BIOLOGICAL NOTES ON *LOXOSTEGE FLORIDALIS* (PYRALIDAE)[1]

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The genus *Loxostege* has a worldwide, largely north temperate distribution and includes several economically important species. The sugar beet webworm, *Loxostege sticticalis* (Linnaeus), is a major Holarctic pest, while the garden webworm, *L. rantalis* (Guenée) is an important North American pest. *L. similalis* of authors has been incorrectly used in place of the correct name, *L. rantalis*: the distinct *L. similalis* (Guenée) is South American (Capps, 1967). Seven species of *Loxostege* are recorded from Florida (Kimball, 1965).

Loxostege floridalis Barnes & McDunnough (Fig. 1) was described in 1913 as a subspecies of the more widespread *L. albiceralis* (Grote). E. G. Munroe (pers. comm.) is currently revising the Nearctic Pyralidae and considers *L. floridalis* to be a distinct species. Barnes & McDunnough (1913) collected larvae of *L. floridalis* on "Florida cranberry" from "Everglade, Fla." (probably Everglades City, Collier County, Florida). There are no other published records using the common name of "Florida cranberry" but the description provided by Barnes and McDunnough suggests it to be *Lycium carolinianum* Walter (Solanaceae), the actual host plant of *Loxostege floridalis*. The plant is commonly known as Christmas-berry, because of the red fruits on the bushes during December. It is native only to coastal areas in Florida and west to Texas, with a record for coastal South Carolina. Although the host plant is used in inland Florida as an ornamental, *L. floridalis* has been recorded only from coastal areas in Florida as far north as Titusville on the Atlantic Coast and Cedar Key on the Gulf Coast.

Larvae of *L. floridalis* collected at Cedar Key were reared in a laboratory in Gainesville, Florida; eggs were not studied.

Larval Biology

Loxostege floridalis has been recorded feeding only on *Lycium carolinianum*. The related *Loxostege albiceralis* has been reared in Texas by R. O. Kendall on *Lycium carolinianum* var. *quadrifolium* C. L. Hitchie (Munroe, pers. comm.). *Loxostege sticticalis* is a much more general

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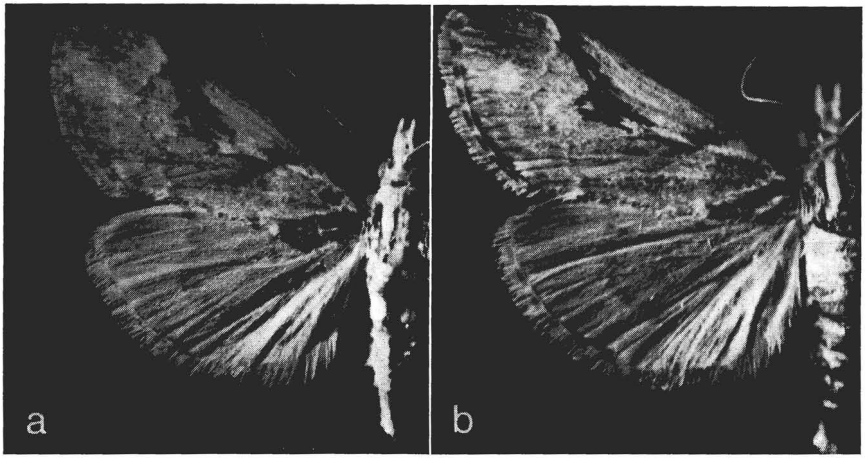

Fig. 1. Adults of *Loxostege floridalis*: (a) male, dorsal aspect (wing expanse 26 mm); (b) female, dorsal aspect (wing expanse 29 mm) (both from Cedar Key, Levy Co., Fla.: male emerged 24 Jan 74, female emerged 26 May 74).

feeder and has been recorded from a variety of plants (Pepper & Hastings, 1941), three of which are species of Solanaceae. The genus is large and fewer species appear to be as restricted to one host as is *L. floridalis*.

On 13 December 1973, 12 fifth (last) instar larvae of *Loxostege floridalis* were found feeding on *Lycium carolinianum* at Cedar Key, Levy County, Florida. The larvae were found clustered as a group among several branches, with some silk webbing evident. The communal feeding of *L. floridalis* is similar to that reported for *L. sticticalis* larvae (Pepper & Hastings, 1941). On 19 December 1973 only one fifth-instar larva was found at the same locality but a number of early second-instar larvae (Fig. 2a) were found clustered on one branch. In the laboratory the larvae of 13 December 1973 became prepupal by 26 December, spun cocoons, and pupated by 2 January 1974. Adults emerged as early as 10 days after pupation. The last-instar larva collected on 19 December 1973, which was subjected to a longer period of natural conditions than the larvae reared in the laboratory, was the only larva to enter diapause after cocoon formation. It was allowed to enter sand, where it constructed an ovate cocoon by 2 January 1974. The cocoon was composed of a thick layer of silk and encrusted with sand particles, making it very stiff and resistant to crushing. The cocoon was 21 mm long, about twice the pupal length. The cocoon had a bulbous apical, hollow chamber that barely became covered by sand

