INCISALIA FOTIS SCHRYVERI (LYCAENIDAE): BIONOMIC NOTES AND LIFE HISTORY

CLIFFORD D. FERRIS
University of Wyoming, Laramie
and
RAY E. STANFORD
Denver, Colorado

In the years that have elapsed since the original description of *Incisalia fotis schryveri* Cross (1937), little additional information has been gathered regarding the biology of the insect. The distributional limits have been imprecisely determined, the immature stages have remained undescribed, and only vague speculation has appeared regarding possible host plants. This paper constitutes the first description of the immature stages and a record of the host plant. The insect was studied in Wyoming (by Ferris) and in Colorado (by Stanford). In the paragraphs which follow, where regional differences exist, state names will be mentioned; otherwise descriptions pertain to the entire range of *schryveri.*

Ecology and Nature of Habitat

Incisalia fotis schryveri occurs in multiple colonies in the eastern foothills of the Front Range of the Rocky Mountains in north-central Colorado, and in the continuation of this range into south-eastern Wyoming. Its northern limits, or possible blend zones with *I. fotis mossii* (H. Edwards), have yet to be determined, but in Colorado it seems to extend no farther south than El Paso Co. Records are also available from Boulder, Clear Creek, Douglas, Gilpin, and Larimer Cos. The species probably occurs also in the northeast portion of Park Co., along the Platte River, and may be found in parts of Teller Co. In Wyoming, it is known from Albany, Carbon, and Converse Cos., and is associated with the Laramie, North Platte, and Platte River drainages. Figure 1 shows records as dots and suggested distribution as shading.

The habitat of *I. fotis schryveri* in Colorado has been characterized briefly by Eff (in Brown, 1957). The species occurs in the Transition Zone, being found in sparsely wooded, brushy foothill canyons ranging in elevation from about 5,600 to slightly over 8,000 feet. The terrain consists in general of east-facing canyons containing intermittent or permanent streams, separated by steeply sloping rocky ridges. The predominant ground cover is *Cercocarpus montanus* Raf.; other characteristic vegetation includes *Juniperus scopulorum* Sarg. (south slopes), *Pseudotsuga*

