

NATURAL HISTORY, IMMATURE STAGES AND HOSTPLANTS OF *MORPHO AMATHONTE* FROM WESTERN COLOMBIA (LEPIDOPTERA: NYMPHALIDAE: MORPHINAE)

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ABSTRACT.— The early stages, natural history and a new larval food plant are reported for *Morpho amathonte* Deyrolle from the Chocó region in western Colombia. The morphology of the immature stages of *M. amathonte amathonte* Deyrolle is compared with *M. amathonte centralis* Staudinger and *M. cypris bugaba* from Central America. A new secretory gland and two sclerotized grooming horn-like protuberances projecting backwards on the epicranium are reported for *M. amathonte*, *M. sulkowskyi* and *M. patroclus* from Colombia. The larval food plant of *M. amathonte amathonte* in western Colombia is *Cespedesia macrophylla* (Ochnaceae), a new hostplant family record for Morphinae. A summary of records for caterpillar hostplants in the genus *Morpho* is provided.

KEY WORDS: Bignoniaceae, biology, Brazil, Central America, Chocó, Colombia, Costa Rica, Ecuador, egg, El Salvador, Erythroxylaceae, Fabaceae, Gramineae, Guttiferae, Lauraceae, larvae, Leguminosae, life history, Menispermaceae, Mimosaceae, Moraceae, *Morpho*, Neotropical, Nicaragua, Ochnaceae, Panama, Poaceae, pupae, Quinaceae, Sapindaceae, South America, Tiliaceae, Trinidad, Venezuela.

This paper summarizes the life history of *Morpho amathonte amathonte* Deyrolle, one of the most spectacular, brilliant and large blue *Morpho* species in the Neotropics. The present paper is part of a series of publications describing the life cycle stages and larval food plants of the little known butterflies from the Chocó region of Colombia, in a combined effort between Fundación Herencia Verde, Proyecto Biopacifico and local butterfly farmers in an experimental butterfly ranching program established in the Tatabro River watershed in western Colombia (Constantino, in press)

The host plants of Neotropical Morphinae are in the families Poaceae, Fabaceae, Menispermaceae, Mimosaceae, Bignoniaceae, Tiliaceae, Sapindaceae, Lauraceae, Guttiferae, Myrtaceae, Moraceae, Quinaceae and Erythroxylaceae (Otero, 1966, 1971; d'Aranjo e Silva, 1968; Barcant, 1970; Young and Muyschondt, 1972, 1973; Young, 1974, 1978, 1982; DeVries, 1987; Urich and Emmel, 1991; DeVries and Martinez, 1993). I report here *Cespedesia macrophylla* (Ochnaceae), the natural food plant of *M. amathonte amathonte* Deyrolle in western Colombia, which include the Ochnaceae as new hostplant family records for the genus *Morpho* (see Table 1). DeVries (1987) reported *Pterocarpus officinalis* (Fabaceae) as the hostplant for the Central American subspecies *M. amathonte centralis* Staudinger. Differences in larval instar coloration, pupa pattern coloration and larval hostplant clearly separates the nominal species of Colombia from the population of Central America.

Although there is a substantial amount of hostplant records (Table 1) based mainly on oviposition behavior of females from

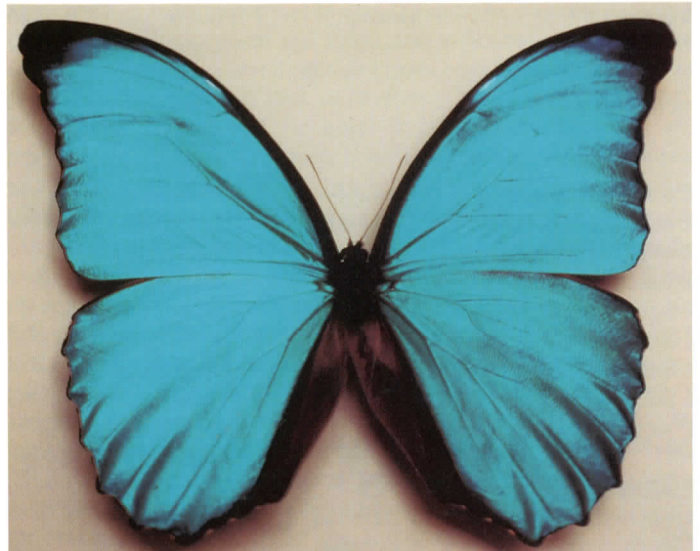


Fig. 1. *Morpho amathonte* adult male reared from egg (Rio Tatabro-Anchicayá, Colombia).

