EARLY STAGES OF SEVEN COLORADO *HESPERIA* (HESPERIIDAE)

JAMES A. SCOTT
Department of Entomology, University of California, Davis, California 95616

This paper adds to the information about *Hesperia* early stages given by MacNeill (1964), whose terminology I use. Taxonomic changes indicated by these early stages are discussed. *Hesperia comma* (Linnaeus) is used as the species name for *H. harpalus ochracea* Lindsey and *H. colorado* (Scudder), and *H. leonardus* Harris is used as the species name for *H. pawnee* Dodge, because of recent taxonomic studies (C. D. MacNeil, in press; Scott, 1975). In addition, I report another obvious method of determining the sex of pupae.

General Characteristics

First instar. The ring pores and setae, especially of the ventral setae, are occasionally aberrant in size or setal position. Setae of head and around the anal prolegs are the same for all species (Figs. 2, 16). Head is unicolorous brown; body is whitish. In setal pattern, Tii is the same as Tiii. Ai and Aii are the same as Aviii except the spiracles are only half as wide; Aiii to Avi are the same as Aviii except the spiracles are like Aii, and there is no sublateral ring-pore, and the proleg has two lateral setae side by side. Aix is the same as Aviii except there is no spiracle, and there is only one lateral seta, situated just above and slightly behind the ring-pore.

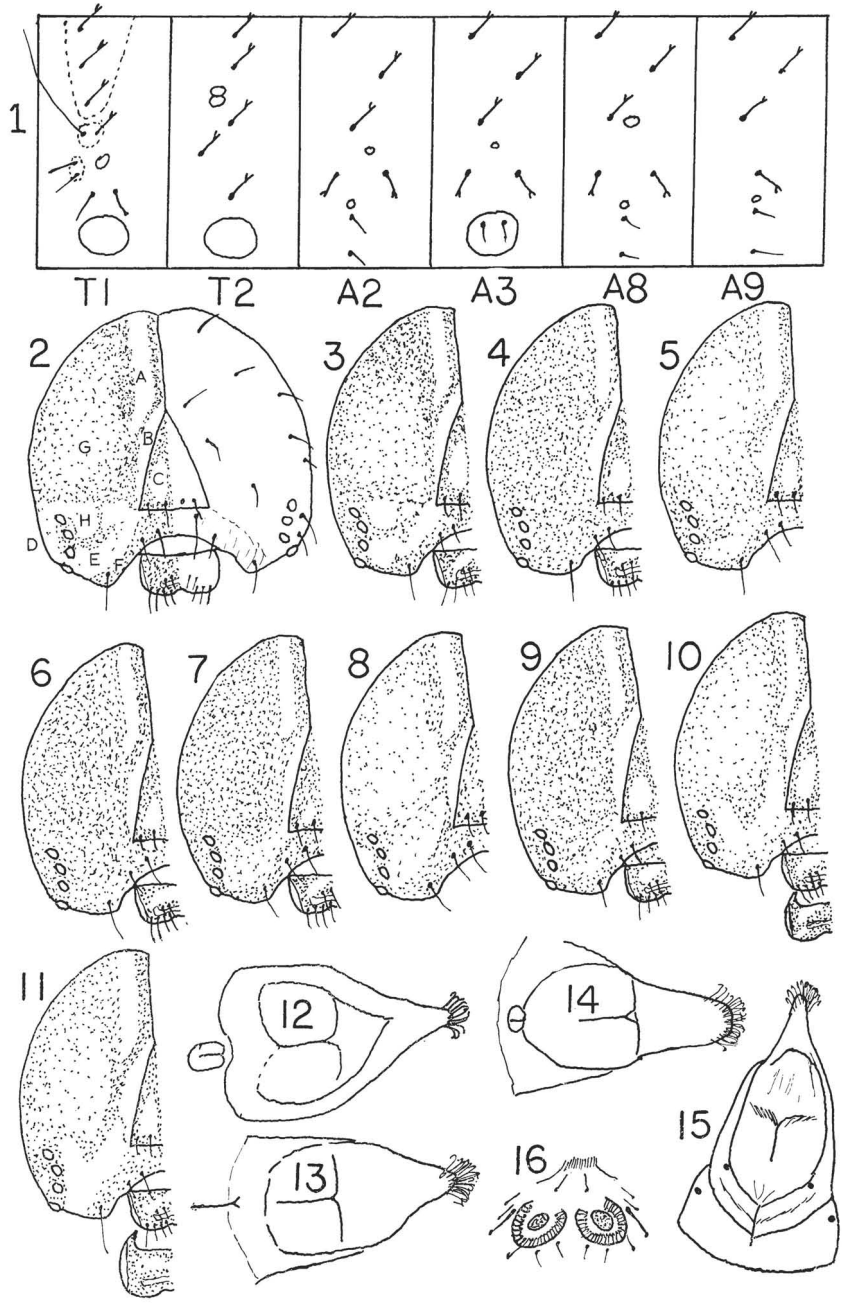
Mature larva. The head has light areas A, B, and C always present (Fig. 2). The body is dingy light brown, sometimes slightly maroon colored. Cranial punctures occur dorsad of a line just above the ocelli. The cranial setal pattern of all species is the same (Figs. 2–11), with a few large setae and many tiny ones. The labrum has 12 setae whereas only 10 occur in the first instar.

