

Research article

The first case of intranidal phragmosis in ants. The ergatoid queen of *Blepharidatta conops* (Formicidae, Myrmicinae) blocks the entrance of the brood chamber

Dedicated to Professor Ch. Noirot

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Summary. Mature nests of the Neotropical myrmicine ant *Blepharidatta conops* are short blind vertical cylinders, in general excavated directly in the ground. Nurse workers hold the larvae in their mandibles while resting along the nest's walls. When nests are visited or inhabited by myrmecophiles and/or predators, especially Histeridae beetles (adults and larvae), ant workers hide their brood in the nest's subsidiary chamber, the entrance of which is then blocked by the peculiar phragmotic disk of the single ergatoid queen in the colony. The extremely modified head and anterior slope of the pronotum of the queen, that jointly form the almost circular frontal disk, represent a new kind of cryptic phragmosis in ants; exceptional modifications of these structures, which are covered with intricate sculpture, enables the queen to behave as a living gate to the brood chamber, yielding entering nest-mates when tapped by them on the disk. Workers use fine grained debris to build a wall at the beginning of the brood's chamber, such that the entrance opening matches the diameter of the queen's frontal disk. Observations in several different Brazilian localities revealed that the queens' frontal disk bear unique locality-specific sculpturing patterns, possibly due to viscous population structures caused by the limited dispersal by virgin queens, whose wing buds never develop.

Key words: Phragmosis, ants, *Blepharidatta*, ergatoid queen, nest defence.

Introduction

The term phragmosis was coined by W.M. Wheeler (1927), to describe a cryptic defensive technique employed by insects that use specially modified body structures to block

nest entrances. Phragmotic-headed ants, for instance, prevent intruders from entering nests by blocking the entrances or by pushing them out of entrance galleries. Phragmosis has been described in several ants: *Camponotus* (subgenus *Colobopsis* and *Hypercolobopsis*), *Colobostruma*, *Crematogaster* (= *Colobocrema*), *Pheidole* (*P. lamia*), and *Oligomyrmex* (= *Crateropsis*) *elmenteitae* (Hölldobler and Wilson, 1990; and below).

Shield-like-headed soldiers and queens of the Neotropical myrmicine *Cephalotes* species of the *pallens* group appear to secrete a fibrous material from thousands of pores that resemble glandular openings, coating and eventually accumulating in a dense tangle of material over the head disk. This material is superficially similar to a mass of fungal filaments (mycelia), but does not have the branching pattern or internal structure indicative of a fungal origin (de Andrade and Baroni Urbani, 1999). In other ant genera, phragmotic structures develop through the accretion of environmental debris held by specialised hairs. These and other structural modifications related to phragmosis in ants have been discussed in detail by Wheeler and Hölldobler (1985).

Reversed phragmosis was described for the queen of *Pheidole embolopyx*, which has a peculiar posteriorly truncated gaster with a rear surface covered with unusual hook-shaped hairs (Brown, 1967). Furthermore, the queen's antennal scapes, anterior clypeal border, and frontal carinae are covered by gelatinous sheaths, varying in size and shape among individuals and on the same queen over time, and often absent altogether. Contrary to expectation, Wilson and Hölldobler (1985) show that *P. embolopyx* queens do not use the gaster to block nest entrances or otherwise to repel intruders directly, nor do the gelatinous structures seem to be especially attractive or repellent to the workers. Poldi (1963,

