



A new species of *Pheles* Herrich–Schaeffer from Northeast Brazil (Lepidoptera, Riodinidae)

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Abstract

A new species of Riodinidae, *Pheles caatingensis* Callaghan & Nobre, **sp. nov.** from Ceará and Pernambuco State in Brazil is described, along with its habitat, behavior and taxonomic differences with other members of the genus *Pheles*. Notes are included on distribution and mimetic relationships with other sympatric insects.

Key words: Caatinga, Neotropics, taxonomy, butterflies, Northeast of Brazil, mimicry.

Resumo

Uma nova espécie de Riodinidae, *Pheles caatingensis* Callaghan & Nobre, **sp. nov.** é descrita, juntamente com seu habitat, comportamento e diferenças taxonômicas em relação a outros membros do gênero *Pheles*. São fornecidas notas sobre sua distribuição e relações miméticas com outros insetos simpátricos.

Palavras-chave: Caatinga, Neotrópicos, taxonomia, borboletas, Nordeste brasileiro, mimetismo.

Introduction

The region of xeric vegetation in the Northeast of Brazil in the interior of the States of Bahia, Sergipe, Alagoas, Pernambuco, Paraíba, Rio Grande do Norte, Piauí and Ceará, referred to as the Caatinga Province (Morrone 2006) is proving to be an endemic area in its own right. Most studies on Lepidoptera to date have concentrated on the areas of greater species diversity like the northern extension of the Atlantic forest (Kesselring and Ebert 1979), and the extension of the Amazon region into the northeastern state of Maranhão (Jaffret and Martins 2008). The butterfly fauna of the dry interior, in particular the drainages of the Rio São Francisco and Rio Paranaíba has been investigated only on occasional trips by collectors from outside the region, especially in the peripheral areas which have resulted in new taxa and biogeographic information. (Callaghan 2001; Callaghan and Soares 2001; Jaffret and Martins 2008). Studies concentrating specifically on the Caatinga fauna have only been recently initiated by the second author with his list of species of Catimbau National Park in Pernambuco (Nobre *et al.* 2008).

The story of *Pheles caatingensis* **sp. nov.** begins with a survey initiated by CEMFAUNA (Centro de Conservação e Manejo de Fauna da Caatinga) of the flora and fauna of a small river, the Riacho dos Porcos in the Municipality of Brejo Santo, Ceará, in preparation for the construction of a dam which would inundate a part of the existing gallery forest. In surveying the Lepidoptera in the affected area, the second author collected a small riodinid which was subsequently identified as a new species. As a result of the importance of this discovery, the Ministry of National Integration intervened and the placement of the dam was changed in order to avoid affecting this critical habitat. The north wall of the dam was moved so that only an altered habitat area upstream from the type locality will be inundated.

In this paper, we describe this new species and its taxonomy, its habitat, behavior and distribution. We relate its habits and appearance to other sympatric insects, which suggests a mimetic association among them.

Material and methods

Dissection of the type material and related taxa followed standard method of soaking the abdomen in 10% potassium hydroxide overnight, and storing in glycerol. Dissections were examined using a stereomicroscope. Twenty-two paratypes and 76 specimens of related species were examined. Fifteen genitalia preparations were made including four of the new species and the rest of specimens of related taxa for comparison. The terminology of the genitalia follows Klots *in* Tuxen (1970).

Pheles caatingensis Callaghan & Nobre, new species

Diagnosis. *Pheles caatingensis* **sp. nov.** belongs to the tribe Riordini Grote 1865 as indicated by a deeply notched posterior section of the tegumen (Fig. 9), and a pedicel forming a posterior tube-like projection not attached to the valvae of the male genitalia (Harvey 1985). Superficially, the new species is closest to the genus *Pheles* Herrich-Schaeffer [1863], particularly with the species *Pheles strigosa*, (Staudinger, 1876) and *Pheles atricolor* (Butler, 1871) sharing the orange scaling on the collar, orange palpa with a short third section, orange scaling on the abdomen around the genitalia, and wing shape and black coloring with a white apical spot on the forewing and with blue streaks between the veins. However, the genitalia of both sexes of *P. caatingensis* **sp. nov.** are different from those of *Pheles*; the male genitalia lack the scobinate patch, or vogelkopf on the end of the pedicel, and have instead a fork serving as a guide for the aedeagus. The aedeagus is modified with a long, curved point on the end. The female genitalia have a highly modified ostium bursae with an evaginated sinus vaginalis and a large, notched medial lamella postvaginalis, all characters not found in *Pheles*. The antennae are clubbed, and the shaft is without heavy scaling found in *Pheles*. However, because of the superficial similarities, *P. caatingensis* **sp. nov.** is provisionally left in the genus *Pheles* until its proper generic placement can be ascertained.

