

NOTES ON *MEMPHIS AULICA* IN COSTA RICA, WITH A DESCRIPTION OF THE FEMALE (LEPIDOPTERA: NYMPHALIDAE: CHARAXINAE)

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ABSTRACT.— The taxonomic status of *Memphis aulica* Röber is reviewed and the female of this species described and illustrated for the first time. It is concluded that in spite of a long history of doubts expressed by several authors, this is a clearly distinct species.

RESUMEN.— Se revisa la situación taxonómica de *Memphis aulica* Röber y se describe e ilustra por primera vez, la hembra de esta especie. Se concluye que a pesar de una larga historia de dudas expresadas por varios autores, esta es una especie muy bien diferenciada.

KEY WORDS: *Adelpha*, biology, Central America, Chiapas, Chiriquí, Colombia, hostplants, Euphorbiaceae, Guatemala, immature stages, larvae, Lauraceae, Mesoamerica, Mexico, Neotropical, Panama, Piperaceae, taxonomy.

The genus *Memphis* (Hübner, 1819) is one of the largest of Neotropical Nymphalidae, as well as being one of the most complex taxonomically, and least understood ecologically and biologically. Around 100 species of *Memphis* are currently recognised (Comstock, 1961, as *Anaea*, subgenus *Memphis*; D'Abbrera, 1988) which were divided into 8 groups by Comstock (1961). Few species of *Memphis* are instantly recognisable and the close similarity of many (especially in the "blue" species of Comstock's groups VI, VII and VIII), coupled with the often considerable within-species variation of superficial characters such as wing shape and color patterns, often makes identification of individual specimens difficult or impossible (DeVries, 1987). A further constraint on the clear separation of species and the understanding of relationships between them is that commonly, many more male than female specimens of *Memphis* are found in collections. A surprisingly large number of species is still known only from males (Comstock, 1961; D'Abbrera, 1988).

The case of *Memphis aulica* Röber is a typical example of the outstanding taxonomic problems which remain to be solved in *Memphis*. This species was hitherto known only from a very small number of male specimens and forms part of a group of species, the reality of some or all of which has been repeatedly questioned.

The objectives of the present article are to assess the status of *Memphis aulica* and, more briefly, those species which appear to be most closely related to it. First, published work on *Memphis aulica* and its apparent relatives is briefly reviewed. Then, a detailed description of female *M. aulica* reared from three sites in Costa Rica is provided. Finally, I compare *M. aulica* with related *Memphis* spp., concluding that it is a well-defined species.

PREVIOUS TREATMENTS OF *MEMPHIS AULICA*

Confusion regarding *Memphis aulica* begins with its description as a subspecies of *Memphis anassa* (Röber, 1916). Careful reading of Comstock (1961) reveals that Röber followed late 19th-century authors in confusing *Memphis anassa* C. & R. Felder with *Memphis cleomestra* Hewitson, and that the resulting name, *Anaea anassa* Röber (not C. & R. Felder) is a synonym of *M. cleomestra*. The logical conclusion to be drawn from this situation — although this was not commented upon by Comstock — is that what Röber actually did was to define *M. aulica* as a subspecies of *M. cleomestra*. That this action was incorrect may now be confirmed on the basis of the descriptions of females given in the present paper.



Fig. 1-2. Male *Memphis* from Turrialba, Costa Rica: 1) *M. aulica* Röber reared from larva on *Croton schiedeanus* hostplant, June 1993. Forewing length 30mm. Author's collection; 2) Male *M. cleomestra* Hewitson captured in forest edge trap with bait of rotting bananas, September, 1993. Forewing length 30mm. Author's collection.

