

DESCRIPTION OF A NEW GENUS FOR “*EUPTYCHIA*” *PECULIARIS* (NYMPHALIDAE: SATYRINAE):
IMMATURE STAGES AND SYSTEMATIC POSITION

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ABSTRACT. Based on distinct character states in life history and adult morphology, the monotypic genus, *Taydebis*, new genus with “*Euptychia*” *peculiaris* Butler as the type species is described. Analysis of the morphological characters and comparisons with four nearby genera suggest that the genus is closely aligned to or should be placed near *Taygetis* Hübner and *Pseudodebis* Forster.

Additional key words: life history, Poaceae, *Pseudodebis*, *Taydebis*, *Taygetis*.

Within the Neotropical Nymphalidae, the subfamily Satyrinae is one of the most poorly understood groups, with many systematic problems and undescribed species, a fact often noted in the literature (Forster 1964, Miller 1968, DeVries 1987:257, Freitas 2002). Adult characters have been useful for understanding relationships in some cases (Forster 1964, Miller 1968), but have been insufficient to resolve some systematic problems in the subfamily. Since Müller (1886) early stages have been shown as a useful source of characters in butterfly systematics (Kitching 1985, Brown & Freitas 1994, Freitas et al. 1997, Penz 1999) including for the Satyrinae (Singer et al. 1983, DeVries et al. 1985, Freitas 2002, Freitas et al. 2002).

“*Euptychia*” *peculiaris* Butler 1874 is a problem species from southeastern Brazil. This species occurs at moderate elevations (800–1700 m) and is known from only a few localities along the Mantiqueira mountains and the Serra do Mar in the states of São Paulo and Santa Catarina (Campo Alegre and Lages) (see list below). The record of Hayward (1973:256) from Misiones, Argentina, requires further confirmation.

The present paper illustrates and describes the critical morphological characters that distinguish this taxon, such as the wing venation and male genitalia. For the first time, the early stages are illustrated and described in detail. A comparative discussion of systematic relationships of “*E.*” *peculiaris* within the Satyrinae is presented and a new genus, *Taydebis*, is described.

MATERIALS AND METHODS

Adults and immatures of “*E.*” *peculiaris* were studied at six different localities in São Paulo State, SE Brazil: banks of the Rio Tietê (Mogi das Cruzes, 700–800 m), Morro Grande Forest Reserve (Cotia, 850–950 m), Núcleo Santa Virgínia (São Luis do Paraitinga, 900–1100 m), Campos do Jordão State Park (Campos do Jordão, 1500–1700 m), Intervalles Park (Capão Bonito, 900–1100 m) and Grota Funda Municipal Park (Atibaia, 900–1000 m).

Fertile eggs were obtained from wild-captured females that were confined in plastic bags. 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 castings were retained in small glass vials. When there was sufficient material, immatures were fixed in Kahle solution (AVLF collection). All measurements were made using a microscope fitted with a calibrated micrometric ocular. Egg size is presented as length and diameter, and head capsule size is the distance between the most external ocelli (as in Freitas 1991). Taxonomic nomenclature follows Miller (1968) as modified by Harvey (1991), who treated the group as a subfamily, down-ranking Miller's subfamilies and tribes to tribes and subtribes, respectively. Nomenclature of wing veins follows Miller (1969), and of body setae follows Hinton (1946).

***Taydebis* Freitas, new genus**

(Figs. 1, 2, Table 1)

Type species: *Euptychia peculiaris* Butler, 1874.

Diagnosis. Eyes hairy, reddish brown. Labial palpus one and a half times as long as head, brown with light brown hairs. Antenna (8.5–9.5 mm) up to 0.4 times the length of the costa; shaft dark brown dorsally, orange brown ventrally, sparse scaled dorsally; club not conspicuously developed, including eleven segments, with apical portion (last five segments) dark brown. Wing venation very similar to *Pseudodebis* and *Taygetis* (Fig. 2). Both wings extremely rounded apically (Figs. 1, 2).