Pupa. The presence or absence, and size of, the dorsal ring pores is variable. Color is dingy light brown. The cremaster shape is somewhat variable. Black circular spots sometimes occur, especially ventrally. On dorsum and anterior of heads the setae are surrounded by pale areas (dark areas have no setae). Abdominal spiracles are functional on segments 2–7, and a non-functional pair occurs on segment 8. Brown spots mottle each segment of the abdomen; these spots are somewhat variable, and are similar between species. Cremaster hooks occur in an undivided cluster. Setae are simple, and incline anteriorly on head.

Just anterior to the cremaster is a small ventral groove (Figs. 12–15). In males of all species examined it is short and bounded by two hemispherical bumps; in females it is long and without bumps. This method of determining the sex of pupae also works in *Limenitis* (Kean & Platt, 1973) and *Phyciodes* (Nymphalidae). MacNeill (1964) showed that male pupae have the stigma visible on wing cases, and that males have slightly broader heads and bigger eyes than females.

Distinguishing Characteristics

H. viridis (Edwards) (1 mi. up Bear Creek, Chaffee Co., Colorado). First instar: sublateral ring pores as large as Ti spiracle. SD1 on Tii twice as long as other



Figs. 1–16. Larvae and pupae of *Hesperia* spp.: (1) setal map of first instar *H. leonardus montana* (from first thoracic (T) segment to ninth abdominal (A)

spatulate setae. Anterior and posterior suranal setae similar. AixD1 normal. Last instar: most heads fairly dark, often lighter at G and E. B has a light lateral protrusion at level of top of area C. Structural striations occur medial to upper ocelli in darker heads. Pupa: proboscis extends 2.5 mm beyond legs, ⅝ of distance to cremaster base, slightly longer than *H. l. pawnee*. Cremaster narrow. Setae fine, short (0.1–0.2 mm), straight or slightly curved. Few ventral black spots occur.

H. uncas uncas Edwards (1 mi. up Bear Creek, Chaffee Co.). First instar: sublateral ring pores as large as Ti spiracle. SD1 on Tii normal. Anterior and posterior suranal setae alike. AixD1 normal. Last instar: very rarely D light, often a light triangular sickle-shaped light area at E, sometimes with G lighter, C rarely small. Structural striations occur mesad of upper ocelli on darker heads. Pupa: proboscis extends 1.3 mm beyond legs. Cremaster very broad, about 1.0 mm wide, with a greater number of hooks which are only slightly hooked (in other entities very hooked). Cluster of oval setae-bearing rings near proboscis wider, about 0.4 mm in diameter (0.3 in other entities). Dorsal and head setae longer, especially on abdomen, about 0.3–0.4 mm (only 0.1–0.2 mm in *comma*, *viridis*, and *pahaska* Leussler), wider, nearly straight. No or very few ventral black spots.

