

Description of Genus *Guaianaza* for “*Euptychia*” *pronophila* (Lepidoptera: Nymphalidae: Satyrinae) with a description of the immature stages

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Abstract

The satyrine *Euptychia pronophila* Butler (Nymphalidae) was described in 1867 in the “catch-all” genus *Euptychia*, but was recently treated as *incertae sedis*. A DNA-based cladistic analysis confirms that it belongs to the Euptychiina, as sister to *Forsterinaria* and closely related to *Taygetis*, *Posttaygetis*, *Parataygetis*, *Pseudodebis*, and *Harjesia*. Although immature morphology also suggests that this species is closely related to *Forsterinaria*, none of the adult morphological synapomorphies for the genera in the aforementioned clade occur in *E. pronophila*, a highly autapomorphic species. Because we were unable to place it with confidence in an established genus, the monotypic satyrine genus *Guaianaza* Freitas & Peña **New Genus** is described, with *Euptychia pronophila* Butler as the type species.

Key words: Atlantic forest, *Forsterinaria*, life history, Neotropics, Poaceae.

Introduction

The butterfly family Nymphalidae is composed of about 7200 species distributed throughout the world (Ackery *et al.* 1999). Nymphalid species exhibit a great variety of color patterns and morphological features, but are united by the synapomorphy of “tricarinate” antennae (Vane-Wright 2003). The Satyrinae is the most diverse subfamily within the Nymphalidae, including about 2400 species of world-wide distribution (Ackery *et al.* 1999). Although the Neotropical nymphalids are relatively well known, the subfamily Satyrinae remains the most poorly understood. Many species await description, many genera and tribes are not monophyletic, and there are no published phylogenetic hypotheses for the subfamily as a whole (Viloria & Pyrcz 1994, Viloria & Camacho 1999, Viloria 2003, Freitas 2004b, Lamas 2004).

The ongoing BIOTA-FAPESP project “Lepidoptera from São Paulo State” focuses on mapping the diversity of Lepidoptera in São Paulo and neighboring states. The satyrine butterfly fauna of the Serra do Mar (SE Brazil) harbors many endemics, of which minimally 10 from São Paulo State are undescribed. It is also apparent that the generic status of several species needs to be revised (see Freitas 2003, Freitas 2004a).

Euptychia pronophila Butler, 1867, was described in the large genus *Euptychia*, which was a “catch-all” for small satyrines at that time (e.g. D’Abrera 1988). This species was not included in Forster (1964) or Miller (1968), and remained in *Euptychia* until being considered *incertae sedis* by Lamas (2004).

A recent DNA-based cladistic study of 165 Satyrinae taxa from 15 subtribes and four tribes (Peña et al., *in press*) confirms the position of *E. pronophila* in the Euptychiina. *Euptychia pronophila* appears as sister to *Forsterinaria* Gray and as part of a larger clade also including *Taygetis rectifascia* Weymer, 1907, *Posttaygetis penelea* (Cramer, 1777), *Parataygetis albinotata* (Butler, 1867), *Harjesia blanda* (Möschler, 1877), and *Taygetis laches* (Fabricius, 1793).

A morphological survey of *Forsterinaria*, *Taygetis* Hübner, *Posttaygetis* Forster, *Parataygetis* Forster, *Pseudodebis* Forster and *Harjesia* Forster indicates that *E. pronophila* lacks the known synapomorphies of each. It appears to be a highly autapomorphic species.

The purposes of this paper are to (1) describe the new genus *Guaianaza* for *E. pronophila*, (2) illustrate morphological characters of immature stages (for the first time) and adults, and (3) discuss the systematic position of *Guaianaza*

Study Sites and Methods

Adults and immatures of *E. pronophila* from 5 different localities in São Paulo State were studied. 1. Paranapiacaba (Santo André, 900–1100 m; 23°46’S, 46°20’W), 2. Morro Grande Forest Reserve (Cotia, 850–950 m; 23°39’S, 46°55’W), 3. Campos do Jordão State Park (Campos do Jordão, 1500–1700 m; 22°30’S, 45°27’W), 4. Intervalles Park (Capão Bonito, 900–1100 m; 24°20’S, 48°20’W) and 5. Serra do Japi (Jundiaí, 700–1100 m; 22°58’S, 46°55’W). Additional material was examined from the states of Minas Gerais, Rio de Janeiro, Paraná, Santa Catarina and Rio Grande do Sul (Museu de Zoologia da USP and the personal collection of the first author [AVLF collection]).