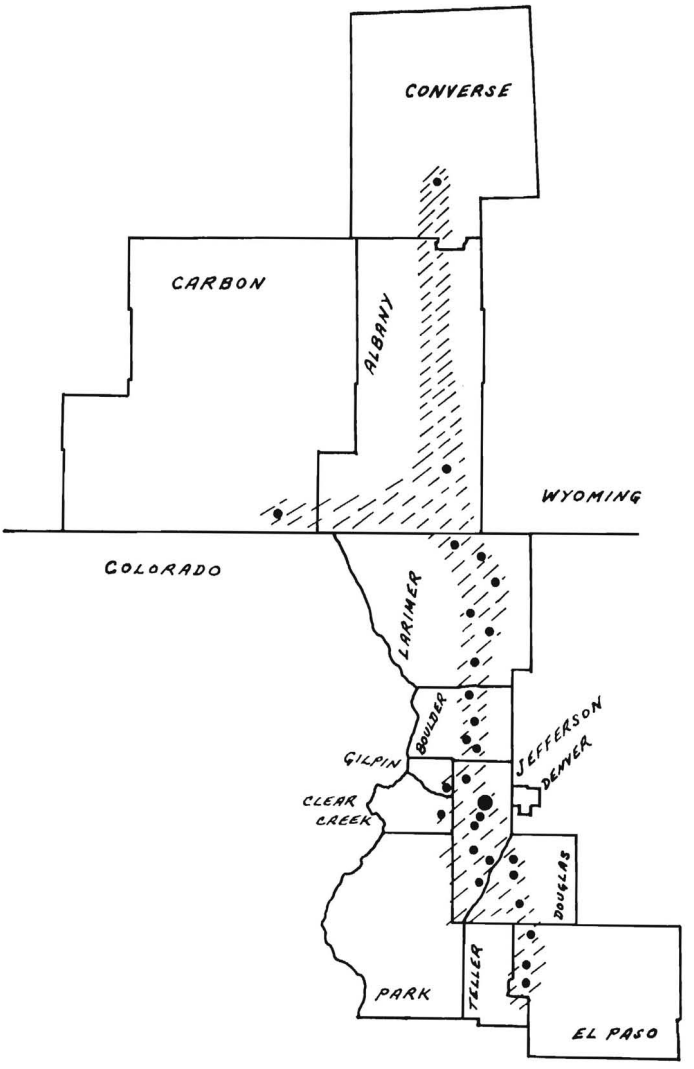

Fig. 1. Known collection areas (dots) and probable distribution (shaded areas) of *I. fotis schryveri*. **Wyoming:** Albany Co.: Pole Mtn. E. of Laramie; Carbon Co.: 20 miles S.E. of Encampment; Converse Co.: Natural Bridge. **Colorado:** Boulder Co.: Flagstaff Mtn., Boulder Canyon, Four-Mile Canyon, Gregory Canyon, Mesa Trail, Sunshine Canyon, Two-Mile Canyon, Sugarloaf, North St. Vrain Canyon; Clear Creek Co.: Clear Creek Canyon; Douglas Co.: Jarre Canyon nr. Sedalia, Platte Canyon; El Paso Co.: nr. Palmer Lake, N. Cheyenne Canyon; Gilpin Co.: Blackhawk Creek; Jefferson Co.: Chimney Gulch (type locality, large dot on map), Coal Creek, Golden, Lookout Mtn., Platte Canyon, Bear Creek Canyon, West of Morrison, Red Rocks Park, Clear Creek Canyon, Golden Gate Canyon, Indian Gulch, S.W. of Morrison, S. Platte Canyon nr. Waterton.

menziesii Franco (north slopes), *Pinus ponderosa* Laws., *Celtis occidentalis* L., *Mahonia repens* G. Don, *Ceanothus fendleri* Gray, *Ribes, Rhus, Yucca, Opuntia, Eriogonum umbellatum* Torrey, and *Chrysothamnus.* Typical riparian shrubs and trees include *Acer negundo* L., *Prunus, Crataegus,* and *Salix. Schryveri* seldom strays more than a few hundred yards out into the prairie, is distinctly uncommon in habitats dominated by *Quercus gambelii* Nuttall, and is nearly totally replaced by three other elfins (*I. polios* Cook and Watson, *I. iroides* (Boisduval), and *I. eryphon* (Boisduval)) above 8,000 feet. Of special interest is the occurrence of the stonecrop, *Sedum lanceolatum* Torrey, in the habitat, as it serves as the host plant for *schryveri.* Although widespread at higher elevations in the Rocky Mountains (where it serves as host plant for *Parnassius phoebus sayii* Edwards), stonecrop occurs in small, rather isolated clusters in the foothills. These are found mostly on well-drained east or northeast slopes with slight water seepage, and tend to be associated closely with *M. repens, Orobanche ludoviciana* Gray, and *E. umbellatum.* According to Eff (*in litt.*), the last of these associated plants may serve as host for *Callophrys sheridanii* (Edwards), a species sympatric and synchronic with *schryveri* in the region discussed in this paper.

Schryveri and *sheridanii* are usually the first non-hibernating species to appear in the spring, often in late March. (Artificial eclosion was effected by Stanford on 3 February 1970 by bringing pupa into a warm room.) The flight period is about three weeks, but stragglers may be found in late May or even early June. A fresh male taken by Stanford in Clear Creek Canyon, Jefferson Co., on 7 September 1968 is considered an atypical emergent rather than evidence of a second brood. The April flight period in Colorado corresponds with the blooming of *B. repens, O. ludoviciana,* and *Salix* species, but *schryveri* is seldom seen at flowers. Males tend to congregate in canyon bottoms, where they perch on various twigs or upon the ground. They exhibit markedly pugnacious behavior, chasing any other butterflies in the vicinity, and even an occasional bird. Frequently a specimen of *Nymphalis antiopa* (L.) or of *Polygonia zephyrus* (Edwards), both common species in the habitat, will be assaulted by dozens of *schryveri* simultaneously. Occasional females are seen in the canyon bottoms, nearly always fresh and either virgin or *in copulo,* but to find them in numbers one must ascend the steep hillsides to the slopes where *Sedum lanceolatum* occurs. Here the females are abundant, especially in the early afternoon. They fly close to the ground and alight frequently upon stones or plants of many kinds. Oviposition has been observed only upon *Sedum,* where a female will deposit a single egg upon the superior surface of a basal leaf. Of nearly fifty eggs re-

