

Mimicry by illusion in a sexually dimorphic, day-flying moth, *Dysschema jansonis* (Lepidoptera: Arctiidae: Pericopinae).

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Abstract. Sexual dimorphism and development in *Dysschema jansonis* (Butler, 1870) are discussed, and wing patterns of females and males are compared with those of their models, female *Parides* spp. (Papilionidae) and transparent-winged ithomiine nymphalids, respectively. Two questions are addressed: Why does *D. jansonis* not display more accurate mimicry? How does *D. jansonis* create the illusion of mimicry?

Introduction

Species of the genus *Dysschema* Hübner, 1818 are well-known examples of diurnalism in moths (Klots & Klots, 1959), and sexual dimorphism of wing pattern and color in Lepidoptera (Watson & Whalley, 1975). They are presumed mimics of unpalatable butterflies of various groups (Fisher, 1958; Gilbert, 1984; Watson & Whalley, 1975), and it is possible that they themselves are unpalatable, Müllerian mimics. The following remarks concern *D. jansonis* in the Republic of Panamá.

Sexual Dimorphism

In general appearance, males and females of *D. jansonis* are strikingly different (Figure 1). However, a careful inspection reveals that the same wing pattern elements are present in both sexes. The dorsal forewings of the two sexes are quite similar, except that the pattern shows slightly more contrast in males. The hind wing pink forms a large blotch at the posterior margin in females, but is reduced to a tiny dot or is absent in males. The dorsal yellow, restricted to a round mark near the anterior margin of the hind wing in females, occupies the basal three fourths of the wing in males. In both sexes, the ventral side closely resembles the dorsal side except that in the male the forewing markings are more pronounced on the ventral surface than on the dorsal, and in



Fig. 1. Left column, from top: *Dysschema jansonis* males (D, YCF), (D, WCF), *Oleria rubescens* (D), *D. jansonis* male (V, WCF); Middle column, from top: *Eurytides ilus* (D), *Papilio anchisiades* (D); Right column, from top: *D. jansonis* females (D), (V), *Parides arcas* female (D).
Figure codes: D = dorsal, V = ventral, YCF = yellow color form, WCF = white color form.

the female the ventral forewing bears a yellow band that is only faintly evident on the dorsal side.

Sexual Differences During Development

Five males and six females of *D. jansonis* were reared from a clutch of 13 eggs laid by a single female, 10. XI. 1982 during daylight hours, on the underside of a leaf of *Spiracantha cornifolia* (Compositae) at the Summit Observatory in the Canal area of the Republic of Panamá (Aiello Lot 82-62). All 13 eggs hatched on 22. XI. 1982. One larva died in its first stadium, another died as a late instar, but the other 11 completed development to adult.

Females passed through eight larval stadia and required 72-80 days (\bar{x} = 75.83 days, s = 3.19) to complete development from egg to adult, whereas males had only seven larval stadia and completed development in 66-69 days (\bar{x} = 67.60 days; s = 1.14). The late larva that died, did so on day 69 as a ninth instar. One can only guess at the sex of that individual; possibly it was an exceedingly small male who had difficulty achieving the minimum weight necessary for pupation.

Early stadia were synchronized; all 13 eggs hatched on the same day, and molting occurred synchronously through stadium six. Larvae in the first through third stadia aggregated, and fed by scraping the upper leaf surface either while strung out along one edge of a leaf, or while lined up parallel to one another to form a feeding front. Fourth

instars began to show conspicuous size variation, and from then on were solitary and ate whole leaf instead of scraping the surface. Molts to seventh and eighth stadia were asynchronous; the molt to stadium seven occurred over two days, and that to stadium eight took place over four days. Following the molt to stadium seven, all larvae were transferred to separate cages and given individual numbers. Six individuals that were larger than the others were numbered 1-6, and all proved to be females; the smaller larvae (numbered 7-11) turned out to be males.

Adult eclosions in both sexes took place between 1500 and 1700 hours.

Mimicry in Females

Dysschema jansonis females resemble females of the aposematic butterflies *Parides* spp. (Papilionidae), when in flight. Like *Parides* (Figure 1), they have yellow and pink markings against a black background. However, in *Parides* the yellow is on the forewings and the pink is on the hind wings, while in *D. jansonis* both color elements are located on the hind wings. This seemingly important discrepancy does not detract from the mimetic effect when the moth is in flight; the human observer, at least, sees the rapidly fluttering moth as a fast-moving *Parides*. The illusion is made possible partly by exposure of the yellow band, on the underside of the forewing, during the high wing-stroke flight of this moth, and partly by the fact that when the wings are spread they are somewhat translucent, and the underside yellow shows through them from above.

There exist a number of other *Parides* look-alikes with much more convincing mimicry. In Panamá, *Eurytides ilus* and *Papilio anchisiades* (Papilionidae) (Figure 1) have the yellow on the forewings and the pink on the hind wings as does *Parides*. A probable explanation for *D. jansonis*'s "imperfect" mimicry of *Parides* can be found in the resting posture of this moth. Both sexes rest, with the forewings covering the hind wings, on foliage or bark where they blend with their background or resemble a bit of dead leaf. A yellow band or large white area on the dorsal forewing might interfere with this resting-posture crypsis. *D. jansonis* has overcome this constraint by employing mimetic illusion, and as a result possesses two distinct modes of visual protection.

Another example of mimicry by illusion can be found in the nymphalid butterfly *Consul fabius*, which resembles a dead leaf when at rest with its ventral cryptic pattern showing, and a tiger-striped *Heliconius* when in flight with the dorsal pattern exposed. The illusion occurs when *C. fabius* flies in sunlight and the dorsal mimetic pattern shows through the wings from below as well (DeVries, 1987).

Mimicry in Males

Dysschema jansonis males resemble various genera of transparent-winged ithomiine nymphalid butterflies (Figure 1). Although scaled,

the wings of *D. jansonis* males appear transparent when in flight, an illusion made possible by the fact that dorsal and ventral surfaces are identically patterned, and enhanced by exposure of the strongly marked ventral forewing during flight. In addition, when the wings are spread, the paler areas are translucent, a fact which can be demonstrated by holding a pinned specimen to the light. Males' fluttery flight further contributes to the ithomiine resemblance.

When at rest, with the forewings covering the hind wings, transmitted light and wing pattern contrast are reduced, and the moths blend well with mottled bark or dried leaves. Reduced contrast can be demonstrated by placing a pinned specimen over a dark background.

Male Color Dimorphism

Some males have white, instead of yellow, hind wings, and while it has been supposed (Druce, 1884; Hering, 1925) that the two forms are mere color variations of the same species, no evidence has been presented until now. Of the five males reared from the single clutch of 13 eggs, three were the white color morph and two were the yellow. Presumably both are ithomiine mimics; transparent-winged ithomiines include species with clear, and species with yellow-tinged wings.

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