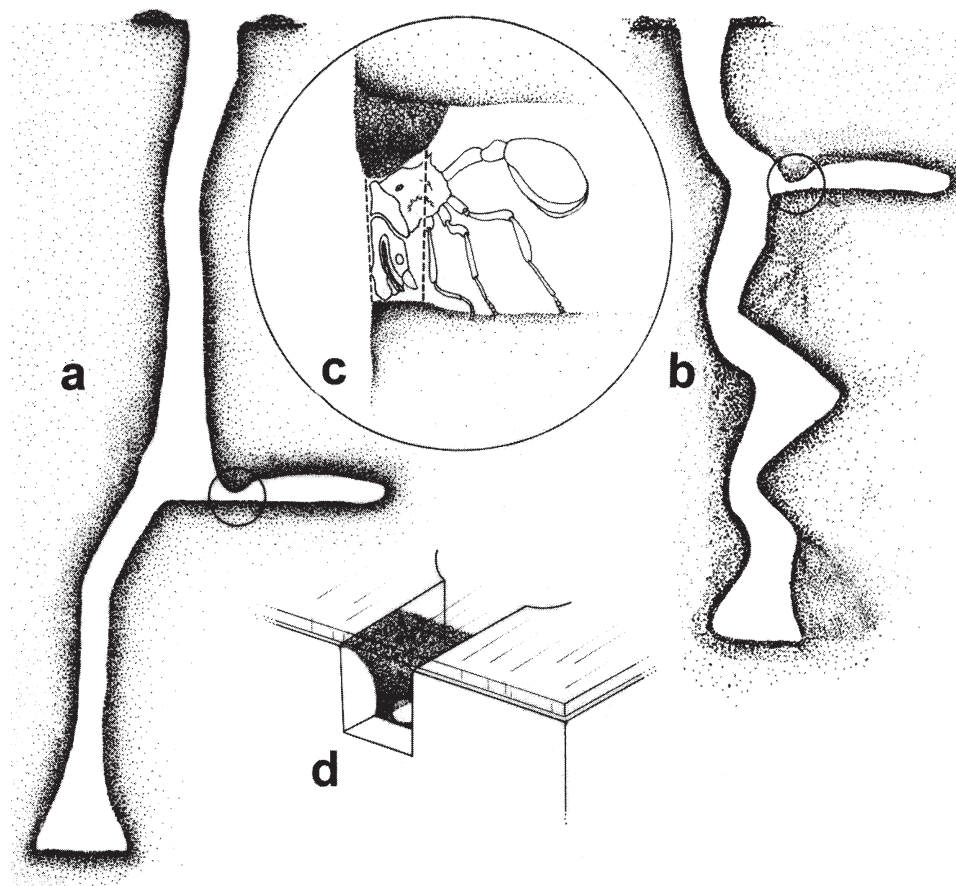


Figure 1. a Schematic drawing of *Blepharidatta conops* nest excavated in uniform clay soil in Selvíria, MS, Brazil. b Schematic drawing of *B. conops* nest excavated in rocky soil in Campinaçu, GO, Brazil. Circles indicate the opening of the subsidiary chamber detailed in Figs. 1c and 1d. c Schematic drawing showing an ergatoid queen of *B. conops*, in side view, blocking the entrance of the subsidiary chamber, encircled by the fine-grained carcasses wall. d Schematic drawing of a laboratory *B. conops* nest in oblique view, showing the fine-grained carcasses wall, and its circular opening at the base

apud Hölldobler and Wilson, 1990) described how the queen of the ponerine *Proceratium melinum* Roger plugs the nest entrance with her rounded first gastral segments.

The flat and very peculiar *Blepharidatta conops* ergatoid queens head disk and anterior slope of the pronotum (ergatoid's frontal disk, hereafter), suggested to us that these structures could serve a phragmotic purpose (Diniz, 1994). However, our previous observations (Diniz et al., 1998) have shown that *Blepharidatta conops* nest openings are far too large for ergatoids to effectively block against visitors; nest openings are in general circular with a diameter up to 2 cm diameter, while the diameter of the ergatoid's frontal disk is at most a little less than 2 mm.

Until recently, *Blepharidatta* ants have been considered extremely rare, and there are very few specimens in museums world-wide. In some localities in the Central Brazilian "Cerrado" domain (a savannah-like vegetation that was once much more widespread), however, we have found in the last few years that *B. conops* are indeed one of the most common ants in some localities, with most nests excavated directly in the ground. Notwithstanding such local abundance in some places, extensive areas covered by cerrados are devoid of *B. conops*, for reasons we will discuss below. The Amazonian *Blepharidatta brasiliensis* and an undescribed species from the wet forests of Bahia, eastern Brazil, nest between leaves over the leaf litter, sometimes occupying the space within

rolled leaves. Their queens are also ergatoids, but unlike *B. conops* they differ from conspecific workers only in size and do not possess modified frontal disks.

Diniz et al. (1998) observed *Blepharidatta conops* populations in Selvíria, MS, Brazil, and found only one wingless queen per colony. We consider these to be ergatoids because their wing buds never develop. *B. conops* workers forage outside the nest during daylight hours, avoiding the warmest period, although a few workers stay out of the nest all day long. Some 30–35% of the workers in each colony are foragers, searching for live arthropod prey and carcasses (mostly ants) in a circular area with an average radius of 1.5 m around the nest opening. *B. conops* nests are aggregated in dense populations with more than 30 nests recorded in an area of 144 m². Mature nests take the form of an almost vertical 20 cm deep channel, not much narrower than the 2 cm diameter opening, and ending blindly in a cone-shaped widening at the bottom. In mature nests, a subsidiary horizontal chamber opens at the midlength of this main channel, where the ergatoid queen and the brood remain most of the time (Figs. 1a and b).

Here we present evidence that queens block the entrance of the subsidiary chamber when potential predators of the ant larvae visit their nests. We further describe a structure the ants build out of fragments of arthropod carcasses at the entrance of the subsidiary chamber tunnel, and discuss the

geographical variation in sculpturing pattern of the frontal disks of queens from the different localities where we have found *B. conops* colonies.

