# BIONOMIC NOTES ON SOME BAGWORM MOTHS (PSYCHIDAE) OF TEXAS

RAYMOND W. NECK
Pesquezo Museum of Natural History, 6803 Esther, Austin, Texas 78752

Jones & Parks (1928) listed 13 species of bagworms that were known to occur in the state of Texas with an additional three species whose presence was "anticipated." Four were later relegated to synonyms at the species level and two were apparent errors, leaving a total of seven species that actually had been definitely recorded from Texas (Davis, 1964). The first Texas record of one of the "anticipated" species has only recently been reported (Neck, 1976), bringing the total to eight.

The four synonyms followed by their present status are as follows: (1) *Thyridopteryx vernalis* Jones = *T. ephemeraeformis* (Haworth); (2) *Oiketicus bonniwelli* Barnes & Benjamin = *O. townsendi townsendi* Townsend; (3) *Oiketicus dendrokomos* Jones = *O. townsendi dendrokomos* Jones; and (4) *Platocoeticus jonesi* Barnes & Benjamin = *Cryptothelea gloverii* (Packard). The first error is an "*Oiketicus* sp." which Jones & Parks (1928) state exists at high elevations in extreme western Texas and southeastern Arizona. Davis (1964) lists this form under "unidentified larval cases." He speculates that this may be an extreme northern extension of *Oiketicus kirbyi*, but his records are restricted to Arizona. The other species, *Prochalia pygmaea* Barnes & McDunnough, is more of a mystery. Jones & Parks (1928) state that it occurs from Bexar Co. (San Antonio) southward, whereas Davis (1964) records only a questionable identification at Dickinson (between Houston and Galveston) and states that the range is "much of the Atlantic and Gulf Coastal Plain from South Carolina to perhaps as far west as Texas." His westernmost confirmed locality is New Orleans.

Five species of bagworm moths are discussed below. *Thyridopteryx meadi* H. Edwards and *Oiketicus townsendi* Townsend (with two subspecies) are not discussed because of the author's unfamiliarity with these two species. No further discussion of *Oiketicus toumeyi* Jones is required because the few data accumulated for this species in Texas have been previously published (Neck, 1976).

## *Thyridopteryx ephemeraeformis* (Haworth)

*Thyridopteryx ephemeraeformis* (Haworth), the evergreen bagworm, is quite common over most areas of the eastern United States, frequently becoming a local economic pest on various species of evergreens. Craighead (1950) reported that this species is known to flourish in Texas on

cedars (*Juniperus* spp.), willows (*Salix* spp.), and cypress (bald cypress, *Taxodium distichum* (L.) Rich.).

In early June 1969, the author received a collection of this species that had been feeding on Barbados cherry (Malphigiaceae: *Malphigia glabra* L.) although two specimens had switched to Japanese yew (Taxaceae: *Taxus cuspidata* Sieb. & Zucc.) and another two had switched to an ornamental holly (Aquifolicaeae: *Ilex* sp.). These latter two plants were located within several feet of the Barbados cherry. Unopened blossoms of the Barbados cherry were utilized in construction of the larval bags.

Bagworms are generally found on a large number of larval foodplants (see records in Davis, 1964) and change foodplants during their larval lifetime. Since this collection contained 52 individuals that had remained on Barbados cherry, a larval foodplant crossover experiment was devised. Rather than continuing to feed the larvae on Barbados cherry, they were fed pyracantha (Rosaceae: *Pyracantha coccinea* Roem.) for an initial 4-week period. For a second 4-week period, the larvae were switched to gum-elastic (Sapotaceae: *Bumelia lanuginosa* (Michx.) Pers.). At the end of the first four-week period a total of 17 live larvae and 11 pupae out of the original collection were still alive. A total of 24 larvae had died. By the end of the second phase of the experiment, all of the remaining larvae had died. Of the 11 pupae (10 ♂; one ♀), only four emerged (3 ♂; one ♀). Although individual bagworm larvae have been reported to switch foodplants (as indeed, four of the collection had switched), this particular pair of plants was found to be unacceptable to these larvae with few exceptions. No larvae were able to survive the second change of foodplant.

