

IMMATURE STAGES OF THE ANDEAN BUTTERFLY

ACTINOTE RUFINA

(NYMPHALIDAE: HELICONIINAE: ACRAEINI)

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Abstract – The early stages of *Actinote rufina* Oberthür, 1917, an uncommon species occurring on the east Andean slopes from Ecuador to southern Peru, are described from a population found on the road to Alfamayo, Cuzco, Peru, in September 2008. Immature stage morphological characters are compared to those found in other species of *Actinote*.

Resumo – Os estágios imaturos de *Actinote rufina* Oberthür, 1917, uma espécie pouco comum que ocorre nas encostas orientais dos Andes desde o Equador ao sul do Peru, foram descritos a partir de uma população encontrada na estrada para Alfamayo, em setembro de 2008. Os caracteres dos imaturos foram comparados àqueles encontrados em outras espécies de *Actinote*.

Key words: Acraeini, *Actinote*, *Actinote rufina*, life-cycle, Nymphalidae, Peru.

In the last few decades, the use and importance of early stage data in insect systematics has been increasing, especially for

butterflies, where characters from immatures are known to be informative for both species identification and phylogenetic reconstruction (see Freitas & Brown 2004).

The genus *Actinote* (*sensu* Silva-Brandão *et al.* 2008) (Nymphalidae: Heliconiinae) contains about 35 described species of Neotropical butterflies, with at least 23 present in southeastern Brazil and 12 in the Andes (Lamas 2004, Paluch 2006, Silva-Brandão *et al.* 2008, Neild 2008, Willmott *et al.* 2009). Due to high similarity among species, variation within species and presence of mimicry, adults of *Actinote* (especially the females) are often difficult to distinguish (D'Almeida 1935, 1958, Penz & Francini 1996). Conversely, the immatures of most species (especially larvae) are quite distinctive, and of a great help for species discrimination (Francini 1989, Francini *et al.* 2004).

The immatures of all known species of *Actinote* are gregarious and feed on species of Asteraceae (Francini 1989, 1992, Brown 1992, Paluch *et al.* 1999, 2001, Silva-Brandão *et al.* 2008). All life stages contain cyanogenic compounds and the adults have a short lifespan (three to seven days on average), occurring in a few (usually one to three) discrete generations throughout the year (Brown & Francini 1990, Francini *et al.* 2005).

Even though knowledge of the immature stages is potentially useful for *Actinote* systematics, there are very few complete published descriptions of early stages for this genus (but see Paluch *et al.* 1999, 2001), and most are for species from southeastern Brazil (D'Almeida 1935, Francini 1989).

The present paper describes the early stages of *Actinote rufina* Oberthür, 1917 and is the first formal description of immatures for any Andean species of *Actinote*, and compares them with those of other *Actinote* species.

STUDY SITES AND METHODS

Adults and immatures of *A. rufina* were studied in the field, at Km 78 along the road to Alfamayo, Alfamayo, Peru (13°3'44"S 72°24'22"W), 2480m elevation (Fig. 1a), on

September 7, 2008. The site lies in subtropical wet montane forest. Larvae were reared in the laboratory in plastic containers, which were cleaned daily, with fresh plant material provided every two or three days (following Freitas 1991). Dry head capsules and pupal castings were conserved in glass vials. Immatures were fixed in Kahle solution (Borror & DeLong 1971), and all the samples (preserved eggs and larvae, head capsules and pupal castings) were deposited at the Museu de Zoologia, Universidade Estadual de Campinas, Campinas, São Paulo, Brazil (Unicamp). All measurements were made using a stereomicroscope fitted with a calibrated micrometric ocular. Egg sizes are height and diameter, and head capsule size is the distance between the most external ocelli (as in Freitas 2007).

RESULTS

Host plant and behavior: On September 7, 2008, around midday, many adults of *A. rufina* were observed flying around a large patch of *Smilax sonchifolius* (Poepp.) H. Rob. (Asteraceae), a plant that was later confirmed as larval host (Fig. 1b). The plants were all growing on a slope along the road edge, covering an area of about 500m². A visual census revealed that more than 50 individuals, mostly males, could be counted in one minute of observation in a small sector of the host plant patch (ca. 25m²), and perhaps 200-400 adults were present in the entire area. Males were observed flying throughout the entire host plant patch, mostly above the plants (3-5 m high) but several were also observed flying inside the host plant patch. Males were frequently observed landing on the upper surface of leaves in the sunlight (Fig. 1c), and a very few males were observed visiting flowers of one unidentified Asteraceae. One worn female was observed for several minutes ovipositing on the underside of a large leaf of *S. sonchifolius* inside the plant patch, with three males simultaneously trying to copulate with her. One additional egg clutch, several last instar larvae and one pupa were also found on the same plant, and later confirmed as being *A. rufina*. During the entire time of our observation, only