Materials and methods

We studied the architecture of *Blepharidatta conops* 100 nests, recording also the number of workers and brood, the composition of the carcasses ring and the presence of myrmecophiles (including predators, commensals and facultative symbionts) in nests. The nests were found in four Brazilian states, respectively in the localities listed below: Campinaçu (Goiás): 13°52'S 48°23'W (1 nest); Chapada dos Guimarães (Mato Grosso): 15°26'S 55°45'W (3 nests) (Diniz, 1994); Gerais de Balsas (Maranhão): 08°33'S 46°43'W (5 nests); Selvíria (Mato Grosso do Sul): 20°22'S 51°25'W (26 nests) (Diniz et al. 1998); Serranópolis (Goiás): 18°18'S 51°08'W (14 nests); Três Lagoas (Mato Grosso do Sul): 20°48'S 51°43'W (1 nest) (Diniz et al., 1998).

Most of these colonies were transferred to the Museu de Zoologia laboratories in 3-cm-diameter glass tubes, 15 cm in length, with water separated from the main chamber at the base by a cotton plug. The whole tube, which was used for transport only, was wrapped in red cellophane paper.

For the laboratory observations we kept the colonies in glass-covered artificial gypsum nests, constructed to imitate as closely as possible the architecture most commonly found in the wild, except that the laboratory nests were kept in a horizontal position, while all excavated nests are approximately vertical. The artificial nests were set in white plastic trays, foraging arenas where we offered food; the lateral walls of the trays were painted with lubricating oil or Fluon, to prevent the workers to cross the vertical walls. The floor of the arenas were coated with soil taken from the original nest sites. Colonies were allowed to settle in the chambers in artificial nests, and fed daily with fresh remains of different ant species collected near or at the Museu de Zoologia.

In two gypsum nests, we observed that, at the end of the tunnel connecting the main cylindrical chamber to the subsidiary chamber, workers accumulated debris in a quantity significantly greater than in other areas of the nest. After a few weeks, we noticed that workers not only brought additional debris, but that they carefully organised the debris. The architecture of the artificial nests, unfortunately, prevented the study of this behaviour in detail. This accumulation of debris at the entrance of this tunnel is also evident in field nests, but the pieces are loosely compacted and excavating the nests destroys these structures. We installed a colony collected in Chapada dos Guimarães in one of the artificial nests, allowing enough time (seven weeks) for the workers to complete this structure. We then transferred the ants to a different artificial nest and cut the original gypsum nest into two pieces, along the nest's main longitudinal axis, to observe details of the debris structure as viewed from the vertical tunnel.

For the scanning electron microscope study using a Leo 440 machine, ergatoid queens from different localities were cleaned in acetone using a Thornton ultra-sound for 30 min, then coated with gold in a Balzer sputter-coater equipment for 90 s at 50 mA. To take measurements of the nearly circular queens' frontal disks (across the middle of the head) and the worker head widths, the individuals were mounted on stiff triangular paper points, as is routinely done for museum specimens, and the largest transverse diameters were measured under a stereo microscope using an ocular micrometer with 10 magnifications, or alternatively, measurements were taken from the electron micrograph scales. We also measured the largest diameters of the circular tunnel opening leading to the subsidiary chamber in the artificial nest prepared as described above.

Two individuals of the beetles (Histeridae: Hetaerinae) found inside *B. conops* nests in Selvíria are under study by Alexey K. Tishechkin at the Department of Entomology of Louisiana State University in Baton Rouge.

Results

B. conops nests contain on average 200 workers, immatures, and a single queen. The nest structure is quite simple, consisting mainly of a blind-ended cylindrical vertical tunnel up to 20 cm deep, excavated directly in the ground, although some nests occupy spaces under the bark of fallen tree trunks. Inside the main tunnel and, especially, in the bottom enlargement, we have found grass fragments or whole blades, seeds, spider and insects corpses. The insect fragments include Ensifera; Blattaria; Isoptera (soldiers and workers); Apicotermiteinae, Nasutitermitinae (*Syntermes* and *Velocitermes*), Termitinae (*Spinitermes*) and unidentified Termitidae; Heteroptera; Coleoptera; Diptera; Hymenoptera Apidae and Formicidae: Ecitoninae: *Labidus praedator*, fragments of Ponerinae: *Ectatomma planidens*, *E. tuberculatum*, *Ectatomma* sp., *Paraponera clavata*, and *Pachycondyla* sp., Pseudomyrmecinae: *Pseudomyrmex* sp., Myrmicinae: *Pheidole* ssp., *Acromyrmex landolti* and *Atta* sp., and Formicinae: *Camponotus* ssp.

