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Short Communication

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Morphology of the Eggs of *Ornithocoris pallidus* (Hemiptera, Cimicidae, Haematosiphoninae)

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Abstract

Morphology of cimicid eggs are scarce, and this is the first record for the genus *Ornithocoris* Pinto, 1927 (Hemiptera: Cimicidae), using scanning electron microscopy (SEM). This genus comprises two species: *Ornithocoris toledoi* Pinto, 1927 (Hemiptera: Cimicidae) and *Ornithocoris pallidus* (Usinger, 1959). The eggs of *O. pallidus* are ellipsoid, and an evident 'lateral flattening', which may give clear asymmetry from the longitudinal axis. The exochorion of the body of the egg and operculum of *O. pallidus* present spherical or polygonal structures in relief, and pseudomicropyles on the border of the operculum, both differing from *Cimex lectularius*. The internal face of the operculum is smooth and the border also presented three layers. It was not possible to observe micropyles in the egg of *O. pallidus*. Bed bugs have a great psychological impact on people, and some people can develop a more or less severe allergic reaction against the bite. Successful control of bed bugs needs serious organization. Studies on egg morphology will add more information to assist in taxonomy studies of *O. pallidus* and can serve as a basis for control studies because eggs are resistant to insecticides.

Key words: Heteroptera, morphology, ectoparasite, swallow, nest

Diversity of exochorion patterns among insect eggs has been shown to have morphological, physiological, and taxonomic importance in different orders (Hinton 1981). The importance of egg structure in defining the status and relationships among heteropteran groups has long been recognized. In the Pentatomidae, patterns of egg morphology have been used to find characterization for phylogenetic studies (Matesco et al. 2012, 2014). Scanning electron microscopy (SEM) is used for morphology and morphometry of the egg exochorion for five species and two morphotypes of Mexican *Triatoma* Laporte, 1832 (Hemiptera: Reduviidae) showed differences in egg ornamentation for each one (Rivas et al. 2013). Barata (1981) also demonstrated species differentiation based on egg exochorion characteristics and established a dichotomous key to *Rhodnius* Stal, 1859 (Hemiptera: Reduviidae).

With regard to Cimicomorpha, eggs of the cimicids have been studied using optical and electron microscopy of *Cimex lectularius* (Linnaeus, 1758) (Hemiptera: Cimicidae) (Southwood 1956, Baker et al. 2013). Cimicids are mainly distributed in the Neotropical region and are temporary ectoparasites that remain on their hosts' nests or in the cracks or crevices of their hosts' shelters (Usinger 1966). The insects of the Cimicidae family constitute small but well-characterized group of heteropterans known by the generic name of 'bedbugs'. This group comprises exclusively hematophagous species, and some of them cause discomfort in the human environment. Its presence denotes miserable conditions and low social level, hence its importance in public health, since which greatly contribute to the deterioration of quality man's life (Forattini 1990). More importantly, they can accumulate in large numbers in human dwellings and cause severe dermatitis due to hypersensitivity reactions, mostly in the form of urticarial papules (Makara and Korossy 1976).

Haematosiphoninae comprises of nine genera; among them, it is *Ornithocoris* Pinto, 1927 (Hemiptera: Cimicidae) with two described species: *Ornithocoris toledoi* Pinto, 1927 (Hemiptera: Cimicidae) and *O. pallidus* (Usinger, 1959) (Di Iorio and Turienzo 2018). The present study describes the morphology of egg of *O. pallidus*. Data will provide support for taxonomy and systematics studies.

Materials and Methods

Ten eggs of *O. pallidus* were randomly selected from 10 swallows' nests removed of the loft of a farmhouse located in the community of Barros, a district in the municipality of Paula Cândido (20°50.492′S; 42°54.26′W), in the mesoregion of Zona da Mata Mineira, Viçosa,

