

# A new clearwing butterfly from northeastern Brazil (Nymphalidae: Danainae: Ithomiini)

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**Abstract.** A new clearwing butterfly, *Napeogenes inachia grazielae* Freitas **ssp. nov.**, is described from the Atlantic Forest in northeastern Brazil. This subspecies is relatively common in forest fragments and has been reported from 17 localities from sea level to 900 m in the Brazilian states of Pernambuco and Alagoas. The immature stages are illustrated and redescribed.

**Key words:** Atlantic Forest, Ithomiini, *Napeogenes*, Solanaceae

## INTRODUCTION

The Brazilian Atlantic Forest originally covered an area of about 1.1 million km<sup>2</sup> and extended for more than 3,300 km along the coast between the latitudes 6°S and 30°S (Morellato & Haddad, 2000; Oliveira-Filho & Fontes, 2000). After more than five centuries of European colonization, the Atlantic Forest has been reduced to less than 16% of its original area, with 80% of the remaining forest comprising patches smaller than 50 hectares (Ribeiro *et al.*, 2009). Due to its conservation status and high level of endemism, the Atlantic Forest is considered a global hotspot for conservation (Myers *et al.*, 2000).

In a small sector of the Atlantic Forest north of the mouth of the Rio São Francisco, the forests are restricted to a narrow strip along the coast and to some patches at the tops of certain plateaus, maintained by orographic rains (the ‘brejos’) (Andrade-Lima, 1982; Oliveira-Filho & Fontes, 2000). This region, which is known as the “Pernambuco Center of Endemism” (*sensu* Brown, 1977, 1979), is the most endangered sector of the Atlantic Forest, harboring several endemic and threatened taxa of plants and animals (Martinelli & Moraes, 2013; MMA, 2018), including butterflies (Freitas & Marini-Filho, 2011). To contribute to knowledge of the biodiversity of the Pernambuco Center of Endemism, the present paper describes a new subspecies of clearwing butterfly in the genus *Napeogenes* Bates, 1862 (Nymphalidae: Ithomiini) from this region.

## MATERIALS AND METHODS

Adult Ithomiini specimens were studied in four collections in Brazil: **DZUP**: Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Paraná; **UFPE**: Universidade Federal de Pernambuco, Pernambuco, Recife; **ZUEC**: Museu de Zoologia da Universidade Estadual de Campinas, Campinas, São Paulo; **ZUEC-AVLF**: André V. L. Freitas collection,

Universidade Estadual de Campinas, Campinas, São Paulo. In addition, photographs of Neotropical butterfly type specimens taken by Gerardo Lamas and available in Warren *et al.* (2017) and images of *Napeogenes inachia tijatawaman* Brévignon, 2007 (Brévignon, 2007) were also consulted and compared with the new taxon described here. Specimen locality data were recorded from all of the above collections, in addition to being compiled from a database of Ithomiini from the Natural History Museum in London (United Kingdom), from the Appendix of Brown (1979) and from the unpublished field lists of Keith S. Brown (material deposited at ZUEC).

In addition, field work was conducted by the author in three forest fragments in the Brazilian states of Pernambuco and Alagoas, when adult and immature stages were located and studied (see details in Freitas & Brown, 2005 and Paluch *et al.*, 2011). Immature stages of the new taxon were brought to the University of Campinas and reared in the laboratory at room temperature (around 28°C and 60% humidity) in plastic containers with leaves of its host plant offered *ad libitum*. The larvae were checked daily to replace the food and to clean the container (as in Freitas & Brown, 2005). The immature stages *in vivo* were photographed with a digital camera.

### *Napeogenes inachia grazielae* Freitas, **ssp. nov.**

Figs. 1, 2, 3

*Napeogenes sulphurina*: Fox & Real (1971: 80); Freitas & Brown (2005)

*Scada zibia amplificata*: Cardoso (1949: 428)

*Napeogenes inachia* ssp. nov.: Brown (1979: 54, quad. 16, 93, Fig. 68, 143)

*Napeogenes (inachia?)* ssp. nov.: Brown *et al.* (2004: 227, Table 1)

*Napeogenes inachia* [n. ssp.] K.S. Brown, MS: Lamas (2004: 178)