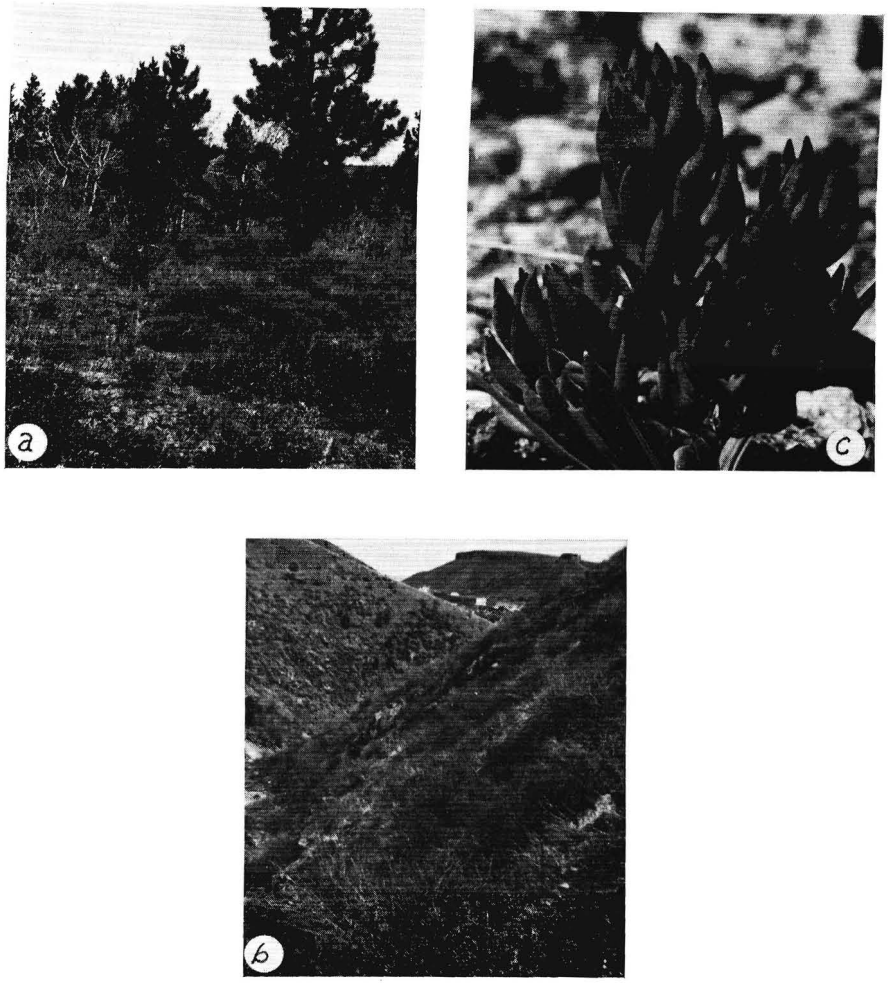

Fig. 2. a, Wyoming habitat. b, Colorado habitat. c, Host plant (*in situ*).

covered in various foothill habitats west of Denver in 1969, all but one or two were so situated. A few *Sedum* plants were found bearing two or three eggs, and an occasional egg was found on the ground beneath or nearby a *Sedum* plant. Maximum concentration of eggs was observed during the last week in April, and by May 10th, only larvae were found on the plants. The early instars fed upon the leaves, both in the field and in the laboratory, but by mid-May, when the plants were in early bloom, the by-then-third or fourth instar larvae preferred the flowers and

buds to the leaves. The pink-buff color of the third and fourth instar larvae is nearly identical to the color of the unopened buds of the Colorado morph of *S. lanceolatum,* while the pale green of the early instars matches the basal leaves, an interesting example of the changing of protective coloration. (See the description of the larvae in Wyoming which follows for comparison.)