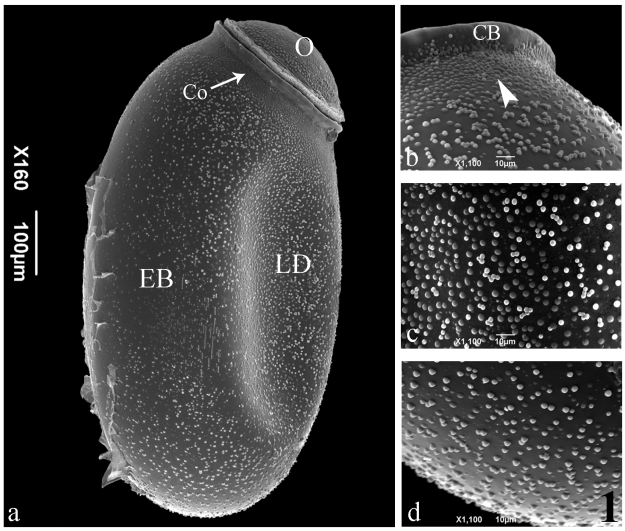

Fig. 1. Scanning electron micrographs of *Ornithocoris pallidus* egg. (a), general view of the exochorion of the body egg and operculum. (b), cephalic region, with polygonal structures more concentrated and flattened (arrowhead). (c), median region. (d), caudal region. CB, chorial border. Co, collar. EB, egg body. LD, lateral depression. O, operculum.

Minas Gerais, Brazil. Eggs were mounted on aluminum stubs with conductive tape, coated with gold, and observed under a scanning electron microscope (JEOL JSM-6390 80kV; Jeol Corp., Tokyo, Japan).

The analyses on the exochorion surface of the egg were done in three regions: cephalic, median, and caudal, each one corresponding to one-third of the total egg length, respectively (González et al. 2009).

Results

The eggs of *O. pallidus* are ellipsoid, with 0.75 mm long (range: 0.70 to 0.80 mm) and 0.38 mm wide (0.35 to 0.40 mm), and an evident 'lateral flattening', which may give clear asymmetry from the longitudinal axis (Fig. 1a).

The exochorion of the egg and operculum of *O. pallidus* is covered with polygonal structures, which are mostly rounded and in relief (Fig. 1a–d). The cephalic region of the exochorion had a smooth chorionic border, followed by a narrow region similar to a collar, a wideband corresponding to a concentration of flattened rounded structures (Fig. 1b) and a region with sparse spherical structures (Fig. 1b). In the median and caudal regions, the ornamentations are elevated, resembling small spheres adhering to the exochorion that are distributed sparsely (Fig. 1c and d).

Egg collar of *O. pallidus* has an internal border divided into three layers. The first is smooth and corresponded to the continuation of the external border; the second present an irregular palisaded region with a porous chorion; and the third has a columnar layout and a chorion with greater porosity (Fig. 2).

Operculum is circular and convex and covered externally with polygonal structures that are mostly rounded and in relief (Fig. 3a). The external border has three narrow layers that are subdivided by smaller areas filled with an amorphous mass of spongy appearance (Fig. 3b). Internal face of the operculum is smooth (Fig. 3c), and the border also has three layers: the external

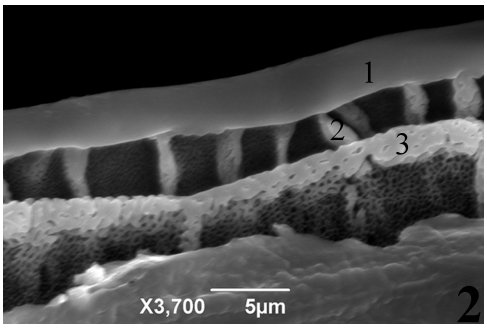

Fig. 2. Scanning electron micrograph of internal border of the collar egg of *Ornithocoris pallidus*, showing three layers. 1, smooth; 2, palisade; and 3, porous.

layer is wide and smooth; the median layer is narrow and subdivided irregularly; and the internal layer is an irregular palisade (Fig. 3d). It was not possible to observe micropyles in the egg of *O. pallidus*.

Discussion

Eggs of *O. pallidus* are ellipsoid and an evident 'lateral flattening' may give clear asymmetry from the longitudinal axis, common in other Heteroptera as Triatominae, Nemopteridae and Pentatomidae (Barata 1981, Hinton 1981, Candan et al. 2005, Matesco et al. 2014). This character, apparently constant in all hematophagous heteropteran eggs that stick to the substrate, is particularly accentuated among Cimicids. However, some species of *Rhodnius* have 'lateral flattening' evident, discreet or absent, which may, in each case, give sharp asymmetry (Barata 1981). This would be an important ecological peculiarity because, without this inclination of the egg, the opening of the operculum during hatching could be partial or totally obstructed by the fixing cement or by elements of the substrate (Barata 1981).