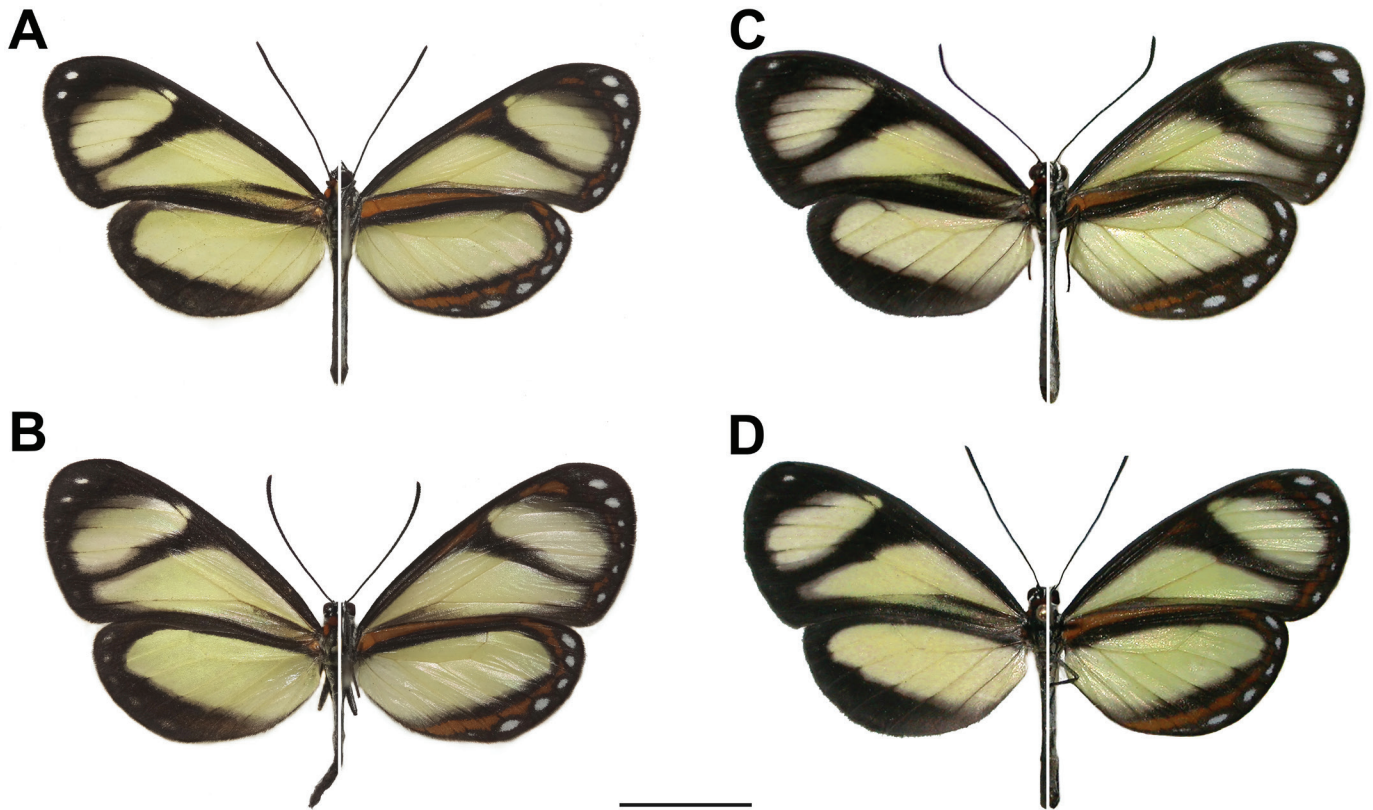
*Napeogenes inachia sulphurina*: Elias *et al.* (2009: 1718, 1722, Fig. 1)

*Napeogenes inachia* ssp.: Paluch *et al.* (2011: 231, 235); Melo *et al.* (2019: 5, 8)

*Napeogenes inachia* [n. ssp.#9] K. Brown, MS: Warren *et al.* (2017)

### Description and diagnosis

**Male.** Antennae entirely black, 11-12 mm (n = 9) in length, with 42-43



**Fig. 1.** *Napeogenes inachia grazielae* ssp. nov. **A.** Holotype male, **B.** Allotype female. *Napeogenes inachia sulphurina* (Camacan, Bahia) **C.** Male, **D.** female. Left = dorsal; Right = ventral. Scale bar = 10 mm.

antennomeres; club with 15 antennomeres, not conspicuously developed. Thorax black with a thin white dorsal line; patagium orange. Forewing length 22-24 mm (mean = 22.3 mm, SD = 0.71, n = 9); hindwing length 16-17 mm (mean = 16.3 mm, SD = 0.5, n = 9). General wing pattern three large patches of translucent yellow bordered by dark brown as follows: forewing with two yellow patches, the subapical ellipsoid, separated by a dark brown transverse bar from a large triangular basal patch extending from wing base to end of discal cell; hindwing with a large yellow patch filling most of wing area. Dorsal forewing with two white marginal dots; anal margin filled with yellow scales, partially separated from triangular yellow patch by a dark brown stripe along discal cell from base to  $CuA_2$ ; a creamy postdiscal costal spot present. Ventral wing margins with reddish scaling and a series of small white marginal dots, six on each wing.

