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Cooperative shield phragmosis by minor workers of *Zacryptocerus pusillus* (Hymenoptera; Formicidae; Cephalotini)

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ABSTRACT. *Cooperative shield phragmosis by minor workers of* Zacryptocerus pusillus *(Hymenoptera; Formicidae; Cephalotini).*- Minor workers of the Neotropical ant Zacryptocerus pusillus are able to close off their nest entrances by forming compound shields by the juxtaposition of their heads. This behaviour is compared with similar defence mechanisms of other cephalotine ants.

KEY WORDS. Neotropical ant, Cephalotini, *Zacryptocerus pusillus*, Defence, Behaviour

A range of ant species, such as *Colobopsis*, *Colobostruma*, a few *Camponotus* species, *Zacryptocerus* and *Cephalotes*, have plug-shaped or shield-shaped heads used to close off their nest entrances (Creighton and Gregg, 1954; Creighton and Nutting, 1965; Wilson, 1976; Hölldobler & Wilson, 1990). Also, a gaster phragmosis has been described in queens of *Pheidole embolopyx* (Brown, 1967), and in workers of *Proceratium melinum* (Poldi, 1963, in Hölldobler & Wilson, 1990).

Examples of group phragmosis, in which workers cooperate in defence, are scarce in the literature, with the exception of *Colobopsis truncatus* (Szabo-Patay, 1928, In Hölldobler and Wilson, 1990). In the Cephalotini tribe, four cases are reported. Santschi (1919) found a nest of *Cephalotes atratus* (L.) under attack by *Nomamyrmex esenbecki crassicornis* (Fr. Smith) in Venezuela. The orifice of the *C. atratus* nest had a diameter of about 10 mm, and was occluded by heads of a group of workers in close proximity. After enlarging the entrance of a nest of *Zacryptocerus maculatus* (Fr.Smith), Kempf (1952) observed the occlusion of a passage by four major workers standing "side-on-side". Creighton & Gregg (1954) reported the situation of two major workers of *Zacryptocerus texanus* (Santschi) back-to-back, closing large passages. Wilson (1976) described a defence mechanism of *Zacryptocerus varians* (Fr. Smith) where both castes participate, blocking an intruder and forming a plug to push it out of the nest.

A similar behaviour is described here in *Zacryptocerus pusillus* (Klug), in which the minor workers cooperate to form a defensive shield.

Observations of phragmosis were carried out on several polydomous adult colonies of *Z. pusillus* found in dried branches or logs at Fazenda Duas Barras, Japu District, Ilhéus, State of Bahia, Brazil, in March 1991. Phragmosis was observed at the natural opening of nests, and also when hollow branches enclosing the colonies were fractured.

In *Z. pusillus*, nest entrances are usually only large enough to permit the admission of minor