In Wyoming, this little butterfly inhabits well-drained slopes and hill crests in the Upper Transition–Lower Canadian Zones. The vegetation characteristic of the region is sagebrush (*Artemesia* species), various grasses, *Pinus flexilis* James, *Pinus ponderosa* Laws., *Juniperus scopulorum* Sarg., *Populus tremuloides* Michaux, *Arctostaphylos uva-ursi* L., *Sedum lanceolatum* Torrey, and various annual and perennial herbs. The elevation ranges from 8,000 to 8,500 feet in most of the habitats.

I. fotis schryveri makes its appearance along with *C. sheridanii* while there are still patches of snow on the ground. It is heralded by the flowering of the sagebrush buttercup (*Ranunculus glaberrimus* Hook.) and pasque flowers (*O. ludoviciana* also known as *Anemone patens* L.). In 1969, *schryveri* was first collected on May 4th with four females and six males being taken. The last specimen, a female, was taken on May 23rd. No examples of this species were seen after this date. In Wyoming, it is sympatric with *I. polios* and *I. eryphon,* although these elfins appear on the wing about midway in *schryveri*'s flight period.

The butterfly is invariably found on the slopes with eastern or southeastern exposure. It appears to be somewhat more sensitive to weather conditions than other species with which it is sympatric. Depending upon air temperature, flight begins as early as 9:00 A.M. (MST) and extends into the afternoon until the first shadows fall over its habitat. It disappears immediately if the sun becomes obscured by clouds. The males are fond of flying about and resting upon low sagebrush plants. They may also be found sunning themselves (wings folded over back) on sandy patches of soil. The females are less active and keep quite low to the ground, frequently resting upon the ground or the host plant. They are most active about noon when they may be seen ovipositing. As in Colorado, the males are prone to combat and may be seen fighting with one another, or with other species, over the tops of the sagebrush clumps. The flight of *schryveri* is quite erratic, although never more than a few feet above the ground. Males and females are found in the same location in about equal numbers (*cf.* Colorado). The species is quite local in Wyoming and the presence of the foodplant does not indicate that the insect will be found. When located, both the insect and the foodplant will generally be in high concentration.

