

THE BIOLOGY AND IMMATURE STAGES OF *PANACEA PROCILLA LYSIMACHE* (LEPIDOPTERA: NYMPHALIDAE) FROM COSTA RICA, WITH THE REPORT OF A NEW LOCALITY RECORD

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Abstract - Descriptions of the immature stages of *Panacea procilla lysimache* are presented, along with new locality records for this butterfly and its larval host plant in Costa Rica. Basic natural history, larval behavior, larval host use, and the distribution of *Panacea procilla lysimache* are discussed.

Key Words: *Batesia*, biology, *Caryodendron*, Euphorbiaceae, Guanacaste, host plants, immature stages, larvae, Neotropical, Nicaragua, pupae.

The Neotropical genus *Panacea* Godman and Salvin occurs from Costa Rica south through Colombia, Venezuela, the Guianas, the Amazon Basin, and into Bolivia (D'Abrera, 1987; DeVries, 1987; Emmel & Austin, 1990; Penz & DeVries, 2002). Members are large, conspicuously marked butterflies characterized by iridescent blue-green dorsal bands and colorful ventral hind wing surfaces. Although widespread and often abundant components of tropical forest faunas in South America, specimens are rare and poorly represented in collections from Central American locations; in fact, the subspecies' known distribution was solely limited to Panama until the first record of *Panacea procilla lysimache* Godman and Salvin from Finca la Selva, Costa Rica by DeVries in 1989. Similarly, detailed information on the life history, ecology and behavior of the various species and subspecies remains generally limited.

As part of a broader ecological research project dealing with the impact of butterfly farming on local species abundance, we were able to study the natural history of a *Panacea procilla lysimache* (Fig. 1-4) population in extreme northwestern Costa Rica. Here, we present information on the biology of the immature stages.

MATERIALS AND METHODS

The immature stages and general biology of *Panacea procilla lysimache* were studied in the field and under laboratory conditions from December 2006 to October 2007 at El Bosque Nuevo, a privately owned 180 ha field station and butterfly farm in Guanacaste Province, northwestern Costa Rica, approximately 8 km north of Santa Cecilia and 12 km south of Lake Nicaragua (11°03'30.4 N"; 85°21'26.2" W) at altitudes between 307-355m. The research site and surrounding area can be characterized as a network of primary and secondary lower montane rainforest interspersed with agroforestry plots, pasture, disturbed sites, homes and roads. Observations of adults were made in the immediate vicinity of the farm and were followed by concentrated searches for the immature stages in the surrounding landscape. Samples of larvae were initially reared on cut host leaves placed in small plastic containers. All rearing containers were housed in a dedicated rearing laboratory with screen windows and maintained under an ambient temperature regime. Following nursery propagation of plants from vegetative samples collected on site, induction of adult oviposition and subsequent larval culture was completed using living potted plant material maintained in a large outdoor screen

enclosure.

LARVAL HOST PLANT

Caryodendron angustifolium Standley (Euphorbiaceae) (Fig. 14-17) was utilized for adult oviposition and larval feeding. This rare rainforest tree appears to be known from only a few isolated specimen records including western Colombia (Antioquia and Chocó), Estación Biológica La Selva in Heredia, Costa Rica, and the type locale of Progreso in Chiriquí, Panama, all below 1000 m (Berger and Huft, 1995; Mitre, 1998, 1997; Taylor and Gómez, 2008; Webster and Huft, 1988; Woodson, 1943). Small numbers of the plant occur naturally on the El Bosque Nuevo property along with many dozen more currently in culture.

IMMATURE STAGES

Egg (Fig. 5). Cream to white; approximately round, with base and micropylar region flattened; chorion with 16 longitudinal ribs, each bearing spines that increase in length from the base to the edge of the micropylar region, where they form a crown. Egg darkens to yellow with embryonic development.