field observations, relatively little work has been published on the early stages or life cycles of *Morpho* (DeVries and Martinez, 1994). The early stages of most *Morpho* species remain unknown mostly because the females are extremely difficult to see when flying high up in the forest canopy, the immature stages are difficult to find on their hostplants, the larvae are highly susceptible to viral diseases in captivity and the complete life cycles for most species take considerable time (up to 4 months from egg to

TABLE 1. A summary of some records for caterpillar food plants in the genus *Morpho*.

SPECIES	LOCALITIES	HOSTPLANT GENERA	PLANT FAMILIES	REFERENCES
<i>M. granadensis polybaptus</i>	Costa Rica	Machaerium	Fabaceae	Young, 1982; DeVries, 1987
<i>M. peleides limpida</i>	Costa Rica	Mucuna, Machaerium	Fabaceae	Young & Muysshondt, 1973
		Pterocarpus, Lonchocarpus	Fabaceae	DeVries, 1987
		Platymiscium, Swartzia	Fabaceae	DeVries, 1987
		Dalbergia, Arachis	Fabaceae	Young, 1974
		Inga	Mimosaceae	Young, 1974
<i>M. peleides limpida</i>	El Salvador	Machaerium	Fabaceae	Young & Muysshondt, 1973
		Inga	Mimosaceae	Young & Muysshondt, 1973
<i>M. peleides insularis</i>	Trinidad	Paragonia	Bignoniaceae	Urich & Emmel 1991
		Erythrina	Fabaceae	Barcant, 1970
<i>M. achilles</i>	Brazil	Platymiscium, Machaerium	Fabaceae	d'Aranjo e Silva, 1968
		Dalbergia	Fabaceae	d'Aranjo e Silva, 1968
		Pterocarpus, Myrocarpus	Fabaceae	Otero, 1971
<i>M. deidamia</i>	Brazil	Inga	Mimosaceae	L. S. Otero (pers. comm.)
<i>M. laertes</i>	Brazil	Quiina	Quiinaceae	L. S. Otero (pers. comm.)
		Machaerium	Fabaceae	Otero 1971, 1966
		Inga	Mimosaceae	Otero, 1971. 1966
		Luhea	Tiliaceae	d'Aranjo e Silva, 1968
<i>M. polyphemus catarina</i>	Costa Rica	Paullinia	Sapindaceae	DeVries, 1987
<i>M. polyphemus polyphemus</i>	El Salvador	Paullinia	Sapindaceae	Young & Muysshondt, 1972
		Inga	Fabaceae	Young & Muysshondt, 1972
<i>M. catenarius</i>	Brazil	Acacia	Fabaceae	d'Aranjo e Silva, 1968
		Erythroxyllum	Erythroxylaceae	d'Aranjo e Silva, 1968
		Inga	Mimosaceae	d'Aranjo e Silva, 1968
		Gymnanthes	Euphorbiaceae	d'Aranjo e Silva, 1968
		Scutia	Rhamnaceae	d'Aranjo e Silva, 1968
		Cupania, Ratonia	Sapindaceae	d'Aranjo e Silva, 1968
<i>M. anaxibia</i>	Brazil	Quiina	Quiinaceae	L. S. Otero (pers. comm.)
		Erythroxyllum	Erythroxylaceae	d'Aranjo e Silva, 1968
		Nectandra	Lauraceae	d'Aranjo e Silva, 1968
		Clusia	Guttiferae	d'Aranjo e Silva, 1968
		Eugenia	Myrtaceae	d'Aranjo e Silva, 1968
		Ficus	Moraceae	d'Aranjo e Silva, 1968
<i>M. amathonte centralis</i>	Costa Rica	Pterocarpus	Fabaceae	DeVries, 1987
<i>M. amathonte amathonte</i>	Colombia	Cespedesia	Ochnaceae	Constantino (present)
<i>M. menelaus menelaus</i>	Brazil	Erythroxyllum	Erythroxylaceae	d'Aranjo e Silva, 1968
<i>M. menelaus temilimbata</i>	Brazil	Machaerium	Fabaceae	L. S. Otero (pers. comm.)
<i>M. cypris bugaba</i>	Costa Rica	Inga	Mimosaceae	DeVries & Martinez, 1993
<i>M. cypris cypris</i>	Colombia	Inga	Mimosaceae	Rodriguez, 1993
<i>M. rhetenor</i>	Brazil	Macrobium	Fabaceae	Ackery, 1988
<i>M. portis</i>	Brazil	Chusquea	Poaceae	d'Aranjo e Silva, 1968
<i>M. aega</i>	Brazil	Chusquea, Bambusa	Poaceae	d'Aranjo e Silva, 1968
		Merostachys	Poaceae	d'Aranjo e Silva, 1968
<i>M. adonis</i>	Brazil	Bambusa	Poaceae	L. S. Otero (pers. comm.)
<i>M. sulkowsky</i>	Colombia	Chusquea	Poaceae	M. D. Heredia (in prep.)
<i>M. rhodopteron</i>	Colombia	Chusquea	Poaceae	Salazar, 1992
<i>M. hercules</i>	Brazil	Abuta	Menispermaceae	d'Aranjo e Silva, 1968
<i>M. richardus</i>	Brazil	Abuta	Menispermaceae	d'Aranjo e Silva, 1968
<i>M. cisseis</i>	Brazil	Abuta	Menispermaceae	L. S. Otero (pers. comm.)
<i>M. hecuba</i>	Brazil	Undet.	Menispermaceae	L. S. Otero (pers. comm.)
<i>M. theseus aquarius</i>	Costa Rica	Undet.	Menispermaceae	DeVries, 1987