H. comma ochracea (1 mi. N of Cheesman Reservoir, Jefferson Co.). Egg: with ventral flange. Micropyle with 4–6 (usually 5) spines, 8–10 (usually 9) faint or absent rosette cells, spicules more common outside rosette. First instar: sublateral ring-pores as large as Ti spiracle. SD1 on Tii normal. Anterior suranal setae short and spatulate, same length as laterals. AixD1 normal. Last instar: pattern of head similar to *colorado*. Pupa: proboscis extends very slightly beyond legs. Cremaster narrow. Setae short (0.1–0.2 mm), wider, somewhat hooked on head. The ventral black spots are few.

H. comma colorado (near Tennessee Pass, Lake Co.). Egg: with ventral flange. Micropyle with 4–5 spines, about 9 cells in rosette, cells faint or absent, spicules entering rosette but more common outside. First instar same as *ochracea*. Last instar: head with G usually light, E and H light and separated by a dark patch narrowly connected to (rarely not connected) dark area around ocelli, D light. Pupa same as *ochracea*.

H. pahaska pahaska (Oak Creek, S of Canon City, Fremont Co., and 1 mi. up Bear Creek, Chaffee Co.). First instar: sublateral ring-pores less than ½ diameter of Ti spiracle (ring-pore on Aii very small or absent). SD1 on Tii normal. Anterior and posterior suranal setae alike. AixD1 normal. Last instar: E sometimes light, F rarely light, C sometimes small, rarely a light spot at D. Heads darker than *l. pawnee* and *l. montana* (Skinner). Structural striations occur mesad of upper ocelli. Pupa: proboscis extends 3–4 mm beyond legs to base of cremaster, twice as long as in *H. l. pawnee*. Cremaster narrow (rarely 0.5 mm wide). Setae short (0.1–0.2 mm), fine, nearly straight. No or very few ventral black spots.

H. leonardus pawnee (Green Mountain, Jefferson Co.). Egg: without flange.

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segment; dotted lines border sclerotized areas; circles are legs, prolegs, spiracles, or ring pores). Head capsules: (2) light-dark pattern of mature larva (left half) illustrating eight potential light areas and setal pattern (right half) of first instar larva of *H. c. colorado*; (3) *H. c. ochracea*, mature larva; (4,5) *H. viridis*, mature larvae; (6) *H. uncas uncas*, mature larva and (7,8) third instar larvae; (9) *H. pahaska pahaska*, mature larva; (10) *H. l. pawnee*, mature larva; (11) *H. l. montana*, mature larva. Pupae: (12) ventral view of cremaster of male and (13) female of *H. l. montana*; (14) male of *H. uncas*; (15) female of *H. c. colorado*. Setal pattern (16) around anal prolegs of first instar *H. l. montana*.

Micropyle with about 7 spines, rosette of 8–10 cells very faint, usually absent, spicules abundant in rosette. First instar: sublateral ring-pores less than one-half diameter of Ti spiracle. SD1 on Tii normal. Anterior and posterior suranal setae alike. AixD1 normal. Last instar: G light, H and E combined in a V-shaped light area, E extending dorsally and almost meeting A, and a darker area between E and A, G light. Pupa: proboscis extends 1.0 mm beyond legs. Cremaster narrow. Setae slightly longer (0.2–0.3 mm), wider, nearly straight or slightly curved. Usually a rim posterior to "sex-mark." Black ventral spots common.

H. leonardus montana (Nighthawk, Douglas Co.). Egg: no flange. Micropyle with 7–8 spines, about 8–10 faint cells in rosette, spicules common in rosette. First instar: same as *pawnee*, except in 3 of 8 larvae there was a brown sclerite within crochets of anal proleg and a black anterior bar within crochets of other prolegs (absent in other entities). Last instar: same as *pawnee* but head slightly darker; D rarely a light spot, G darker, light only near dark spot where E and A come near each other. Pupa: same as *pawnee* except setae often narrower and black spots few.