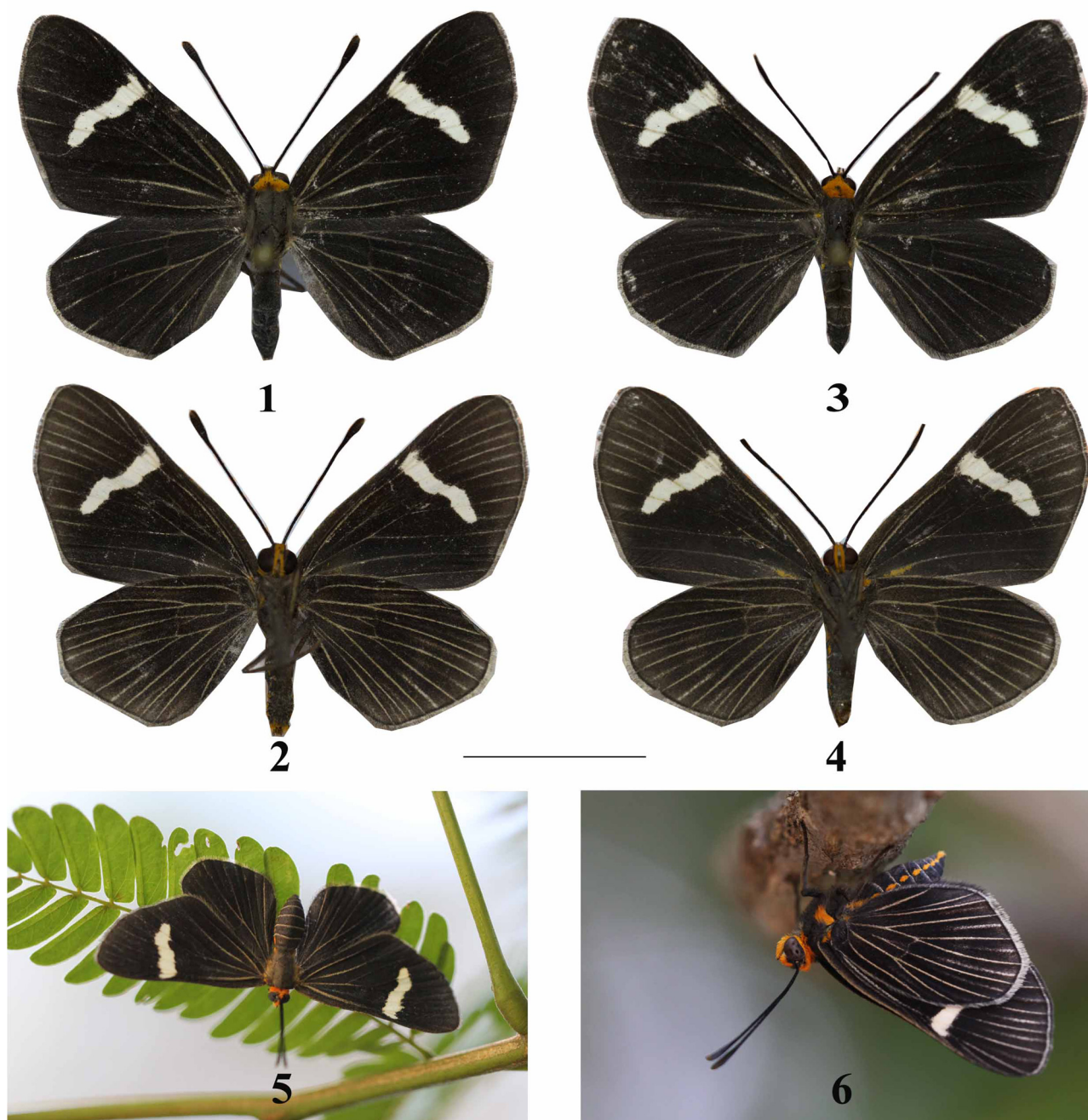
Description. **MALE:** (Figs 1,2,7,8,9,11.) Forewing length of holotype: 15.1 mm; Paratypes: 13.5 – 16.0 mm (n=16). **Wing Shape:** Forewing costa slightly concave medially, curving slightly to apex, distal margin curved slightly convex to Cu1, then straight to tornus, anal margin straight. Hindwing costa curved to rounded apex, distal margin rounded from apex to M3, then straight to rounded tornus, anal margin slightly curved to base. **Dorsal surface:** Wing ground color black, variable white scaling along the veins, except 3A. Fringe white and black scaling intermixed with a white marginal line. Forewing with a white 1 mm wide irregular subapical transverse band from R2 to cell Cu1–Cu2, slightly bent in cell M3–Cu1 with a few scattered brown scales along the edge, and a longitudinal white streak in cell Cu2–2A. **Ventral surface:** Maculation and color similar to dorsal surface. Ground color black with variable white scaling along the veins, especially on forewing apex distally of the white subapical band with white streaks distally in cells M1–Cu2 and along costal border of cell; hindwing with white scaling along all veins and additional faint parallel white streaks distally in cells M1–3A; some irregular orange scaling at base of both wings; white forewing band as on dorsal surface.