Description of adults. Male. Forewing length 20–23 mm, hindwing length 16–19 mm (n = 15). Body dark brown, abdomen ventrally light brown. Upperside ground color of wings medium brown, without marks, except for a dark brown zigzag sub marginal line on both wings, and a light marginal line on the hindwing. Underside ground color lighter brown, three-tone: forewing discal area darker, hindwing distal half lighter. Two prominent scalloped brown lines crossing both wings 35% and 60% out from base; sub marginal region of forewing with a diffuse darker brown area with four



FIG. 1. Adult male (top) and female (bottom) of *Taydebis peculiaris* from Parque Estadual de Campos do Jordão, SP.

minute light blue centered black ocelli bordered with orange in spaces R5-M1, M1-M2, M2-M3 and M3-Cu1; sub marginal area of hindwing with two prominent light blue centered black ocelli with orange margins in spaces Rs-M1 and M1-M2, minute similar ocelli in spaces M2-M3 and M3-Cu1, somewhat larger in Cu1-Cu2 and Cu2-1A. A dark brown zigzag sub marginal line and a light marginal line are present on both wings. Male genitalia (Fig. 2) with an elongated saccus, well developed tegumen and long pointed uncus. The gnathos appears as two long pointed processes. Valvae trapezoidal ending with a single well developed point. Aedeagus with one large cornutus. Additional morphological characters (legs and labial palpus) are shown in Fig. 2.

Female. Forewing length 22-24 mm, hindwing length 17-22 mm (n = 6). Body dark brown, ventral abdomen light brown. General color and pattern very similar to but in general lighter than that of males. Wings more rounded than in males.

Variation. Variation in the dorsal wing surfaces is very low, with most variation being recorded on the underside. The size of the ocelli is variable in both sexes, and in some individuals only the two prominent ocelli of the hindwing can be seen without magnification. The wing pattern is also variable, being weakly marked in some few individuals from Campos do Jordão. Some females have the underside ground color much more yellowish, especially in the sub marginal and anal areas.