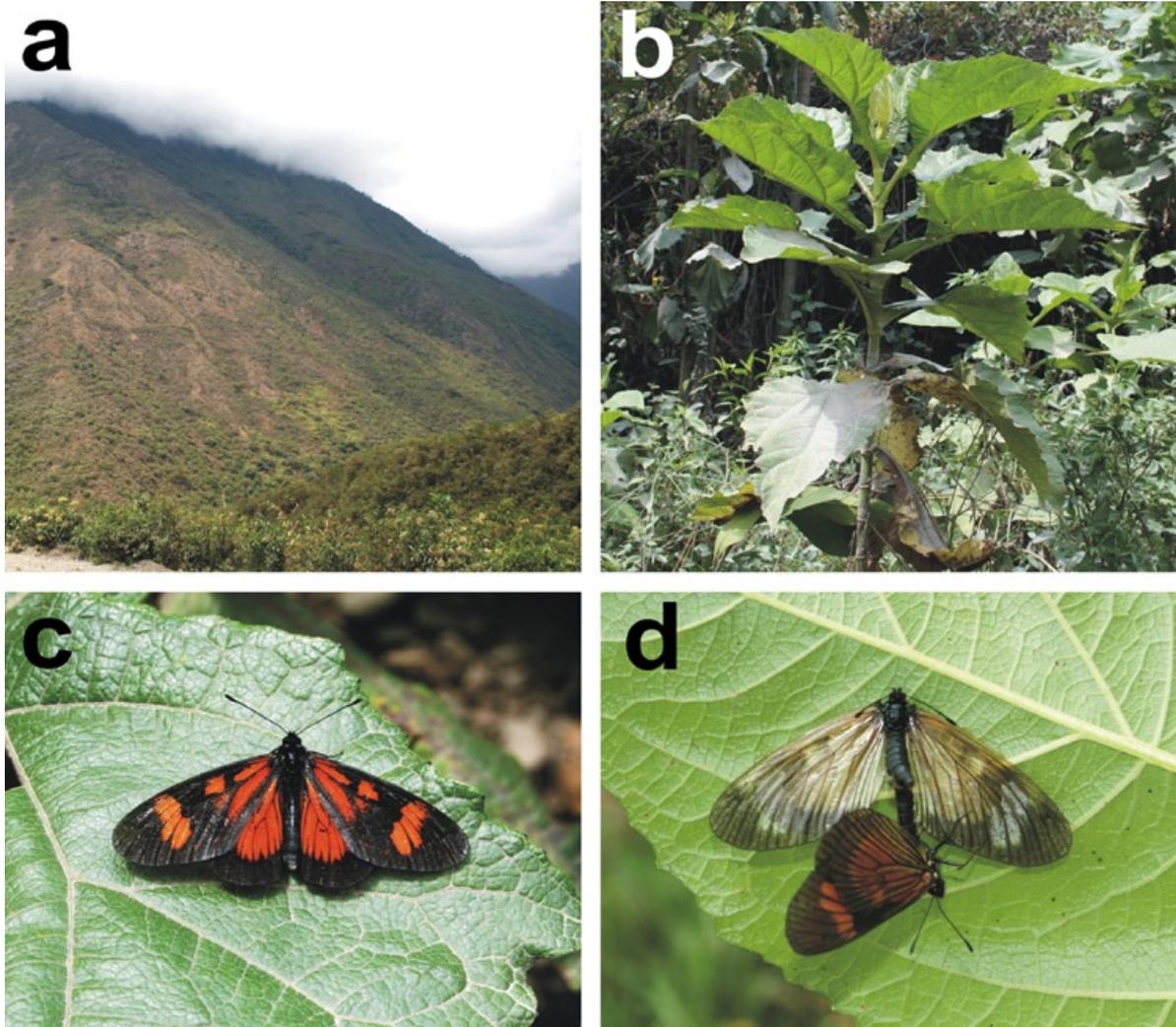


Fig. 1. **a**) General view of the habitat of *Actinote rufina*; **b**) *Smallanthus sonchifolius* (Asteraceae), the larval host plant of *A. rufina*; **c**) adult male landing above leaf; **d**) a couple of *A. rufina* in copula (note the pale female).

eight females were observed in the area, and in four cases, they were positioned on the under side of the leaf, with their wings open and with 1-4 males attempting copulation (Fig. 1d). The four females observed in flight were all pursued by males, in an apparent attempt to copulate with them.