Dissections were made using standard techniques. Legs, palpi, male and female abdomens were soaked in hot 10% KOH solution for 10 min and dissected parts were stored in glycerol. Drawings were made using an OLYMPUS SZ30 stereomicroscope and a SPENCER 501 camera lucida. Morphological terms for genitalia largely follow Klots (1956).

Fertile eggs were obtained from wild-captured females, which were confined in plastic bags, and larvae were collected in the field. Larvae were reared in plastic containers cleaned daily, with fresh plant material provided every two or three days (following Freitas

1991). Observations and data were recorded on behavior and development times for all stages. Dry head capsules and pupal cases were retained in glass vials. When there was sufficient material, immatures were fixed in Kahle solution (Borror & DeLong 1971). All measurements were made using a stereomicroscope fitted with a calibrated micrometric ocular. Egg size is presented as length and maximum diameter, and head capsule size is the distance between the most external stemmata (as in Freitas 1991). Taxonomic nomenclature follows Lamas (2004). Nomenclature of wing veins follows Miller (1969). Vouchers (immatures and adults) are deposited at the Museu de História Natural (Unicamp) (AVLF leg.).

***Guaianaza* Freitas & Peña, New Genus**

(Figs. 1–4)

Type species: *Euptychia pronophila* Butler, 1867: 105.

Diagnosis

Peña & Lamas (*in prep.*) suggested that *G. pronophila* belongs to a group of genera containing *Forsterinaria*, *Harjesia* and *Taygetomorpha*, based on their distinctive combination of characters: (1) brown colored wings on both surfaces; lack of markings on upper-side surfaces (with exception of a diffuse dark brown line on the margin of FW upperside); (2) relatively thin dark brown discal, postdiscal and marginal lines on underside wing surfaces as opposed to *P. albinotata* (figured in D'Abrera 1988: 755 as *Taygetis albinotata*); and (3) rather simple ocelli on underside wing surfaces, consisting of a light colored (white or yellowish) dot always present, circled by up to three concentric rings of different colors, never two light color dots as pupils, as in *Megeuptychia antonoe* (see Peña & Lamas 2005). Based on the above study, the genus *Taygetis* does not belong to this group, since its type species, *T. virgilia* (Cramer, 1776) (figured in Uehara-Prado *et al.* 2004: 13), possesses conspicuous orange marginal areas on the hindwing upperside.

Morphological characters of the male genitalia, particularly shape of the penis and remarkably small gnathos, the relatively long body setae and light head capsule in the first instar, and the short scoli in the last instar larvae suggest that *Guaianaza* is closely related to *Forsterinaria*. However, *Guaianaza* does not possess the elongated valva shape of *Forsterinaria*. It also does not have the square-cut posterior valva tip of *Taygetomorpha* (Forster 1964: 68, fig. 18) or the well developed gnathos of *Harjesia* (Forster 1964:78, figs. 43, 44). The lack of shared synapomorphies and the presence of several autapomorphic traits (i.e. a parallelogram-shaped valva with a deep dorsal posterior concavity, a very short uncus, and the particular “N”-shaped appendices angulares, make it difficult to place *G. pronophila* with confidence in an established genus.

Superficially, *Guaianaza* most closely resembles species of *Forsterinaria* and *Harjesia blanda*, although it is distinguished by its smaller size, lack of white scales on the FW

underside, and possessing light brown ocelli with a white center on the HW underside spaces M_2 - M_3 and M_3 - Cu_1 . The male genitalia of *Guaianaza* (Figs. 2H, I) differs from the above cited taxa (see figures in Peña & Lamas 2005 for *Forsterinaria* and Forster 1964, fig. 43 for *H. blanda*).