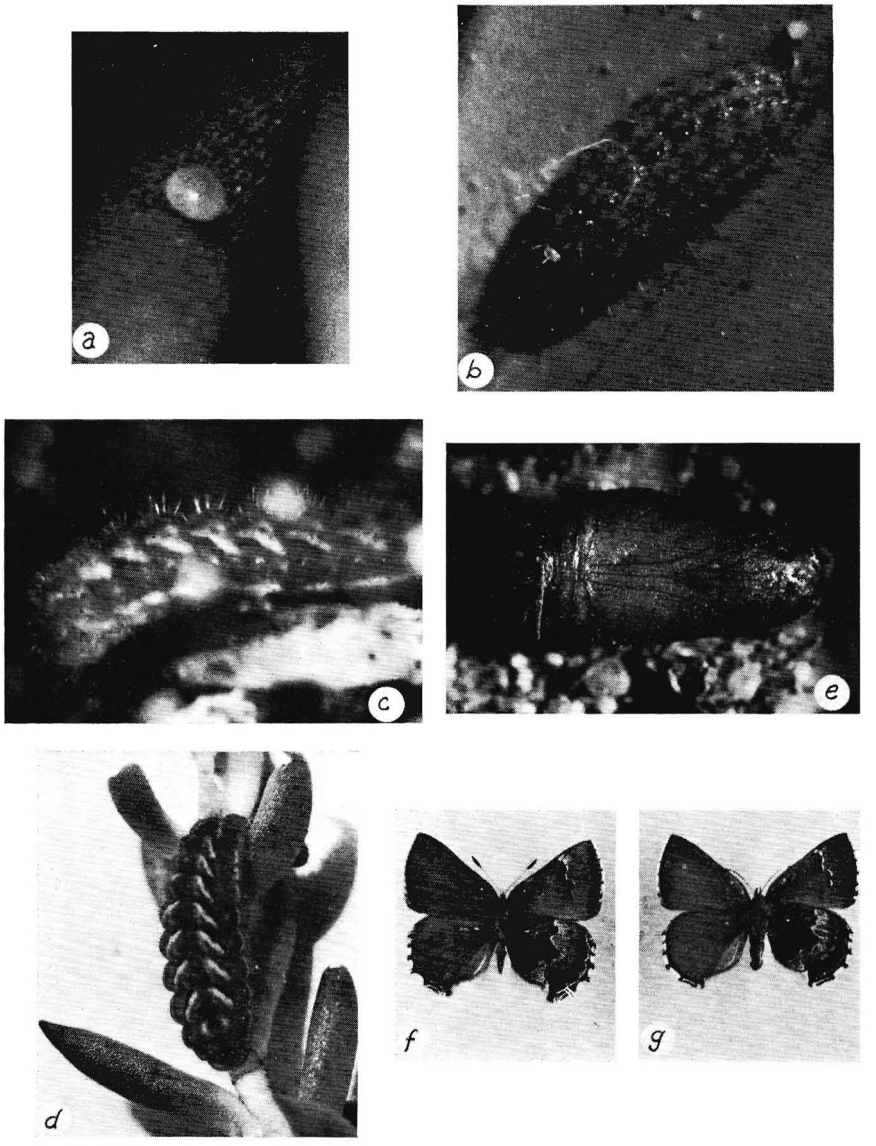

Fig. 3. a, Ovum on seedum leaf. b, Second instar larva prior to moulting. c, New third instar larva. d, Pupa, ventral aspect. e, Fourth instar larva in characteristic head down feeding position; note intensity of chevron markings. f, Adult male, dorsal and ventral surfaces. g, Adult female, dorsal and ventral surfaces.