Head: Eyes dark brown (grey in live specimens), marginal scaling, frons and head dorsally orange; labial palpi short, light orange with black tips; antennal length 7.9 mm, base of antennae and segments black without heavy scaling, clubs segmented and rough, reddish brown scaling ventrally.

Body: Dorsal surface color of thorax black, thorax pubescent laterally, epaulets black; ventral surface of thorax dark grey, pubescent, with a lateral orange spot, forelegs dark grey and very pubescent; midlegs and hindlegs femur black, tibia and tarsus lighter with some yellow scaling; abdomen dorsally black with light scaling caudad on segments, an orange line laterally and tufts of orange scaling around genitalia.

Genitalia: (Figs. 7,8,9) Uncus slightly bilobed, tegumen short, with a deeply indented notch on the posterior margin (Fig. 9), falces curved, sharp, posterior extension slightly indented dorsally; vinculum fused to posterior margin of tegumen at base of the notch, vinculum narrow, curving L-shaped with small flange and attached to ventral center of valvae without saccus; valvae cup shaped, extending caudad to a sharp, upward curving point; dorsally from the valvae extends a high, elaborate transtilla fusing the posterior half of the valvae with two sharp,

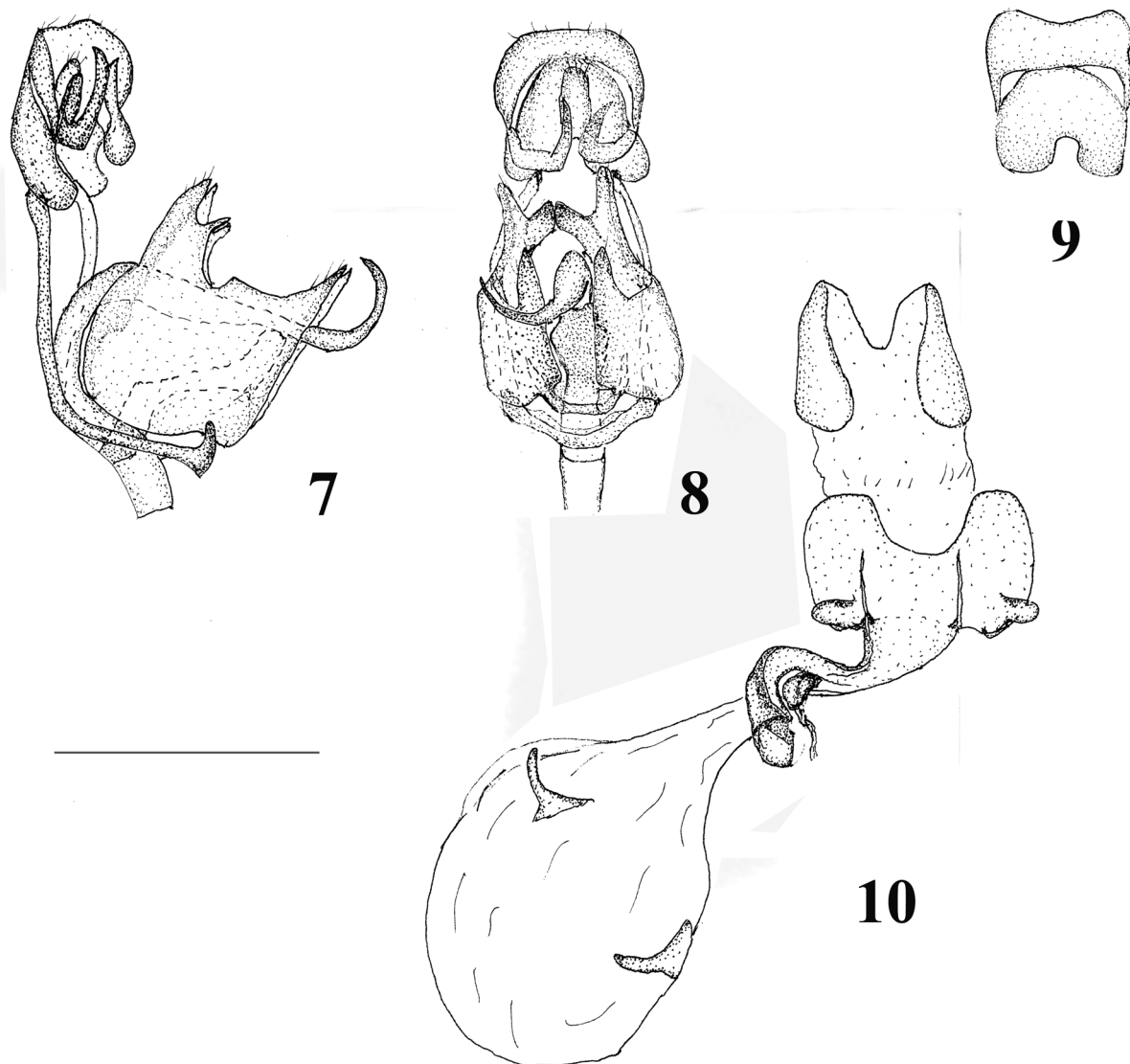
dorsally projecting processes on each side; aedeagus curved, with a long, curved, pointed tip; pedicel forms a posterior tube-like projection from the aedeagus, terminating in a wide, bifurcated structure supporting the aedeagus and connected basally to the valvae.