pupa). In the case of *M. cypris* Westwood, the immature stages were recently described after more than 140 years since its original description (DeVries and Martinez, 1993). Even more dramatic for Neotropical butterflies are cases like that of the transparent-winged satyrid, *Haetera piera* Linnaeus, from the Amazon basin, in which their immature stages and hostplant were described after more than 235 years since the original description of the species (Constantino, 1993, 1995). For conservation purposes, it is a priority to know the immature stages of the butterflies and their natural hostplants, particularly critical in the tropics due to the accelerating rates of deforestation and habitat destruction (Constantino, 1992).

Morpho amathonte ranges from Nicaragua to Colombia and northwestern Ecuador (D'Abbrera, 1984). There are only two recognized subspecies: *M. amathonte centralis* Staudinger, distributed from Nicaragua to Panamá, and *M. amathonte amathonte* Deyrolle, distributed in western and central Colombia and northwestern Ecuador (Pacific Coast), in rain forest habitats from sea level to about 1000m elevation. Some authors, like Krüger (1924-25), treat *M. amathonte* as a subspecies of *M. menelaus* Linnaeus. However, in the most recent treatments of Neotropical Morphinae (viz., LeMoult and Real, 1963; Young, 1973; D'Abbrera, 1984; DeVries, 1987), *M. amathonte* is treated as a good species. The males of *M. amathonte* are entirely metallic blue on the upperside, except for the apex which is black. The female is light metallic blue, with wide black marginal bands and a row of white spots on the upper wings. Males fly along rivers and streams at low elevations, whereas the females fly high in the forest canopy, which makes them more difficult to see.

In Colombia, nothing has been published about immature stages for the genus *Morpho*. Described below is the first and most detailed report of immature stages for the genus *Morpho* from Colombia. There are only three, partial unpublished, records of immature stages from Colombia: for *M. cypris cypris* Westwood, *M. sulkowsky* Kollar, and *M. patroclus* Felder, by Rodriguez (1993), Heredia (in prep.), and Constantino (in prep.), respectively.