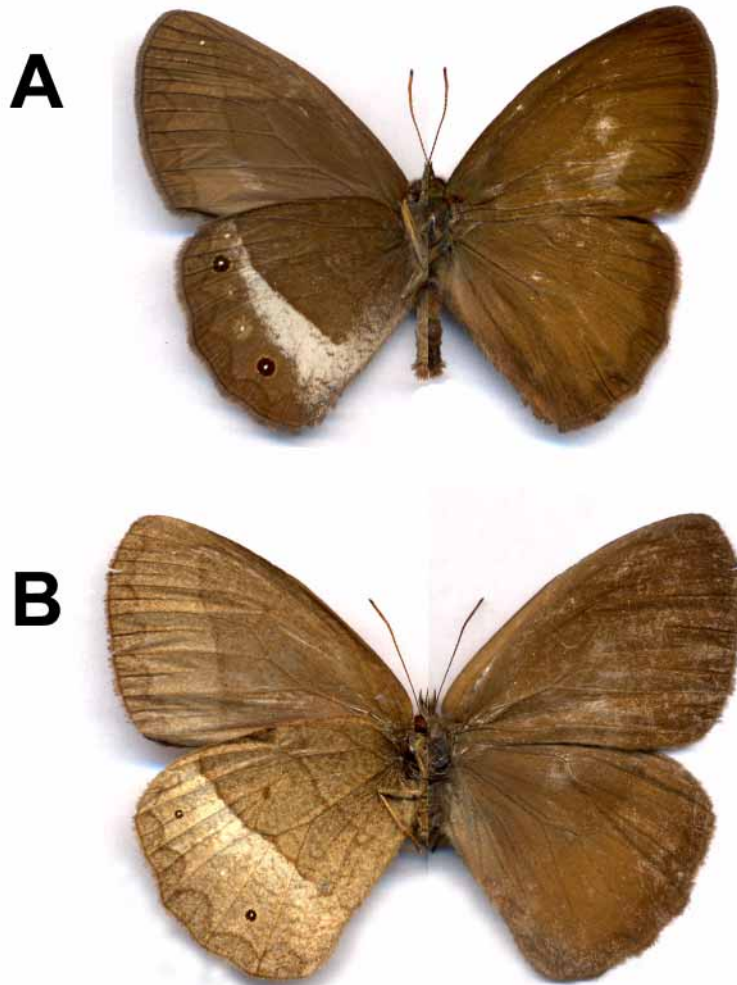


FIGURE 1. Adult male (A) and female (B) of *Guaianaza pronophila* from Parque Estadual de Campos do Jordão, Campos do Jordão, SP. Dorsal and ventral views on the right and left hand-sides, respectively.

Guaianaza is distinguished from *Forsterinaria* by having HW underside ocelli 2 and 3 light brown with a white dot in the center. In *Forsterinaria* these ocelli are either simple white dots (in most species) or, at least in one species (*F. pyrczi* Peña & Lamas 2005), black with a white dot in the center. In *G. pronophila* the white area on the HW underside is distal to the postdiscal line. When white scales occur on the HW underside of *Forsterinaria* species, such as *F. boliviana* (Godman, 1905), they occur in the discal area, proximal to the postdiscal line.