We have never found carcasses or even fragments inside the subsidiary chamber, except during the short time when the carcasses are offered to the larvae; as soon as the larvae stop feeding, the carcasses are removed (Diniz et al., 1998). Sixteen out of 26 nests excavated in Selvíria housed myrmecophile visitors either in the bottom enlargement or along the nest walls, belonging to Isopoda (6 nests), Diplopoda (6 nests), pseudoscorpion (1 nest), Lepismatidae (2 nests), Japygidae (1 nest), and Diptera larva (1 nest), either alone or in combination. Five out of the fourteen nests dissected in Serranópolis housed myrmecophile visitors, also either in the bottom enlargement or along the nest walls. We did not record the visitors in the nests excavated in the other localities.

Diniz et al. (1998) described the nest development of *B. conops* in uniform soils. Mature nests (Fig. 1a) differ from incipient nests in that the entrances of older nests are completely surrounded by a "carcasses ring". Our recent observations in different localities have shown that nests that are constructed in non-uniform or rocky soils (Fig. 1b) differ from nests excavated in uniform soils in being more irregular in shape. Nests excavated in all kinds of soil are composed of a single cylindrical structure, the sum of all sections attaining also some 20 cm in depth, and, most importantly, all *B. conops* nests exhibit the same kind of architecture, containing a single subsidiary chamber linked to the main nest by a tunnel.

A comparative study of the composition of the carcasses rings in different localities confirms that they are composed of the same material found inside the bottom enlargement of the nests, that is, mostly large pieces of arthropod corpses, as can be seen in Fig. 1 of Diniz et al. (1998). These authors have also described the frequent emigration of colonies to new nests; on average each colony moves to a new nest every 4 months. Before moving, workers excavate several provisional new nests in the vicinity of the older nest; ultimately one of these is chosen, and the workers transport immatures and the queen to the new location.

As the nests mature, workers prepare or select fine-grained debris, mainly very small fragments of the arthropod car-

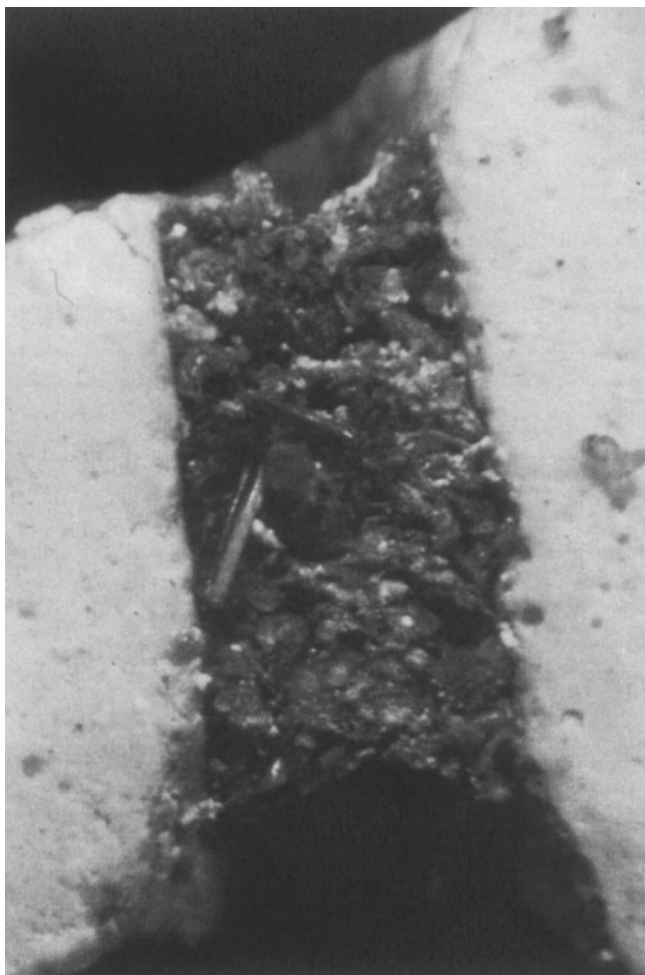


Figure 2. Cross-section of the subsidiary chamber opening of a *Blepharidatta conops* artificial gypsum nest, in which the workers have constructed a fine-grained carcass wall, viewed from above (see text for explanation and measurements)

casses (coxae, antennae, etc.), and construct from this a wall at the beginning of the tunnel (wider at its superior margin than at the bottom; see Fig. 1 d). At the bottom of this wall they leave a circular opening, small enough to accommodate exactly the queen's frontal disk (Fig. 1 c).