The single female emerged in mid-July with male emergence occurring in late July and early August. The female pupal case measured 27 mm in length. The mean pupal case length and mean larval bag length for males were, respectively, 17.7 (SE = 0.9; N = 3) and 40.7 mm (SE = 2.8; N = 3). The same two measures for the dead pupae (those which never emerged) were 15.9 (SE = 0.6; N = 7) and 42.9 mm (SE = 1.1; N = 7). Student's t-tests revealed that the difference between the respective means of the dead and emerged pupae was significant for pupal case length ($t = 2.7$; $p < 0.05$) but not for larval bag length ($t = 1.5$; $p > 0.1$). This difference in pupal length represents variations in the amount of leaf material consumed by the larvae. However, the fact that the larval bag length of the dead pupae was equal to (actually slightly longer than) that of the emerged pupae indicates that these dead pupae represented larvae which had shrunk below each individual larva's maximum size because of limited or total refusal to feed on the foodplant material provided in the laboratory. Emergence of an adult from a pupa is at least

partially dependent upon the amount and quality of resources ingested by a larva even though the ingestion level may well have been sufficient for pupation.

A further collection of *T. ephemeraeformis* from Lubbock, Lubbock Co., was received in early October 1969. These individuals, which had been feeding on ornamental eastern red cedar (Cupressaceae: *Juniperus virginiana* L.), included two live male pupae, nine live female pupae, one empty female pupal case, two dead larvae, and two parasitized larvae. One male emerged on 15 October with five females emerging by 14 October. Parasites that had attacked one of the larvae had emerged through exit holes, leaving cocoons similar to those constructed by *Iphiaulax* (Hymenoptera: Ichneumonidae). Wasps in the other bag were preparing to pupate when received. The adult wasps, which emerged on 14 October, were identified as a hyperparasite, *Habrocytus thyridopterigis* How. (Pteromalidae), which has been reported from this bagworm species in West Virginia (Kulman, 1965). Judging from the size of the larval bag that contained these wasps, this hyperparasite attacks the parasites of rather young larvae. Dead specimens of *Spilochalcis* sp. (probably *mariae* (Riley)) have been found in larval cases of this species. The mean larval bag and pupal case length for males were 38.5 (SE = 1.5; N = 2) and 15 mm (SE = 1.0; N = 2), respectively. The same measures for females were 43.4 (SE = 1.1; N = 10). A t-test revealed significant differences between males and females for both larval bag length ($t = 4.1$; $p < 0.005$) and pupal case length ($t = 14.1$; $p < 0.001$) despite the small sample sizes involved.

*Thyridopteryx ephemeraeformis* has been found on numerous host plants in the Austin area. A large, extinct colony was discovered on Oriental arbor vitae (Pinaceae: *Thuja orientalis* L.). Specimens have also been found on this plant in San Marcos, Hays Co. In Austin, isolated larval cases have been found on peach (Rosaceae: *Prunus persica* Batsch), cedar elm (Ulmaceae: *Ulmus crassifolia* Nutt.), plateau live oak (Fagaceae: *Quercus fusiformis* Small), turk's cap (Malvaceae: *Malvaviscus arboreus* Cav. var. *drummondii* (T. & G.) Schery), Texas persimmon (Ebenaceae: *Diospyros texana* Scheele), agarita (Berberidaceae: *Berberis trifoliolata* Moric.), pyracantha (Rosaceae: *Pyracantha coccinea* Roem.), willow baccharis (Compositae: *Baccharis salicina* T. & G.), Mexican plum (Rosaceae: *Prunus mexicana* Wats.); bald cypress (Taxodiaceae: *Taxodium distichum* (L.) Rich.), greenbriar (Liliaceae: *Smilax bona-nox* L.), ashe juniper (Cupressaceae: *Juniperus ashei* Bucch.), Texas sugarberry (Ulmaceae: *Celtis laevigata* Willd.), slender bamboo (Gramineae: *Bambusa* sp.), and western soapberry (Sapindaceae: *Sapindus saponaria* L. var. *drummondii* (H. & A.) L. Benson). These

individual larvae apparently result from dispersal by first-instar larvae. These isolated larvae contained the two sexes in approximately equal numbers (eight ♂; six ♀).