FIGURES 1–6. Adults. 1, *Pheles caatingensis* sp. nov. holotype male, dorsal surface; 2, Same, ventral surface 3, *Pheles caatingensis* sp. nov. female paratype, dorsal surface; and 4, Same, ventral surface 5, *Pheles caatingensis* sp. nov. dorsal view of a live female; 6, *Pheles caatingensis* sp. nov. lateral view of a live female showing thoracic and abdominal markings.

FEMALE: (Figs. 3,4,5,6,10) Forewing length 14.7mm (14.1–15.5mm, n=4). Wing color and markings nearly identical to male.

Wing shape: Forewing, same as male with distal margin slightly broader, hindwing same. *Dorsal surface:* Ground color black as in male, with white scaling along the veins and the white post discal transverse band slightly wider than on male; margin and fringe white. *Ventral surface:* Ground color black with veins outlined in white with parallel lines in the cells distad of white band on forewing and on hindwing and some orange scaling at base, as on male.



FIGURES 7–10. Genitalia. 7, *Pheles caatingensis* sp. nov., Male genitalia, lateral view. 8, Same, ventral view. 9, Same, showing indentation of posterior margin of tegumen. 10. *Pheles caatingensis* sp. nov., female genitalia, ventral view.

Head: Eyes black, marginal scaling, frons below antennae and dorsally orange, labial palpi slightly longer than male, visible in front of face when viewed dorsally, orange with lighter tips than male, antennae length 7.9 mm, black with black scaling around base, as in male; *Body:* Dorsal surface color of thorax and abdomen black, ventral surface cream; forelegs, midlegs and hindlegs with dark orange scaling, lighter than male; abdomen (Fig. 6) black with broken orange lateral line, segments outlined caudally with white scaling; slight orange scaling around papillae anales.