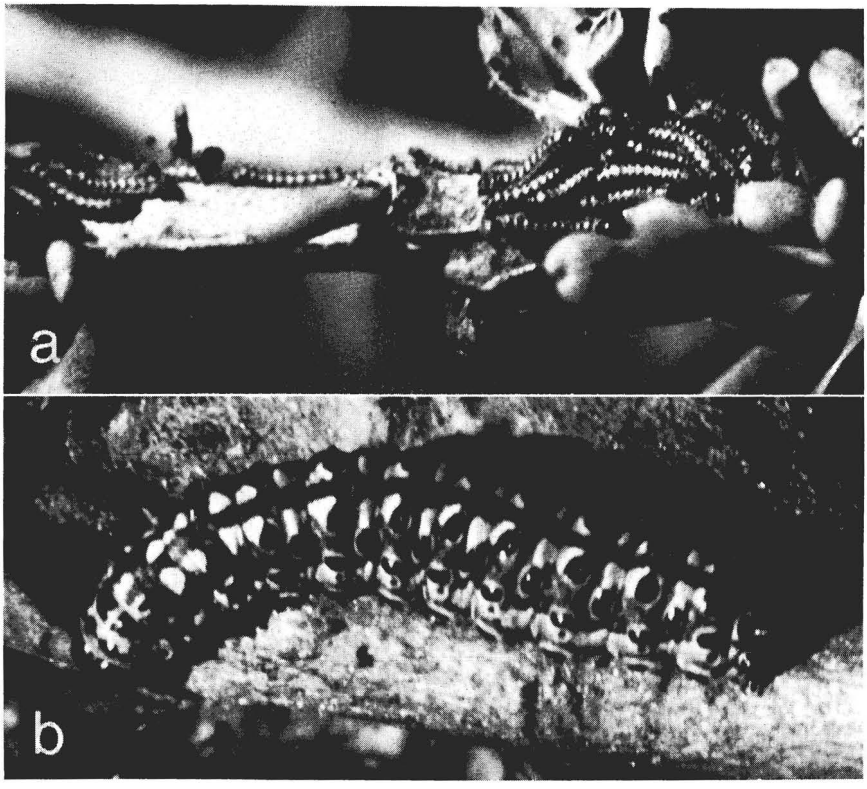

Fig 2. Larvae of *Loxostege floridalis*: (a) early 2nd-instars (2×) clustered among leaves of host, *Lycium carolinianum*; (b) 5th-instar (3×), dorsal aspect (all from Cedar Key, Levy Co., Fla., 19 Dec 73).

when in the substrate and it was separated internally from the main pupal chamber by a thin layer of silk. On 12 May 1974 the cocoon was removed from the sand and found to still contain a prepupal larva, which pupated shortly thereafter, and a female emerged on 26 May (Fig. 1b).

Paddock (1912) and Pepper & Hastings (1941) also record substrate cocoon formation for *L. sticticalis* but the cocoon is about twice the length of the *L. floridalis* cocoon; very elongate and without a separate, hollow bulbous apical chamber. In both species the apex of the cocoon is just below the substrate surface, although Pepper & Hastings (1941) observed that larvae of *L. sticticalis* make their cocoons deeper in the substrate during colder weather in Montana. *L. rantalis* has a cocoon similar to that of *L. sticticalis* and has similar behavior (Smith & Franklin, 1954). During the winter *L. floridalis* larvae diapause under natural

conditions much as *L. sticticalis* larvae do in the first generation in May. Pepper & Hastings (1941) found a variable percentage of larvae of *L. sticticalis* from the same egg lots to enter larval diapause in May–June in Montana. The factors that induce larval diapause in some larvae but not in others are not yet known.

Second-instar larvae of *L. floridalis* collected on 19 December 1973 at Cedar Key molted on 23, 26, and 31 December (only a few were not synchronized), becoming prepupal by 9 January 1974. Of 40 larvae reared about half had spun cocoons in the rearing bags by 11 January 1974, with pupation occurring from 12–21 January. Adults of pupae formed by 12 January emerged on 24 January and sequentially thereafter with an average pupation period of 12.2 days. Pupation periods in *L. sticticalis* are in the same range of two weeks time in the summer for those larvae not diapausing (Pepper & Hastings, 1941).