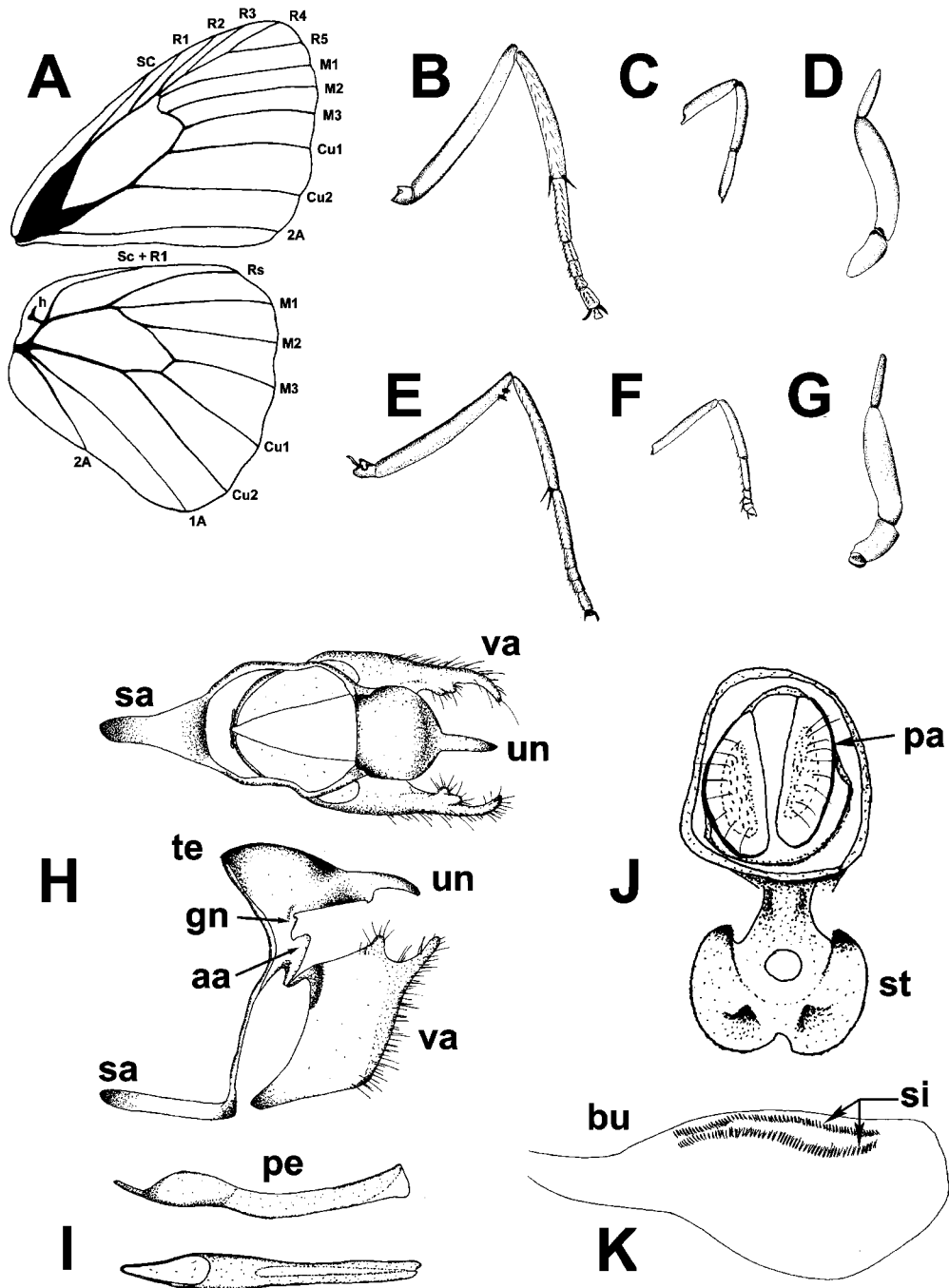


FIGURE 2. Morphological characters of *Guaianaza pronophila*; **A**, male wing venation - forewing above and hindwing below (forewing length 20 mm); **B**, male midleg (femur length 3.1 mm); **C**, male foreleg (femur length 0.7 mm); **D**, male palpus (third segment length 0.7 mm); **E**, female midleg (femur length 3.1 mm); **F**, female foreleg (femur length 1.3 mm); **G**, female palpus (third segment length 0.7 mm); **H**, male genitalia, dorsal view above, lateral view below (saccus length 0.7 mm); **I**, penis, lateral view above, dorsal view below (length 1.6 mm); **J**, female genitalia, posterior view (papilla anales length 0.8 mm); **K**, female corpus bursae, lateral view (signa length 0.8 mm); sa = saccus, va = valva, pe = penis, un = uncus, gn = gnathos, te = tegumen, aa = appendices angulares, st = sterigma, bu = corpus bursae, si = signa, pa = papillae anales.

Although it might be premature to identify unique apomorphies for *Guaianaza*, given our current poor knowledge of the subtribe Euptychiina, the following are distinctive characters: (1) valvae parallelogram-shaped; (2) valvae with deep dorsal posterior concavity, and; (3) appendices angulares “N”-shaped.