Laboratory Developmental Rates

At least half the eggs of the only high altitude entity, *H. comma colorado* (10,400′) had a laboratory diapause; and the larvae of this taxon developed faster than the other entities (6,000–7,000′) which had no laboratory egg diapause and slower larval development. In *H. c. colorado* the period from oviposition to pupation took 50–59 days indoors in males, 56–63 days in females; the pupal stage lasted 14–15 days (occasionally 17) in males, 16–17 days in females. In the other entities, development from oviposition to pupation took 83–106 days (129 in one *H. c. ochracea*) in males, 102–114 (rarely 93) in females; the pupal stages lasted 22–29 days (rarely 36) in males, 19–30 in females. *H. c. colorado* apparently differs genetically from neighboring lower altitude populations because the developmental rates are shorter than for *H. c. ochracea* under identical laboratory conditions and wing pattern differences are maintained despite rearing in the laboratory.

Taxonomic Conclusions

The early stages generally support the conclusions of MacNeill (1964). The primitive condition of the first instar suranal plate seems to be with anterior resembling posterior setae. *H. l. pawnee* and *H. l. montana* are very similar, as are *H. c. ochracea* and *H. c. colorado*. *H. l. pawnee*, *H. l. montana*, and *H. p. pahaska* fit well into the *leonardus* group of MacNeill. *H. uncas*, however, may have to be removed from the *comma*-group, because the suranal anterior setae resemble posterior setae, the cremaster is peculiar, the first-instar sublateral ring-pores are larger than those of *H. juba* (Scudder) and *H. comma*, the pupal proboscis extends well beyond the legs, and the pupal oval-fields and dorsal setae

differ from those of *comma*. Altogether, *H. uncas* may resemble the ancestor of *Hesperia* more than *juba* or *comma*.

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LIFE HISTORY NOTES ON THREE TEXAS SPHINGIDAE

Manduca rustica (Fabricius). Hodges (1971, Fasc. 21, Sphingoidea, The Moths of America North of Mexico. London) gave this species as utilizing Verbenaceae and Boraginaceae as larval foodplants. Specific Texas larval foodplants in these families are *Lippia alba* (Mill.) N. E. Brown (Verbenaceae) and *Ehretia anacua* (Berl.) I. M. Johnson (Boraginaceae). On 16 October 1974, John B. Vernon found a larva on *L. alba* at Bentsen-Rio Grande Valley State Park. In the laboratory the larva readily accepted the closely related *Lantana camara* L. and was reared to an adult. At the same location, on 23 November 1974, Frank R. Hedges and Edward C. Knudson each found a larva of *rustica* on *E. anacua*. Determination was made by comparison with color photographs of the larva previously found. These larvae would not accept the *L. camara*; one died and the other was vacuum freeze-dried by Hedges.

Erinnyis ello (L.). Hodges gave only Euphorbiaceae as larval foodplants for this common species. On 16 October 1974, John B. Vernon and the author found larvae on *Bumelia angustifolia* Nutt. (Sapotaceae) at several locations in Hidalgo Co. Larvae were found in green, dark brown, and intermediate color forms, as described in Hodges. One larva of each color form was reared to adult stage, each producing a male.

Aellopos titan (Cramer). This species is occasionally common in the Lower Rio Grande Valley of Texas, and according to Hodges the larvae feed upon Rubiaceae. A specific Texas foodplant in this family is *Randia mitis* L. Frank R. Hedges observed a female ovipositing upon this plant near Mission, in Hidalgo Co., on 22 September 1974. Nine ovae were collected. The larvae were reared by Hedges on another rubiaceous plant, *Cephalanthus occidentalis* L. (Common Buttonbush). As stated by Hodges, the larvae occurred in both green and brown color forms. One adult was reared from each color form, and the remainder of the larvae vacuum freeze-dried by Hedges in various instars.

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MIKE A. RICKARD, *4628 Oakdale, Bellaire, Texas 77401.*