

## MATERNAL CARE IN THE NEOTROPICAL CENTIPEDE *OTOSTIGMUS SCABRICAUDA* (CHILOPODA: SCOLOPENDROMORPHA)<sup>1</sup>

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**ABSTRACT:** This paper provides the first field report of maternal care in a Neotropical centipede. Nine females of *Ostostigmus scabricauda* were found taking care of eggs or first instar nymphs at São Sebastião Island, southeastern Brazil. Brood-guarding females were found in the leaf litter or under fallen trunks. The mean clutch size was  $29.1 \pm 15.7$  and no egg was observed to be infected with fungi. The nymphs are non-pigmented and hatch with 21 segments. Egg-laying in *O. scabricauda* probably takes place in the beginning of the wet-warm season (October), and the reproductive season lasts until February. Predation pressure in the leaf litter and the high risk of infection due to fungi may have favored the evolution of maternal care in many arthropods living on the soil, such as centipedes.

Parental investment is defined as any behavior exhibited by a parent towards the progeny which increases its survival rate at the cost of the aptitude of the parent to invest in another progeny (Trivers, 1972). Among arthropods this may include investment by females in the choice of an appropriate site for oviposition, incubation, and egg-guarding, as well as the feeding of young by one or both parents (Clutton-Brock, 1991).

There are about 2500 described species of centipedes (order Chilopoda) in both temperate and tropical regions (Cloudsley-Thompson, 1958; Lewis, 1981). Centipedes usually live in damp and dark places such as under stones, fallen leaves, logs, under barks, or in crevices. The reproductive biology of centipedes is poorly known, but at least some species present some degree of parental care. Females in the suborders Scolopendromorpha and Geophilomorpha lay their eggs in clusters and guard the eggs from oviposition to hatching, then caring for the young until they disperse (Brunhuber, 1970).

While the female guards her offspring she is very sensitive to disturbance and commonly abandons the egg-batch which may be attacked by fungi or predators. Thus, females and their brood cannot be transported to the laboratory in order to observe their behavior and development (Brunhuber, 1970). Among the Scolopendromorpha, maternal care has been reported only for *Scolopendra cingulata* (Heymonds, 1901; Klingel, 1960), *S. dalmatica* (Heymonds, 1901), *S. amazonica* (Lewis, 1966), and *Cormocephalus anceps anceps* (Brunhuber, 1970), all from Asian and African regions. There is no record of maternal care in Neotropical centipedes.

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The genus *Otostigmus* (Scolopendridae: Otostigminae) has a global distribution, including the Americas, Africa, Oceania, India and Japan. Its representatives range from 4-12 cm in length and their tegument is colorful (Bücherl, 1939a). *Otostigmus scabricauda* H. & Saus., 1870 is common in Brazil, especially in the coastal forests. Observations on reproductive behavior from laboratory indicate that in this species females take care of their eggs and nymphs (Martins & Knysak, 1996). However this behavior has never been recorded in nature and this paper provides the first field account of maternal care for a Neotropical centipede.

#### MATERIAL AND METHODS

This study was conducted on São Sebastião Island (23°47' S; 45°24' W), southeastern coast of São Paulo State, Southeast Brazil. Approximately 80% of the island is area covered by Atlantic Forest (IBGE, 1983). The climate is warm and wet with maximum rainfall in December (2000 mm) and minimum in August (80 mm). Collections of centipedes were made between 100 and 900 m altitude during March and February 1997, and from December 1997 to January 1998 (wet and warm season). Individuals of *Otostigmus scabricauda* were found during a study of litter invertebrate diversity. A leaf litter area of about 5800 m<sup>2</sup> corresponding to 92 plots of 64m<sup>2</sup> was sampled. All centipedes found were collected and later preserved in 70% ethanol. During the collection I recorded the behavioral responses of the individuals to disturbance, such as attempts to escape, and the egg or nymph cannibalism. Voucher specimens are in the Museu de Zoologia da Universidade de São Paulo (MZUSP), São Paulo, Brazil.

#### RESULTS AND DISCUSSION

I found nine females of *Otostigmus scabricauda* with offspring: three of them cared for eggs and six cared for first instar nymphs. Female length ranged from 36.4 to 53.5 mm. Brood-guarding females were found in the leaf litter (n = 5) or under fallen trunks (n = 4). The female curls herself around the eggs or the young, laying on her side and enclosing the brood between her legs and the ventral surface of her body (Fig. 1). As recorded for other centipede species, the eggs and the young are thus safeguarded from contact with the soil (see Cornwell, 1934; Lawrence, 1947; Brunhuber, 1970). When disturbed during brooding, the females abandon their eggs or young (7 observations), or eat them (2 observations). Apparently, females caring for first instar nymphs abandon their offspring more frequently than females caring for eggs ( $\chi^2 = 5.5$ ; d.f. = 1;  $p > 0.05$ ). After the mother deserts, the nymphs generally flee, or burrow themselves in the soil.

The mean clutch size was 29.1 (S.D. = 15.7; range = 16 - 58; n = 9). The



Figure 1: Female of *Otostigmus scabricauda* curled around her early-hatched nymphs as found under a fallen trunk in nature.

eggs are oval, yellowish, and have a mean individual volume of  $48.5 \text{ mm}^3$  (SD =  $5.9 \text{ mm}^3$ ; range =  $40.6 - 56.8 \text{ mm}^3$ ;  $n = 10$ ) (Fig. 1). No egg was observed to be infected with fungi. The nymphs are non-pigmented and have a mean length of  $11.6 \text{ mm}$  (S.D. =  $1.1 \text{ mm}$ ; range =  $8.4 - 13.5 \text{ mm}$ ;  $n = 65$ ) (Fig. 1a). The nymphs hatch with 21 segments, and as in other scolo-pendromorphs (see Cloudsley-Thompson, 1958) the development is epimorphic (the young display the complete number of segments upon hatching). The embryonic phase of *Otostigmus scabricauda* under laboratory conditions ranged from 45 to 60 days and the nymphs remain with the mother for 15 -20 days before dispersal (Martins & Knysak, 1996). If the incubation time in the field is similar to that described in the laboratory, egg-laying in *O. scabricauda* probably takes place in the beginning of the wet-warm season (October), and the reproductive sea-

son lasts until February. The same pattern seems to occur in other scolopendrid species that reproduce during the rainy season (see Lewis, 1966).

Despite the large number of species of centipedes in the Neotropical region (see Bücherl, 1939b) the behavior and ecology of the group is still poorly known. The developmental stages of the Geophilomorpha (Palmén & Rantal, 1954) and Scolopendromorpha (Lawrence, 1947; Brunhuber, 1970) have already been described and in these groups maternal care is crucial for the survival of the eggs and young. The female grooms the eggs and juveniles; this apparently increases offspring survival, because without the mother the eggs and nymphs always die from fungal attack or unknown reasons (Brunhuber, 1970). In some cases a female can also move her egg batch to other microsites with better temperature and humidity conditions (see Brunhuber, 1970). Among arthropods, parental care is commonly associated with physically harsh or biologically dangerous habitats (Clutton-Brock, 1991; Zeh & Smith, 1985). Predation pressure in the leaf litter and the high risk of infection due to fungi may have favored the evolution of maternal care in many arthropods living on the soil, such as some beetles (Scott, 1990), earwigs (Wilson, 1971), crickets (West & Alexander, 1963), harvestmen (Goodnight & Goodnight, 1976; Mora, 1990), spiders (Horel & Gundermann, 1992), and probably centipedes.

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H. P. B.