Description. Eyes hairy, dark reddish brown. Palpus one and a half times as long as head, brown with light brown hairs. Antenna (7–9 mm) up to 0.4 times the length of the forewing costa; shaft dark brown dorsally, orange brown ventrally, sparse dorsal scaling; club dark brown, not conspicuously developed, including 11–12 segments. Wing venation similar to *Forsterinaria* and most Euptychiina (Fig. 2A).

Male (Fig. 1A). Forewing length 19–21 mm, hindwing length 15–17 mm, antenna length 7–8 mm (n = 9). Body dark brown, abdomen ventrally light brown. Upperside wings ground color medium brown, without marks; margins of both wings dark brown. Underside wings ground color brown. FW underside with two transverse lines; a marginal scalloped line and a medial irregular oblique line 60% out from base; internal area lighter, delimited by these two lines; with four minute white dots in spaces R_5 - M_1 , M_1 - M_2 , M_2 - M_3 and M_3 - Cu_1 . HW underside background color darker than FW; with three transverse lines, a marginal scalloped line, a medial oblique line 60% out from base, and a basal irregular inconspicuous line 30% out from wing base; internal area delimited by marginal and medial lines lighter in color, with a large white contrasting area, expanding from costa to anal region in a triangular shape, and extending through anal region in a diffuse marbled pattern; four ocelli usually present in pale internal area in spaces M_1 - M_2 (1), M_2 - M_3 (2), M_3 - Cu_1 (3) and Cu_1 - Cu_2 (4); ocelli numbers 1 and 4 black with white center, ocelli numbers 2 and 3 light brown with white center.

Male genitalia (Figs. 2H, I). Saccus short; weakly developed tegumen with very small gnathos, appendices angulares “N”-shaped; very short pointed uncus; valvae parallelogram-shaped in lateral aspect, with deep dorsal posterior concavity, with one small dorsal process; penis slightly curved upwards; cornuti absent. Additional characters (legs and palpi) are illustrated (Figs. 2B-D).

Female (Fig. 1B). Forewing length 21–22 mm, hindwing length 17–18 mm, antenna length 8 - 9 mm (n = 3). Body dark brown; ventral abdomen light brown. Wing shape more rounded than in males; background color and pattern very similar to that of males, but in general lighter; white area on hindwing usually diffuse and not contrasting; basal irregular line usually conspicuously marked; ocelli smaller and more inconspicuous than those of males; hindwing ocelli 1 and 4 conspicuous, ocelli 2 and 3 almost lacking.

Female genitalia (Figs. 2J, K). Corpus bursae ovoid, signa long, formed by two rows of tiny teeth; ductus bursae not sclerotized; sterigma heavily sclerotized, somewhat rounded, with two marginal and two internal teeth; papillae anales semicircular. Additional characters (legs and palpi) are shown (Figs. 2E-G).

Variation. Based on our sample, pattern variation on the upperside surface of wings is minor. Most wing pattern variation occurs on the underside. The size of the ocelli on the

hindwings is variable in both sexes; in some individuals only ocelli 1 and 4 are easily visible without magnification. The size and intensity of the white area is also variable, being strongly contrasting in some individuals and weakly marked in others. In some females the white area is as dark and contrasting as in males, and a few males are pale, similar to the usual female pattern.

Description of early stages. The following descriptions are based on immatures reared from Paranapiacaba (eggs and first instar) and Serra do Japi (molting antepenultimate through last instar). Females did not oviposit readily in plastic bags, and with this method two females from Paranapiacaba yielded one egg each. Egg and first instar descriptions are based on these two eggs, while penultimate and last instar description are based on larvae collected in the field at Serra do Japi.

Egg (Fig. 3a). Spherical, bright yellow, marked with many small depressions visible under the stereomicroscope. Mean height 1.08 mm ($n = 2$), mean diameter 1.04 mm ($n = 2$). Duration: 8 days ($n = 2$).

First instar (Figs. 3b, c, 4). Head capsule pale yellow, with long setae and bearing a pair of very short scoli on vertex, each with two long narrow setae ending in a fine point. Third stemmata larger than the other stemmata. Head capsule width 0.62–0.70 mm ($n = 2$); scoli 0.02 mm ($n = 2$). Body light yellow with long setae and a pair of short caudal filaments. Setae light yellow, except those on T1 and A8–A10 that are black; setae relatively long (prothoracic seta D1 measured as 0.34 mm); body chaetotaxy illustrated in Fig. 4. Both larvae died before completing the first instar.

