THE LIFE HISTORY OF *PROBLEMA BYSSUS* (HESPERIIDAE)

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Existing in widely scattered colonies from Florida to Texas and north to southern Illinois and Iowa, *Problema byssus* Edwards, is a real prize for the skipper enthusiast. Here in Missouri, in the western part of its range it is confined to the few remaining areas of virgin prairie. Although *byssus* is an extremely local species it is often found to be abundant once a colony is located. The host plant in this region is a tall broad-leaved grass, *Tripsacum dactyloides* L. (gama grass). This plant grows in large beds, usually in the dampest part of the prairie locale. The golden byssus confines its activities to the area of the grass beds, rarely straying farther away than the nearest flowers. Although gama grass grows in many locations other than virgin prairie, *Problema byssus* seems unable to adjust to another habitat.

The species is single brooded, adults flying from early June (males) to late July (stray females). The males emerge at least a week ahead of the females and spend most of their time battling among themselves and visiting nearby flowers. They are especially attracted to milkweed (*Asclepias*), Indian hemp (*Apocynum*), and purple cone flower (*Echinacea*). With the emergence of the first females the habits of the males undergo a radical change. From this point on the males are seldom observed fighting or visiting flowers. Most of their time is now spent in slow, skipping flight back and forth across the grass beds in search of emerging females. The males are active, powerful fliers, difficult to catch. The females are less active, with a slow sluggish flight, rarely straying from the grass beds.

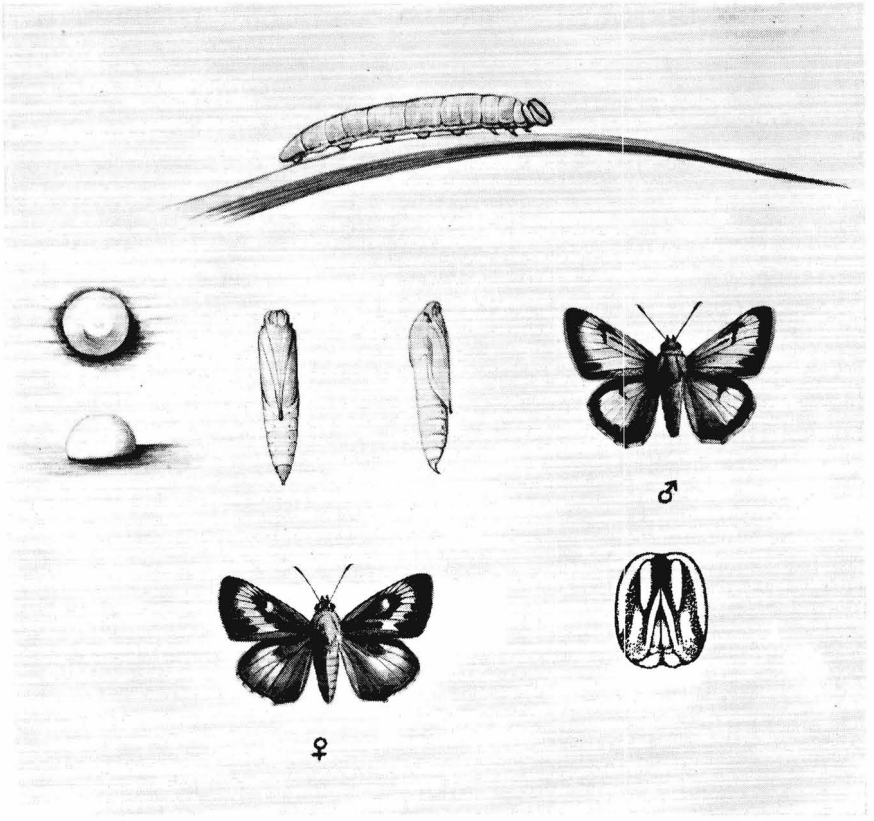
The following life history observations were conducted over a five-year period, 1959 through 1963, on collections taken in the largest known colony in this area. Numerous observations of wild larvae were made during this period in the same locale located just south of Holiday, Kansas, in Johnson County.

EGG. Chalky white, no pattern visible under 25 power magnification. Shape hemispherical, flattened at apex. Width and height about 1.5 mm.

Ova are deposited at random on both upper and lower sides of the leaves. The larvae emerge in eight to nine days.