The exochorion of the body egg and operculum of *O. pallidus* is covered with polygonal structures, which are mostly rounded and in relief, different from the *C. lectularius* what has pointed structures delimiting polygonal areas (Baker et al. 2013).

The egg collar of *O. pallidus* presents an internal border divided into three layers, like in *C. lectularius* (Baker et al. 2013). However, they differ from layers in the *C. lectularius* eggs, which are large and all porous. This feature may contribute to a more efficient respiratory system, as observed in other Heteroptera (Haridass 1986, Wolf et al. 2002). Harpactorinae eggs have highly porous chorionic collar extensions, in this region enabling the passage of atmospheric oxygen to the interior of the eggs (Haridas 1986). The operculum aspect is similar to *C. lectularius* (Baker et al. 2013).

The characteristics that are used for subdividing the Heteroptera group into Pentatomomorpha and Cimicomorpha include micropylar processes and, respectively, pseudomicropyles and micropyles (Southwood 1956). It was not possible to observe micropyles in the egg of *O. pallidus*. In Cimicidae, absence of micropyles may be associated with the type of copula, because fertilization occurs before ovulation and formation of the chorion (Cragg 1920). Corroborating this result, studies using optical microscopy have only confirmed the presence of pseudomicropyles in *C. lectularius*, which is typical of the eggs of Cimicidae. However, did not mention this structure in an analysis using SEM (Baker et al. 2013).

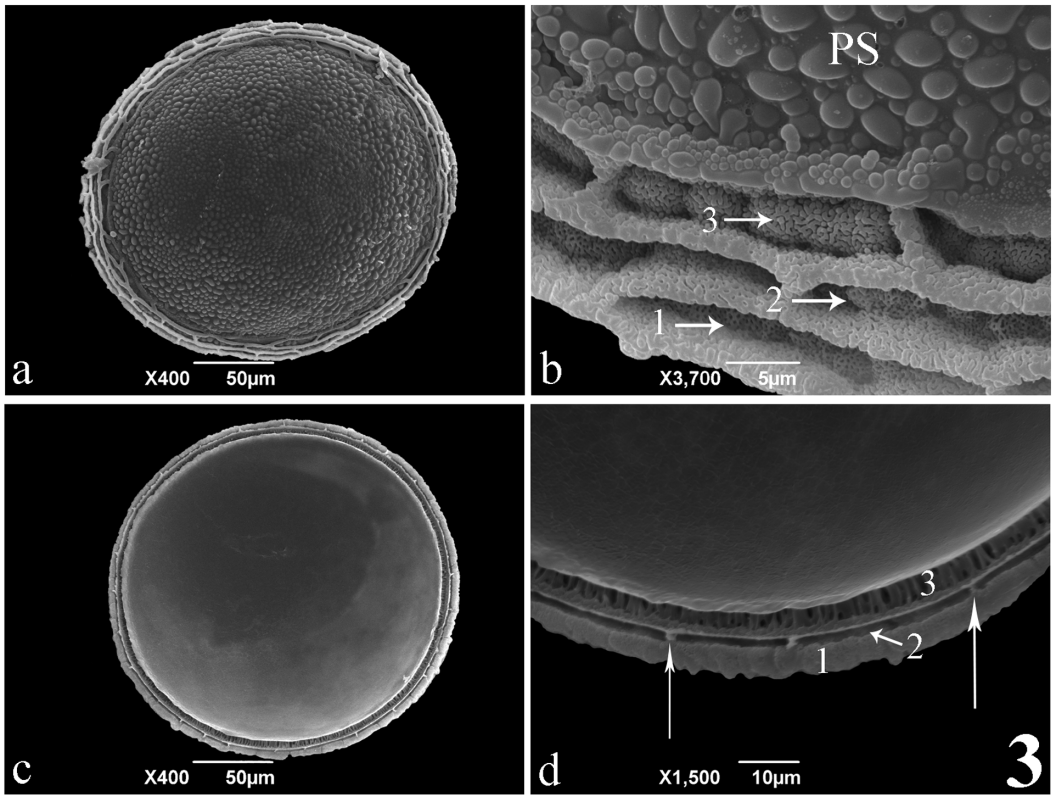

Fig. 3. Scanning electron micrograph of the operculum of *Ornithocoris pallidus* egg. (a) external view. (b) details of the external chorial border with three layers (1, 2, and 3). (c) internal view. (d) details of the internal border with three layers (1, 2, 3) (arrows show divisions of the layer 2). PS, polygonal structures.

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