Newly hatched larvae first consumed the egg chorion, and then, after several hours, began to feed on leaf tissue. Larvae were strongly gregarious, and all activities occurred at the same time, such as feeding, resting, or moving between leaves. Last instars were found dispersed in the field, suggesting that they become solitary just before pupation. First instar larvae scratched the leaf surface while feeding only on the superficial tissue, while last instar larvae were observed consuming the entire leaf, creating holes in the leaves.

Immature stages

Egg (Figs. 2a,b). Light yellow when first laid (Fig. 2a), changing gradually to reddish during the first 24 hours (Fig. 2b); barrel shaped with 17 - 20 longitudinal ribs and ca. 12-15 weakly marked transverse ribs; mean height 0.938 mm (range 0.90 - 1.00 mm, SD = 0.0346, n = 10), mean diameter 0.704 mm (range 0.66 - 0.76 mm, SD = 0.0295, n = 10). The collected cluster had 89 eggs (Fig. 2a), but the oviposition process was interrupted, so more might be found naturally. One additional cluster found in the field had ca. 200 eggs. Duration 13 days, in the laboratory, with all larvae emerging at the same time.

First instar (Figs. 2c,d). Head black, smooth, without scoli, mean width 0.48 mm (range 0.46 - 0.50 mm, SD = 0.0133, n = 10); body light yellow, without scoli and with long black setae arising from sclerotized insertions; a conspicuous dorsal black prothoracic plate present; legs black, prolegs with lateral dark grey plate, anal plate black. Maximum length 3.5 mm. All larvae were killed and preserved in the first instar due to lack of additional food for subsequent stages.

Last instar (Figs. 2e,f). Head entirely black, smooth with thin dark setae and without scoli, spines or chalazae, width 3.3 - 3.5 mm (n = 3); body dark grey dorsally, yellow ventrally except for the last two segments which are dark brown, covered with long dark scoli that contrast with long white setae; legs black, prolegs yellow and anal prolegs black; anal plate black. Maximum length: 32 mm (n = 3).

Pupa (Fig. 2g). General profile elongated, ground color pale beige with dark brown markings in wing cases and abdomen; abdominal segments mobile, with a series of five pairs of subdorsal black tubercles from segments A2 to A6. Length 16 - 20 mm (n = 2).

DISCUSSION

A comprehensive study comparing immature stage morphology among *Actinote* is in preparation by Freitas *et al.*, so we confine our comments here to noting particular points of interest. In general, the behavior and appearance of the immatures of *A. rufina* are similar to those of other species of *Actinote*. Eggs and larvae are gregarious, as is the case in all other species of