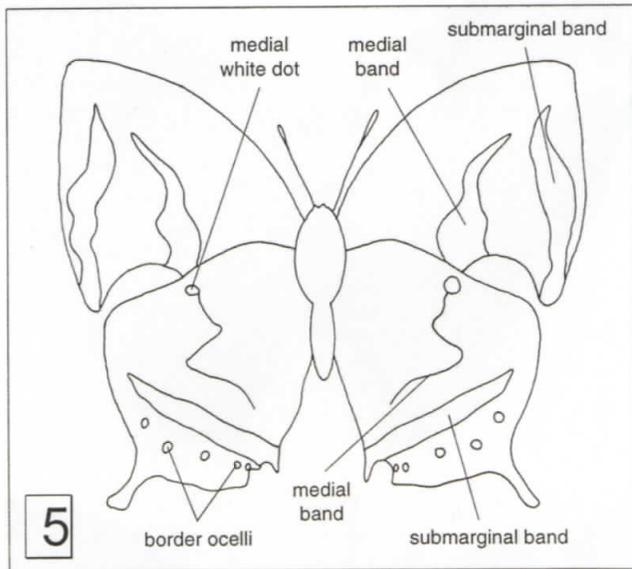


Fig. 3-6. Females of *Memphis aulica* Röber: 3), field-caught individual, dorsal view, forewing length 36mm. Turrialba, Costa Rica (BMNH); 4), individual reared on *Croton schiedeana* hostplants, dorsal view, forewing length 33 mm; larva found on understory hostplant in old secondary forest, Finca El Cerro, Florencia de San Carlos, Costa Rica, 330m.a.s.l. (Biodiversity Institute Costa Rica); 5) generalised ventral wing pattern for females of group VIII of *Anaea*, subgenus *Memphis* (Comstock, 1961; terms for pattern units follow Nijhout (1991)); 6) ventral view of same field-caught individual as Fig. 3 (forewing length 36mm).

Röber's description of *Anaea anassa* and its then new subspecies, *aulica*, is as follows:

"*A. anassa* Fldr. (= *ada* Btlr.) from Veragua and Colombia is known to us only from the male sex. This form appears to be very constant. It is not rare. — *aulica* subsp. nov. from Chiriqui is smaller, has broader and more coherent blue markings on the forewings; the margin of the hindwings is more greenish and proximally more sharply defined. The undersurface is darker without any rust-brown marking at the inner angle, it is more profusely scaled in whiteish and the brown bands on the hindwings are absent."

Röber illustrated a male of this new subspecies in his plate 120Ae (see Fig. 1 of the present paper); he had no females.

Subsequently, Comstock (1961) obtained two male *Memphis* which corresponded with Röber's description of *M. anassa aulica*, one of which he illustrated. Comstock elevated *aulica* to full specific status, stating that Röber's description of it as a subspecies

of *anassa* was a mistake "apparently following mistaken determinations of *anassa* by Druce and Godman and Salvin" (Comstock, 1961, p. 127). What exactly Comstock meant by this has already been explained. He does not explain his rejection of Röber's view that these males belonged to a subspecies of *M. cleomestra*, but it may have been due to his possessing specimens of this latter species from the same site - Lino, Chiriquí, Panamá.

Notwithstanding his elevation of Röber's subspecies to a full species, Comstock (1961) went on to express doubts about the true status of *M. aulica* and obviously closely related species such as *M. orthesia* Godman and Salvin, *M. memphis* C. & R. Felder and his own new species, *M. annetta* Comstock. Indeed, he concluded his treatment of *M. aulica* with the comment that "the material is scant, with unsatisfactory information, so that it now seems best to regard them as four separate species", a remark that could perhaps just as easily have led to the opposite conclusion. DeVries (1987) added to

the doubts about *M. aulica* and its relatives by observing "it is unclear whether this species (*aulica*) is distinct from *M. cleomestra*". As a final contribution to the confusion clearly reigning, an anonymous note in the corresponding specimen drawer in the Natural History Museum, London, states simply: "*octavius* = *anassa* = *cleomestra* = *ada* = *aulica*". While few would probably agree with this latter position, there is clearly much work to be done to clarify and confirm distinctions between species in this particular group of *Memphis* spp.



Fig. 7. Female *Memphis orthesia* Godman & Salvin, dorsal view. Turrialba, Costa Rica, October 1991, captured in forest edge trap with bait of rotting bananas. Author's collection. Compare with Fig. 3.

NOTES ON REARED SPECIMENS OF *MEMPHIS AULICA*, WITH A FIRST DESCRIPTION OF THE FEMALE

During 1992-1994, the present author reared 7 *Memphis* butterflies from identical larvae found on *Croton schideanus* Schld. (Euphorbiaceae) hostplants at three lower to middle elevation sites in Costa Rica (Finegan, in preparation). The first 5 reared adults were males which were constant in the color, patterns and shape of their wings and which, with respect to the characters mentioned, corresponded extremely closely to those illustrated as *M. aulica* by Comstock (1961) and DeVries (1987) (Fig. 1; compare with male of *M. cleomestra* in Fig. 2). The final two adult insects were females, which I therefore conclude to be the hitherto undescribed female of *M. aulica*. Comparing these reared females with field-caught individuals in my personal collection, I was able to identify three more females of *Memphis aulica* which I had tentatively cataloged as *Memphis beatrix* Druce (see below). The following description is therefore based on 5 female *Memphis aulica*. Two males (both reared) and two females (one field-caught, one reared) are deposited in each of the Biodiversity Institute (INBio), Santo Domingo de Heredia, Costa Rica, and the Natural History Museum, London, England, UK.

