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Color polymorphism in *Pachycoris torridus* (Hemiptera: Scutelleridae) and its taxonomic implications

Polimorfismo de color en *Pachycoris torridus* (Hemiptera: Scutelleridae) y sus implicaciones taxonómicas

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Pachycoris torridus (Scopoli, 1772) (Hemiptera: Scutelleridae) is widely distributed in Latin America and it is a serious pest to the plantations of *Jatropha curcas* Linnaeus in Brazil, damaging fruits and seeds (Rodrigues et al. 2011). This species exhibits twenty one different morphs (Monte 1937, Sánchez-Soto et al. 2004, Santos et al. 2004, Pikart et al. 2011), which were misidentified as eight different species (Costa-Lima 1940).

The high chromatic variation of *P. torridus* makes necessary to describe new phenotypes of this insect to assure its correct taxonomic identification. However, the source and function of the color variation of *P.* torridus are unknown. In this study, we describe six new chromatic patterns for *P. torridus* in Brazil, and provide a brief discussion about the taxonomic and ecological implications of such variation.

This study was carried out at the Universidade Federal de Viçosa (UFV) in Viçosa, Minas Gerais State, Brazil (20°46' S; 42°52' W) in November 2009. The Köppen climate classification of this subtropical region is of the Cwb (rainy summers, and cool and dry winters) with average temperatures of 22.4 °C in the summer and 18.3 °C in the winter, and a mean annual rainfall of 1221.4 mm. The area of this study includes agricultural crops used for research studies such as corn, cotton, sunflower, beans, wheat, and coffee, which are surrounded by a fragment of secondary forest with native species.

Adults of *P. torridus* were collected when feeding on *Jatropha curcas* Linnaeus (Euphorbiaceae) and transferred to the Laboratory of Biological Control of Insects of the UFV, where they were killed and mounted for identification. The identity of *P. torridus* was confirmed by comparing the individuals collected with material deposited at the Museu Regional de Entomologia (UFVB) of the UFV.

The color patterns of adults of *P. torridus* included six patterns not previously recorded (Monte 1937, Sánchez-Soto et al. 2004, Santos et al. 2004, Pikart et al. 2011). The most frequent color pattern of *P. torridus* was black body with

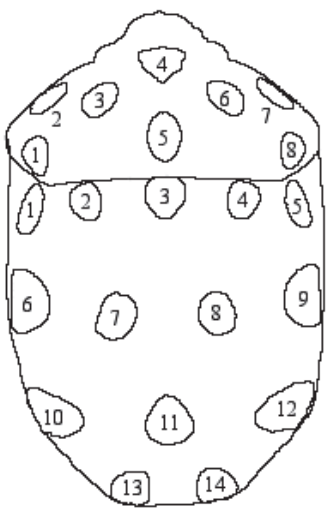

Fig. 1: Spot numbering system established to describe color patterns of *Pachycoris torridus* (Scopoli, 1772) (Hemiptera: Scutelleridae).

Sistema de numeración de manchas establecido para describir los patrones de color de *Pachycoris torridus* (Scopoli, 1772) (Hemiptera: Scutelleridae).

eight spots on the pronotum and fourteen on the scutellum either yellow or red, and with the ventral part of the body metallic green (Monte 1937).

The new color patterns were described following the spot numbering system (Fig. 1) suggested by Monte (1937):

Pattern 22: Black body with red spots. On the pronotum, spots one and eight joined, respectively, with spots three and seven. On the scutellum, spots seven and eight joined, and spots 10, 11 and 12 joined forming a continuous strip (Fig. 2A).

Pattern 23: Black body with yellow spots. On the scutellum, spots 10, 11 and 12 joined forming a continuous strip (Fig. 2B).

Pattern 24: Black body with orange spots. Spots seven and eight joined on the scutellum, and spots 10, 11 and 12 joined forming a continuous strip (Fig. 2C).

Pattern 25: Black body with yellow spots. Spots four and five very close together, but not joined on the pronotum. Spots six and nine joined, respectively, with spots seven and eight on the scutellum (Fig. 2D).

Pattern 26: Black body with yellow, orange or red spots. Spots six and nine joined, respectively, with spots seven and eight, and spots 10, 11 and 12 joined forming a continuous strip on the scutellum (Fig. 2E).

Pattern 27: Black body with yellow spots. Spots four and five joined on the pronotum. Spots two, three and four joined forming a continuous strip, and spots six and nine joined, respectively, with spots seven and eight on the scutellum (Fig. 2F).

