to found an independent colony, rearing the first batch of workers alone the first few months. Nevertheless, in some of these monogynous species (*e.g.*, *L. emarginatus*, *L. niger*, *L. pallitarsis*), foundress queens cooperate to build a common nest. After the first workers hatched, only one queen will remain, because either the workers kill the less fertile ones, or because the dominant queen expels or kills the other females. The colony, primarily polygynous, becomes then monogynous. This phenomenon, called pleometrosis, does not mandatorily occur in a species: only 25% of European *L. niger* colonies have a pleometrosis-based foundation, while the remaining 75% are strictly monogynous. Oligogynous and polygynous colonies have been observed only in few species: *L. spathepus*, *L. brunneus*, *L. flavus*, *L. turcicus, L. fuliginosus* and *L. sakagamii* (Janda et al. 2004). The occurrence of polyandry, polygyny and pleiometrosis in a species depend on the local conditions. [16] (And references therein)

How many nests?

Polydomy is a social structure where distinct nests regularly interchange workers and brood [17]. Polydomy is facultative in Lasius species and has been reported in *L. flavus* [18], *L. neoniger* [19, 20], *L. minutus* [21], *L. neglectus* [22] *and L. sakagamii* [23]. *Polydomous* colonies of *L. alienus* and *L. neoniger* occupy different nests in winter and during the active season, leading to a seasonal polydomy. Polygyny is associated with polydomy in *L. minutus*, *L. negecltus*, *L. sakagamii*, and with monogyny in the three other polydomous *Lasius* species. The social structure plasticity is perfectly illustrated in *L. flavus*, where, even within a 100m² area, colonies can differ by their number of queens and nests [18].

Social parasitism

Most of ant colonies are founded by one or several queens that take care of the eggs before the first workers emerge and take over the nursing task. However, in less than 2% of ant species [24], queens and/or workers are unable to provide care to the eggs and larvae. The colony must therefore find a host colony – from the same or other species. This relation is generally referred to as social parasitism. *Lasius* parasitic species display only a temporary social parasitism [16]. The parasite young queen is adopted and the host queen killed by the intruder or by her own workers. The host workers rear the brood of the new queen and are thus progressively replaced by workers of the parasite species. [25]

*L. umbratus* takes the social parasitism relation one step further. This species parasitizes other species of the same genus, *L. niger* or *L. alienus* [24, 26]. However, being a parasite does not prevent it from being parasitized by a third species of the *Lasius* genus, *L. fuliginosus* [13, 26]. By parasitizing a parasite, *L. fuliginosus* earns the name of hyper-parasite. However, *L. fuliginosus* is not an obligate parasite of *L. umbratus* and can for instance be found in *L. niger*’s nests.

A more complete list of parasitic species in *Lasius* and other genera, as well as an open discussion about the evolutionary origins of social parasitism in ants, are available in the review of Janda et al. [16] and in references therein.

**Caste pattern**

As stated above, there is a strong caste dimorphism between the queens and workers. However, workers are indistinguishable from each other. The division of labor is thus more age-based than morphology-based and a high behavioral plasticity is observed [27].

Mutualistic interactions

***With Aphids*** *(see ant-Hemiptera associations)*

Aphid farming is widespread among *Lasius* species*,* although this activity also occurs in other genera [28]. Ants feed on the honeydew excreted by Aphids, which provides a carbohydrate-rich solution [29]. However, the Aphids also benefit from the interaction (mutualism). By tending *Aphis fabae*, *L. niger* ants prevent the Aphids from predation, increase their excretion and reproductive rates, modify the dispersal pattern along the plant [30–33]. Workers of the ant *L. productus* [34] and *L. neoniger* [25] do not differentiate the Aphid’s egg from their own in the way they tend them, increasing substantially their survival. *L. niger* is able to discriminate Aphid species according to their cuticular hydrocarbons [35]. This recognition mechanism prevents useless efforts in rearing non-trophobiont Aphids.

With Lepidoptera

*Plebejus argus* lay their eggs in the neighboring of colonies of *L. niger* and *L. alienus*. Driven by pheromonal signaling, the ants bring the eggs inside the colony where they will be protected from extrinsic mortality. The ants benefit from this interaction by feeding on a solution comprised of saccharine and amino acids, produced by a gland on the larva’s back. At the imago’s emergence, the butterfly leaves the nest. [36, 37].

Ecological status

Endangered species

Only three species belonging to the *Lasius* genus are indexed in the IUCN red list among which two are listed under the former genus *Acanthomyops* instead of *Lasius*. *L. reginae*, *L.* (*Acanthomyops*) latipes. *L.* (*Acanthomyops*) *murphyi* are all the three classified as vulnerable. [38–40]

*L. balearicus* the sole endemic *Lasius* species from Mediterranean islands [41] has been recently described as a new species and, according to the authors, should be classified as endangered (EN) in the IUCN Red List because of climate change.

***Lasius neglectus: an invasive species***

Like other invasive species, *L. neglectus* is organized in a polygynous supercolony structure [42]. Within the interconnected nests of the supercolony, the population can reach and even exceed 35 500 individuals [14]. Their presence leads to exclude other ant species and decreases the species richness of Isopoda [43]. Furthermore, the countless Aphids that the supercolony needs to maintain to feed on results in damaging the trees [42]. This invasive species would come from Asia Minor and it is now widespread in Northern and Western Europe. Since it does not require warm temperatures to thrive, it can spread out into temperate areas with ease. [44] All this appoints *L. neglectus* as a potential issue in conservation ecology, like the Argentine ant, *Linepithema humile* [45].

A type species at the edge of aging research

Social insects emerge as a remarkable model to study aging, notably by their overall longevity and the difference in lifespan between the castes [46, 47].Two Lasius species stand out by their maximal lifespan recorded in the protected conditions of a laboratory [48]: L. flavus (22,5 years) and L. niger (28,5 years). The latter has been the subject of many recent studies trying to disentangle the effect of age and caste on the phenotype, either by using a global genomics approach [49] or by targeting specific mechanisms such as telomere length and telomerase activity [50], or oxidative damages [51]. L. niger is so far the only ant species where such questions have been asked so thoroughly. This final point and the previous ones emphasize the diversity of research conducted on Lasius species, from ecology to the molecular bases of aging.

 **Cross-references** (OPTIONAL)

Aging

Ant-hemiptera associations

Ants: ecological roles

Honeydew

Polydomy (polycaly)

Social parasitism

Super-colonies of ants

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 **Figures**

Pictures of *Lasius* nests, workers, parasites, aphids ?