MATERIALS AND METHODS

Field observations were made on *Morpho amathonte* during November 1994 at the upper Anchicayá River, Colombia, located on the Pacific Coast-Chocó region at 400m elevation in primary rain forest habitats. At Alto Anchicayá, I witnessed oviposition behavior in *M. amathonte* and conducted a study of the early stages by confining recently deposited eggs in large plastic bags with fresh cuttings of the larval hostplant. These cuttings were replaced every 3 days and sprayed with tap water to avoid dehydration. All observations and rearings were done at ambient temperatures at the field station of Fundación Herencia Verde, by the Tatabro River. Immature stages were photographed and measured. Cast skins and head capsules were preserved in alcohol. Voucher material of the hostplant was deposited in the herbarium of the Universidad del Valle, Colombia. The positive taxonomic identification of the larval hostplant, known locally by the common name "pacó de monte," was confirmed by botanist Jorge Ramos, director of the herbarium of the Universidad del Valle, Cali.

RESULTS

Egg-placement Behavior and Larval Hostplant

On November 1994, at 1100h, I observed a female of *M. amathonte* ovipositing on a young *Cespedesia macrophylla* (Ochnaceae) tree in the forest edge along a road near the town of Aguaclara. The female laid a single egg on the dorsal surface of an older leaf, then immediately took flight, circled the tree and repeated the oviposition behavior on the upper side of the blade of older leaves. After careful searching of the oviposition sites, a total of 3 eggs were collected, then kept in a moist container with leaf cuttings of the larval food plant. Once the first instars hatched, the larvae were exposed to fresh leaf cuttings of *Cespedesia macrophylla*. They also accepted *Cespedesia spathulata* in captivity. Two weeks later, after carefully searching adjacent trees of *C. macrophylla*, I found a solitary first instar larva feeding on the underside of an old leaf. Despite the hostplant being a very common and abundant tree in secondary forests, the females prefer to oviposit on isolated trees in tracts of intact forest. The low percentage of larvae of *M. amathonte* found on *C. macrophylla* after careful searching more than 100 trees in a transect of 2 km, may suggest that *M. amathonte* uses an alternate hostplant. The hostplant of *M. amathonte centralis* in Costa Rica (DeVries, 1987), *Pterocarpus officinalis* (Fabaceae), is a possibility as an alternate host. However, the discovery of eggs and a first instar larvae of *M. amathonte* feeding naturally on *C. macrophylla* in Colombia, secures the Ochnaceae as a new hostplant family for Neotropical Morphinae.

Description of Early Stages

Egg: The egg is hemispherical in shape, 1.4mm in diameter, smooth in surface texture, pale green, laid singly and within two days after being deposited, develops a lateral reddish-brown band distinctly broken into small dots. The egg stage lasts 14 days.

First instar larvae: The 1st instar is about 0.8cm long just after hatching. Head: The head capsule is broader than the width of the body and is velvet red and hairy. The face is hairy white with two vertical red bands. The body is bright yellow in ground color, with dark-red lines and bands on the dorsum and sides. The lines on the dorsum forms two ovals interspersed with tufts of redish-white hairs. The dorso lateral areas on segments T-1 and T-2, just behind the head with two pairs of long tufts of redish-white clusters of hairs curved forward. The dorso lateral areas on segments A-1 to A-2, A-4 to A-5 and A-7 to A-8 presents a pair of tufts of redish-white hairs per segment, being the ones on segments A-1 and A-2 very short and completely red. The last segment on A-10 bears two short sclerotized caudal tails with translucent setae. There are also lateral long lateral white hairs above the legs on each body segment. The 1st instar larva lasts 10 days.

Second instar larvae (Fig. 2): The 2nd instar is about 2cm long. Head: the head capsule is now more densely covered with bright red short seta. The second instar closely resembles the 1st instar, but the tufts of hair on segments A-4 to A-5 and A-7 to A-8 are longer and more dense. The two yellow ovals are interspersed with dark red bands on segments T-1 to T-3, A-4 to A-5 and A-7 to A-8. The 2nd instar larva lasts 18 days.