Female of *Memphis aulica*

Forewing length was 36mm in each of 3 field-caught females (see example in Fig. 3) and only 33mm in the two reared specimens (see example in Fig. 4), probably due to the lower nutritional quality of the cut leaves with which the larvae were fed.

The ground color of the upperwings is a velvety bluish-black, fading to tan on the hindwing costa and apex, and speckled with white on the hindwing costal margins (Fig. 3-4). The hindwing vannus is also tan with

a fine white pubescence. The forewing costa is an iridescent pale blue or blue-green finely speckled with black and white. The FW discal cell is entirely an iridescent blue-green; this same color covers the basal third of cell M3, the basal half of cell CU1, the basal 2/3 of cell CU2 and the vannus as far as the excavated portion of the FW. The FW has 3 iridescent blue dashes located towards its apex. The outer and lowermost of these dashes is in cell M2 but is sometimes barely evident, as in the field-caught specimen in Fig. 3. The inner 2 dashes are of the same size, or the central one may be bigger; the 1st (proximal) dash covers the basal part of cells R4 and R5 and the 2nd is found 2/3 of the way distally along cell M1.

The HW discal cell is also an iridescent blue-green, this color extending to the costa above the discal cell as well as covering the basal half of cell R1 and 2/3 to 3/4 of cells R5 to CU2. One of the reared specimens has a prominent sub-marginal ocellus on the midline of each of cells R1-CU1, with 2 small ocelli in cell CU2 (Fig. 4). The ocelli are mere white traces in R1, R5 and M1, but are distinctly white proximally and black distally in the remaining cells. In the other 4 specimens available to me the upper wing ocelli are bare traces, except in cells M2 and M3. The HW margin is very finely speckled with white from cell M1 to the vannus, including the margins of the spatulate tails.

For the description of the apparently monotonous undersides of the female of *M. aulica* and comparison with its relatives, I make reference to a generalised underside pattern for females of Comstock's group VIII (Fig. 5). This generalised pattern was based on the illustrations in Comstock (1961), DeVries (1987) and on specimens in the author's collection. The terms for pattern units used in Fig. 5 and in the following description are those of the nymphalid ground plan proposed by Nijhout (1991; Chapter 2). The interpretation of the homology of the pattern units of this group of female *Memphis* with those of the nymphalid ground plan is naturally tentative, but at least provides a framework for a more organised description of these complex patterns. Following Nijhout (1991) and earlier authors cited by him, the ocelli of the ventral wing surfaces of Charaxinae are interpreted as homologous with the border ocelli (pattern unit h) of the ground plan. It may be noted that some authors (e.g. Descimon, 1986) do not share this interpretation.

The ground color of the underside is a dark beige to pale greyish-brown, speckled with silver-grey which becomes especially prominent in bright direct light (Fig. 6). There is a very small, horizontally elongated submarginal white spot on the midline of each forewing cell, these interpreted as border ocelli by homology with the hindwing (see below). The faint medial and submarginal bands of the FW are formed by series of irregular dark brown dashes, and are considered to be derived from pattern units f and g respectively; the medial band is most prominent in the vannus and in cell CU2 (Fig. 5-6). The costal margin is speckled with black and silver grey and the distal margin with silver grey. The HW costal margin is also speckled with black and silver grey and the medial white dot is relatively large. The HW medial band (also interpreted as being derived from pattern unit f) is defined proximally by a darker area than the ground color and distally by dense silver-grey speckling. The submarginal dark band is defined by black and blue-grey speckling and again may be considered to represent pattern unit g. The border ocelli are formed by the combination of an irregular white dash proximally, a similar blue-grey dash distally and an irregular black central dash. As in the hindwing upper surface and in agreement with the groundplan (Nijhout, 1991), there are 2 ocelli in cell CU2 and one each in the centres of cells CU1, M3 and M2. The hindwing tails are speckled with white, blue-grey and black.

