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ON THE BIOLOGY AND FOOD PLANTS OF *LYGAEUS TURCICUS* (FABR.) (HEMIPTERA: LYGAEIDAE)[1]

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Abstract.—The food plant of *Lygaeus turcicus* (F.) is shown to be the false sunflower, *Heliopsis helianthoides* (L.) (Sweet) (Asteraceae) rather than species of milkweeds (Asclepiadaceae). The literature is reviewed and the records of *L. turcicus* on milkweeds are believed to pertain to *Lygaeus kalmii* Stål. Laboratory rearing records are summarized for *L. turcicus* on seeds of *Heliopsis helianthoides, Asclepias syriaca* L. and sunflowers. Nymphs of all five instars and the egg are described. The nymphs are compared and contrasted with those of *Lygaeus kalmii.*

For many years I have been puzzled by the scarcity of *Lygaeus turcicus* (F.) in New England and the upper midwest despite the abundance of its supposed food plant, the large milkweed, *Asclepias syriaca* L., and the abundance upon this plant of the closely related milkweed bug, *Lygaeus kalmii* Stål. Although on two occasions specimens were taken in late summer on this milkweed, I have never encountered a breeding population in the northeast. The scarcity of *turcicus* could have several causes: 1) it is at the northern periphery of its range in the northeast; 2) it does not breed in the northern states, but rather migrates north in the summer, as is the case with *Oncopeltus fasciatus* (Dallas) (Dingle, 1965); 3) it is outcompeted by *Lygaeus kalmii*; or, 4) it is associated with some plant other than *Asclepias syriaca* L. With the last thought in mind, I have spent considerable time in the field observing other milkweed plants, but without finding a specimen of *L. turcicus.*

It has been apparent for sometime (see Slater, 1964) that many records of *L. turcicus* actually refer to *L. kalmii* and others cannot, in the absence of specimens, be assigned to either species. Indeed some authors, e.g., Heidemann (1894), have considered the two to be synonymous; this is certainly not the case as both adults and nymphs differ in a number of ways.

Uhler (1872) stated that eggs were deposited on *Asclepias.* In 1878 he noted that records in the T. W. Harris collection suggested that adults and nymphs were present on *Asclepias syriaca.* Provancher (1886) reported tak-

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ing it on *Asclepias cornuti* Dcne. (=*A. syriaca*). Townsend (1887), in a detailed paper treating the life history of what he called *turcicus,* quoted from Uhler's (1878) paper to demonstrate that in Michigan *turcicus* was taken on *Asclepias syriaca* as early as 1832 (Harris collection) and that "larvae" were present. Townsend also noted however that *turcicus* was seldom found in Michigan "on any other plant than *A. tuberosa* although sometimes on *A. syriaca.*" He does mention an individual specimen taken on ragweed, "a tall weed," and a flowering almond, but considered these accidental occurrences. In 1891 Townsend again reported *turcicus* feeding on *A. tuberosa* L. and seemed to have little doubt that this was the principal food plant.

There are numerous later records on milkweeds. Robertson (1891) reports *turcicus* on flowers of *A. cornuti* and *A. incarnata* L., Blatchley (1895) reports adults and nymphs on *A. cornuti,* Morrill (1910) states that *Asclepias* is the natural food and, as recently as 1944, Froeschner reports it on flowers of *Asclepias tuberosa.* Nymphs are recorded as present several times suggesting that milkweeds are the host plants and that the preferred host may be the butterfly weed, *A. tuberosa.* I have attempted to take *turcicus* from the orange butterfly weed on a number of occasions without success, although *Lygaeus kalmii* occurs there.

It is true that other plants have been associated with *turcicus.* Morrill (1910) reports it on cotton (this record apparently repeated by Hargreaves, 1948) and on alfalfa in Texas. Banks (1912) lists it from *Ceanothus* in Virginia (record repeated by Barber, 1912, 1923, and Torre-Bueno, 1946, among others). Blatchley (1926) lists it from flowers of *Rhus hirta* (L.) Sudw. Robertson's (1929) compendium of plant associations lists it on flowers of 26 species of plants, only three of which are milkweeds. None of these non-milkweed records give any indication that immature stages were present and therefore do not suggest a breeding host relationship.

Several references establishing *Lygaeus kalmii* Stål as breeding on various species of milkweeds can be found in the literature (Simanton and Andre, 1936; see Slater, 1964, for references), and it has been reared in the laboratory on dry milkweed seeds in a manner similar to *Oncopeltus fasciatus* (Dallas). The paucity of recent records of *L. turcicus* on milkweeds, coincident with the increase of records of *L. kalmii,* strongly suggests that the earlier records of *turcicus* might in part, or entirely, refer to *L. kalmii.* (See following article by Wheeler for *kalmii* food plants.)