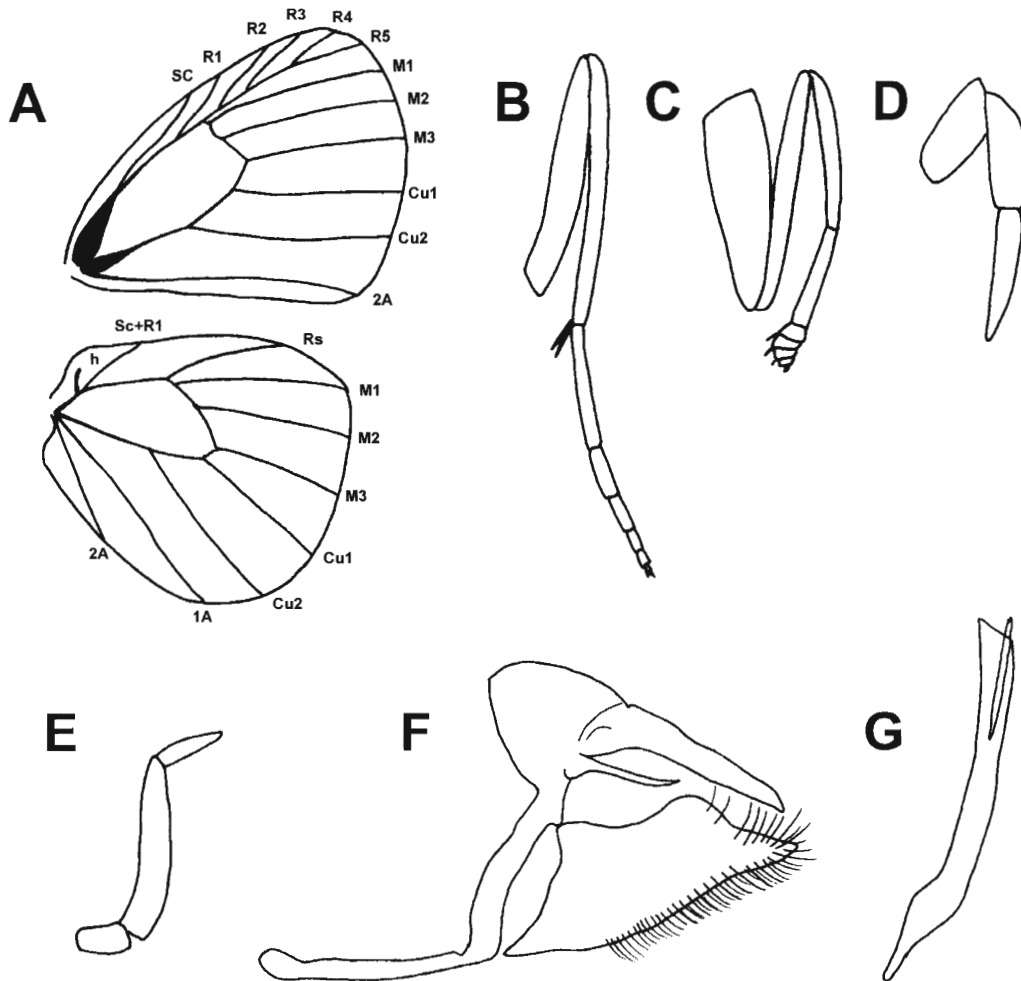


FIG. 2. Morphological characters of *Taydebis peculiaris*. **A**, Male wing venation—hindwing above and forewing below; **B**, Male midleg; **C**, Female foreleg; **D**, Male foreleg; **E**, Male labial palpus; **F**, Lateral view of male genitalia; **G**, Aedeagus in lateral view.

Description of early stages. The following descriptions are based on immatures reared from Santa Virginia and Morro Grande. The typical features of the immatures are very similar at these two sites. However, the number of instars was variable with four instars in Morro Grande (Table 2) and five in Santa Virginia (see discussion). Females laid individual eggs when confined in plastic bags, suggesting the oviposition of isolated eggs as the usual situation in nature.

Egg. Spherical, light green, without visible ridges or marks under the optic microscope. Height and diameter 0.92 mm ($n = 30$). Duration: 5–7 days.

First instar (Figs. 3a, b, 4). Head capsule black, with enlarged chalazae, bearing a pair of short scoli on vertex, each with two long narrow setae ending into a fine point. Third stemma larger than the other stemmata. Head capsule width 0.66–0.72 mm (mean = 0.69 mm, SD = 0.017, $n = 30$); scoli 0.08–0.12 mm (mean = 0.11 mm, SD = 0.013, $n = 30$). Body beige, becoming light green after feeding, smooth, with many weak white longitudinal stripes and a pair of short caudal filaments. Setae XD, D, SD and L thickened with clubbed tips; body chaetotaxy illustrated in Fig. 4. Maximum length 5 mm. Duration: 8–9 days.

Second instar (Fig. 3c). Head black with two diverging scoli on vertex. Head capsule width 0.90–1.02 mm (mean = 0.97 mm, SD = 0.039, $n = 26$); scoli 0.28–0.40 mm (mean = 0.34 mm, SD = 0.031, $n = 26$). Body slender, light green with many longitudinal white stripes; caudal filaments short. Maximum length 10 mm. Duration: 7–8 days.

Third instar. Head black with green front and two short black diverging scoli on the vertex. Head capsule width 1.20–1.42 mm (mean = 1.32 mm, SD = 0.053, $n = 18$); scoli 0.40–0.56 mm (mean = 0.46 mm, SD = 0.050, $n = 18$). Body dark green with many longitudinal yellow stripes; caudal filaments short. Maximum length 16 mm. Duration: 6–8 days.

Fourth instar. Head green with a pair of short scoli with red tips. Head capsule width 1.70–1.90 mm (mean = 1.78 mm, SD = 0.055, $n = 17$); scoli 0.58–0.74 mm (mean = 0.63 mm, SD = 0.044, $n = 17$). Body emerald green, with many longitudinal thin yellow and light green stripes; caudal filaments short. Maximum length 22 mm. Duration: 9–10 days.

Fifth (last) instar (Fig. 3d–f). Head the same as in previous instar. Head capsule width 2.45–2.75 mm (mean = 2.54 mm, SD = 0.090, $n = 10$); scoli 0.75–0.88 mm (mean = 0.82 mm, SD = 0.039, $n = 10$). Body color same as fourth instar. Maximum length 33 mm. Duration: 9–10 days.