Third instar larvae (Fig. 3): The 3rd instar larva grows to about 3.8 cm. The head capsule is now pale red and sparsely hairy and the face with gray seta. The body is bright yellow but the lines and bands become darker, almost black. The dorso lateral tufts of hair are denser with more white hairs. The red band on segments T-1 to T-3 is now divided by small yellow spaces. The 3rd instar larva lasted 18 days.

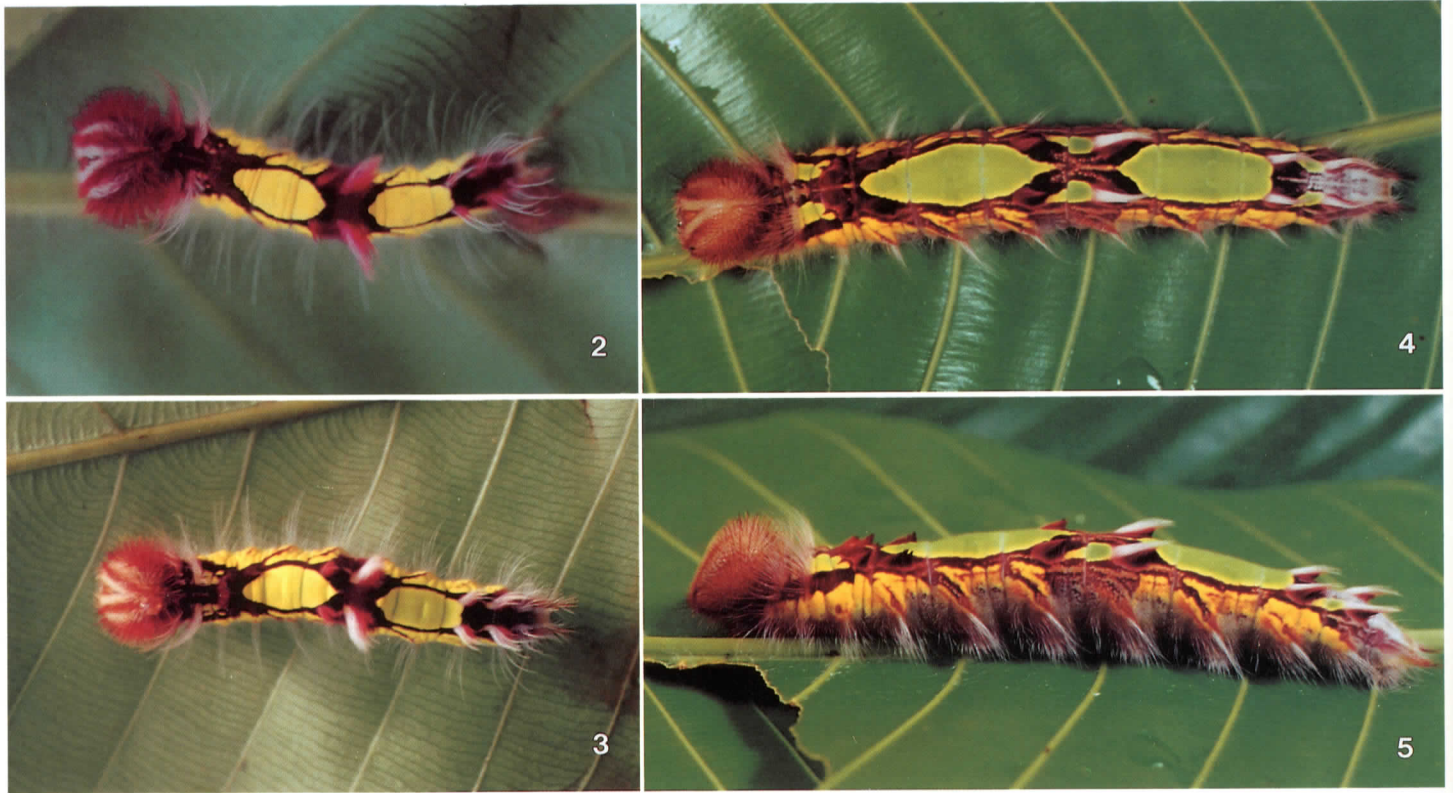


Fig. 2-5. *Morpho amathonte* larvae: 2) 2nd instar larva (Rio Tatabro-Anchicayá, Colombia); 3) 3rd instar secreting an oily fluid from the epicranial gland after being molested; 4) 4th instar larva (dorsal view) on hostplant *C. macrophylla*; 5) 4th instar larva (lateral view).



