

### Summary

The green and brown alternative pupal colors in the butterfly, *Papilio demodocus*, appear to be environmentally determined. Larvae reared under controlled conditions in Uganda produced about two-thirds green and one third brown throughout the year, but in Sierra Leone green pupae were more frequent in the wet season and brown in the dry. The difference between the two localities is correlated with differences in the seasonal distribution of rainfall and its effect on green and brown background colors. There is some evidence that green pupae are formed on green backgrounds and brown pupae on non-green backgrounds.

---

## THE LIFE HISTORY OF *SCHINIA LIGEAE* (NOCTUIDAE)

D. F. HARDWICK

Entomology Research Institute, Canada Department of Agriculture,  
Ottawa, Ontario

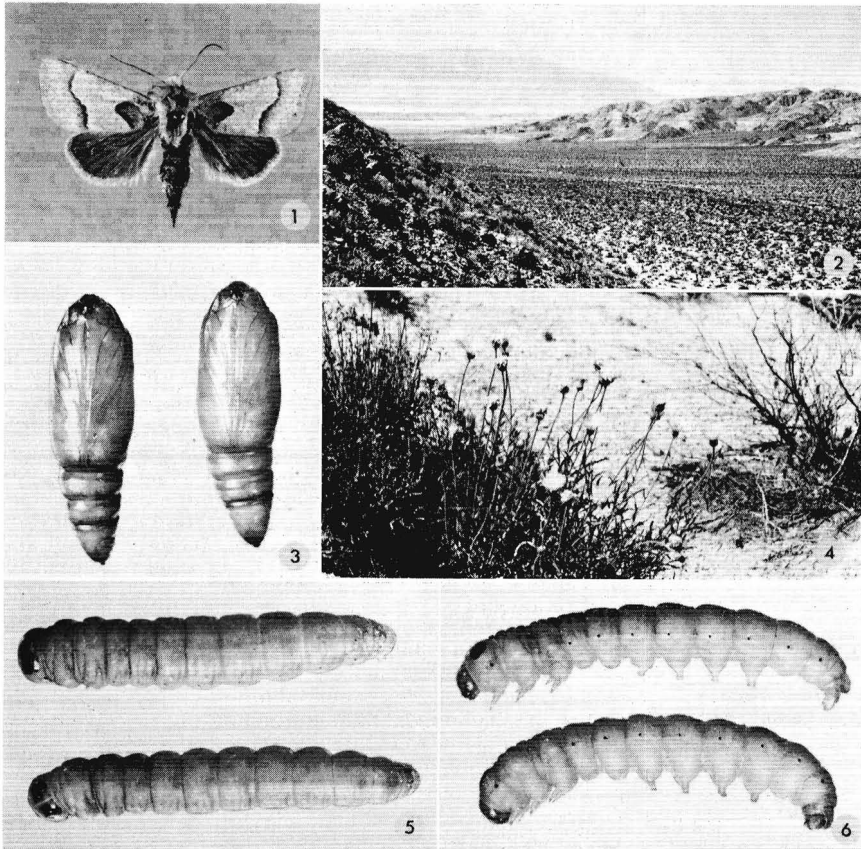
*Schinia ligeae* (Smith, 1893, p. 331) feeds in the larval stage on the blossoms of the Mojave Aster, *Machaeranthera tortifolius* (Gray) (Figs. 2, 4). According to Munz (1963), *tortifolius* occurs on the Mojave and northern Colorado deserts of southern California and is distributed from there eastward to southwestern Utah and western Arizona.

Specimens of *Schinia ligeae* in the Canadian National Collection were taken in various localities on the northern Colorado Desert and the Mojave Desert except for one specimen taken in the Valley of Fire in southern Nevada and another at Ehrenberg, Arizona. The distribution of the moth, therefore, may well correspond with the distribution of its host plant.

*Schinia ligeae* is a spring-flying species and its flight is co-ordinated with the early blossom period of its host plant. Specimens examined were taken between the middle of March and the end of April.