**Female.** Very similar to male, with the dark brown borders slightly broader. Antennae length 10-11 mm (n = 7), with 41-42 antennomeres; club with 15 antennomeres. Forewing length 22-24 mm (mean = 22.6 mm, SD = 0.98, n = 7); hindwing length 16-18 mm (mean = 16.7 mm, SD = 0.76, n = 7).

This taxon is distinguished from the most similar subspecies, *Napeogenes inachia sulphurina* Bates, 1862, by the following characters: 1) in *N. inachia grazielae* ssp. nov., the yellow patches on both wings are much larger, especially on the forewing; conversely, the dark brown borders are much broader on *N. inachia sulphurina*, with black scaling usually filling most of the anal margin; 2) the white marginal dots are usually reduced in *N. inachia sulphurina*; 3) males and females of *N. inachia sulphurina* present conspicuous black scaling along the veins extending to the yellow patches on both wings, in males this usually includes the discal cell, from  $M_2$  to R (absent in *N. inachia grazielae* ssp. nov.); 4) in *N. inachia sulphurina*, the translucent yellow patches are surrounded by darker translucent areas, reducing the size of these yellow patches, whereas these dark areas are minimal in *N. inachia grazielae* ssp. nov., with yellow filling almost all of the translucent areas (Fig. 1).

**Type material.** Holotype male (Fig. 1A), deposited in the Museu de Zoologia da Universidade Estadual de Campinas (ZUEC), Campinas, São Paulo, Brazil. Labels on the holotype (four labels separated by transverse bars): / HOLOTYPUS / Brazil, Alagoas, Quebrangulo, RE[serve]BIO[lógica] de Pedra

Talhada, Ponto 6, -9.251450° -36.428430°, 740 m, 03-08.VI.2019, Augusto H. B. Rosa, Luísa L. Mota, Junia Y. O. Carreira leg. / DNA Voucher BP U127 / AHBR 187 / Holotypus *Napeogenes inachia grazielae* Freitas det. 2019 / ZUEC LEP 11060 /.

Allotype female (Fig. 1B), deposited in the Museu de Zoologia da Universidade Estadual de Campinas (ZUEC), Campinas, São Paulo, Brazil. Labels on the allotype (four labels separated by transverse bars): / ALLOTYPUS / Brazil, Alagoas, Quebrangulo, RE[serve]BIO[lógica] de Pedra Talhada, Ponto 6, -9.251450° -36.428430°, 740 m, 03-08.VI.2019, Augusto H. B. Rosa, Luísa L. Mota, Junia Y. O. Carreira leg. / Allotypus *Napeogenes inachia grazielae* Freitas det. 2019 / ZUEC LEP 11061 /.