Pupa (Fig. 3g–h). Entirely green, elongated, smooth, with short ocular caps and slightly projecting alar caps bordered with a thin yellow line. Total length 12–14 mm. Duration 10 days ($n = 7$).

Etymology. The name is a reduced combination of *Taygetis* and *Pseudodebis*, possibly the two most closely related genera.

TABLE 1. Comparisons of *Taygetis* with related genera.

| Species | Eyes | Forewing apex | Hindwing margin | Shape of aedeagus | Aedeagus: length/width | Shape of uncus | Shape of gnathos | Tegumen | Saccus: ratio length/width |
|---|--|---------------|-----------------|--------------------------|------------------------|-------------------|--------------------|---------------------|----------------------------|
| <i>Taygetis peculiaris</i> ¹ | hairy | rounded | not wavy | straight | 12 | straight, slender | elongated, pointed | pronounced | 13 |
| <i>Pseudodebis griscola</i> ² | few sparse hairs | rounded | slightly wavy | strongly curved | 23 | curved, broad | elongated, pointed | pronounced | 11 |
| <i>Pseudodebis euptychidia</i> ³ | hairy | rounded | slightly wavy | straight | 18 | curved, slender | short, rounded | pronounced | 6 |
| <i>Pseudodebis valentina</i> ⁴ | hairy | rounded | slightly wavy | straight | 12 | curved, slender | short, broad | slightly pronounced | 5 |
| <i>Taygetis kera</i> ⁵ | hairy | acute | wavy | straight | 13 | straight, broad | elongated, pointed | pronounced | 7 |
| <i>Taygetis laches</i> ^{5,6} | hairy | truncate | wavy | straight | 25 | straight, slender | elongated, pointed | slightly pronounced | 8 |
| <i>Taygetis ypthima</i> ⁷ | very short sparse hairs in lateral portion | acute | wavy | straight | 12 | straight, slender | elongated, pointed | pronounced | 4 |
| <i>Taygetis mermeria</i> ⁴ | hairy | acute | wavy | straight | 10 | straight, slender | elongated, pointed | not pronounced | 6 |
| <i>Taygetis celia</i> ⁴ | hairy | truncate | wavy | straight | 10 | straight, slender | short, rounded | not pronounced | 4 |
| <i>Taygetis sylbia</i> ⁴ | hairy | acute | wavy | straight | 6 | straight, broad | elongated, pointed | not pronounced | 4 |
| <i>Taygetis echo</i> ⁸ | few sparse hairs | rounded | wavy | straight | 14 | straight, slender | elongated, pointed | not pronounced | 5 |
| <i>Harjesia blanda</i> ⁴ | hairy | rounded | wavy | straight | 8 | curved, slender | elongated, pointed | not pronounced | 4 |
| <i>Posttaygetis penicula</i> ^{4,9} | hairy | rounded | wavy | curved at the distal end | 15 | straight, broad | short, rounded | not pronounced | 4 |

Source of material (all localities in Brazil): 1—this paper; 2—Jaru, RO; 3—Linhares, ES; 4—Marechal Thaumaturgo, AC; 5—Jatai, SP; 6—Campinas, SP; 7—Campos do Jordão, SP; 8—Alta Floresta, MT; 9—Morro do Diabo, SP.