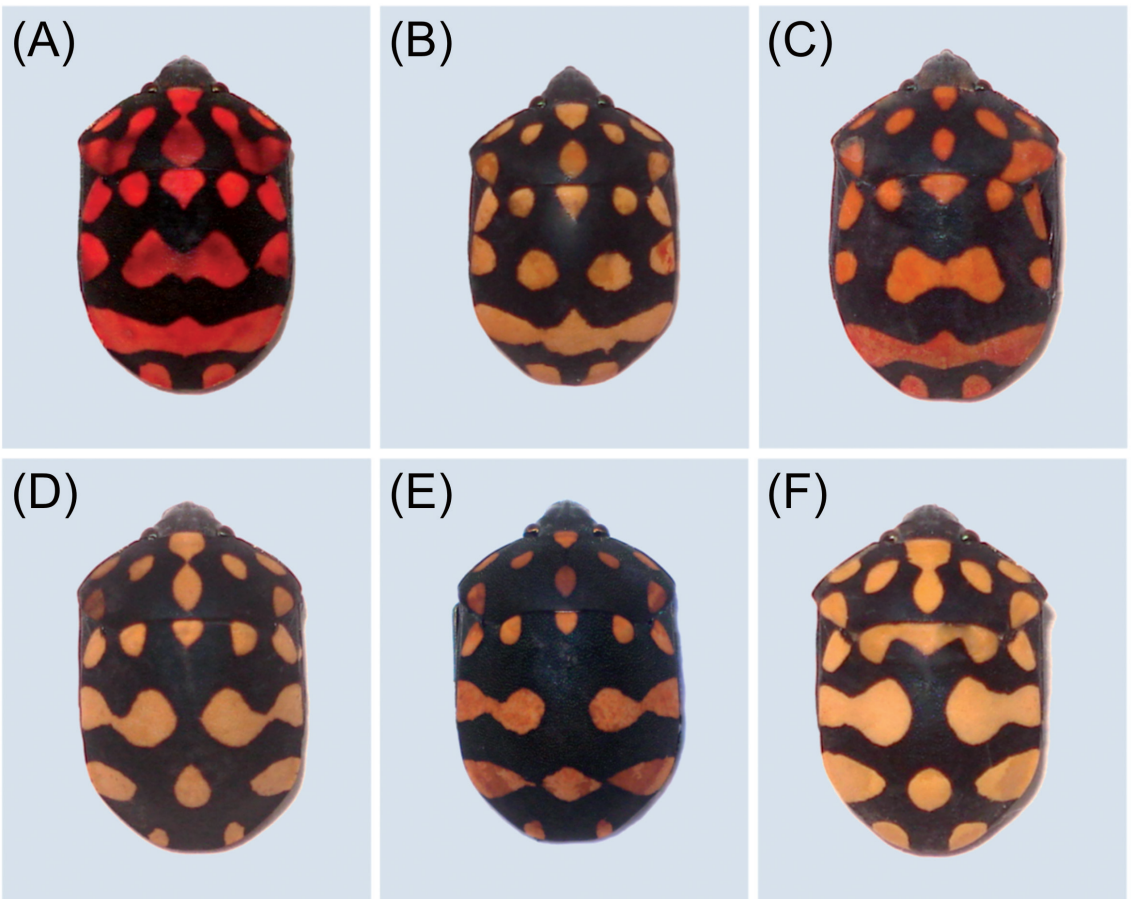

Fig. 2: Color patterns of *Pachycoris torridus* (Scopoli) (Hemiptera: Scutelleridae): (A) pattern 22; (B) pattern 23; (C) pattern 24; (D) pattern 25; (E) pattern 26; (F) pattern 27.

Patrones de coloración de *Pachycoris torridus* (Scopoli) (Hemiptera: Scutelleridae): (A) patrón 22; (B) patrón 23; (C) patrón 24; (D) patrón 25; (E) patrón 26; (F) patrón 27.

Some insects are unpalatable to predators and often advertise them using conspicuous warning colors as bright orange, red and yellow (Ruxton et al. 2004). Predators learn to associate the presence of chemical defense with visual signals, and the presence of polymorphisms would play a role as self-reinforcing signals in the avoidance learning by predators (Joron et al. 1999). The new color patterns of *P. torridus* described in this study are discretely different from the basic pattern, forming a continuum which could facilitate the avoidance learning by predators. Besides, *P. torridus* is phenotipically similar to two sympatric species: *P. klugii* Burmeister, 1835 and *P. stallii* Uhler, 1863. These species present color polymorphism associated with aposematic behavior and toxic compounds sequestration from Euphorbiaceae plants as defense mechanism against predators (Wink et al. 2000, Williams et al. 2001). Due to the similarity in color pattern between them, and because they co-occur in a large area, these species may form a Müllerian mimetic complex. The presence of chemical defenses in *P. torridus* was not verified but it could sequester toxic compounds during feeding on Euphorbiaceae plants. Further genetic and behavioral studies are required to explain the function of *P. torridus* polymorphism and the hypothesis of the Müllerian mimetic complex.

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