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REPORT OF PARTIAL BILATERAL GYNANDROMORPH OF *DISMORPHIA SPIO* WITH NOTES ON ADULT SEXUAL DIMORPHISM AND ILLUSTRATIONS OF IMMATURE STAGES

Additional Key Words: wing homeosis, polymorphism, sexual mosaics, wing pattern development in butterflies, egg, larva, immature stages, Pieridae, Dismorphiinae

Gynandromorphs have historically attracted the attention of developmental biologists. Their morphology and biology can shed light on evolution, genetic control and the role of sexes in the animal kingdom. For instance, Zhao et al. (2010) recently described the autonomy of the somatic sex identity in chickens based on a few available chicken gynandromorphs. Butterflies have contributed to studies of gynandromorphs more than any other group of animals, thanks to their large and frequently sexually dimorphic wings and their popularity with collectors. Sibatani (1980, 1983) brought attention to the significance of these wing pattern aberrations for understanding developmental biology. An unusual population of *Meleageria daphnis* (Denis & Schiffermüller) blue butterfly, which contained 60% of either mosaics or bilateral gynandromorphs, was discovered in 1988 in southern Russia shortly after the Chernobyl disaster (Dantchenko et al. 1995), raising the question of a possible connection between the events. If the background radiation proves to be the cause of this phenomenon, this unusual butterfly population might prove to be a prelude of an increased rate in human birth defects in the Chernobyl region (Wertelecki 2010). Mark Scriber has used the tiger swallowtail group as a model for many years, and recently illustrated how both laboratory-obtained and wild interspecific hybrids are likely to develop into mosaic and perfect bilateral gynandromorphs (e. g., Scriber et al. 2009). He also showed, in examples of wild-collected sexual mosaics of *Papilio glaucus*, how certain wing-pattern-controlling genes (in this case genes controlling melanism) appear to be sex-specific, and hence account for different degrees and patterns of melanism on male and female parts of the wings. All of the above studies illustrate the importance of reporting new gynandromorphs.

Observations: sexual dimorphism. Although sexual dimorphism in *Dismorphia spio* has been noted previously (e.g. Smith et al. 1994), only the presence/absence of the white androconial patch on the hindwing has been mentioned as a sexually dimorphic characteristic. In addition to the genitalic differences, I have identified four characters of *D. spio* that differ between sexes:

1. Presence (male)/absence (female) of white androconial areas on the dorsal hindwings, as previously noted by various authors.
2. Wing-span/antennal-length ratio is greater in females than in males:
   Measurements of 12 males and 12 females of Dismorphia spio from Jarabacoa, Dominican Republic, chosen at random from the McGuire Center for Lepidoptera and Biodiversity (FLMNH) collection, showed non-overlapping ranges of wing-span/antennal-length ratio between the sexes (Males = 3.91 ± 0.17; Females = 4.32 ± 0.18) (T-test; $P<0.0001$).
3. On the forewing of the female, the postdiscal band tapers marginally. Measurements conducted on 6 males and 6 females chosen at random from the McGuire Center for Lepidoptera and Biodiversity (FLMNH) collection, showed non-overlapping ranges of band length/width in its midpoint ratio (Males = 4.1 ± 0.97; Females = 7.43 ± 1.13) (T-test; $P<0.0003$).
4. The anal margin of the forewing is always more rounded in males. Hence, the anal angle is not defined; instead apical margin gradually transitions into anal margin, which forms a concave line. In females, on the contrary, the anal angle is well defined, with anal margin forming a sinusoid-shaped line.

Observations: gynandromorph. In 1996, I collected an unusual specimen of *Dismorphia spio* Godart (Pieridae: Dismorphiinae) near Jarabacoa, Dominican Republic. Several color morphs were present sympatrically in this locality both in males and females (Fig. 1M-1 to M-3; 1F-1 to F-4). When the same sexually dimorphic characters listed above were examined in this asymmetrical specimen (Fig. 1G), which exhibits orange scales on its right forewing, the conclusions were as follows:

1. The specimen in question possesses extensive white androconial areas on both hindwings, which are characteristic of males regardless of the color morph. It might, therefore, at first glance, be perceived as a male with a mosaic pattern of orange scales on the right forewing.