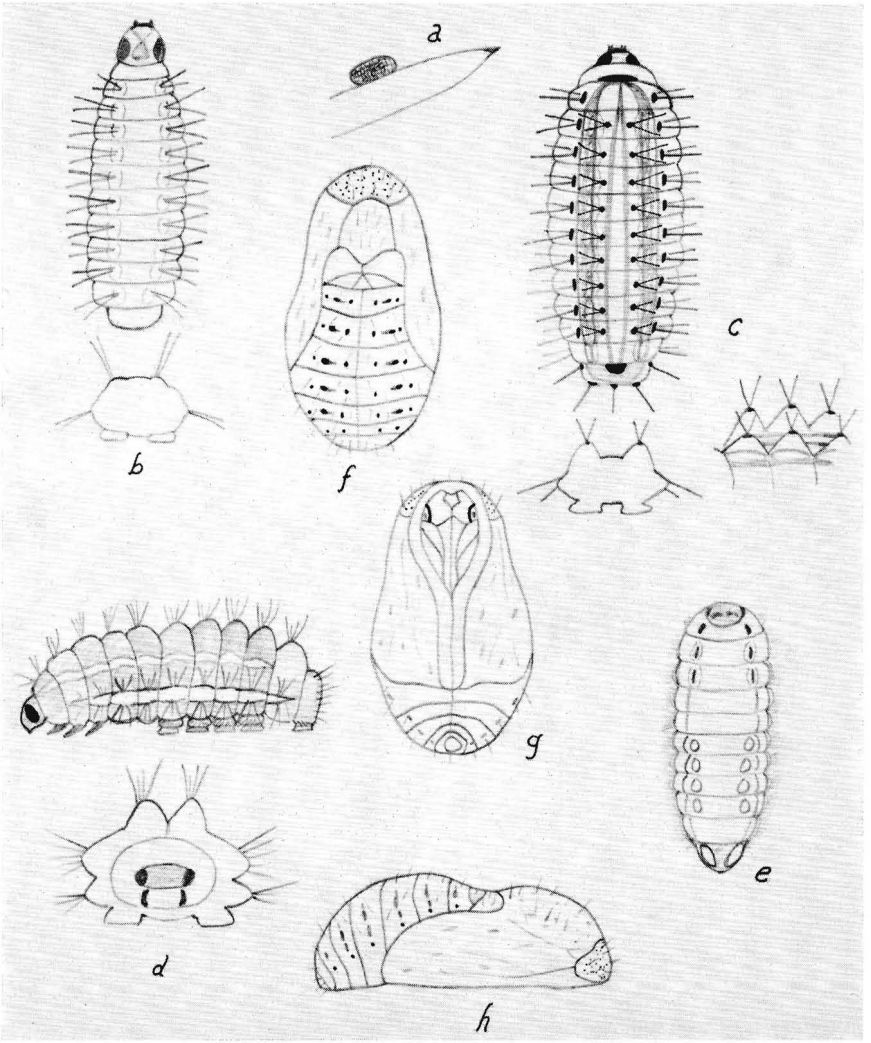

Fig. 4. a, Ovum. b, First instar, dorsal view and transverse section through a middle segment. c, Second instar, dorsal view, transverse section through a middle segment, angled view of dorsal surface of three segments showing tubercles. d, Third instar, lateral and anterior views. e, Fourth instar, ventral aspect just before pupation. f, Pupa, dorsal aspect. g, Pupa, ventral aspect. h, Pupa, lateral aspect.

The foodplant grows quite close to the ground, frequently under the clumps of sagebrush. In Wyoming, *S. lanceolatum* is distinctly polymorphic. At low elevations (7,500′), the plant is dark green with deep rose leaf tips and crown. In the Laramie Mountains in the *schryveri*

habitat, stonecrop is a yellowish gray-green with the leaf tips only faintly rose tinted and the crown yellow-green. Plants from the Sierra Madre Mountains (Carbon Co.) are distinctly rose to rust colored with yellow crowns. The flowers vary from pale yellow-green to yellow in the Laramie Mountains, and are bright yellow in the Sierra Madre Mountains.

The differences in larval feeding and adult flight patterns between the Colorado and Wyoming insects would appear to be simply adaptations to different habitats as determined by the location and morphology of the host plant.

Life Study

The description of the life stages which follows is based upon material collected in 1969 on the slopes of Pole Mountain, Sherman Range of the Laramie Mountains in Albany County, to the east of Laramie, Wyoming. This is an area in which *schryveri* has not been previously reported. The study is based upon 37 males and 32 females taken in the field. In all respects, excepting feeding habits of the larvae, as discussed previously and below, the immature stages of the Colorado and Wyoming insects are similar.

On 16 May, one egg was located on the foodplant, S. *lanceolatum*. On 17 May, a female was captured while ovipositing. On that day and the following day, three additional living females were taken. Additional eggs were secured from the habitat as well. The four females all proved to have been mated although two appeared freshly emerged. In all, about 100 eggs were obtained. The insects showed no reluctance to ovipositing in captivity. They were kept in widemouth specimen jars (screened tops) into which soil and the foodplant had been introduced.

Ovum: The eggs are oblate spheroids, pale green, about 0.8 mm in diameter. They are deposited in the natural state singly on the larger clusters with only one egg per *Sedum* cluster, which makes their location in the field somewhat tedious and time consuming. In captivity the females deposited on a single plant cluster until exhausted. In Wyoming, the one-egg-per-plant cluster in the wild state seems to be a natural protection. The larvae are extremely voracious and the foodplants are quite small in early spring. It was observed that one larva could, during its four instars, devour a single cluster of the host plant. Since, in the field, the clusters of *Sedum* may be separated by several feet, the one egg per cluster rule seems to be a guarantee of a food source to the developing larva. The eggs (in the wild) are normally deposited at the base of a leaf on the under surface (*cf.* Colorado observations). Eggs were deposited in captivity from 18 to 22 May, 1969. The eggs were maintained at an average temperature of 21° C with a plus or minus 5° C (approximately) daily variation. In the field at this time, the temperature range was from about 2° C to 24° C (air temperature) for the habitat. Twenty-four hours prior to emergence of the larvae, the eggs turn in color from pale translucent green to opaque white.

First Instar: The first larva, from the eggs of 17 May, was observed on the morning of 23 May. The first instar is illustrated in Figure 4. Initially the larva is about

1 mm long and pale yellow-green. Within 24 hours, the larva has reached 2–3 mm and the color has changed to pale tan or dark buff. The hairs are uniformly black.