DIAGNOSIS OF *MEMPHIS AULICA* AND ITS RELATIVES, WITH EMPHASIS ON FEMALES

As will be evident from the preceding description, the female of *M. aulica* shows a general color pattern which is repeated in many other species of the genus. Careful study of the plates in Comstock (1961) reveals special similarity, however, to female *Memphis florita* Druce and *Memphis beatrix* Druce. The former species is known only from Peru and Ecuador and should not be confused with the apparently mesoamerican *M. aulica* for this reason. Additionally, in specimens of *M. florita* in the Natural History Museum, London, the blue upperwing color is a cooler, redder, steelier shade than that in *M. aulica*, while *M. florita*, with a FW length of 34-39mm (Comstock, 1961), is probably always somewhat

bigger than *M. aulica*. *Memphis beatrix* is present in Costa Rica and probably shares forest habitats with *M. aulica* in the 700m-1500m altitudinal range (see data in DeVries, 1987). However, female *M. beatrix*, with its FW length of 37-40 mm (Comstock, 1961) is instantly distinguishable from *M. aulica* in terms of size. Additionally, the HW margin in *M. beatrix* is apparently always straight (see illustrations in DeVries, 1987, and Comstock, 1961) while in the *M. aulica* available to me, it is always convex.

The species considered by previous authors to be closely related to *M. aulica* may now be considered; they are *M. cleomestra* (DeVries, 1987 and by implication, Röber, 1916) and *M. orthesia*, *M. annetta* and *Memphis memphis* (Comstock, 1961). Female *M. aulica* are easily and quickly distinguished from those of *M. cleomestra* by the upperside patterns, the broad two-tone basal blue areas on both upperwings in the latter species making it one of the few *Memphis* to be instantly recognisable (some females in the Natural History Museum collection are identified as *M. anassa*, with one specimen from Bogotá, Colombia bearing a label stating "determined by H. Druce as *Anaea anassa* Bd"; there is an illustration of the same in Godman and Salvin, Tab. 36, 3,4; all these individuals are in fact *M. cleomestra*, the misidentification arising from the confusion identified by Comstock (1961) and already referred to).

With the benefit of the description of the female of *M. aulica* provided here, it now seems clear that this species is quite distinct from *M. orthesia*, *M. annetta* and *M. memphis*. *Memphis orthesia* — like *M. beatrix* sympatric with *M. aulica* in Costa Rica (DeVries, 1987; Finegan, pers. observ.) — seems markedly smaller than *M. aulica*. Comstock's data indicated this, though his samples were small and he could only compare males; his forewing lengths for female *M. orthesia*, however, at 32-34mm, are markedly smaller than the 36mm of my field-caught *M. aulica*. DeVries (1987) gave 30-33mm for females of *M. orthesia*. The upperwing color patterns of both sexes are also distinct. The females of *M. orthesia* from Mexico and Guatemala illustrated by DeVries and Comstock lack the outermost FW spot normally evident in cell M2 in *M. aulica*, while that illustrated by DeVries has the acute FW tips I have so far never encountered in any *M. aulica*, whether male or female. Field-caught and reared female *M. orthesia* in the present author's collection show more marked differences. Those from Turrialba, Costa Rica, usually have only a reduced innermost spot in cells R4 or R5, or may, like males of the species, have no spots at all. A female from Boca del Chajul, Chiapas, Mexico, supplied to me by Montes Azules S.A., similarly has only the innermost spot. Thus in terms of size, color pattern and sometimes wing shape (and also larva and hostplant: see below), *M. orthesia* should always be easily distinguishable from *M. aulica*.

Memphis annetta, as described and illustrated by Comstock (1961), seems so clearly different to *M. aulica* that — bearing in mind also the apparently South American distribution of the former species — there seems to be no possibility of confusing the two species. The males of *M. memphis*, illustrated by Comstock (1961), on the other hand, are so different from each other that discussion of their similarity or otherwise to *M. aulica* becomes complicated. Both, however, have acute FW tips, which again would seem to distinguish them clearly from *M. aulica*, while like *M. annetta*, *M. memphis* is of apparently South American distribution.

Where descriptions of the early stages of these *Memphis* spp. and the identities of their hostplants are available, these prove to be reliable criteria for the separation of species (as they do in *Adelpha*, another large and complicated genus of Neotropical Nymphalidae; DeVries, 1987). The hostplant of *M. orthesia* at Turrialba is *Ocotea*

cernua (Nees) Mez (Lauraceae), while the final-instar larva of this species belongs to a different color pattern group from that of *M. aulica* (Finegan, in prep.). The final instar larva of *M. cleomestra* is in the same color pattern group as that of *M. aulica*, but the hostplants of the former species are Piperaceae (De Vries, 1987).

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