Genitalia: (Fig. 10) Corpus bursae round with two long, curved and pointed invaginate signa; ductus bursae leaves corpus bursae as wide, short, lightly sclerotized tube; ostium bursae funnel shaped, bent to the right when viewed caudad; the connection to the ductus bursae is a complex sclerotized evaginated tube, the sinus vaginalis, connected to a smaller tube forming a receptacle for the ductus seminalis; the ostium bursae ventrally extends into the medial lamella postvaginalis, which is a broad, deeply notched plate with two rounded processes at the base; papillae anales rounded, deeply bifurcated and pubescent.

Type material. Holotype *MALE* with the following label: BRASIL: Ceará, Brejo Santo –PMN 12, PISF – 08.V.2013, C.E. Nobre, leg.

The holotype is deposited in the Museu Unicamp, Campinas, São Paulo)

Paratypes: BRASIL: 17 males, 5 females, Ceará, Brejo Santo - PMN 12, PISF – 5 December, 2012, C.E.

Nobre, leg; *ibid* 2 males, PISF – 22 April, 2013, C.E. Nobre leg; *ibid* 2 males PISF – 22 April, 2013, T.B. Souza, leg; *ibid* 10 males, PISF – 8 May, 2013, C.E. Nobre, leg. ; 1 male (DZ28.358), 1 female (DZ21.059), Bahia, Juazeiro, 19 February, 1966, ex- col. D’Almeida(DZUP); 1 male (DZ28.356), *ibid* 300m, 19 July, 1973, Cursino & Mielke leg (DZUP); 1 male (DZ26.411), *ibid* 17 September, 1967, Cursino leg.(DZUP).

Paratypes are deposited in the Museu do CEMAFAUNA-Caatinga, Univasf, Petrolina, and the Coleção Entomológica Pe. J. S. Moure, UFPR (DZUP), and the collection of C. Callaghan, Bogotá, Colombia.

Etymology. The species is named after the biogeographic Caatinga Province in which it is found.

Biology. The type locality of *Pheles caatingensis* **sp. nov.** is situated in the Brazilian Northeastern semiarid domain, in the municipality of Brejo Santo, Ceará state (altitude of 380 meters (7°35’12.67” S, 38°52’08.08” W; Fig.23). The average annual rainfall is around 930 mm concentrated between January and April (FUNCEME 2013). The habitat is a narrow gallery forest with trees up to 15 meters high on the margins of the Riacho dos Porcos, a permanent stream sustained by the Açude Atalho dam upstream (Fig.14). In many spots, crops and pasture replace the native gallery forest as it winds through the surrounding shrub-dense, deciduous Caatinga vegetation. Tree species that occur in this habitat include: *Pterogyne nitens* Tul., *Lonchocarpus sericeus* (Poir.) Kunth ex DC., *Geoffroea spinosa* Jacq., *Enterolobium contortisiquum* (Vell.) Morong, and *Ziziphus joazeiro* Mart. (Fabaceae); *Sideroxylum obtusifolium* (Roem. & Schult.) T.D.Penn (Sapotaceae) and *Sapindus saponaria* L. (Rhamnaceae); Lianas are abundant, especially in the rainy season, including *Serjania glabrata* Kunth (Sapindaceae), and some Araceae (Figs. 12,13,14).

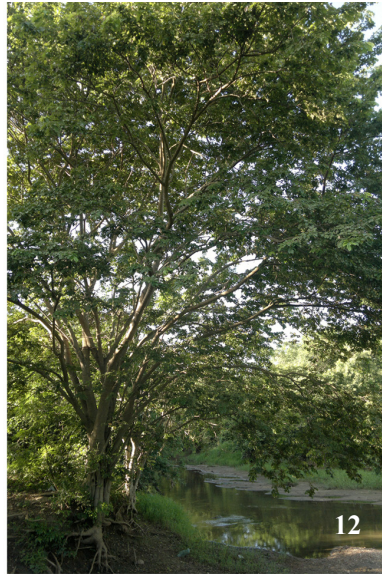
In addition to human activities, the gallery forest habitat is threatened by *Cryptostegia grandiflora* R. Br. (Apocynaceae) an exotic Southeast Asian plant, which occurs throughout the margins of Riacho dos Porcos, and in some spots has replaced the local vegetation (Fig.15). Due to its known aggressiveness (Grice 1997; Silva & Cavalcante 2009), monitoring this species is important to prevent further damage to the already compromised local gallery forest, in addition to its effects on the biology of *Pheles caatingensis* **sp. nov.** The vines and foliage of this plant cut sunlight from the forest floor, limiting the presence of understory vegetation (Fig.16). This has an impact on the habitat of *Pheles caatingensis* **sp. nov.**, for in areas where the plant was common, the butterfly was notably infrequent.