The structure and composition of the carcass wall is unrelated to soil type; the wall is always made from relatively small pieces of carcasses, much finer than the pieces composing the entrance ring or those found at the nest bottom enlargement. The position of this wall within the nests does not facilitate direct observation of ergatoid behaviour, but our indirect evidence suggests the ergatoid queen blocks the entrance to the chamber with her very much-modified frontal disk.

After construction of the carcass walls in both laboratory nests, the queens were never seen outside the subsidiary chambers, while in nests where the walls were not constructed or were incomplete, ergatoid queens frequently visited the main tunnel. The queens in wall bearing nests were observed beneath the carcass walls for long periods, that is, they could not be seen at the subsidiary chamber; as said before, the artificial nest structure prevented direct observation in these instances. The shape and diameter of the wall passage matches the shape and diameter of the queen's frontal disk, as will be explained below. In Figs. 1 c and d we present our interpretation of the "carcass wall" structure and how the queens block the entrance of the chamber. Figure 2 shows the superior margin of the carcass wall taken from one of the laboratory nests, composed of very small carcasses pieces.

Figure 3 a presents an scanning electron micrograph of the frontal disk of a queen collected in Campinaçu in frontal view. Note that the anterior slope of the pronotum and head disk share the same sculpturing pattern. In Fig. 3 b, we present a scanning electron micrograph of the anterior end of a queen collected in Selvíria, in side view, showing the compound eyes (not visible in the frontal view), the extreme

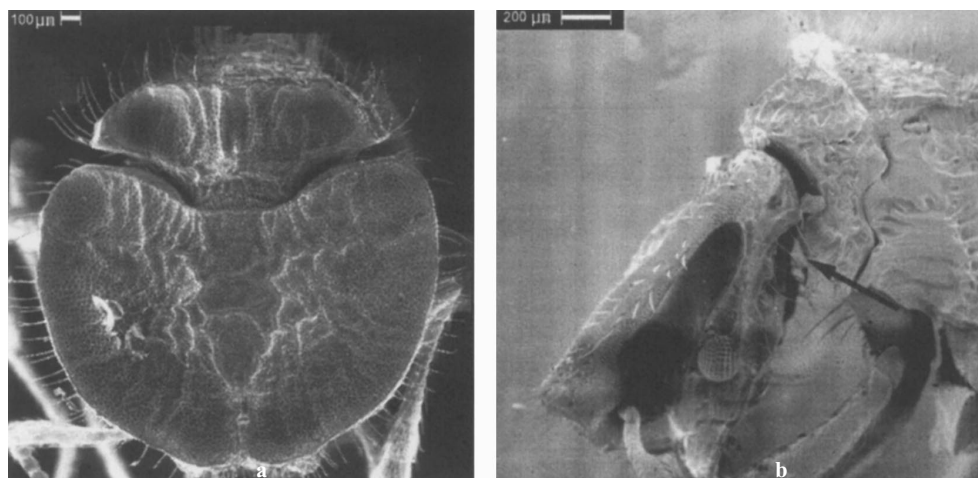


Figure 3. a Scanning electron micrograph of the *Blepharidatta conops* ergatoid queen frontal disk, in frontal view, showing the extreme modifications in shape and form of the head and anterior slope of the pronotum, both of which share the same sculpturing pattern. Note also the stiff barbed hairs, protruding laterally and regularly from the continuous edges of the head and pronotum dorsum. b Scanning electron micrograph of the *Blepharidatta conops* ergatoid frontal end, in side view, showing the deep antennal scrobe, the compound eyes not visible in frontal view, and the lock and key structure of the head ventral face and pronotum (see arrow), that helps keeping the head in place while blocking the entrance of the subsidiary chamber