Penultimate instar. Head green with a pair of very short scoli. Head capsule width 1.58 mm ($n = 1$); scoli 0.26 mm ($n = 1$). Body emerald green, with many thin longitudinal yellow and light green stripes; caudae short. Maximum length 16 mm. Duration: 8 days ($n = 1$).

Last Instar (Figs. 3d–f). Head the same as in previous instar. Head capsule width 2.40–2.44 mm ($n = 2$); scoli 0.42–0.44 mm ($n = 2$). Body color similar to previous instar, but with two conspicuous yellow sublateral stripes. Maximum length 25 mm. Duration: 8 days ($n = 2$).

Pupa (Figs. 3g–i). Short and stubby, with short ocular caps. Ground color beige, with dark brown lines and patches producing a marbled pattern. Total length 8 mm ($n = 1$). Duration: 12 days ($n = 1$).

Biology. Adults are frequently found in large bamboo patches above 900 m high in the Serra do Mar and Serra da Mantiqueira, in both primary and secondary forests. Both sexes can fly from near the ground up to the canopy surrounding bamboo patches. Oviposition behavior was not observed in the field, and field collected larvae were found feeding on a species of *Chusquea* bamboo (Poaceae). Larvae feed isolated on the underside of mature leaves, far from the shoot tips. They are cryptic and difficult to find on the host-plant.

Etymology. The name is masculine and derived from Guaianazes, a tribe of Native Americans that inhabited the region where this species occurs.