In northeast Texas (Titus Co.), *T. ephemeraeformis* has been found feeding on the following plants: eastern red cedar (Cupressaceae: *Juniperus virginiana* L.), American elm (Ulmaceae: *Ulmus americana* L.), slippery elm (Ulmaceae: *Ulmus rubra* Muhl.), alder (Corylaceae: *Alnus serrulata* (Aiton) Willd.), and American hop hornbeam (Corylaceae: *Ostrya virginica* (Miller) K. Koch.).

### *Oiketicus abbotii* (Grote)

*Oiketicus abbotii* (Grote) is restricted to the Atlantic and Gulf Coast from Virginia to Texas (Davis, 1964). Although the possibility exists that *O. abbotii* is part of a polytypic species, *O. kirbyi* Guilding, which would include the two above species and *O. townsendii*, Davis (1964) reports that the larval bags of these three taxa are quite distinct. The larval bags of *O. abbotii* and *T. ephemeraeformis* are of similar size but are easily distinguished by a single character. Twigs on larval bags of *O. abbotii* are placed transversely so that a cross section of the bag reveals an angular polygon. Twigs on larval bags of *T. ephemeraeformis* are placed longitudinally so that a cross section of the bag is roughly circular.

The author has found *O. abbotii* in Brownsville, Cameron Co., on a wide variety of host plants, e.g., tepeguaje or giant lead tree (Leguminosae: *Leucaena pulverulenta* (Schlect.) Benth.), mesquite (Leguminosae: *Prosopis glandulosa* Torr.), avocado (Lauraceae: *Persea americana* Mill.), Texas sugarberry (Ulmaceae: *Celtis laevigata* Willd.), Japanese honeysuckle (Caprifoliaceae: *Lonicera japonica* Thumb.), arbor vitae (Pinaceae: *Thuja orientalis* L.), and common rose (Rosaceae: *Rosa* sp.). The only infestation which could be called a colony was found on a single pyracantha bush (Rosaceae: *Pyracantha coccinea* Roem.).

Collection of larvae from the aforementioned pyracantha bush occurred in mid-July 1967. Larvae were quite active at this time but became relatively inactive in the latter part of July although increased activity became apparent in early August (all larvae observed in laboratory). Earliest adult emergence (♀) occurred on 30 August, but the next one (♀) did not emerge until 15 September. Final emergence (♂) occurred 4 October. Females tend to emerge earlier; five of the first six adults were female and the final three to emerge were males.

Of 33 larval cases collected in late June and early July at various localities in Brownsville, seven (21.1%) showed signs of parasitism. In late June, 10 adults of *Iphiaulax manteri* Nett. (Hymenoptera: Braconi-

dae) emerged from one of the bags. The cocoons of the wasps were present in two layers of five each, with the individual cocoons being parallel to the long axis of the bag. Stephens (1962) reported *Iphiaulax* sp. [near *I. sublucens* (Blanch.) + *I. diversus* (Vierick)] as attacking *O. kirbyi* in Costa Rica. Larvae of this form act as ectoparasites that gradually make their way to the center of the host.

In late July a mud wasp, *Pachodynerus astraeus* Cameron (Hymenoptera: Vespidae) emerged from one larval case. Examination of the interior of the case revealed two additional wasps. Each of the three cells were separated by a 2 mm thick layer of dried mud. The entire lining of the bag was covered by a layer of dried mud of 1 mm thickness. The bottom part of the bag was closed by a plug that was sculptured by the mother wasp. Davis (1964) reports a similar occurrence with bags of *O. toumeyi* being used by *Pachodynerus acuticarinatus* (Cameron). Whether the wasps utilize only empty bags or kill the inhabitant larva is unknown. Several additional bags of *O. abbotii* containing similar wasp cells from which adult wasps had previously emerged were collected.

*Oiketicus abbotii* also exhibits the common sexual dimorphism. Larval bag and pupal case mean lengths for males of the pyracantha colony were 50.5 (SE = 1.4; N = 6) and 18.7 mm (SE = 0.8; N = 6) respectively, whereas the two lengths for females were 61.0 (SE = 1.0; N = 5) and 25.2 mm (SE = 0.9; N = 5). The means are significantly different between the sexes for both larval bag length ($t = 8.1$; $p < 0.001$) and pupal case length ($t = 8.2$; $p < 0.001$).