Larva

Last-instar larvae of *L. floridalis* (Fig. 2b) dark gray, with a line of merging yellow spots on either side of midline adjacent to dorso-lateral elevated pinacula. Elevated pinacula become larger on segments nearer head, forming scoli on the dorsum of meso- and metathorax. Pinacula and scoli black, ringed with yellow on integument. Lateral to pinacula, a longitudinal line of merging orange spots margined with yellow. Lower lateral pinacula have integumental yellow bars at bases. Prolegs and venter, gray; thoracic legs, black. Head capsule, orange with most of vertex black, lower frons black, clypeus white, and labrum black. Last-instar larvae 26–32 mm in length.

A more extensive larval description is not included because S. Allyson (Canada Department of Agriculture) is currently preparing detailed larval descriptions for the Nearctic species of *Loxostege*.

Pupa

Pupa of *L. floridalis* (Fig. 3–4) yellow-brown with dark brown markings. Most of markings on dorsum of abdomen. Pupae average 11 mm long, 4 mm wide. Head produced to a point apically. Mesothorax moderately convex dorsally, flattened in the center, and prominently divergent from metathorax in lateral aspect (Fig. 4a). All 10 abdominal segments visible; segments 1–8 have similar dark brown marking on each segment (Fig. 3a). Spiracles of abdominal segments 2–3 surrounded by conspicuously dark, heavily sclerotized enlargements of exoskeleton. Setae, sparse. Proleg scars visible on abdominal segments 5–6 ventrally. Cremaster (Fig. 3b) has six posteriorly directed setae and two dorsal recurved hook-like setae. Cremaster of female as illustrated (Figs. 3–4); male cremaster bulbous (twice ♀ size) to enclose larger genitalia.

The pupa of *L. floridalis* is similar morphologically to that of *L. sticticalis* but the lighter coloration and lack of brown markings in *L. sticticalis* will distinguish the two species. Pupae of other *Loxostege* species were not available for comparisons.

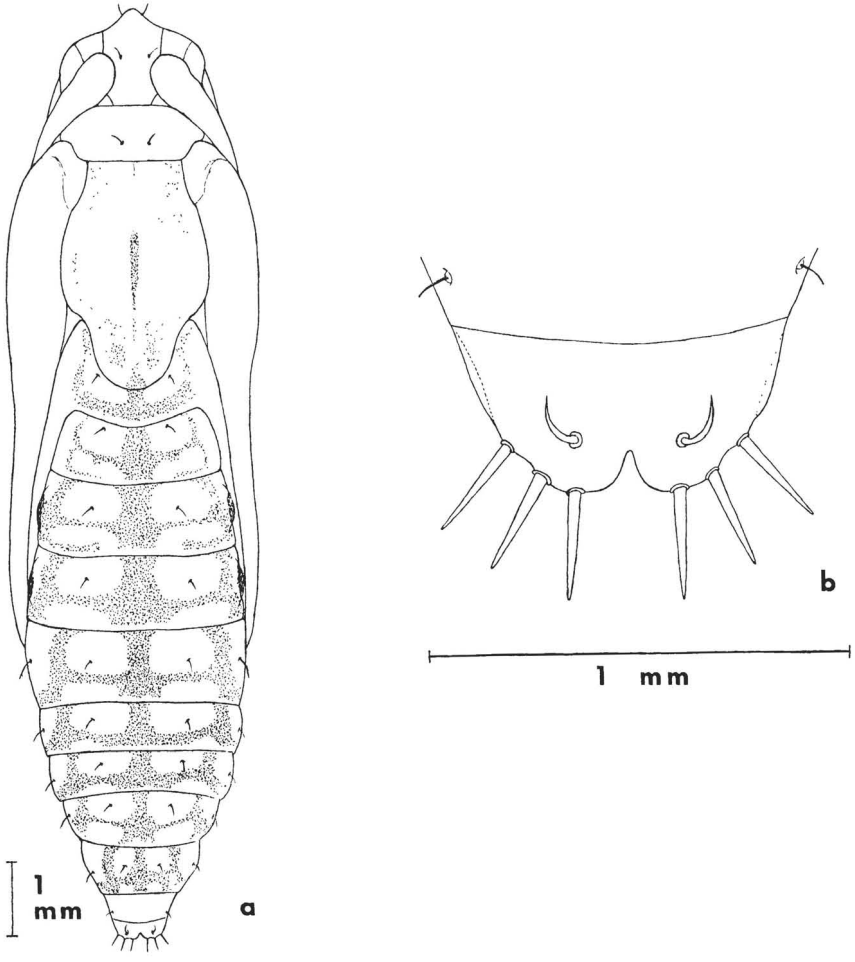

Fig. 3. Pupa, ♀, of *Loxostege floridalis*: (a) dorsal aspect; (b) cremaster, dorsal aspect (Cedar Key, Levy Co., Fla.).