FIRST INSTAR LARVA. Body pale green, sparsely covered with short white hair; a tiny white mark dorsally at each intersegmental fold; prothoracic shield dark brown, almost black; head dull red brown with numerous yellow hairs, mandibles black.

The larva first eats the entire eggshell and then wanders about the



EXPLANATION OF PLATE

Mature larva, lateral aspect and enlarged view of head case. Egg, lateral and dorsal aspect. Pupa, ventral and lateral aspect. Adult male and female from Holiday, Johnson County, Kansas.

grass blade and selects a spot for its first tent. No preference of position was noted, some larvae choosing the tip, others the base or middle area of a grass blade. The larvae cut a section across the leaf about one-fourth inch deep and fasten the edge back making a tent about one inch in length. The tent is held in place by strong silk strands placed at one-sixteenth inch intervals. On the second day the larvae begin eating, choosing a spot just above the tent.

SECOND INSTAR LARVA. Body color pale watery green, translucent, with blotchy appearance; body without noticeable taper, sparsely covered with bristly white hairs, several longer ones on the anal segment; spiracles protruding, giving appearance of a row of warts along each side; prothoracic shield dark brown; head dull

orange brown, mandibles darker brown; a pale gray band beginning at base of each mandible and extending across face parallel to epicranial suture, following suture to crown; frons slightly raised, dark brown; another dull gray band beginning at back of mandibles follows outer edge of epicranial plates to crown; head thinly covered with white bristles.

The larval tent in this instar measures about two and a half inches in length and is made by folding together an entire leaf and sealing the edges with silk.

THIRD INSTAR LARVA. Body color pale green, translucent, with a few long hairs on last abdominal segment, thickly dusted with minute black dots; first spiracle on each side enclosed by a silvery wart; prothorax white, prothoracic shield black, extending from spiracle to spiracle; body without noticeable taper; head pale orange brown; two cream-colored bands starting at crown, paralleling epicranial suture to base of mandibles, another cream-colored line follows outer edges of epicranial plates from base of mandibles to crown, a cream-colored line circles the back of head bordering prothorax; frons darker brown and slightly raised; head thinly covered with short white bristles.

FOURTH INSTAR LARVA. Body color pale yellow green, last abdominal segment dull yellow; body covered with minute short white hair and thickly sprinkled with very tiny black warts; head light red brown with two white stripes starting at base of mandibles, extending to crown parallel to epicranial suture and continuing around and down outer edge of epicranial plates; frons with two white vertical lines; labrum white, noticeably extended, mandibles much darker brown; prothorax white; prothoracic shield black.

This is the instar in which hibernation takes place. Larvae reared on potted grass plants in the house continue to feed for several weeks at a very retarded rate. Wild larvae, however, follow an entirely different pattern of behavior. Shortly after entering the fourth instar the wild larvae construct a silken lined chamber from three to six inches in length within the larval tent. Although still very active when disturbed, the larvae make no further attempt to eat and their coloring undergoes a radical change. The entire body becomes a pale creamy white covered with minute black bristles. The head turns to a purplish black color with a blistered appearance. There is no visible pattern on the head. The hibernation stage is probably triggered by rain and cool nights which begin to occur in late August in this area. Without these stimuli the larvae being reared on potted grass in the house continue to feed at a slow rate and begin entering the fifth instar in late September. By late April the first warm spring rains have aroused the quiescent larvae and they cut through their silken shroud and begin devouring the tender new leaves of the host plant. For about a week they feed hungrily, growth is fairly rapid but there is no change in the previously described drab coloration of the larvae. After feeding for seven to ten days the larvae enter the fifth instar.

FIFTH INSTAR LARVA. Body color pale yellowish green, last two abdominal segments paler, covered with numerous short white bristles; integument translucent, heart appearing as a bright green middorsal line; a pale yellow shading at each intersegmental fold; prothoracic shield white with a thin black edging from spiracle to spiracle; abdominal area pale greenish white; head deep reddish brown with white bands and markings, area at back of head white; two white bands parallel stalk of epicranial suture to crown and on around outer edges of epicranial plates to base of mandibles; a small vertical white dash at either side of the frons; mandibles dark brown edged with white, labrum white; entire head with a rough texture; frons dark brown with a small central white area, edged with narrow white lines.