Pheles caatingensis **sp. nov.** individuals concentrate in the shade of large trees, resting on the lower surface of the leaves with wings spread and antennae together (Figs. 5,6). On April 25, 2013, after sunset, numerous individuals possibly displaying leek courtship behavior were seen flying rapidly, in short circular patterns around two *Geoffroea spinosa* trees (Fig. 12). No adults were observed feeding on flowers, although one individual was observed on the wet soil on the river margin (Fig.11). From the start of the rainy season in December, 2012 to April 2013, the population had increased from about 30 individuals to hundreds, mostly concentrated in an area of gallery forest about 45.000 m², although individuals were recorded all along the Riacho dos Porcos. However, the population falls during the dry season from June to December.

At the same location, there is a large population of *Melanis aegates* (Hewitson 1874), (Figs.17,18) with individuals displaying similar color pattern and behavior to *Pheles caatingensis* **sp. nov.** including leek behavior at sundown, as noted for other *Melanis* species (Callaghan 2003). *M. aegates* is also recorded in a similar habitat 300 kilometers northwards in the Ceará State (4°33’40.18”S; 39°45’44.70”W, 470m) according to specimens in the Universidade Federal da Paraíba (UFPB) entomological collection but no *Pheles caatingensis* **sp. nov.** were seen at this locality (C. E. Nobre, pers. obs.).

There is a possible mimicry ring in the area with other insects converging on the black and white wing pattern and yellow/orange scaling on the head and abdomen. In addition to *Melanis aegates*, the pattern is shared with *Acraephia perspicillata* (Fabricius 1781), (Hemiptera: Fulgoridae) (Fig.19); *Melanchroia chephise* (Stoll, 1782)(Fig.20), *Melanchroia aterea* (Stoll, 1781) (Lepidoptera: Geometridae)(Fig.21); and *Hyperalonia morio erythrocephala* (Fabricius, 1805) (Diptera: Bombyliidae) (Fig. 22). These last three, however, are found only in adjacent sunny areas.

The black and white wing pattern with blue veins and red/orange head coloring is common throughout the Amazon basin, both in day flying moths, particularly Geometridae, and butterflies of the family Riodinidae. Among the latter are species of *Pheles*, as mentioned above, and the genus *Esthemopsis* of the tribe Symmachiini. Among the species of *Esthemopsis* sharing these patterns are *E. alicia* (H.W. Bates, 1865), *E. pherephatte caeruleata* (Godman and Salvin, 1878) and *E. teras* (Stichel, 1910). This mimicry complex is particularly common in the western Amazon, from eastern Colombia to northern Bolivia (Callaghan, unpublished data).



FIGURES 11–16. Habitat and type locality of *Pheles caatingensis* sp. nov. 11, Male *Pheles caatingensis* sp. nov. feeding on wet earth, 12, *Geoffroea spinosa* tree on which leek behavior was observed. 13, Understory view of type locality, 14, General view of Rio dos Porcos at the type locality, 15, Native forest overgrown by *Cryptostegia grandiflora*, 16, Area beneath *Cryptostegia grandiflora* showing depletion of understory vegetation.



FIGURES 17–22. Insects forming a mimicry ring with *Pheles caatingensis* sp. nov. with similar color patterns. 17, *Melanis aegates* live female (Lepidoptera: Riodinidae), 18, *Melanis aegates* ventral view (left) and dorsal view (right), 19, *Acraephia perspicillata* (Hemiptera: Fulgoridae), dorsal view (left) and ventral view (right); 20, *Melanchroia chephise* (Lepidoptera: Geometridae), dorsal view (left) and ventral view (right); 21, *Melanchroia aterea* (Lepidoptera: Geometridae), dorsal view (left) and ventral view (right), 22, *Hyperalonia morio erythrocephala* (Diptera: Bombyliidae) live individual.