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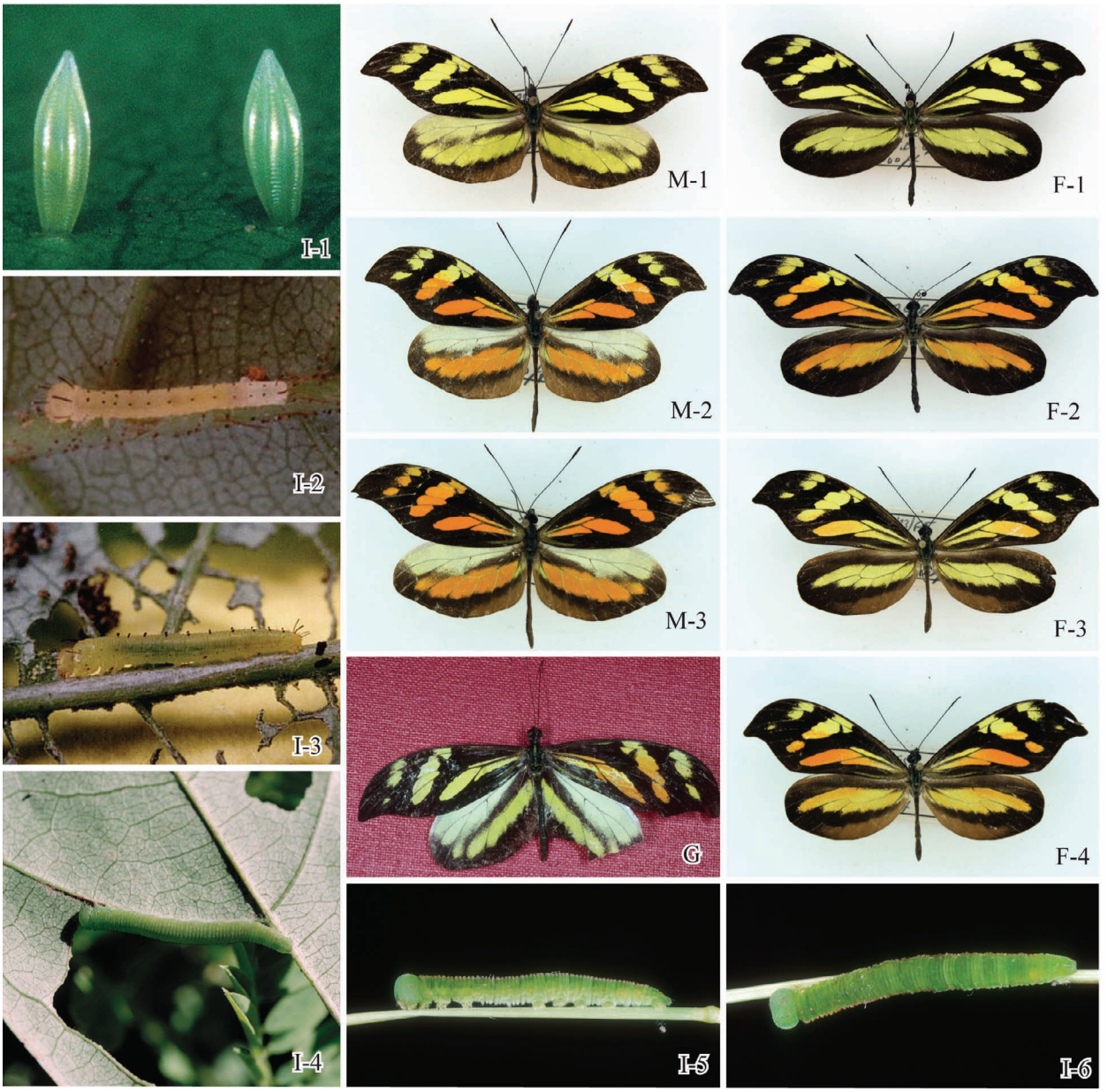


FIG. 1. *Dismorphia spio* (Pieridae) from Cordillera Central, Dominican Republic: (**I**) Immatures on *Inga vera* (Fabaceae): I-1 Eggs; I-2,3 – First instar larva; I-4,5,6 – Last instar larva; (**M**) Males of different color forms; (**F**) Females of different color forms; (**G**) Sexual mosaic gynandromorph - ¾ - male, ¼ female.