Fig. 6. *Morpho amathonte*, pupal shell.

Fourth instar larvae (Fig. 4-5): The 4th instar larva is about 7cm. Head: the head capsule is now pale brown, sparsely hairy and with two gray vertical lines on the face. The head capsule is now less wide than body. Body overall color now yellow-green in the dorsal ovals and a conspicuous "x" pattern between the two ovals. Lateral side of body now with fine filigree cream and pale maroon patterns. Dorso lateral tufts of hair shorter, especially on segments T-1 to T-2 and A-1 which are completely red. The total 4th instar duration is 18 days.

Fifth instar larvae: The last instar larva attains a body length of about 10cm. The body is now wider than the head. The general appearance of the 5th instar larva is very similar to that of the previous instar, but the body assumes a thicker profile, and the annules on the body segments are more prominent. Body now with lime-green ovals with dark red lines between the ovals and along the sides. The lateral side of body still yellow but with gray-maroon marks and patterns. Total 5th instar duration is 19 days.

Prepupa: at this stage the larva stops feeding and loses all traces of yellow and red becoming completely dull green. The prepupal stage lasts 4 days.

Pupa (Fig. 6): pale green, ovoid, head area slightly bifid with white areas surrounding the spiracles, in addition to a conspicuous semicircular white band that covers laterally the dorsal area of segment A-6. There is no noticeable change in the coloration of the pupa as the adult develops, although usually within 24 hours of eclosion, the wingpads darkens strongly and the abdominal segment between A-5 and A-6 become loose and slightly separated. The pupal stage lasts 19 days.

Larval Behavior and Secretory Glands

The larvae are solitary, feeding during the early morning hours and during the night. When not feeding, the larvae rest at all times at the base undersides of large leaves. The larvae of

Morpho possess at least two secretory glands: *the cervical gland*, located anterior to the first set of legs, extruded when a caterpillar is molested and which emits a strong odor, and *the grooming gland*, located between the subdorsal tufts on segment A-1, which secretes a liquid that is groomed into the subdorsal tufts of setae. Both secretory glands are likely to serve a defensive function (DeVries and Martinez, 1993). A new gland, termed here as *the epicranial gland* which has apparently never been described previously, secretes a drop of a clear oily fluid from a dorsal pore located on the epicranium (Fig. 3) which is then combed into the various tufts of setae along the body. The larvae is able to retain the drop of the fluid on a groove located on the epicranium. The groove is bifurcated at the end in two sclerotized sharp spikes projected backwards. These spikes or small horns are used to comb the oily fluid into the subdorsal abdominal tufts of setae. Usually, the spikes are difficult to see in live larvae because they are concealed by the setae on the head capsule, but can be seen easily under the microscope in the head capsules of all instars that have been preserved in alcohol. When larvae are molested, they lift the head backwards, and the drop of liquid is combed into the subdorsal setae on T-1 and T-2. Then with a slow, rotating motion of the head, the drop is combed into all abdominal subdorsal tufts and setae. This oily substance acts as an insect repellent against parasitic wasps and ants, in addition to being a water repellent. The epicranial gland and sclerotized spikes projected backwards have been observed also in two other species of *Morpho* caterpillars in Colombia: *M. sulkowskyi* and *M. patroclus* (M. D. Heredia, in prep.; L. M. Constantino, pers. observ.)

Life cycle

The complete life cycle of *M. amathonte* requires about 120 days (4 months) from egg to adult, with the egg lasting 14 days, the larvae about 83 days, the prepupal stage 4 days, and the pupa 19 days.

Hosts

Cespedesia macrophylla and *C. spathulata* (Ochnaceae), in western Colombia.

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