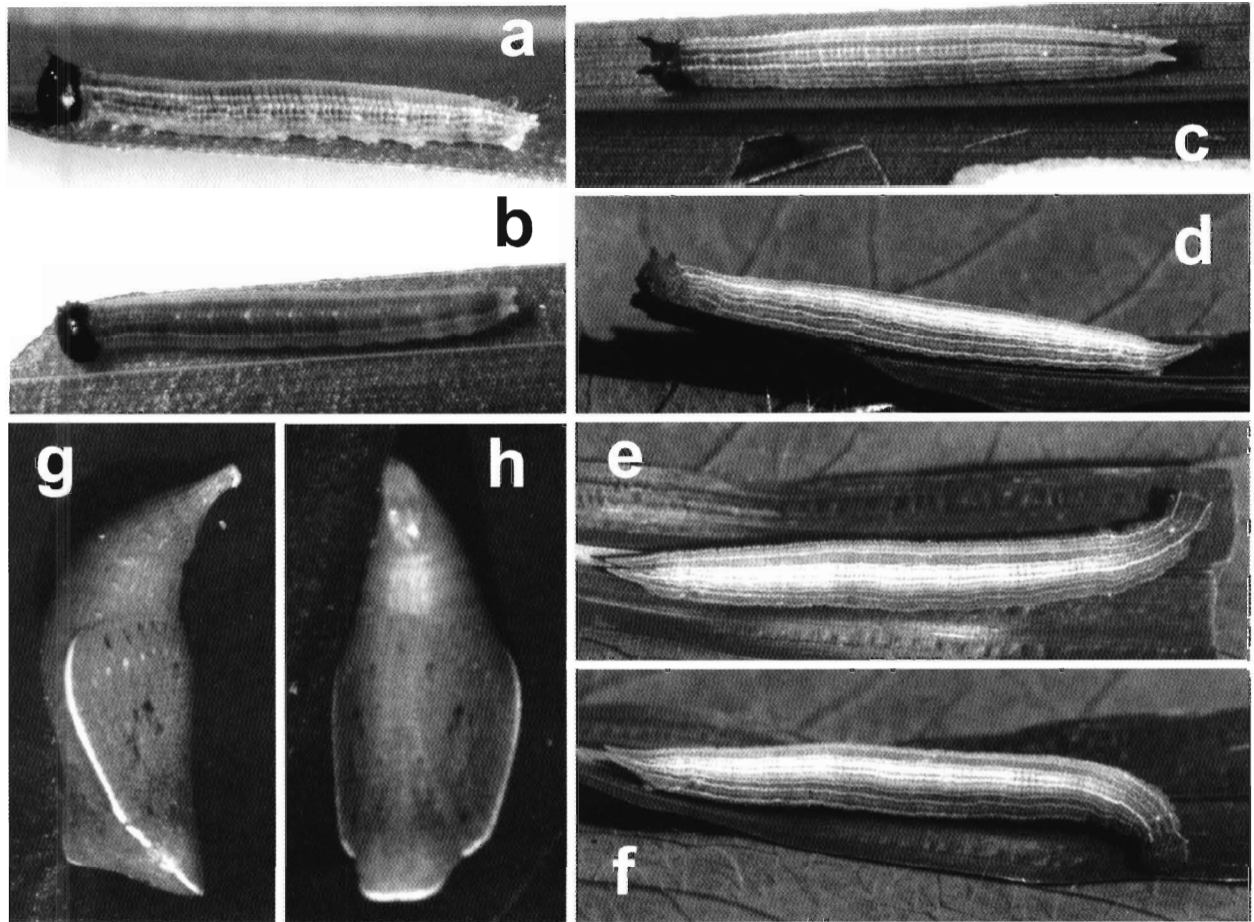


FIG. 3. Early stages of *Taydebis peculiaris*. **a, b**, First instar (lateral, dorsal); **c**, Second instar; **d, e, f**, Fifth (last) instar (lateral and two dorsal views); **g, h**, Pupa (lateral, ventral). All specimens from Santa Virgínia, SP.

Habits. This species is frequently found in grass fields and swampy areas at medium to high altitudes, independent of the conservation status of the area. Oviposition behavior was not observed, and the host plant in the field is unknown. In the laboratory, larvae readily accepted the Carpetgrass *Axonopus compressus* (Sw.) P. Beauv. ("grama misioneira"), a common grass with soft leaves used in shaded lawns in Brazil.

Systematic position. A genus near *Taygetis* and *Pseudodebis* (Table 1); distinguished from *Pseudodebis* by the elongated pointed gnathos (short, rounded in *Pseudodebis*), the longer saccus and a straight uncus in lateral view (curved in *Pseudodebis*). Distinguished from most *Taygetis* by the longer saccus, rounded forewing apex, and the presence of a well-developed tegumen (weakly developed in most *Taygetis*). Characters from immatures also support the affinities of *Taydebis* with *Pseudodebis* and *Taygetis* (see below).