2. The right antenna of this specimen is shorter than the left. The relative length of the left antenna in proportion to the wing-span is 4.57, which falls into the range typical for males. The relative length of the right antenna in proportion to the wing-span is 5.7, which falls between the male and female range. The clearly male-like yellow left wing of the specimen is 1% shorter than the mosaic right wing. The shorter right antenna and the longer right wing strongly suggest the presence of female tissue in these two organs.
3. On the right forewing, the postdiscal band tapers marginally, which is typical of females. This band is shorter and maintains uniform width on the left forewing, which is typical of the male specimens. The ratio of band length to its width in its midpoint on the left forewing is 5.1, which falls into the male range, while it is 7.3 on the right forewing, which falls into the female range. This is another indication that the right forewing is of female sex.
4. The shape of the right forewing is more characteristic of the female, with its anal angle better defined than

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in the left forewing. The anal margin of the left forewing is concave typically of the males.

Discussion. The color polymorphism in *D. spio* has probably arisen and is maintained as a result of mimicking, in the case of the yellow forms, *Heliconius charithonia* L., and, in the case of the orange form, *Lycorea cleobea* Godart, with both of which *D. spio* occurs sympatrically. Another possible model for the orange form is *Euides melphius* Godart, though it is less likely, since it is relatively rare (Smith et al. 1994). Unlike *P. glaucus*, there is no available evidence linking color to gender in *D. spio*. Therefore, it is possible that the bilateral gynandromorph specimen exhibiting two color forms is simply a result of fertilization of a binucleate egg by two sperms carrying different color genes. The question is: why, if such was the mechanism, the result is not a perfect bilateral gynandromorphy, but rather what can be described as ¾ - male, ¼ female? The sexual mosaics can be formed by the postzygotic loss of one sex chromosome. For instance, if that was the case in one of the blastomeres of a male, following the second division, than a quarter of the resulting adult cells could turn female. In this particular case, if that was the mechanism, the orange coloration was unmasked only after the loss of one sex chromosome, therefore indicating presence of sex-linked color control genes in this species. Further research into molecular and chromosomal mechanisms of color inheritance in *D. spio* would be useful in explaining the observed phenomenon.

Immature stages. Collected on *Inga vera* Wind. (Fabaceae), the eggs (Fig. 1I-1), first instar larva (Fig. 1I-2, 1I-3) and mature larvae (Fig. 1I-4, 1I-5, 1I-6) are photographically illustrated here for the first time. A more detailed description of immature stages including morphological drawings, can be found in Bauza (1991).

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LITERATURE CITED

BAUZA, J. A. T. 1991. Biología de *Dismorphia spio* (Godart) en Puerto Rico (Lepidoptera Pieridae: Dismorphiinae). Carib. J. Sci. 27(1-2): 35-45.

DANTCHENKO, A., T. C. EMMEL & A. SOURAKOV. 1995. Nuclear pollution and gynandromorphic butterflies in Southern Russia. Holarctic Lepid. 2(2): 77-79.

SCRIBER, J. M., R. MERCADER, H. ROMACK & M. DEERING. 2009. Not all bilateral gynandromorph butterflies are interspecific hybrids: new *Papilio* specimens from field populations. J. Lepid. Soc. 63(1): 37-47.

SIBATANI, A. 1980. Wing homeosis in Lepidoptera: A survey. Developmental Biol. 79: 1-18.

———. 1983. A compilation of data on wing homoeosis in Lepidoptera. J. Res. Lepid. 22(1): 1-46.

SMITH, D. S., L. D. MILLER & J. Y. MILLER. 1994. The butterflies of the West Indies and south Florida. Oxford University Press, Oxford. 264pp, 32 pl.

WERTELECKI, W. 2010. Malformations in a Chernobyl-Impacted region. Pediatrics 125(4): e836-e843 (DOI: 10.1542/peds.2009-2219).

ZHAO, D., D. MCBRIDE, S. NANDI, H. A. MCQUEEN, M. J. MCGREW, P. M. HOCKING, P. D. LEWIS, H. M. SANG, & M. CLINTON. 2010. Somatic sex identity is cell autonomous in the chicken. Nature 464: 237-243.

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