**Paratypes** (all from Brazil). *Alagoas*: Quebrangulo, RE[serve]BIO[lógica] de Pedra Talhada, Ponto 6, -9.251450° -36.428430°, 740 m, 03-08.VI.2019, 2 males, 4 females, Augusto H. B. Rosa, Luísa L. Mota, Junia Y. O. Carreira leg. (ZUEC LEP 11062, ZUEC LEP 11063, ZUEC LEP 11064, ZUEC LEP 11065, ZUEC LEP 11066, ZUEC LEP 11067), (ZUEC), 03-08.VI.2019, 1 male, 3 females, Augusto H. B. Rosa, Luísa L. Mota, Junia Y. O. Carreira leg. (DNA Voucher BPU 081, AHBR 185, DNA Voucher BPU 076, AHBR 188, Voucher BPU 055, AHBR 186, Voucher BPU 120, AHBR 184) (ZUEC LEP 11070, ZUEC LEP 11071, ZUEC LEP 11072, ZUEC LEP 11073), (ZUEC); Ponto 8, -9.248310° -36.425190°, 750 m, 03-08.VI.2019, 2 males, Augusto H. B. Rosa, Luísa L. Mota, Junia Y. O. Carreira leg. (ZUEC LEP 11068, ZUEC LEP 11069), (ZUEC), Ponto 3, -9.254910° -36.430770°, 655 m, 21.XI.2018, 1 female, E. P. Barbosa leg. (DNA Voucher BPU 083, AHBR 183) (ZUEC LEP 11074) (ZUEC), Ponto 5, -9.250720° -36.427090°, 765 m, 21.XI.2018, 1 male, P. E. Gueratto leg. (DNA Voucher BPU 164, AHBR 177) (ZUEC LEP 11075) (ZUEC); Ibataguara, Usina Serra Grande, Coimbra, 01-03.VIII.2003, 1 male, 1 female, A. V. L. Freitas leg. (B-796; USGCO), (ZUEC LEP 11082, ZUEC LEP 11083) (ZUEC). *Pernambuco*: Timbaúba/Vicência, Engenho Água Azul, 01.V.1988, 2 males, K. S. Brown Jr. leg. (ZUEC LEP 11076, ZUEC LEP 11077) (ZUEC); São Lourenço da Mata, Tiuma, 100 m, 22.IV.1961, 1 male and 1 female, K. S. Brown Jr. leg. (ZUEC LEP 11078, ZUEC LEP 11079) (ZUEC); Ipojuca, 200 m, 23.IX.1961, 2 females, K. S. Brown Jr. leg. (ZUEC LEP 11088, ZUEC LEP 11081) (ZUEC).

**Etymology.** This subspecies is named for Graziela Consentini das Chagas, in recognition for her support in all my biological endeavors, and for always being such excellent company, allowing the realization of field work in all of our trips together.

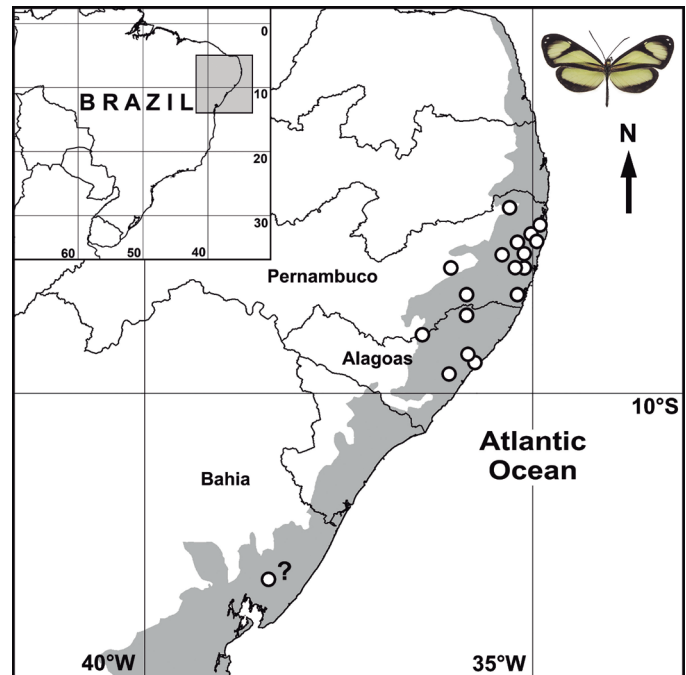
**Taxonomy and variation.** Following the suggestion of Brown (1979), the new taxon described here is considered a subspecies of *N. inachia*, with additional support from analyses of DNA sequence data (Elias *et al.*, 2009; AVLF, unpublished data). *Napeogenes inachia* (Hewitson, 1855) is a widespread species, including 21 recognized subspecies, 11 of which are still not described (Lamas, 2004; Brévignon, 2007; Warren *et al.*, 2017), and together with *Napeogenes rhezia* (Geyer, [1834]), this is one of only two species of *Napeogenes* that occur in the Atlantic Forest (Brown, 1979; Elias *et al.*, 2009). Among the 10 described subspecies, six of them have large reddish margins on the dorsal wings (mainly on the hindwing and along the anal margin of the forewing); only four lack these reddish margins, being similar to *N. inachia grazielae* **ssp. nov.** These includes *N. inachia sulphurina*, from coastal Brazil (see above), and three taxa found in the western Amazon to the east Andean foothills, namely *Napeogenes inachia patientia* Lamas, 1985, *Napeogenes inachia pozziana* (Oberthür, 1878) and *Napeogenes inachia juanjuensis* R. Fox & Real, 1971.