### Behaviour

*Schinia ligeae* is a predominantly nocturnal species and the eggs are deposited at night in the heads of the Mojave Aster. The eggs are inserted among the florets from the upper surface of the head, usually at a stage when the individual florets of the blossom have not as yet opened. On the basis of the few eggs observed throughout the incubation period, eclosion usually occurs on the fifth day after deposition. The newly hatched larva bores into an adjacent floret and feeds within it for the duration of the first stadium. The second-stadium larva feeds in the head

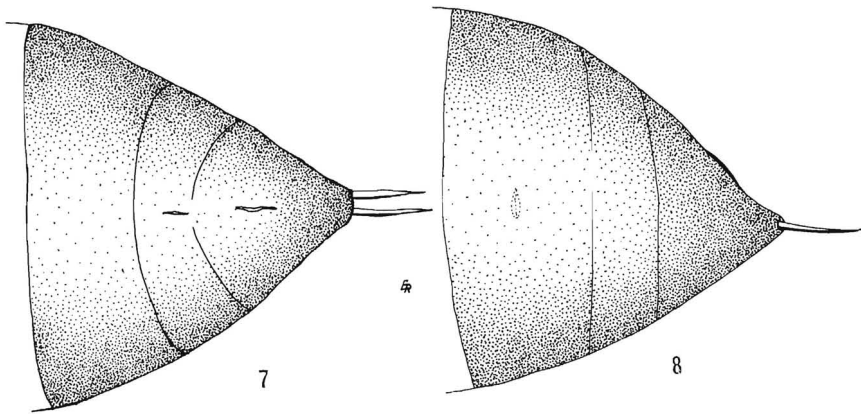


Figs. 1-6. *Schinia ligeae* (Smith), its habitat and food plant. 1, Adult, Desert Hot Springs, Calif.; 2, Fan Hill Wash near Desert Hot Springs where eggs and larvae were found abundantly in the heads of Mojave Aster; 3, ventral aspect of pupae; 4, food plant, *Machaeranthera tortifolius* (Gray); 5, 6, fourth-stadium larvae.

from a position between the florets. Early in the fourth stadium the larva may leave the first head and bore into a second, which it attacks from the top. The larva remains concealed within the aster heads throughout its period of feeding. The fully fed larva makes its way to the ground and tunnels into the soil to pupate. All individually reared larvae matured in four stadia.

#### Description of Stages

The few gravid females taken in southern California did not oviposit readily in captivity and the developmental data recorded here were based



Figs. 7, 8. Apical abdominal segments of pupa. 7, Ventral; 8, right lateral.

largely on individuals dissected as eggs from the heads of Mojave Aster at Fan Hill Wash near Desert Hot Springs, California. Larvae were reared individually at room temperature using the techniques outlined by Hardwick (1958). The estimate of variability following the mean for various values is the standard deviation.

**Adult** (Fig. 1). Head and thorax pale fawn-grey. Abdomen fawn-grey or occasionally smoky-grey. Forewing pale grey marked with light fawn. Transverse anterior line white, usually smooth, acutely excurved. Basal space light fawn, usually becoming paler toward base of wing. Transverse posterior line white, inconspicuously scalloped between veins, shallowly excurved around cell, then straight to inner margin. Median space whitish-grey. Orbicular and reniform spots absent. Sub-terminal space narrow, concolorous with basal space. Terminal space cream. Often a series of indistinct intervenal dashes at margin of wing. Fringe concolorous with terminal space. *Hind wing* light to dark smoky-brown. An indistinct discal lunule and outer-marginal band sometimes evident. Fringe white with a yellowish basal line. *Underside* of forewing with basal and median areas uniform chocolate-brown; outer and apical areas of wing dull cream. Hind wing dull cream, usually with an evanescent discal lunule.

*Expanse*:  $26.9 \pm 1.6$  mm (62 specimens).

**Egg**. Pale cream when deposited, becoming suffused with pink on day after deposition. Pink darkening to an orange-brown during next few days; anterior half of egg darker than posterior half. Egg becoming grey, then head capsule becoming visible through chorion a few hours before hatching.