Fifth Instar Larva (Fig. 6-7). 42-45 mm long; head black with short setae and adorned with a pair of white-tipped, black dorsolateral scoli (to approximately 15 mm in length or over three times as long as the height of head); scoli densely covered with small tubercles bearing a short seta, and 9-10 prominent spines loosely distributed around the shaft from the base to over one half the length of the scoli; postgenal region on each side of head bearing spines. Body orange with white prothorax; thoracic legs, spiracles and proleg shields black; body scoli black on black chalazae (except where noted otherwise); scoli long and sparsely covered with spinules; branched body scoli with stem; T1 with white prothoracic plate; bifurcated white subdorsal scoli with black tip, a branched white supraspiracular scoli with black tip, and a simple subspiracular scoli with black tip; T2 with five-branched subdorsal scoli off short stem, three-branched supraspiracular scoli off short stem, and simple subspiracular scoli, cuticle in the anterior dorsal portion of T2 darkened (variable) and rough; T3 with five-branched subdorsal scoli, three-branched supraspiracular scoli, and two simple subspiracular scoli aligned horizontally; A1 to A7 with single unbranched dorsal scoli on a small chalaza located on anterior portion of each segment; A7 with a single three-branched dorsal scoli with stem on a large chalaza located at the posterior end of the segment; A8 with a single five-branched dorsal scoli with stem on a large chalaza located at the posterior end of the segment; A2 to A7 with single three-branched subdorsal scoli with stem (A7 sometimes with four-branched scoli); A8 with five-branched subdorsal scoli with stem; A2 to A8 with bifurcated superspiracular with short stem; A2 to A6 with three subspiracular scoli, one bifurcated off short stem, remainder simple; A7 and A8 with two simple subspiracular scoli (sometimes bifurcated on A8); A9 with five-branched subdorsal scoli; anal plate oval, black and convex with a pair of small simple scoli.

Sixth Instar Larva. 58-63 mm; our observations indicate that some larvae may occasionally go through supplementary instars. Six larval instars were documented periodically. Although not observed, it is possible that more than six larval instars



Figs. 1-4. Adults of *Panacea procilla lysimache* from El Bosque Nuevo property, Guanacaste Province, Costa Rica. 1, male, dorsal view. 2, male, ventral view. 3, female, dorsal view. 4, female, ventral view.

are produced. Similar to fifth in morphology except noticeably larger in size and more yellow-orange in color.

Pupa (Fig. 11-13). 26-38 mm long; pendant, although pupa may be suspended more horizontal to substrate. Overall cream-yellow to bright yellow with black spots and lines; elongate and cylindrical in shape, and without projections. Head with oblique dorsolateral crests; anterior portion of crest with black spot; black spot anterior to eye; black spot on eye; surface of wing with transverse elongated black spots and eight triangular black spots along posterior margin; abdomen with incomplete longitudinal dorsal, subdorsal, spiracular, ventrolateral, and ventral rows of black spots; attached by black cremaster to silk pad on substrate.