DISCUSSION

The supposed systematic position of *Taydebis peculiaris* was based on both adult and immature morphology. The male genitalia are very similar to two other genera as discussed above, and different from the other series of genera of euptychiines. The last instar is similar to that of *Pseudodebis marpessa* and some *Taygetis* (Murray 2001), but also has remarkable similarities with *Godartiana* (unpublished results). The first instar has long narrow setae on the head capsule, most similar to those of *Posttaygetis penelea* (D. Murray in prep.), and different from *Taygetis* that has wide, flattened fan-shaped setae. The pupa also has a few characters very similar to some *Taygetis* species, including the slightly projecting alar caps bordered with a yellow line (Young 1984, AVLF unpublished data).

The general appearance of the immatures of *T. peculiaris* is not divergent from those of most known euptychiines, including first instar larva with two

TABLE 2. Data from a larval lot of *Taydebis peculiaris* with only four instars (Morro Grande, Cotia, SP).

| | Duration (days) | Head capsule width (mm) | Length of scoli (mm) | Maximum length (mm) | n |
|------------|-----------------|-------------------------|----------------------|---------------------|---|
| 1st instar | 7-8 | 0.68 | 0.08-0.10 | 6 | 4 |
| 2nd instar | 6-7 | 1.02 | 0.36-0.38 | 12 | 4 |
| 3rd instar | 6-7 | 1.6 | 0.44 | 17 | 4 |
| 4th instar | 10 | 2.28-2.22 | 0.62-0.66 | 30 | 3 |

short head horns, an elongated striped mature larva and a smooth pupa (Young 1984, DeVries et al. 1985, DeVries 1987). The body setae with clubbed tips in the first instar are also present in many Satyrinae (Murray 2001, and AVLF unpublished data from more than 60 neotropical species); their function is still unknown.

Even if *Taydebis* is distinguishable from most species of the nearby genera, the present scenario shows that the boundaries among these and other genera in this series are still not established. A more careful comparison (Table 1) suggests that many different taxonomic entities may be included under the genera *Pseudodebis* and *Taygetis*, including "*Pseudodebis griseola*" and "*Taygetis celia*", which should be placed in two new different genera.

Thus, the correct position of *Taydebis* within the Euptychini may well need further investigation, and additional cladistic studies (morphological and/or molecular) could help to further clarify this placement.

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LITERATURE CITED

BROWN, K. S. JR. & A. V. L. FREITAS. 1994. Juvenile stages of Ithomiinae: overview and systematics. *Trop. Lep.* 5:9-20.
 DEVRIES, P. J. 1987. The butterflies of Costa Rica and their natural history. Papilionidae, Pieridae, Nymphalidae. Princeton University Press, Princeton, New Jersey.
 DEVRIES, P. J., I. J. KITCHING & R. I. VANE-WRIGHT. 1985. The systematic position of *Antirrhoea* and *Caerois*, with comments on the higher classification of the Nymphalidae (Lepidoptera). *Syst. Entomol.* 10:11-32.
 FORSTER, W. 1964. Beiträge zur Kenntnis der Insektenfauna Bolivians XIX. Lepidoptera III. Satyridae. Veröffentlichungen der zoologischen Staatssammlung München 8:51-188, pls. 27-35.
 FREITAS, A. V. L. 1991. Variação morfológica, ciclo de vida e sistemática de *Tegosa claudina* (Eschscholtz) (Lepidoptera, Nymphalidae, Melitaeinae) no Estado de São Paulo, Brasil. *Rev. bras. Entomol.* 35:301-306.
 ———. 2002. Immature stages of *Eteona tisiphone* (Nymphalidae: Satyrinae). *J. Lepid. Soc.* 56:286-288.
 FREITAS, A. V. L., K. S. BROWN JR. & L. D. OTERO. 1997. Juvenile stages of *Cybdelis*, a key genus uniting the diverse branches of the Eurytelinae. *Trop. Lep.* 8(1):29-34.
 FREITAS, A. V. L., D. MURRAY & K. S. BROWN JR. 2002. Immatures, natural history and the systematic position of *Bia actorion* (Nymphalidae). *J. Lepid. Soc.* 56:117-122.
 HARVEY, D. J. 1991. Higher classification of the Nymphalidae (Appendix B), pp. 255-273. *In* Nijhout, H. F. (ed.), The development and evolution of butterfly wing patterns. Smithsonian Press.
 HAYWARD, K. J. 1973. Catálogo de los ropalóceros argentinos. *Opera Lilloana* 23:1-318, 1 map.
 HINTON, H. E. 1946. On the homology and nomenclature of the setae of lepidopterous larvae, with some notes on the phylogeny of the Lepidoptera. *Trans. R. Entomol. Soc. London* 97:1-37.