*Dimensions of egg*: length,  $1.55 \pm 0.08$  mm; diameter,  $0.87 \pm 0.06$  mm (25 eggs).

**First-Stadium Larva**. Head varying from medium orange-brown through smoky-brown to blackish-brown. Prothoracic shield smoky-fawn to dark smoky-brown. Suranal shield similar in colour but usually paler. Trunk translucent yellowish-grey in newly hatched larva with purplish gut showing through; older larvae cream to light yellow. Spiracles with dark-brown rims.

*Head width*:  $0.518 \pm 0.017$  mm (25 larvae).

*Duration of stadium*:  $4.5 \pm 0.6$  days (39 larvae).

**Second-Stadium Larva**. Head light to medium orange-brown, often mottled

dorsally with smoky-brown. Prothoracic shield varying from light orange-brown to fawn; variably suffused with dark smoky-brown, often heavily so; a pale median line often evident on shield. Suranal shield paler than prothoracic shield. Trunk varying from cream to light yellow. Spiracles with medium- or dark-brown rims. Thoracic legs fawn, variably suffused with smoky-brown.

*Head width:*  $0.864 \pm 0.031$  mm (25 larvae).

*Duration of stadium:*  $3.4 \pm 0.7$  days (39 larvae).

**Third-Stadium Larva.** Head bright orange-brown, suffused and mottled with smoky-brown. Prothoracic shield black, margined with fawn or smoky-brown, and with a narrow median line of pale grey or light cream. Suranal shield varying from fawn-grey to orange-brown. Trunk greyish-cream, without maculation except for increased transparency over heart. Spiracles with black rims. Thoracic legs varying from light fawn to pale orange-brown and suffused with smoky-brown.

*Head width:*  $1.41 \pm 0.07$  mm (25 larvae).

*Duration of stadium:*  $3.7 \pm 0.7$  days (39 larvae).

**Fourth-Stadium Larva** (Figs. 5, 6). Head bright orange, almost indiscernibly mottled with light orange-brown. Prothoracic shield varying from fawn to light orange-brown, with a black or smoky-brown submarginal patch on either side and with a narrow, pale yellow, median line. Suranal shield light orange-brown, weakly mottled with smoky-brown. Trunk various shades of grey, usually slate-grey on entering stadium but becoming paler with increasing size; trunk assuming a dull reddish tone on dorsum as larva approaches the prepupal phase. Spiracles with black rims. Thoracic legs varying from dull yellow to light orange-brown.

*Head width:*  $2.09 \pm 0.12$  mm (8 larvae).

*Duration of stadium:*  $6.3 \pm 1.4$  days (39 larvae).

**Pupa** (Figs. 3, 7, 8). Mahogany-brown, suffused with olive on proboscis and thoracic appendages. Spiracles on segments 2, 3 and 4 borne in shallow oval depressions; spiracles on segments 5, 6 and 7 borne in noticeably deeper pits. Spiracular sclerites moderately broad. Anterior marginal area on each of abdominal segments 5, 6 and 7 strongly sclerotized and raised into a rounded, prominently pitted ridge. Proboscis terminating a short distance anterior to apex of wings. Cremaster usually consisting of two rather short setae borne at the narrowly rounded apex of the tenth abdominal segment; a few pupae with a short slender seta lateral to each of the median pair.

*Length from anterior end to posterior margin of fourth abdominal segment:*  $8.9 \pm 0.4$  mm (24 pupae).

### Acknowledgments

I appreciate the assistance of Mr. John E. H. Martin, Entomology Research Institute, in providing the photographs for this paper, and of my associate Mr. Eric Rockburne in measuring larval structures and in drawing the cremaster area of the pupa.

### Literature Cited

- HARDWICK, D. F. 1958. Taxonomy, life history, and habits of the elliptoid-eyed species of *Schinia* (Lepidoptera: Noctuidae), with notes on the Heliolithidinae. Can. Ent. Suppl. 6.
- MUNZ, P. A. 1963. A California flora. University of California Press, Berkeley.
- SMITH, J. B. 1893. Descriptions of Noctuidae from the Death Valley. Insect Life 5: 328-334.