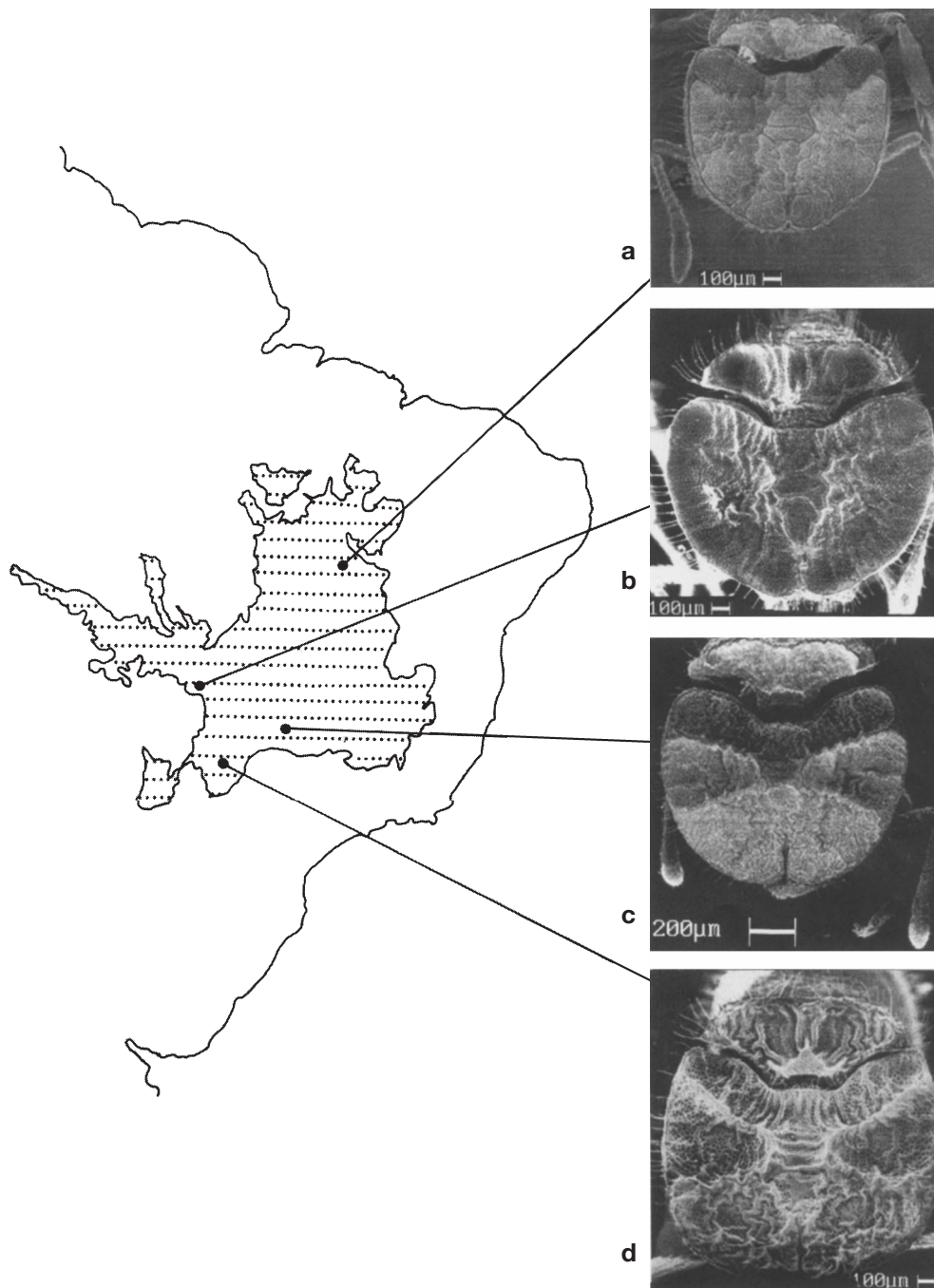


Figure 4. Scanning electron micrographs of four *Blepharidatta conops* ergatoids anterior ends, collected in four different localities within the Brazilian “cerrados” (see text for ex-planation), respectively, in a Balsas, MA; b Chapada dos Guimarães, MT; c Serranópolis, GO; and d Selvília, MS

enlargement of the frontal carinae over the antennal scrobe, and the shape of their head and pronotal margins (respectively anterior and posterior) that enables the head to lock against the pronotal anteroventral face. The similarly sized, regularly spaced, stiff hairs protruding laterally from the perimeter of the head and pronotum anterior slope may help the queens to keep the anterior end in position while blocking the entrance of the tunnel.

In the second artificial nest where we observed the construction of a wall, the workers dismantled the wall three months after starting the construction, before we were able

to measure the passage or open the nest to study the wall's structure.

The queens from different localities have the frontal disks largest diameter in average, respectively (in mm): for Serranópolis 1.55, sd = 0.03 (N = 12; range = 1.47–1.57); for Balsas 1.20, sd = 0.06 (N = 5; range = 1.107–1.24); for Selvília 1.45 (N = 1); and for Chapada dos Guimarães 1.51 (N = 1). Worker head widths from the same colonies are, in average, respectively: for Serranópolis 0.87, sd = 0.04 (N = 5; range = 0.80–0.91); for Balsas 0.75, sd = 0.05 (N = 5; range = 0.70–0.80); and for Selvília 0.78 (N = 1, holotype;