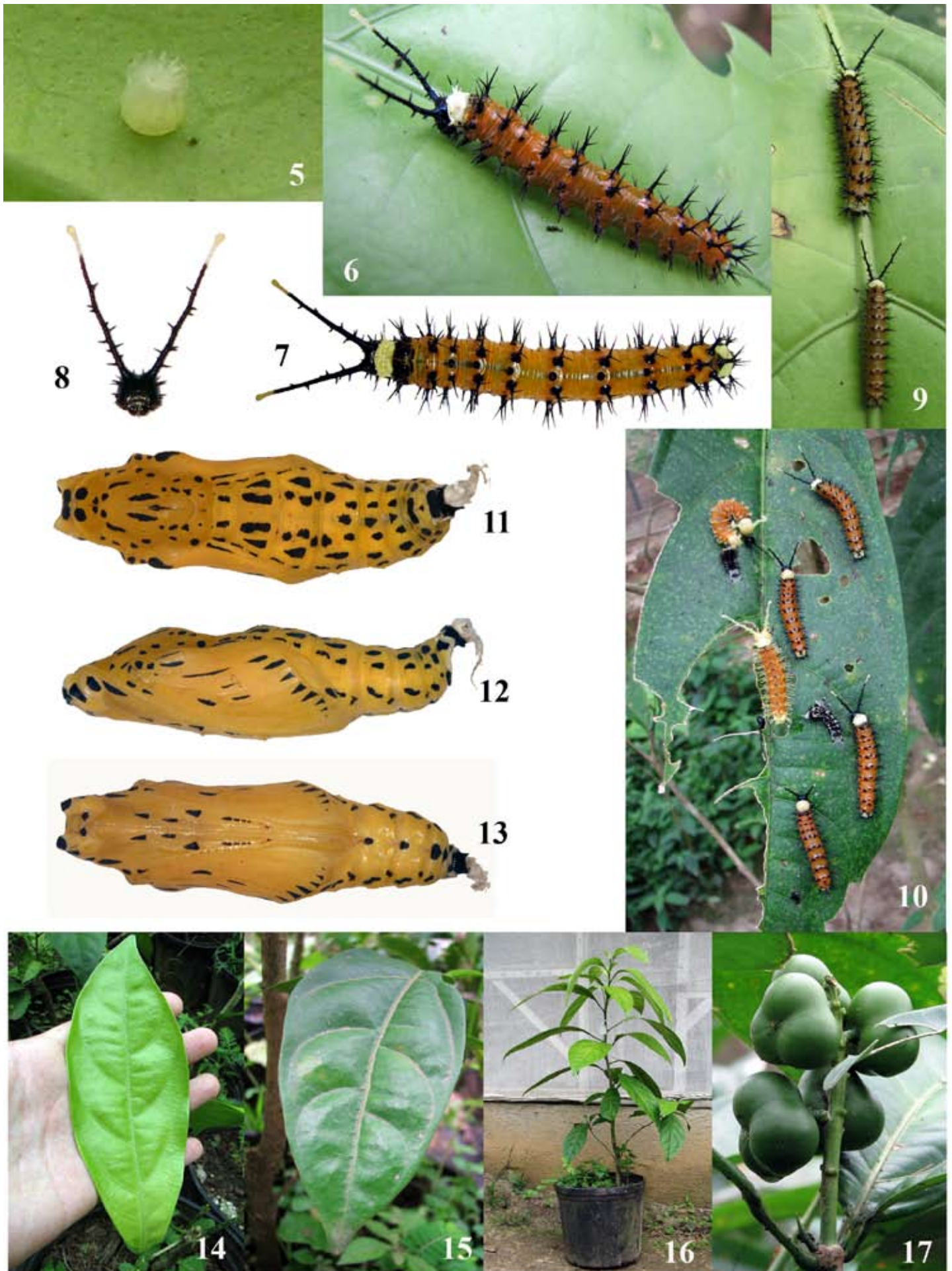
DISCUSSION

Our observations at El Bosque Nuevo represent new locality records for both *P. procilla lysimache* and *C. angustifolium* in Costa Rica. Documentation of multiple adult individuals over several months and of both sexes indicates the presence of a local breeding population in the area. The new site's elevation (307-355 m) is higher than that of Estación Biológica La Selva (35-130 m) where all previous Costa Rican records originate. The close proximity of El Bosque Nuevo to Lake Nicaragua suggests that

P. procilla lysimache will soon be recorded as part of the butterfly fauna of Nicaragua.

All wild adults were observed as isolated individuals. Courtship and mating were not observed, even under captive situations. Eggs were laid singly on the underside of mature host leaves. All larval instars were moderately gregarious, especially during molting (Fig. 10), but last instar larvae pupated solitarily. Larvae were almost always observed feeding on mature host leaves rather than new terminal growth. Late instar larvae frequently rested on the upper surface of mature leaves along the mid-vein when not actively feeding (Fig. 9). When disturbed or approached by an observer, larvae would raise their anterior segments off the substrate at a 45-90° angle and bounce fiercely (and synchronously if multiple larvae were present). Similar behavior was observed in pupae, which would either repeatedly bounce up and down or snap violently from side to side. This vigorous response to disturbance may be effective at startling approaching predators or thwarting direct attack.

The information presented here on *P. procilla lysimache*, coupled with that of DeVries (2001) and Teshirogi (2007), advances our



understanding of the basic biology of the charismatic Neotropical genus *Panacea* and helps further illustrate the morphological similarity of its immature stages and host choice to those of *Batesia hypochlora* Felder and Felder. This study also emphasizes the collaborative research opportunities available with the growing global butterfly farming and ranching industry.

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Figs. 5–17. Immature stages and larval host plant of *Panacea procilla lysimache*, El Bosque Nuevo property, Guanacaste Province, Costa Rica. **5**, egg, immediately following oviposition. **6**, fifth instar larva, lateral view. **7**, fifth instar larva, dorsal view. **8**, head capsule from fifth instar larva. **9**, fifth instar larvae resting on med-vein of mature host plant leaf. **10**, larvae, note gregarious nature during molting. **11**, pupa, dorsal view. **12**, pupa, lateral view. **13**, pupa, ventral view. **14**, young leaf of *Caryodendron angustifolium*. **15**, mature leaf of *Caryodendron angustifolium*. **16**, *Caryodendron angustifolium* plant in culture at El Bosque Nuevo. **17**, *Caryodendron angustifolium* with fruit.