SIXTH (FINAL) INSTAR LARVA. Length 37–43 mm; body color dull blue green with a yellowish overcast dorsally; last two abdominal segments powdery white ventrally due to thick pads of wax flake secretions; integument translucent with the darker green heart clearly visible; intersegmental folds appear as yellow rings; body thickly covered with minute white hair when viewed under magnification; spiracles cream colored with a minute green wart above and below each; prothoracic shield dark brown dorsally; body with almost no noticeable taper; head small (only about half the circumference of body), pale reddish brown with cream-colored areas; outer edges of the epicranial plates edged with cream from crown nearly to base of mandibles; arms of epicranial suture narrowly edged, cream-colored; two broad cream-colored lines parallel stalk of epicranial suture; two pale vertical areas located in lower central portion of each epicranial plate; frons cream-colored centrally; mandibles reddish brown; a few short white bristles on head, which has a slightly blistered appearance.

In the last instar the larva rolls a leaf and fastens it for several inches with a heavy silken strand about every fourth of an inch for the length of the tent. These tents measure from seven to nine inches in length and are open at the top and bottom. The tent is provided with a thin lining of silk. As the larvae near full growth they construct their tent from two grass blades. The larvae eat the first few inches from one leaf and where the base of the tent is to begin they eat all but the midrib for about one-half inch. The base of the other grass blade is then eaten away in the same manner and the two blades drawn together and fastened with strong silken strands. This makes a beautiful piece of camouflage as it appears to be a single grass leaf. Wild larvae are observed feeding in the daylight but when approached or the plants are touched they rapidly move backwards to the center of the tent.

COCOON. Dense, of shiny white silk.

The cocoon is spun among the rubbish at the base of the plants, among the grass stems, or in a rolled up leaf near the host plant. In the breeding cage cocoons were also spun on the top and sides of the cage in both vertical and horizontal positions. Pupation occurs three days after the start of the cocoon.

PUPA. Long and slender, 6–7 mm at widest point, 23–27 mm in length; color a beautiful pastel cream with a few tiny brown dots; cremaster a tapering, ventrally curving point, strongly inbedded in silk lining of cocoon.

Emergence of adults occurs about two weeks following pupation.

The time spent in each instar is variable; the following represents an average life cycle.

EGG	: Eggs laid in late June emerge eight to nine days later.
FIRST INSTAR	: Six to seven days.
SECOND INSTAR	: Seven to eight days.
THIRD INSTAR	: Eleven to thirteen days.
FOURTH INSTAR	: About eight and a half months, the hibernation stage covering the period from late August to late the following April.
FIFTH INSTAR	: Ten to thirteen days.
FINAL INSTAR	: Ten days to a little over two weeks (females seem to develop more slowly).
PUPA	: Thirteen to sixteen days. The first adults normally emerging about the start of the second week in June.

My thanks go to Dr. John R. Reeder of Yale University for the host plant determination and to William Howe of Ottawa, Kansas, for the illustration of the life history.

BOOK REVIEW

PRODROMUS LEPIDOPTERORUM SLOVACIAE [Prodromus of the Lepidoptera of Slovakia]. By Karel Hrubý. 1964. 962 pp., 3 maps. Published by the Slovak Academy of Sciences. Klemensova Street 27, Bratislava, Czechoslovakia. Price 83,- Kčs.

Slovakia is an interesting and beautiful country in Central Europe. There are a number of different land formations; in the southern part it is the great Lowland of the river of Danube with xerothermic localities, in the north there are the mountains of which the Tatra is the highest (with the Peak of Gerlach 2,663 m).

The fauna of Lepidoptera of Slovakia was intensively investigated, but results of this work were published in different languages and dispersed in short faunistic contributions. Therefore, comprehensive research work was very difficult. Hrubý's work is of great importance for the students of Lepidoptera in Central Europe.

The introductory parts of the book are written simultaneously in Slovak and Latin. These chapters treat the history of faunistic work of the Slovak Lepidoptera and zoogeography and ecology of butterflies and moths (pp. 5–59). The bibliography (pp. 60–98) contains 889 citations published in the period of 1772–1960. Lists of revised collections and of all recorded localities (pp. 99–127) conclude this part of the *Prodromus*.