Distribution. (Fig 23) The species appears to be rare and local but widespread. A few individuals were located elsewhere along the Riacho dos Porcos, but not in the same numbers as at the type locality. In June, 2013 an additional colony was located in Cabrobó municipality Pernambuco state (8 19'39.95" S, 39 20'23.38" W) in a sparse forest consisting mainly of algaroba, (*Prosopis julifolia*,) along a nearly dry stream bed. There are also specimens in the Coleção Entomológica Pe. J. S. Moure, UFPR (DZUP) from northern Bahia State (Juazeiro, 300m). These findings suggest that *Pheles caatingensis* sp. nov. is widespread in the Caatinga in other similar humid habitats well into the dry season.

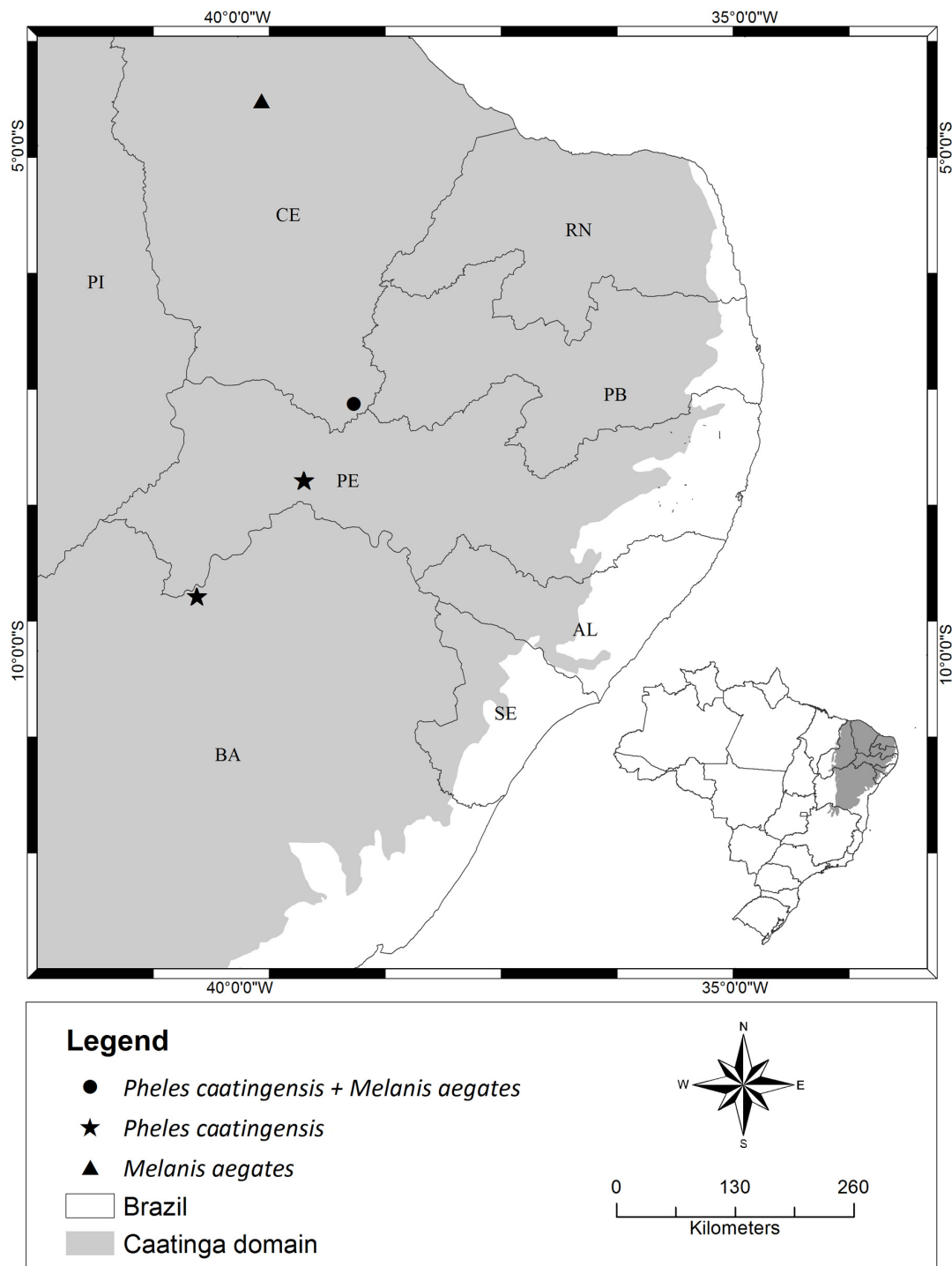


FIGURE 23. Location map.

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