The establishment of the principal food plant of *L. turcicus* came quite unexpectedly; the manner in which this question was resolved emphasizes strongly the importance of, and need for, enthusiastic amateurs in American entomological study.

In 1979 the Rev. James M. Sullivan of St. Louis, Missouri sent me a letter expressing his pleasure with the recent publication of my book with Dr. R. M. Baranowski (Slater and Baranowski, 1978). Rev. Sullivan stated that for many years he had been collecting host plant records of various Hemiptera, and he included sample pages for several species, one of which was *Lygaeus turcicus*. The Sullivan records indicated that *turcicus* did not breed upon milkweeds but rather on the composite *Heliopsis helianthoides* (L.) Sweet, the false sunflower. Rev. Sullivan generously made available his entire file on *turcicus*, and to him is due the credit for establishing the definitive host plant.

The Sullivan records list *turcicus* from 18 species of plants in eight families. Of 49 records 28 are from *H. helianthoides*, and 11 of the remaining 21 are from other composites (Asteraceae). *H. helianthoides* was the only plant upon which copulation was observed and the only plant upon which nymphs were taken; his records included all collections made later than June 30. There was only a single record of *turcicus* occurring on a milkweed—adults taken on the inflorescence of *Asclepias incarnata*.

The most compelling of the Sullivan records for *L. turcicus* on *H. helianthoides* are summarized:

1. September 5, 1976—nymphs of various instars feeding.
2. September 8 to September 29, 1976—nymphs present and molting to later instars on same plants during period.
3. September 15, 1976—eight nymphs present, one reared to adult.
4. Records of adults copulating June 30, 1972, July 30, 1973, August 28, 1974 and August 9, 1977.
5. More than 50 specimens July 25, 1979.
6. Six records of feeding from June through August of several years.

On August 15, 1982 A. G. Wheeler, Jr. (pers. comm.) took many adults and first, second and third instar nymphs on *H. helianthoides* in Randolph County, West Virginia (Route 219 midway between Valley Head and Mingo).

In July and August 1979 Rev. Sullivan sent specimens of *L. turcicus* from St. Louis, Missouri. They were carried through four generations in this laboratory entirely upon the dried seed heads of *H. helianthoides* with almost no mortality.

As noted below *turcicus* was reared successfully for more than one generation on dried sunflower seeds and also upon seeds of *Asclepias syriaca*. Specimens were reared both in the open laboratory and in an environmental chamber. Growth was more rapid on milkweed seeds than upon sunflower seeds.

Thus it appears that *L. turcicus* utilizes *Heliopsis helianthoides* as its principal and possibly only breeding host. However, it certainly is capable, in the laboratory at least, of completing its life cycle on other plants, including milkweeds. This is not really surprising, as in the laboratory *Oncopeltus fasciatus* has been successfully maintained upon both sunflower and peanut seeds, although there is no evidence that it ever breeds upon these plants in the field. The choice of host plants in the field depends upon many factors, not merely the ability of the insect to survive and reproduce on a given plant. Slater and Wilcox (1973) suggest that many essentially host specific Lygaeidae tend to colonize other plants; occasionally such attempts are successful for a generation or two, and in some cases a "better" host may be selected, which, in time, becomes the primary plant upon which the insect breeds.

While there is no firm evidence that *L. turcicus* breeds upon any other plant than *H. helianthoides,* the number of Rev. Sullivan's records from other composites suggests that under favorable conditions some of these species may serve as hosts.

What is clearly evident is that *L. turcicus* is not a milkweed bug. It is unfortunate that Robertson (1929) apparently did not distinguish *turcicus* from *kalmii.* To my knowledge he is the only previous author to report *turcicus* from *H. helianthoides.* Many of his records are from composites, suggesting that he did, in part, have *turcicus* before him. (Robertson worked at Carlinville, Illinois not far from the St. Louis area.)

The scarcity of *L. turcicus* in the north, compared with populations in the middle Mississippi valley area, suggests that its breeding range may be more southern than previously thought, with a late summer movement northward in favorable years. Northern records should be carefully checked to attempt to test this hypothesis.

LABORATORY REARING

Eggs of *L. turcicus* were obtained from St. Louis County, Missouri, July 25, 1979. The insects were maintained for two generations in plastic containers with dry seeds of *H. helianthoides* and a water source. At this time fresh seed heads were introduced together with dried seeds, and individual egg masses were isolated in petri dishes. The colonies were first maintained at room temperatures and later placed in a rearing chamber at 75°F with a 16-hour day cycle for most of their development.

When seed heads of *H. helianthoides* were introduced into a colony, insects of all instars sought them actively. Young nymphs moved deep into the heads and were almost invisible despite the bright red color of the abdomen. Eggs were laid in clumps or loose masses of 15 to 50, preferentially upon cotton but sometimes loosely in the litter on the floor of the rearing cages.