Second Instar: Initially growth is quite rapid and the first larval moult of the 23 May larvae occurred on 25 May. The second instar is rose-pink and white. The pink approximates the color of the leaf buds at the top of the foodplant. Initially the larvae spend most of their time at the tops of the *Sedum* clusters. The hairs are now neutral light color. In this instar, larval length increased from 3 to 5 mm.

Third Instar: Larvae hatching on 23 May moulted into the third instar on 27 May. The basic colors were similar to those of the second instar but with a pattern change and more pink than white. The larvae have a very liquid appearance at this point. The color subsequently changes into a medium rose-pink. The light portions dorsally are very light cream while ventrally the color is a medium cream. During this instar, the length increased from 5 mm to 1 cm.

Fourth Instar: The third and fourth instars are very similar, and for this reason it was difficult to note exactly when the moult between them first occurred. It appeared to be 6 June. The last of the larvae made the transition on 13 June. The colors are somewhat muted relative to the third instar. The light areas are somewhat darker and there is an overall undertone of greenish. Just prior to pupation, the ventral areas become a dark cream color. In both the third and fourth instars, the hairs are neutral (straw) color. The larval size increased from 0.8 mm (minimum value of maximum length of third instar) to 2 cm. Prior to pupation, the larvae spin a fine light mat of silk and shrink in size to 1 cm. They assume the ovoid shape of the pupa. The prepupal stage lasts from 24 to 72 hours. During the premoult period of the last two larval stages, the caterpillars also spun light mats and remained inactive for period up to 24 hours.

Pupa: The first pupa was formed on 13 June, thus giving the period from deposition of egg to pupation as 28 days. The average length of the pupae is 0.9 cm. Initially the wing areas of the pupa are medium cream in color and the abdominal area is bright pink. Within 24 hours, the color has changed to a uniform medium brown. In captivity, the pupae were formed on the glass sides of the rearing jars, on the soil in the open, or under debris. They were loosely attached to light silk mats. The larvae exhibited a gregarious nature before pupation and clusters of from 6 to 8 pupae were common. A total of 84 pupae were obtained, the last on 4 July.

The various stages of development are illustrated in the accompanying figures.

In Colorado (material collected and observations made in April–May, 1969, Chimney Gulch (type locality) and Indian Gulch, Jefferson Co.) pupation occurred between 27 May and 8 June in the laboratory; the average duration of the egg stage was 6 days (5–8), and of the larval stage 31 days (27–35). Field observations were too few to establish the length of the larval stage in nature, but the fact that fourth instar larvae were found as late as 14 June would suggest a slightly longer maturation time in the cooler natural environment than in the 22–24° C laboratory. Pupation occurs on the ground, often several feet away from the host plant which served a given larva, and usually in a semi-sheltered spot such as near to a small stone. No pupal dissections were made to determine the stage in development when diapause takes place, but the fact that reared insects emerged from pupae within 2–4 days of their transfer from outdoors to indoors (Stanford, Denver, Colo., Feb., 1970) suggests

that imaginal development is nearly complete at diapause. Some of the Wyoming pupae showed the wing pattern of the imago within a week after pupation.

Adult: The mature insect is illustrated (Fig. 3:f,g). It is here described in detail because Cross (1937) failed to do so in his original description:

Dorsal primaries of male uniformly warm gray-brown with pad just slightly paler than ground color; dorsal primaries of female generally fulvous with apex, costal and outer margins warm gray-brown; dark color of apical area extending into subapical region. Both sexes with fringe white with some black hairs at the vein ends. Dorsal secondaries of male with basal and discal areas uniformly warm gray-brown; lower half of limbal area, extending over anal angle, and approximately one-third of lower anal margin dark fulvous; female generally fulvous over entire dorsal surface with some darker scaling in basal area and along anal margin. Fringes in both sexes same as in primaries.