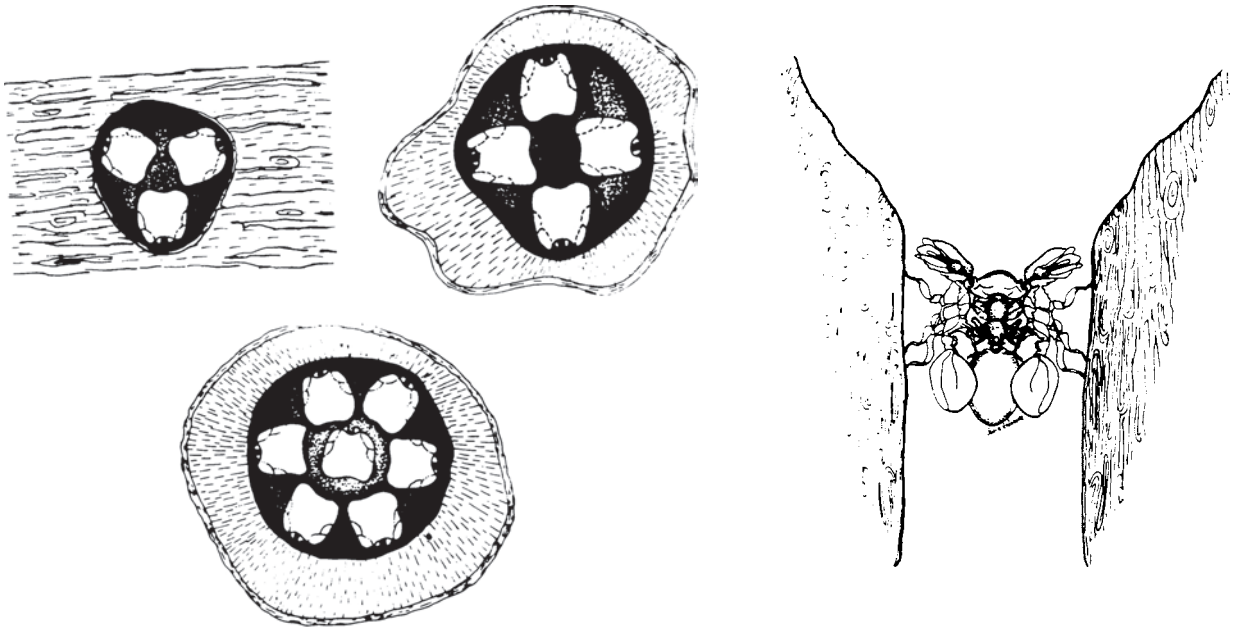

FIGURE 1. Some examples of group shields of *Zacryptocerus pusillus minor* workers: A. frontal view - B. position assumed by the workers in the burrow (center of a shield of 7 workers).

[Algunos ejemplos de escudos cooperativos de obreras minor de *Zacryptocerus pusillus*: A. -vista frontal - B. posición asumida por obreras en la entrada del hormiguero (centr o de un escudo de 7 obreras).]

workers and can be occluded by the heads of the major workers, as reported for various Cephalotini (Creighton & Gregg, 1954; Creighton & Nutting, 1965; Hölldobler & Wilson, 1990). However, some passages are too large to be occluded by a single major worker head. In these cases, and in the circumstances where the nest was abruptly opened, the formation of organized group shields by the heads of 2 to 7 workers was observed as presented in figure 1.

The number of minor workers participating in the formation of the shields depends on the diameter of the burrow. The same behaviour was observed for natural burrows as much when the nest was disturbed and opened. As in the case of *Z. texanus* major workers (Creighton & Gregg, 1954), the head of the ants forms an angle of approximately 120 degrees with the body axis. In the burrow, the area occluded by the ants was always the narrowest, sometimes located more than 1 cm below the entrance. In shield formed by two and four minor workers heads, it was observed that the ants organized them selves in pairs, back-to-back. In the case of the shield formed by seven minor worker heads, the last positionned worker was that of the center, and this one is also the first to quit the shield.

The observations of these group shields are rather ephemeral and last more or less 10 to 15 seconds, after which the ants generally withdraw in the nest. It is presumed that it is a defensive behaviour, originated by an alarm or aggregation pheromone, which may recruit the nearest minor workers and stimulates their shield-like organization. The occlusion of a narrow burrow by a major worker may last the same time or more, but afterwards, the major stay generally withdrawn near the nest entrance in vigilant waiting. The very short time of

maintenance of the shields by the minor workers suggests that this behaviour does not prevent *Z. pusillus* against possible predators. More probably, it may be directed to discourage other ant species, competitors for the nest site, which, with no special aggressivity for the first occupants, look quickly for unoccupied cavities in the wood in the aim of colonization (polydomous species) or fundation. It is probably the case of *Pseudomyrmex* and a number of other not dominant arboreal ants, even few other *Zacryptocerus*, which live in a similar niche to that of *Z. pusillus* and are extremely abundant in the areas where the observations were carried out.

Kempf (1952) argumented that the workers of *C. atratus* are able to form a compound shield with their heads because of their monomorphic characteristics (later refuted by Corn (1980)), and he suggested that the obstruction of a passage is not performed by minor workers in the higher Cephalotini because of the extreme prognathism of their head. Later, Wilson (1976) shown that both minor and major workers of *Z. varians* may have different and complementary attitudes. For example, numerous workers of both subcastes can form a compound plug to expulse an intruder. This behaviour has to be compared with that observed in *Z. pusillus*, except that, in this species, the major workers have apparently no function in the defensive aggregations. The apparent lack of major workers in the cooperative shields may be due to the low proportion of that workers in the colonies, if compared with the minor workers (more or less 1:20-50). Thus, the formation of cooperative shields by minor workers can also be understood as an adaptative mechanism to compensate the local unavailability of major workers.

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Resumen

Fraqmosis de escudos cooperativos de obreras minor de Zacryptocerus pusillus *(Hymenoptera; Formicidae; Cephalotini).*

Las obreras minor de la hormiga neotropical *Zacryptocerus pusillus* son capaces de cerrar las entradas de los hormigueros formando escudos compuestos por la yuxtaposición de sus cabezas. Este comportamiento es comparado con mecanismos de defensa similares de otras hormigas Cephalotini.

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