Individual nymphs were not isolated, but colonies were examined daily and notes on egg laying, copulation, molting and death of adults recorded. While this method is less accurate than isolating individuals, the large number of observations taken from 35 colonies, some of which were maintained through several generations, has yielded data that is probably a reasonably reliable expression of the life cycle. The duration of the first stadium is appreciably shorter than that of stadia II, III, and IV, the latter three stadia

Table 1. Summary of laboratory rearing of *Lygaeus turcicus* (F.) reared on *Heliopsis helianthoides* (L.) Sweet.

	N	Mean	Median	Range	SD
Copulation to egg laying	17	5.06	5.5	3–8	1.56
Adult emergence to copulation	13	6.92	7	5–10	1.61
Egg laying to hatching	34	7.24	8	6–10	1.13
Instar I to instar II	35	3.77	4.5	2–7	1.19
Instar II to instar III	45	6.93	7	4–11	1.88
Instar III to instar IV	51	7	7	3–11	1.93
Instar IV to instar V	52	6.62	7.5	4–12	1.83
Instar V to adult	73	9.47	11	4–19	3.15
Adult longevity	34	60.91	59	26–97	19.31

are of equal length, and the duration of the fifth stadium is the longest (Table 1, Fig. 1). This life cycle agrees with those of many other hemipterans. The longevity of the adults is extremely variable but can be as long as three months.

In addition to the colonies maintained on *Heliopsis helianthoides,* similar colonies were established on commercial sunflower seeds and dried seeds of *Asclepias syriaca. Lygaeus turcicus* is capable of completing its life cycle on both of these food sources. Although these colonies were observed only sporadically on milkweeds, the length of the life cycle and the mortality appeared similar to colonies reared on *Heliopsis.* Where only sunflower seed was available, mortality was increased, the individual nymphs were smaller, and the duration of individual stadia appeared more erratic.

In several crosses attempted between *Lygaeus kalmii* and *Lygaeus turcicus,* no mating was observed and no fertilized eggs were produced.

IMMATURE STAGES

Nymphs of *Lygaeus turcicus* are readily distinguishable from those of *Lygaeus kalmii.* In the latter species the abdomen is conspicuously longitudinally striped with red and pale yellow. There is a broad, median, red stripe and an even broader red stripe somewhat laterad of midway between meson and each lateral margin. The intervening area is pale yellow with a "sprinkling" of tiny red dots; the lateral margins are broadly white. In *turcicus* the abdomen has the appearance of being nearly uniformly red rather than striped. However, as noted in the descriptions that follow, there is a tendency for early instars to have obscure stripes. In such cases *kalmii* nymphs can readily be distinguished by having a very conspicuous transversely elongate-elliptical black spot in the center of the sub-lateral red stripe on each ab-

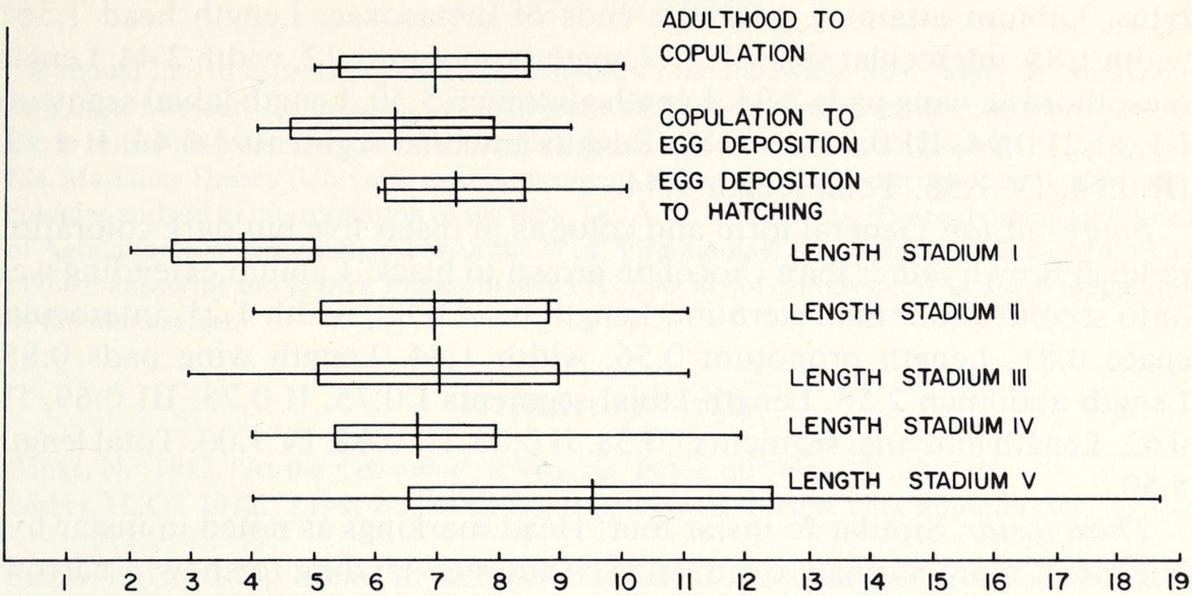

Fig. 1. Length of life cycle of *Lygaeus turcicus* (F.) reared on *Heliopsis helianthoides* (L.) Sweet.