Adult Biology

Nothing has been published on the behavior of adult *Loxostege floridalis* but inferences can be made from studies of the congeneric species. *L. sticticalis* is bivoltine with a larval diapause of up to 10 months, from July until the following May, in Montana (Pepper & Hastings, 1941). Published records of *L. floridalis* indicate a similar pupation-emergence behavior but a multivoltinism commensurate with the more moderate Florida climate (Kimball, 1965). *L. floridalis* evidently has four generations in Florida. December larvae become adults during

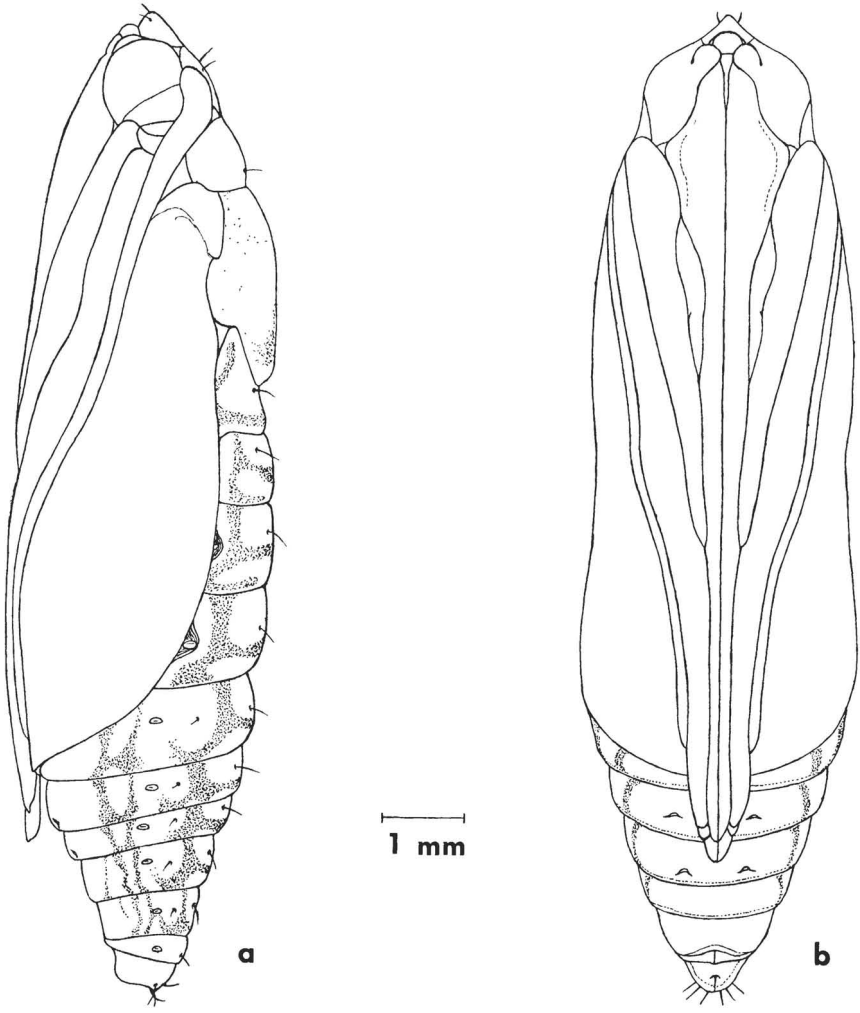

Fig. 4. Pupa, ♀, of *Loxostege floridalis*: (a) lateral aspect; (b) ventral aspect (Cedar Key, Levy Co., Fla.).

January and February except for a percentage of larvae that diapause until May. Although the winter is mild in coastal southern Florida, there is a dry season from mid-winter to June, making diapause useful to insure survival of the population in the event of a particularly dry spring. The second generation of adults emerges in May and the third generation emerges in September. Adults present in November form the fourth generation that produces progeny for the January adults.

From collections data there appears to be a sequential emergence of adults of *L. floridalis* to produce adult activity over a longer time period than delineated above for the four generations. A similar emergence overlap is found with *L. sticticalis* in Montana (Pepper & Hastings, 1941). Available records, however, indicate a lack of adults of *L. floridalis* from June–August. The voltinism of *L. floridalis* has not yet been fully studied, but it is possible that a portion of the June larvae do not emerge as adults until November, much as some larvae of the winter generation partially bypass one generation and wait until May to emerge. The remainder of the June larvae may estivate until September rather than emerge after two weeks as in other generations. Such a strategy would be adaptive to insure survival of a portion of the population during adverse conditions such as excessive heat during the summer of any given year.

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