Several additional infestations on pyracantha in Brownsville were discovered by or reported to the author. Explanation for this abundance on pyracantha at that time is unknown. Possibly this occurrence illustrated a temporary host race as discussed by Jones & Parks (1928). A return to these infestation sites in the summer of 1969 revealed no populations. If a host plant race had developed, its occurrence was temporary.

At localities other than Brownsville, only isolated foodplant records are available. One larval bag was found on southwestern bernardia (Euphorbiaceae: *Bernardia myricaefolia* (Scheele)) at Goliad State Park, Goliad Co. At Lake Corpus Christi State Park, San Patricio Co., larvae have been observed feeding on Texas persimmon (Ebenaceae: *Diospyros texana* Scheele), guayacan (Zygophyllaceae: *Porlieria angustifolia* (Engelm.) Gray), and little lead tree (Leguminosae: *Leucaena leucocephala* (Lam.) de Wit).

### *Cryptothelea gloverii* (Packard)

*Cryptothelea gloverii* (Packard) occurs along the Atlantic and Gulf Coasts from South Carolina to Central America. The general form of the

larval case in this species is similar to that of *T. ephemeraeformis* but only one-half to one-third the length. In Austin, *C. gloverii* has been found infesting retama (Leguminosae: *Parkinsonia aculeata* L.), western soapberry (Sapindaceae: *Sapindus saponaria* L. var. *drummondii* (H. & A.) L. Benson), Texas sugarberry (Ulmaceae: *Celtis laevigata* Willd.), and common yarrow (Compositae: *Achillea millefolium* L.). In Brownsville, *C. gloverii* had been found on pyracantha (Rosaceae: *Pyracantha coccinea* Roem.) and lime prickly ash (Rutaceae: *Zanthoxylem fagara* (L.) Sarg.). The record on pyracantha was a fairly large colony on the same bush as the colony of *O. abbotii*. Small bits of leaves, bark and fruits were attached to the bags. The bags were found attached to almost all parts of the plant, e.g., trunk, stems, leaves, and even other bagworms. Larvae sought the security of the internal branches prior to pupation.

Collections were made during the first half of July, at which time the bags varied from 5 to 16 mm in length, with the majority being from 13–15 mm. Adult emergence occurred during mid-July with male pupal case length (N = 5) being very constant at 6–7 mm. Numerous mites were noticed on many of the bags. These mites have been predaceous on eggs as reported by Stephens (1962) for *O. kirbyi* in Costa Rica. On 12 July, the hatching of a total of 245 larvae from one larval case within ca. 3 hr was observed, with most of the hatching occurring within the first 2 hr. Behavioral patterns, i.e., orientation of abdomen and construction on initial larval bag, of the larvae were similar to those reported by Kaufman (1968) for *T. ephmeraeformis*.

A return trip was made in December 1969 to the Brownsville locality where *O. abbotii* and *C. gloverii* had been observed in the summer months of 1967. No trace of either species could be found. Food supply failure did not seem to be a logical reason for the local extermination because the pyracantha plant was in excellent condition and exhibited no evidence of previous extreme defoliation. Although there had been insecticide use to the east and southeast (directions of prevailing winds), drift is thought to have been minimal because ground-level hand spraying was employed. Three bird nests, probably constructed by mockingbirds, *Mimus polyglottus* (L.) (Passeriformes: Mimidae), a voracious insectivorous bird, were present in the bush. Stephens (1962) reported damage to a substantial number of bags of *O. kirbyi* which he attributed to an unknown bird species. Davis (1964) believes that some bird predation of bagworms (cases that exhibited holes) is the result of woodpeckers.

Overzealous collecting can be ruled out because bags in the top of the bush were not collected. These upper bags were not on the bush at the

time of the re-check. This fact raises the possibility that Hurricane Beulah, the eye of which passed within 20 mi of the area in September 1967, led to the decimation of this colony.