Variation in the wing pattern of *N. inachia grazielae* **ssp. nov.** is limited, and includes the extent of reddish scaling on the ventral wings and the amount of dark brown scaling along the anal margin on the dorsal forewing. In addition, there is some variation in the width of the transverse dark brown bar crossing the forewing.

**Distribution.** This subspecies is known from several forest remnants in the Brazilian states of Pernambuco (Caruaru, Igarassu, Ipojuca, Jaqueira, Recife, São Lourenço da Mata, Tamandaré, Vicencia, Pombos, Moreno, Escada) and Alagoas (Ibateguara, Quebrangulo, Maceio, Rio Largo, São Miguel dos Campos). There is a record from a locality in the north of Bahia state (Catu municipality) (Brown 1979: Appendix), but the specimen has not been located to confirm its identity (Fig. 2).

**Natural history and immature stages.** *Napeogenes inachia grazielae* **ssp. nov.** is present in several forested habitats from sea level to 900 m in well preserved and secondary forests, including some large urban parks. These butterflies can be locally common, even abundant, in some ithomiine pockets, where hundreds of individuals can be observed together with their co-mimics in the genera *Scada* Kirby, 1871 and *Aeria* Hübner, 1816 (Freitas & Brown, 2005). Adults can be observed in the early morning feeding on flowers at forest edges, and on bird droppings inside the forest. Adults were observed in the forest interior later in the day, where they were usually observed landed on leaves (Fig. 3K). Both sexes fly typically below 1.5 m, with occasional individuals observed flying high in sunny spots inside the forest. Courtship and copulation were not observed, and based on field observations, males are not territorial.

The immature stages of *Napeogenes inachia grazielae* **ssp. nov.** were described in Freitas & Brown (2005) from two