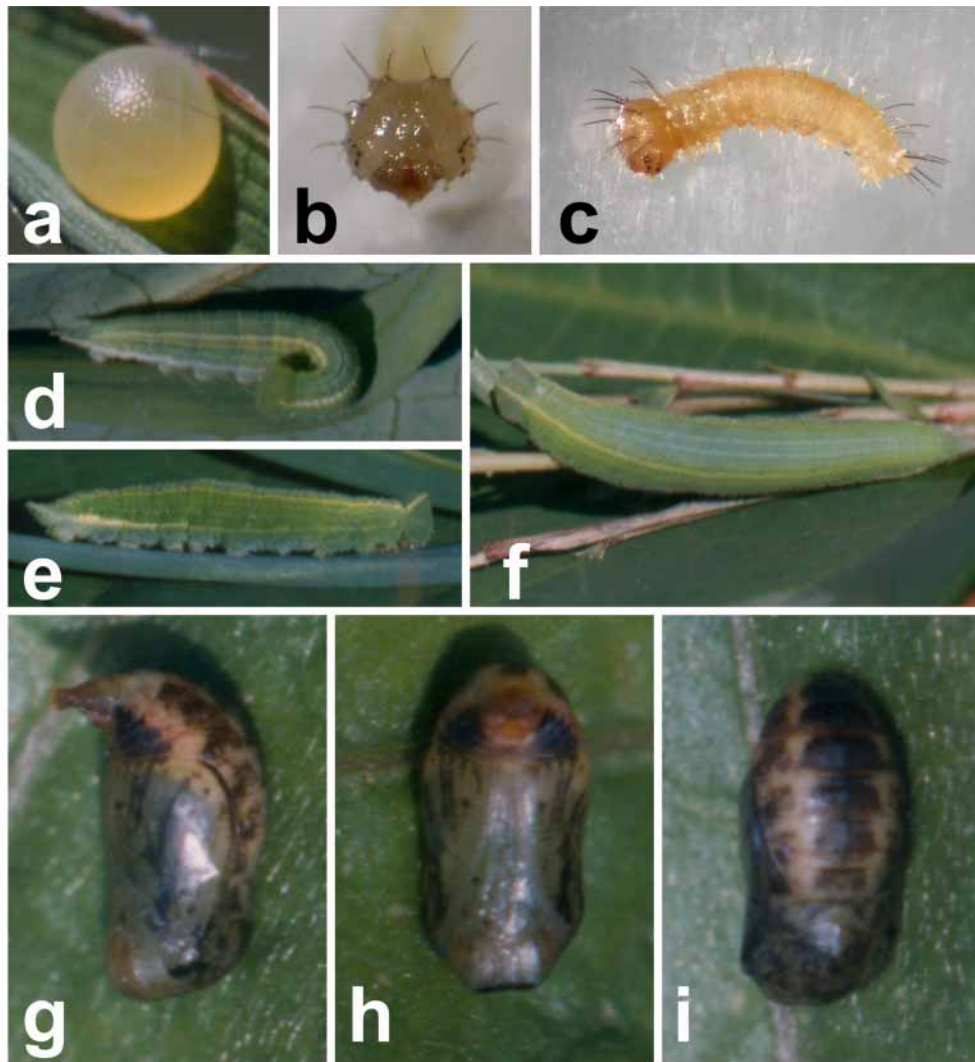


FIGURE 3. Immatures of *Guaianaza pronophila*; **a**, egg; **b**, **c**, first instar; **d**–**f**, last instar; **g**–**i**, pupa (lateral, ventral, dorsal).

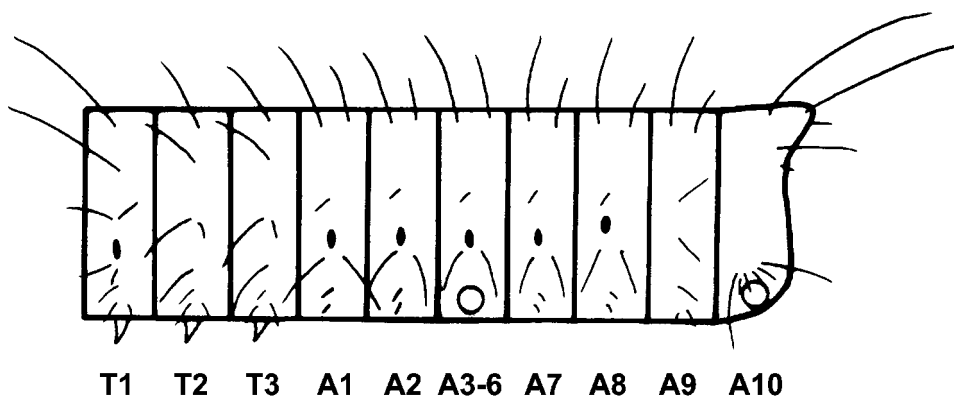


FIGURE 4. Body chaetotaxy of the first instar of *Guaianaza pronophila*.

Discussion

The immatures of *G. pronophila* are similar to those of most Euptychiina (DeVries 1987, Murray 2001, 2003, Freitas 2003, 2004a). Their most distinctive structures are the relatively long body setae and light head capsule in first instar, and the short head scoli in the last instar. These first instar characters are similar between *G. pronophila* and *Forsterinaria quantius* (Godart [1824]) (based on immatures of *F. quantius* reared by the first author), suggesting that these taxa may be closely related. However, these characters were also reported for two species of *Hermeuptychia* Forster, a genus that is distantly related to *Guaianaza* or *Forsterinaria* (Peña *et al. in press*). *Guaianaza pronophila* and *F. quantius* are also similar in the overall shape of the last instar, including the very short scoli of the head capsule (more developed in most species of Euptychiina). Curiously, the last instar of *Guaianaza* is almost identical in color pattern and shape to the penultimate (3rd) instar of *F. quantius*, but the last (4th) instar of *F. quantius* becomes dark brown and without the longitudinal lines present in the previous instar. We consider these larval characters a strong indication that *Guaianaza* and *Forsterinaria* share a recent common ancestor, and similar conclusions were reached independently using DNA sequence data (Peña *et al. in press*). The use of multiple lines of evidence (i.e., larval and adult morphology and DNA sequences) will lead to a more robust understanding of the systematic relationships within the Satyrinae.

In summary, the systematic position of *Guaianaza pronophila* near the genus *Forsterinaria* is reinforced by the shape of aedeagus and the remarkably small gnathos in adults; and by the relatively long body setae and light head capsule in first instar, and the short scoli in last instar (based on immatures of *F. quantius* reared by the first author). However, since we have no clear synapomorphies to include the species in any other nearby genera, we describe the monotypic genus *Guaianaza* to include this taxon.

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