Ventrally sexes similar. Primaries with apical area extending along outer margin a rich brown tending to gray-brown at the tornus. Limbally, black oval spots in cells Cu_1 to R_5 as a submarginal row. Postmedian area brown suffused with gray and white, and separated from the median portion by an irregular band which is white distally and almost black radially (basally). Discal area gray-brown tending to brown, with dark scales in basal area and with fulvous scales toward the irregular band. Secondaries with irregular band repeated. Discal and basal areas a warm brown with some gray suffusion. A submedian dark irregular band. Postmedian area gray-brown heavily suffused with white. A submarginal row of black spots, diminishing in size, one in each of cells to Cu_2. Remainder of limbal area brown irrorate with lighter scales basally and darker scales distally. A thin white band along the outer margin followed distally by a brown band showing enlargement along vein ends. Fringes as in dorsal aspect.

Head, crown, and front with dark gray-brown scaling in male and red-brown scaling in female; eyes black, hairy, bordered (ringed) with white. Thorax and abdomen concolorous with dorsal wing surfaces, and hairy. Underside of abdomen heavily overlaid with white hairs. Legs, dark gray-brown shot with white.

Wingspan of specimens in authors' collection: males and females (LFW) 1.3–1.4 cm.

The specimens from Colorado are not significantly different from those taken in Wyoming. In the Colorado material, the fulvous color of the limbal area of the secondaries is less pronounced and the general appearance of the underside is of a cooler tone of brown, that is, gray-brown rather than a warm brown. These variations are not considered as significant.

Acknowledgments

The authors would like to thank Dr. John Reeder, Curator, Rocky Mountain Herbarium, University of Wyoming for making the determination of the host plant. Dennis R. Groothuis supplied the Converse Co., Wyoming collection records for *schryveri*. Additional Wyoming records were taken from De Foliart (1956). M. Fisher and J. D. Eff provided records and field assistance for the Colorado study. Thanks are also due

John Emmel for making comments on this paper. It should be noted that he has successfully reared *schryveri* larvae on *Sedum spathulifolium* Hook., from eggs sent by Stanford and Eff. The botanical nomenclature used herein is based on Porter (1964, 1968) and Craighead (1963).

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LEREMA ANCILLARIS (HESPERIIDAE) NEW TO TEXAS AND THE UNITED STATES

In an earlier paper (1970, Lepid. Soc. 24: 59), the author briefly described the effects of hurricane "Beulah" in 1967 on the Lepidoptera populations of extreme south Texas, and the discovery of three Lycaenidae new to the U.S. A new skipper record is now given, believed also to be associated with that hurricane:

Lerema ancillaris liris Evans, 1955. A catalogue of the American Hesperiidae indicating the classification and nomenclature adopted in the British Museum (Natural History). Part IV. Hesperiinae and Megathyminae. London. British Museum. 499 pp., pls. 54–88. (Describes new sub-species of Hesperiidae. Type locality, Atoyac & Veracruz, Mexico. Type in B.M.).

One ♂, good condition, Santa Ana National Wildlife Refuge, near Alamo, Hidalgo Co., Texas, 28 September 1968 (*leg.* R.O.K.; *det.* H. A. Freeman).

Evans described *liris* from 21 specimens collected in Mexico, Guatemala, Roatan Island, Honduras, Nicaragua, and Costa Rica. H. A. Freeman (personal communication) advises that this species is common over much of Mexico, and is one of the most common species at Ciudad de Valles, Veracruz, and Oaxaca. Ciudad de Valles is about 300 miles south of Santa Ana National Wildlife Refuge, site of the first U.S. record.

Joseph F. Doyle, III records collecting a ♀ *Synapte salenus* Mabille, 27 August 1968 at the Santa Ana National Wildlife Refuge. No doubt the appearance of this insect north of the Rio Grande was also associated with hurricane "Beulah."

As with the Mexican Lycaenidae which were apparently displaced by "Beulah," it will be interesting to learn whether or not these Hesperiidae become established in extreme south Texas. There are no other known records from the United States for any of these species; however, other like specimens must have been present at the time (1968). Should any of these become resident north of the Rio Grande, the significance of great weather disturbances on insect dispersal will have been established.

ROY O. KENDALL, *135 Vaughn Place, San Antonio, Texas.*