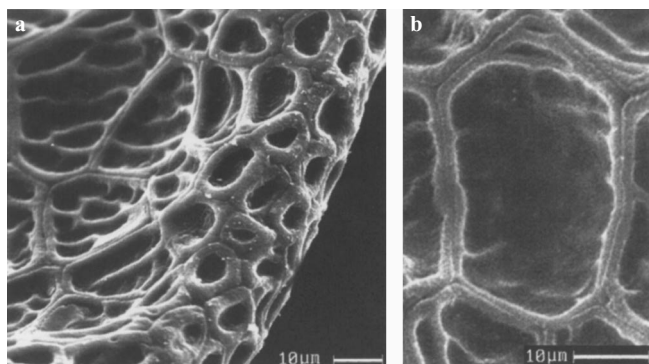


Figure 5. a Scanning electron micrographs of a detail of the *Blepharidatta conops* ergatoid left margin of the head disk, collected at Selvíria, MS (detail of Fig. 4d). b Scanning electron micrographs of a detail of the *Blepharidatta conops* ergatoid head disk, collected at Chapada dos Guimarães, MT (detail of Fig. 4b)

see Diniz, 1994). The maximum diameter of the tunnel opening in the artificial nest where the workers completed the wall is 1.2 mm ($N = 1$).

Queens from different localities differ not only in size, but also in the sculpture of the frontal disk, although in a given population the ergatoids are very similar to one another. Workers and males from the different localities do not differ so dramatically. In Fig. 4 we present scanning electron micrographs of ergatoid queens frontal disks from four different localities.

The sculpture of the frontal disks (Fig. 5a) is composed of polygonal units (Fig. 5b), uniform in size and shape in the specimens depicted in Figs. 4a and b, but more compact in certain areas of the specimens in Figs. 4c and d. For instance, the sculpture at the head margins and in the ridges of the specimen in Fig. 4d is quite different than that in uniformly sculptured specimens.

Nests release males from August to February (Diniz, unpub. field observations), although in laboratory colonies males are produced year round. On one occasion we found a dealate male inside the main tunnel of a field nest – a syndrome often associated with nomadic ant species (Hölldobler and Wilson, 1990). In the laboratory, males actively search for nests, and, when close enough, are brought inside by groups of workers. We have never observed more than one male in a nest at a time. Inside the nest the male is groomed by workers and meets the virgin queen near the nest entrance, where copulation takes place.

Nests often house one or more myrmecophiles. In five out of 26 nests excavated in Selvíria we found larvae and adult Histeridae beetles either in the bottom enlargement or along the nest walls; in addition to histerids, two of the nests also contained pseudoscorpions and diplopods (Diniz, 1994).

B. conops larvae are held in the mandibles of the workers positioned along the nest wall or laid on the floor of the subsidiary chamber, but are never found in the widened bottom chamber. *B. conops* workers feed their larvae by trophallaxis, after chewing the corpses or fragments of the arthropod prey and some vegetal material. Diniz (1994)

observed histerid beetles taking full grown larvae from workers' mandibles. The recovery of larvae by the workers is made impossible by the beetles' behaviour; after "stealing" a larva, a beetle "crouches" over it, bending its legs under the carapace, and thus assuming the format of an almost perfect half sphere. The beetles' smooth integument prevents their removal from the nest by the ants.

Queens actively walk throughout the nests. However, in nests where we found myrmecophiles such as histerid beetles, the majority of the ants immatures were located in the subsidiary chamber. In the presence of predators, the queen uses her extremely modified anterior end to block the entrance of the tunnel wall that leads to the subsidiary chamber, preventing the predators from reaching the brood (Fig. 1b). The diameter of the opening in the wall is fitted to the ergatoid queen's frontal disk.

Discussion

We report a new kind of phragmosis in ants, in which *Blepharidatta conops* ergatoid queens from Central Brazil block the entrance of a subsidiary nest chamber against invading predators. Phragmosis has never been observed within nests before. Except for Poldi's (1963) observation of *Proceratium melinum*, this is also the first example of a reproductive female ant employing modified body structures for passive defence.

Phragmosis by *B. conops* ergatoid queens (Figs. 3 and 4) is achieved by the impressive growth of the frontal carinae, resulting in a flat heart-shaped structure, and by the extreme modification of the anterior slope of the pronotum, which completes the circular form of the frontal disk. In other phragmotic-headed ants only the head disk is circular and flattened. Moreover, the anterior slope of the *B. conops* pronotum shares with the head disk a singular sculpture pattern, not found on the rest of the pronotum.

Stiff, straight, barbed hairs arise around the perimeter of the disk formed by the head and pronotum. Much smaller curved hairs are sparsely distributed over the surface of the frontal disk. Neither hair type is, however, adequate to capture dirt as in other phragmotic ants. We suggest that the longer hairs encircling the flat anterior end of the ergatoids may serve a sensory function, communicating the frontal disk position relative to the entrance of the subsidiary chamber.