### *Astala confederata* (Grote & Robinson)

*Astala confederata* (Grote & Robinson), the lawn bagworm, occurs in the eastern United States west to about the 100th meridian. Larvae have been found feeding on Texas spear grass, *Stipa leucotricha* Trin. & Rupr., and Johnson grass, *Sorghum halepense* (L.) Pers. (both Gramineae). The larval stage of this species is an inconspicuous ground-level feeder until it attaches to a tree trunk or building wall and thereupon pupates in April and May (Jones & Parks, 1928). A series of bags was collected at Austin in mid-May 1969. Most bags showed prior adult emergence, although one bag still contained a live larva. Adult emergence from those bags containing live pupae occurred for several days following collection, with several egg masses present in other bags hatching on 1 June. The adult male of *A. confederata* is somewhat larger than the previous species and much darker, being almost black.

### *Astala edwardsi* (Heylands)

*Astala edwardsi* (Heylands), the chalk-hills bagworm, is restricted to Texas and Oklahoma (Davis, 1964), preferring barren areas where thin herbage only partially covers the limestone-derived soils. Jones & Parks (1928) report that the larvae eat both dead and living vegetable matter. I have observed one specimen feeding on thatch on the soil surface. The odd pencil-shaped bags are normally found on posts or tree trunks in September as the larvae ascend from the ground level. I have observed this species from the following localities in Texas: Crutchfield Ranch, Burnet Co.; 3 km S of Seguin, Guadalupe Co.; Austin, Travis Co.; and Longfellow, Pecos Co.

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## BUTTERFLIES ASSOCIATED WITH AN ARMY ANT SWARM RAID IN HONDURAS: THE "FEEDING HYPOTHESIS" AS AN ALTERNATE EXPLANATION

Drummond (1976, J. Lepid. Soc. 30: 237–238) reported that a few female *Mechanitis isthmia* Bates (Nymphalidae: Ithomiinae) and male *Graphium philolaus* (Boisduval) (Papilionidae: Papilioninae) were attracted to a swarm raid of army ants (*Eciton burchelli* (Westwood)) in Honduras. As an explanation, Drummond suggested a "reproductive odor hypothesis" to account for the attraction of female *Mechanitis* to the swarm raid: the strong, unpleasant odor mimicked the courtship scent of male *Mechanitis*, thus causing females of this species to follow the swarm. As Drummond indicated, the attraction of male *Graphium* to the swarm raid was puzzling since, like ithomiines, males produce the courtship scent. Recent literature on the feeding behavior of selected butterflies suggests an alternative explanation to these interesting observations.

The acquisition of nutrients by adult butterflies of both sexes may be of widespread importance (Gilbert, 1972, Proc. Natl. Acad. Sci., U.S.A. 69: 1403–1407; 1976, Biotropica 8: 282–283; Arms et al., 1974, Science 185: 372–374). Adult butterflies are attracted to nutrient sites having an odor of decay (Gilbert, 1972, in litt.; Young, 1975a, Stud. Neotrop. Fauna 10: 19–56; 1975b, Rev. Biol. Trop. 23: 101–123; Young & Muyshondt, 1973, Carib. J. Sci. 13: 1–49). Ithomiine butterflies are attracted to fresh deposits of bird droppings splashed on leaves (pers. obs.). Drummond (in litt.) suggested that the male *Graphium* might be responding to an odor stimulis that elicits food searching behavior. These observations suggest that the attraction to nutrient sites by adult butterflies involves odors of decay, although this is only speculation at the present time.

Assuming that odors of decay cause the attraction of adult butterflies to nutrient sites, I suggest a "feeding hypothesis" as an alternative explanation for Drummond's findings: both the *Mechanitis* and *Graphium* butterflies were being "fooled" by the swarm raid odors. The odors of decay associated with the swarm raid triggered food searching behavior by these butterflies, causing them to follow the army ants. Such an explanation accounts for the attraction of both sexes to the ants. Under the feeding hypothesis, the attraction of butterflies to puddling sites, bird-droppings, manure heaps, etc. is aided by responses to characteristic odors associated with these sources of nutrients (amino acids, sodium, etc.).

ALLEN M. YOUNG, *Invertebrate Division, Milwaukee Public Museum, Milwaukee, Wisconsin 53233.*