dominal tergum from segments two through six. In *turcicus* this area is undifferentiated in color. These dark spots, plus the darkened areas around the abdominal scent glands, give nymphs of *kalmii* a striking spotted appearance.

The labium is much longer in *turcicus* than in *kalmii.* In *kalmii* the labium reaches only the metacoxae in early instars and only between the mesocoxae in later instars. In *turcicus* the labium reaches well onto the abdomen as late as the fourth instar, and even in the fifth instar it attains the posterior end of the metacoxae.

DESCRIPTION OF *Lygaeus turcicus* NYMPHS

Fifth instar. Coloration bright orange-red with strongly contrasting chocolate brown to black coloration as follows: a broad comma-shaped area that curves antero-laterad on each pronotal calli area, a small paler spot on posterior pronotal margin on either side of midline, meso- and metathoracic wing pads, antero-lateral corners of scutellum, elliptical areas around abdominal scent gland openings between terga 4–5 and 5–6, a mesal patch on tergum 8 and sterna 7 and 8, all appendages (but distal ends of femora paler). Dorsal coloration of head chiefly dull reddish brown. Vertex with a speckled, longitudinal, dark stripe on either side of midline, darkened anteriorly on tylus along inner margins of juga. Head below orange posterior to antennal bases, dark brown anteriorly.

General form typical for genus. First antennal segment exceeding apex of tylus. Labium attaining posterior ends of metacoxae. Length head 1.56[2], width 1.88, interocular space 1.31. Length pronotum 1.12, width 2.44. Length mesothoracic wing pads 2.94. Length abdomen 5.50. Length labial segments I 1.00, II 0.94, III 0.94, IV 0.88. Length antennal segments I 0.44, II 1.12, III 0.94, IV 1.38. Total length 9.44.

Fourth instar. General form and color as in instar five but dark coloration reddish brown rather than chocolate brown to black. Labium extending well onto second abdominal sternum. Length head 0.88, width 1.31, interocular space 0.81. Length pronotum 0.56, width 1.44. Length wing pads 0.88. Length abdomen 2.56. Length labial segments I 0.75, II 0.75, III 0.69, IV 0.62. Length antennal segments I 0.38, II 0.75, III 0.62, IV 1.00. Total length 5.50.

Third instar. Similar to instar four. Head markings as noted in instar five but much more strongly contrasting. Abdomen tending to show a narrow, darker, longitudinal orange stripe and shading to darker orange laterally. Lateral abdominal margins with a narrow white stripe present. Length head 0.94, width 1.12, interocular space 0.78. Length pronotum 0.50, width 1.25. Length wing pads 0.38. Length abdomen 1.56. Length labial segments I 0.62, II 0.62, III 0.62, IV 0.62. Length antennal segments I 0.31, II 0.56, III 0.62, IV 0.75. Total length 4.50.

Second instar. Very similar to instar three. Thoracic terga each marked with an irregular transverse dark "dash." Abdomen laterally with a broad pale yellow to translucent white border. Length head 0.66, width 0.76, interocular space 0.51. Length pronotum 0.32; width 0.90. Length abdomen 1.73. Length labial segments I 0.42, II 0.42, III 0.42, IV 0.42. Length antennal segments I 0.20, II 0.37, III 0.37, IV 0.56. Total length 3.05.

First instar. Head and thorax brown, strongly contrasting with bright red abdomen, each thoracic tergum marked with a nearly black transverse dash, similar to instar II. Abdomen nearly uniformly red except for pale margins. (Abdominal coloration variable; some nymphs have abdomen pale yellowish flecked with red and a darker reddish central longitudinal stripe.) Legs and antennal segments I–III pale brown, antennal segment IV suffused with reddish. Labium extending to middle of abdomen. Length head 0.59, width 0.56, interocular space 0.39. Length pronotum 0.20, width 0.56. Length abdomen 1.02. Length labial segments I 0.34, II 0.34, III 0.34, IV 0.34. Length antennal segments I 0.15, II 0.29, III 0.27, IV 0.49. Total length 1.81.

Egg. Smooth, glabrous, broadly elliptical with ten short subtruncate chorionic processes around anterior pole. Length 1.34, width 0.76.

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[2] All measurements are in millimeters.

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