The shape of the head in relation to the anterior face of the pronotum certainly supports the hypothesis that the whole frontal disk structure is used to block the subsidiary chamber. In Fig. 3b we have indicated with an arrow, the region where the posterior margin of the head contacts the anterior margin of the pronotum, constituting a possible locking mechanism that serves to maintain the frontal disks in place.

Although it was not possible to directly observe the queen's behaviour when blocking the entrance of the tunnel, we did observe workers entering and leaving the chamber. The queen was never observed outside the subsidiary chamber after the completion of the entrance wall. We, therefore, hypothesise that the *B. conops* ergatoid queen forms a "living

door", remaining in place until a few taps from the antennae of an entering worker on the outside, or a signal from an ant ready to exit from the inside, causes the queen to step back and stand aside briefly, giving way to nestmates.

The construction of a fine-grained carcass wall at the entrance of the subsidiary chamber was observed only in two laboratory nests. In both nests, however, soil from the original sites was available to the workers, but the ants still resorted to using arthropod parts. Also, in several natural nests, we have observed a very fragile wall at the subsidiary chamber entrance, too delicate to be transported to the lab. The observation that the workers dismantle the carcass wall at the entrance to the subsidiary chamber may relate to the fact that *B. conops* colonies frequently move to new nests, as pointed out by Diniz et al. (1998). Interestingly, we have never observed the ants dismantling the carcass ring outside the nest opening.

The frontal disks of *B. conops* queens are covered by intricate sculpture. Using Harris' (1979) terminology, the sculpture of the margins and ridges of the queens' frontal disks can be described as cancellate (Fig. 5), while the polygonal units that cover the spaces between the ridges is better described as areolate-rugulose. The surface is covered by coeloconic sensillae, probably functioning to sense pressure. However, the cancellate cells of the frontal disks margins are also formed from closely packed polygons, much smaller in size, which assume a peculiar circular shape due to the packing effect. The same effect occurs at the ridges, that is, the ridges are composed of the same units, closely packed and smaller than in other areas of the frontal disk.

Queens from the same locality share the same frontal disk sculpture pattern and shape. The phragmotic frontal disks of queens from different populations of *B. conops*, however, vary in terms of sculpture pattern; some queens of some populations have rather flat heads (Figs. 4a and b), while others have strong ridges of closely packed sculptures (Figs. 4c and d), although the general pattern of sculpture remains constant across localities. In short, we were not able to find locality differences among ergatoids when the frontal disk sculpture was studied. No morphological differences were found among workers or males from different localities.

At first we thought these patterns might be correlated with different soil textures, but queens from nests excavated in irregular soils can have uniformly sculptured frontal disks, and vice versa. These extreme variations in shape and sculpturing pattern of queens may be instead related to a viscous population structure resulting from limited dispersal mode of ergatoid queens. Based on multiple lines of evidence, the scenario we imagine for the founding of new colonies is as follows: a virgin queen (in general one per colony at a time) visits the outer edge of the nest, attracting a winged males from a different colony, mates and returns to the parent nest. Alternatively, males can seek for nests, get inside, have their wings taken by the workers, and be kept by the workers to mate with the new queen as soon as she emerges from the pupa. Shortly after being mated the queen leaves the nest accompanied by a small group of workers that has already excavated a new nest, some meters away from the original

one, resulting in very dense populations, made up of closely related individuals. Individual populations are very far from each other. We were not able to determine how many colonies compose a population in *B. conops*, but our observations suggest this figure can reach hundreds if not thousands.

As mentioned above, *Blepharidatta* ants were considered extremely rare until recently; although our observations now indicate that this is the result of poor collecting. In fact in some localities they are one of the most common ants (Rosa da Silva and Brandão, 1999). All localities where we have found *B. conops* belong to the western part of the cerrados, that is, places that were seldom surveyed in the past, and that have been recently opened through the construction of roads or development of agricultural and/or hydroelectric plants. No *B. conops* specimens have ever been collected in the much more well surveyed eastern cerrados, suggesting this ant species belongs to the cerrado ant fauna segment under Amazonian influence.

Several genera of Histeridae have been recorded in ant's nests (see revision in Hölldobler and Wilson, 1990). Some Histeridae living with non-legionary ants are known to be detritus feeders in nest middens; others are predators of their hosts, or scavengers on prey captured by hosts, or both; some solicit regurgitated food from ant hosts. In the present case, we have observed larvae and adult Histeridae Hetaerinae preying on *B. conops* larvae, but never soliciting food from the ant workers. These beetles can thus be considered predators of *B. conops* larvae, and may have been, along with other predators, the driving force leading to the striking modifications in queen morphology, which set them apart from the queens of other *Blepharidatta* species and, indeed, from all other ant queens as well.

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