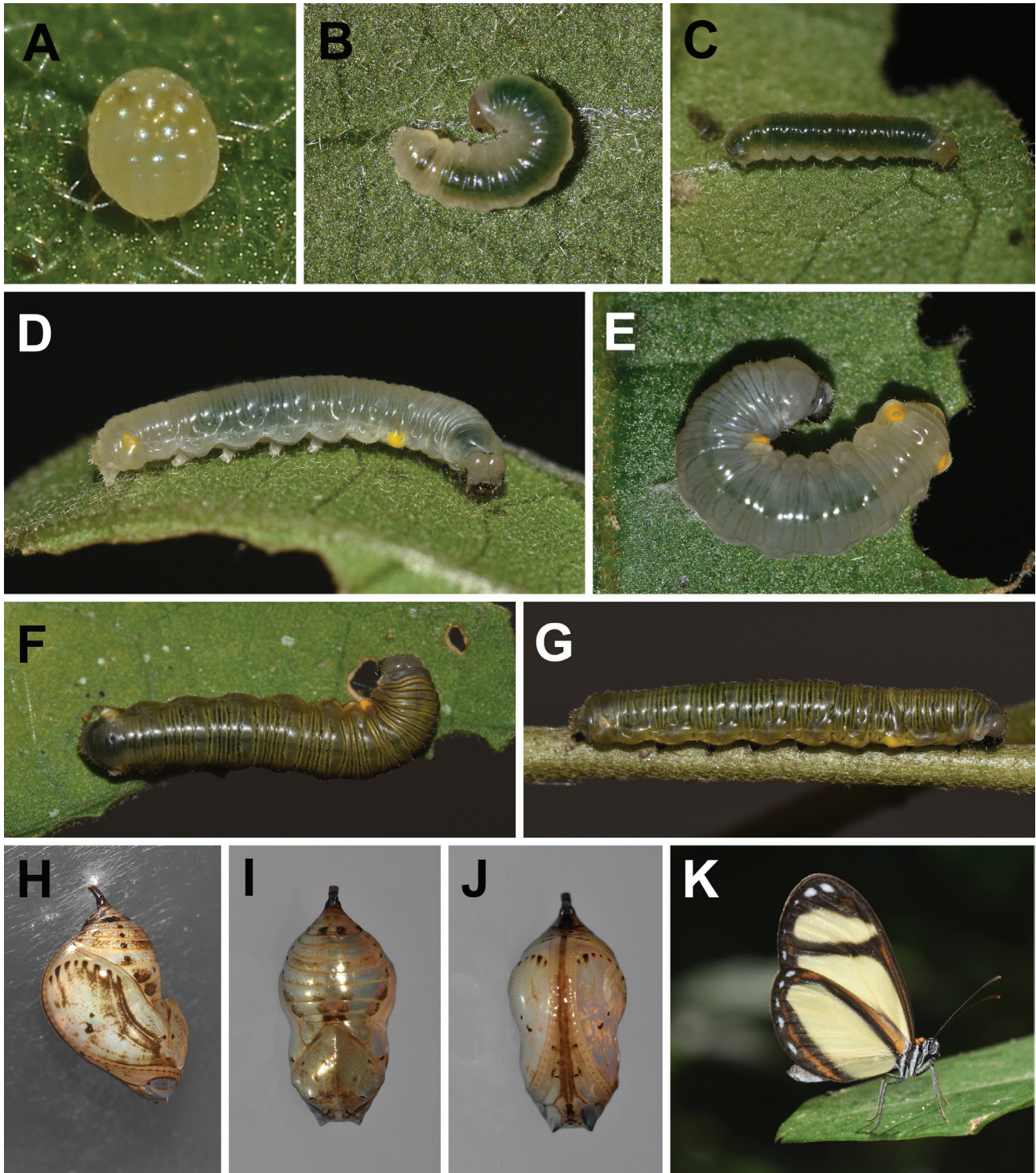


**Fig. 2.** Known distribution of *Napeogenes inachia grazielae* **ssp. nov.** (open circles). The question mark corresponds to the locality of Catu (north Bahia) and needs confirmation (see text). The dark gray area in coastal region corresponds to the original distribution of the Atlantic Forest.

localities in northeastern Brazil. A short description based on the above study and recent data from Pedra Talhada is here provided, with clearer images of all life stages. At Pedra Talhada, eggs were laid on a small scandent vine in the genus *Lycianthes* (Solanaceae), very similar to that previously reported in two other localities (Freitas & Brown, 2005). Eggs were laid singly on the underside of mature leaves of its host plant. **Egg.** Rounded, chorion with 14-15 longitudinal ridges, and 8-9 transverse ridges (Fig. 3A). **First instar.** Body white, changing to green after feeding, head light yellow. **Second instar** very similar to first instar (Fig. 3B,C). **Third instar.** Body light gray with conspicuous sublateral semicircular tubercles from A1 to A8. **Fourth instar.** Similar to third instar, with a pair of yellow markings, the first on sublateral semicircular tubercles on A1 and the second circling the spiracle on A8 (Fig. 3D,E). **Fifth (last) instar.** Body dark olive gray with thin transverse yellow lines; legs black; prolegs with a lateral black plate; the sublateral semicircular tubercles and the yellow markings present and conspicuous; head cream with a frontal transverse black band (Fig. 3F,G). Larvae were observed resting in a “J” position in all instars (Fig. 3B,E). **Pupa.** Short, slightly bent, beige after pupation, with many brown markings on the abdomen and wing cases; becoming entirely reflective after two days; cremaster dark red; ocular caps short and pointed (Fig. 3H-J). The total life cycle (from egg to adult) lasts about 30 to 35 days.

## DISCUSSION

Although very similar to *N. inachia sulphurina*, the subspecies described here, *N. inachia grazielae* **ssp. nov.**, is quite distinct and the differences are consistent, in particular



**Fig. 3.** Life stages of *Napeogenes inachia grazielae* **ssp. nov.** **A.** egg, lateral; **B, C.** second instar, dorsal and lateral; **D, E.** fourth instar, lateral and dorsal; **F, G.** fifth (last) instar, dorsal and lateral; **H, I, J.** pupa, lateral, dorsal and ventral; **K.** reared adult.

the size of the yellow patches, which are consistently larger in the new subspecies. In fact, most of its co-mimics in the Pernambuco center of endemism also have relatively larger yellow patches in comparison with the populations in the southern sectors of the Atlantic Forest, for example *Scada karschina delicata* Talbot, 1932 and an undescribed subspecies of *Aeria olena* Weymer, 1875 (Freitas *et al.*, in prep.).

Based on current data, *N. inachia grazielae* **ssp. nov.** is present at 17 different localities, including some disturbed

forests and urban parks, and although a formal evaluation of its conservation status has not been completed, this taxon can be considered not threatened. Nevertheless, it is still important to search for additional localities where this taxon occurs. For example, there are no data from the very few forest remnants in the northern and southern sectors of coastal Alagoas state. Also, confirming the identity of the populations from northern Bahia is important to better define the limits of the distribution of this subspecies.

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