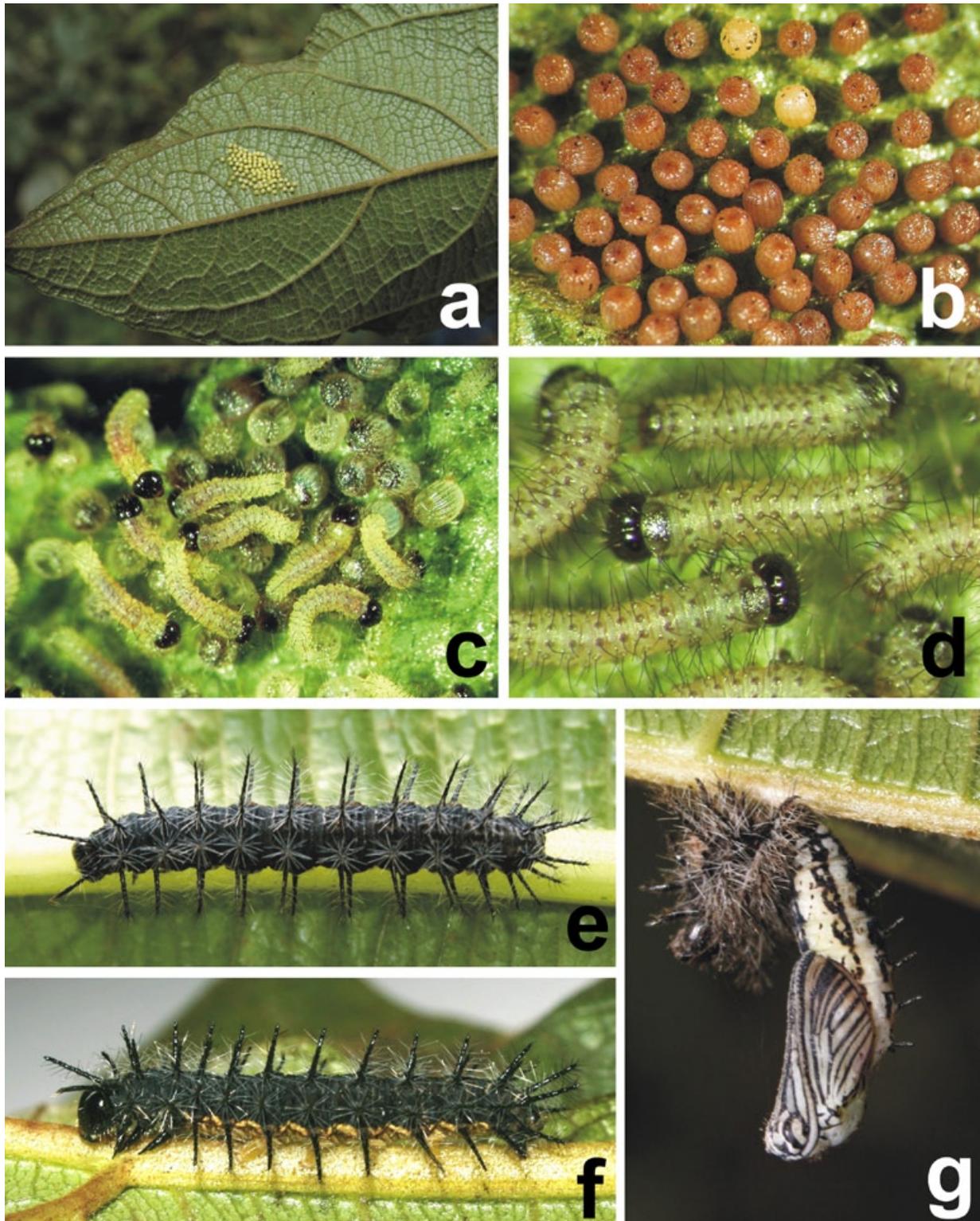


Fig. 2. Immature stages of *A. rufina*: **a**) egg cluster (general view just after oviposition); **b**) egg cluster (magnified view, 7 days after oviposition); **c, d**) group of first instar; **e, f**) last instar (dorsal, lateral); **g**) pupa (lateral view).

Actinote (DeVries 1984, Francini 1989, Paluch *et al.* 1999, 2001) for which the life histories have been described. In fact, gregarious immatures is a condition present in most known Acraeini, and have been reported in the few known *Altinote* (*sensu* Lamas 2004) and in most of the Palaeotropical Acraeini (Van Son 1963, DeVries 1987, Pierre & Bernaud 2002, 2007, Pierre & Amiet 2007).

First and last instars are both similar to those described for other species of *Actinote* in general pattern and scoli distribution (Francini 1989, Paluch *et al.* 1999, 2001). The relative size of body scoli in the last instar is shorter than in *A. carycina* Jordan, 1913 (Paluch *et al.* 2001) and equivalent to that observed for *A. surima* (Schaus, 1902) (Paluch *et al.* 1999). The color patterns resemble that of *A. bonita* Penz, 1996 (R. B. Francini, pers.

comm.).

The pupa is very similar to those of most known *Actinote* in general shape and color pattern. The series of five pairs of subdorsal tubercles on the abdomen is the condition found in most known species of *Actinote*, except for *A. canutia* and *A. mamita*, which have six pairs of subdorsal tubercles (Francini 1989, Paluch *et al.* 1999, 2001). These tubercles are relatively longer in *A. rufina* than those observed in *A. surima* and *A. carycina* (see Paluch *et al.* 1999, 2001).

We encourage others to publish early stage descriptions for additional species of *Actinote*, especially from the Andes, to improve our knowledge of morphological variation and contribute to our understanding of this group's systematics.

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