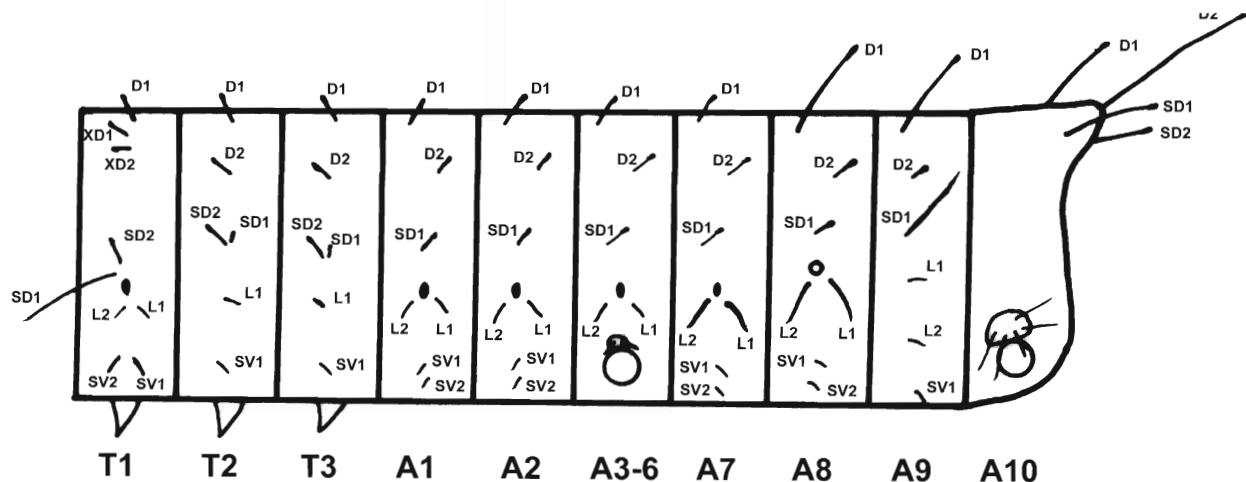


FIG. 4. Chaetotaxy of the first instar larva of *Taydebis peculiaris*.

- KITCHING, I. J. 1985. Early stages and the classification of the milkweed butterflies (Lepidoptera: Danainae). *Zool. J. Linn. Soc.* 85:1-97.
- MILLER, L. D. 1968. The higher classification, phylogeny and zoogeography of the Satyridae (Lepidoptera). *Mem. Am. Entomol. Soc.* 24:iii + 174 pp.
- . 1969. Nomenclature of wing veins and cells. *J. Res. Lepid.* 8(2):37-48.
- MÜLLER, W. 1886. Sudamerikanische Nymphalidenraupen: Versuch eines natürlichen Systems der Nymphaliden. *Zoologische Jahrbücher (Jena)* 1 (3/4):417-678, pls 12-15.
- MURRAY, D. 2001. Immature stages and biology of *Taygetis* Hübn. (Lepidoptera : Nymphalidae). *Proc. Entomol. Soc. Washington* 103(4):932-945.
- PENZ, C. 1999. Higher level phylogeny for the passion-vine butterflies (Nymphalidae, Heliconiinae) based on early stage and adult morphology. *Zool. J. Linn. Soc.* 127:277-344.
- SINGER, M. C., P. J. DEVRIES & P. R. EHRLICH. 1983. The *Cissia confusa* species-group in Costa Rica and Trinidad (Lepidoptera: Satyrinae). *Zool. J. Linn. Soc.* 79:101-119.
- YOUNG, A. M. 1984. Natural history notes for *Taygetis andromeda* (Cramer) (Satyridae) in Eastern Costa Rica. *J. Lepid. Soc.* 38:102-113.

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