Pacific Insects 6 (2): 234–241 August 31, 1964

ECOLOGICAL NOTES ON THE LARVAE OF SOME PYRALOID MOTHS IN FIJI[1]

By Alden D. Hinckley[2]

B. P. Bishop Museum, Honolulu, Hawaii

Abstract: Notes on the plant hosts and natural enemies of 24 pyraloid moths in Fiji are summarized. The locations in which the pyraloid larvae feed are analyzed in relation to the growth forms of the host plants and the taxonomic classification of the larval parasites but no clear correlations are demonstrated. It is concluded that damage by certain species of pyraloids is of economic importance; that larval parasitization is generally low; and that further introduction of parasites should be attempted.

Special attention was given in this study to pyraloid larvae feeding in concealed locations on their plant hosts, *e. g.* leaf rollers and pod borers. The parasites attacking larvae in both concealed and exposed situations were also studied and, whenever possible, the average level of parasitization was estimated.

Samples were taken at various points on Viti Levu and held for moth and parasite emergence in gauze-topped jars or cotton-stoppered vials at the Koronivia Research Station in Southeast Viti Levu. Viti Levu is the largest (10,385 sq km=4,010 sq miles) island in the Fiji group. Annual rainfall is 178 cm (70″) in the NW and 304 cm (120″) in the SE, being heaviest during the summer months (January–March) in both zones.

The assistance of Mr. J. W. Parham, Botanist, Dept. of Agriculture, Fiji; Dr. E. G. Munroe, Entomology Research Institute, Dept. of Agriculture, Canada; and the taxonomic specialists at the Commonwealth Institute of Entomology, is gratefully acknowledged. I also wish to thank Mr. R. J. A. W. Lever for starting, and Mr. B. A. O'Connor for continuing, a very useful card file of host records. The work of Miss Afe Saua and Mr. S. R. Singh in laboratory rearings, as well as that of Ratu Filipe Lewanavanua and Jonah Uluinaceva in field collections, deserves both thanks and commendation.

SPECIES

In this section, records of parasite attacks, host plants, and other relationships are summarized for each of the 24 species studied. Except for numbers 2, 5, 13, 17, 18, and 24, all the species belong in the family *Pyraustidae*.

---

1. These notes were compiled during the period from August 1960 to August 1963 while I was employed as Entomologist with the Department of Agriculture in the Colony of Fiji.
2. Present address: c/o F. A. O.–S. P. C. Rhinoceros Beetle Project, Apia, W. Samoa.

1. **Agathodes rebeli** Tams

Larvae of this pyraustid were observed rolling the leaves of a papilionaceous shade tree, *Erythrina variegata*, and there was some larval parasitization by the ichneumonid, *Trathala flavoorbitalis* (Cameron). *Trathala* (ex *Cremastus*) appears to have been established from Hawaiian introductions made in 1935.

2. **Alucita candidialis** Walker

The hairy larvae of this alucitid made "shot holes" in the young leaves of *Ipomoea congesta* (=*Pharbites insularis*). The host plant was far more pubescent than most *Ipomoea* spp. and its leaves resembled those of some cucurbits. The pupa of *A. candidialis* was formed on the leaf and the adult was a white, plume-winged moth. Neither larval nor pupal parasites were noted.

3. **Antigastra catalaunalis** Duponchel

Larvae of this pyraustid, which had not previously been recorded in Fiji, severely damaged the seed capsules of sesame, *Sesamum orientale*, at Koronivia in 1963. The early instars first skeletonized, then webbed, the leaves. The later instars bored within the seed capsules and the pupae were formed in lace-like cocoons between the capsules and the stems. About 30 % of the larger larve were killed by the green muscardine fungus, *Metarrhizium anisopliae*, before they could pupate.

4. **Crocidolomia binotalis** (Zeller)

Known as the cabbage cluster caterpillar, *C. binotalis* fed on English cabbage, *Brassica oleracea* var. *bullata*, and other cruciferous plants. Eggs were laid on the lower surface of leaves. On English cabbage, the clusters of 5 to 10 caterpillars often did severe damage to young leaves in the "heart" of the plant. Pupation occurred in the soil. Indigenous parasites, the braconids, *Apanteles* sp. and *Chelonus* sp., have been recorded (Lever, 1945), "neither being of any appreciable control value."

5. **Cryptoblabes plagioleuca** Turner

Larvae of this phycitid were common on the native cycad, *Cycas rumphii*. They webbed together 2 pinnae and fed between them. *C. plagioleuca* has also been reared from loquat, *Eriobotrya japonica*, and cotton, *Gossypium* sp. A chalcidid, *Brachymeria ?fijiensis* Ferriere, was reared from the pupae of *C. plagioleuca* and an elasmid, *Elasmus* sp., had previously been recorded parasitizing the caterpillars.

6. **Diaphania indica** (Saunders). Formerly placed in the genus *Margaronia.*

This leaf roller was reared from various cucurbits. The only larval parasites recovered during the study were *Chelonus* sp. near *striatigena* Cameron and *Trathala flavoorbitalis* although *Apanteles* sp. and *Casinaria* sp. are also known to attack *D. indica* in Fiji. In recent samples, parasitization was usually less than 5%. No pupal parasites were observed although *Brachymeria* sp. had been noted previously.

7. **Hedylepta diemenalis** (Guenée). Sometimes placed in *Nacoleia.*

This pyraustid rolls the leaves of papilionaceous legumes in the following genera: *Arachis*,

Centrosema, *Desmodium*, *Dolichos*, *Glycine*, *Indigofera*, *Phaseolus*, *Pueraria*, and *Vigna*. It has also been recorded from the mimosaceous tree, *Albizzia lebbek*. Larval parasitization was generally below 10 %. *Trathala flavoorbitalis* and *Chelonus* sp. near *striatigena* were observed. One sample of 9 *H. diemenalis* included a larva which had been parasitized by an unidentified tachinid. Earlier parasite records: *Apanteles inquisitor* Wilkinson from larvae as well as an ichneumonid, *Echthromorpha agrestoria immaculata* (Krieger) (=*diversor* Morley), and a chalcidid, *Brachymeria ?fijiensis*, from pupae.

8. **Herpetogramma stultalis** (Walker). This had been placed in *Psara* or *Pachyzanchla*.

This leaf roller defoliated the amarantaceous weed, *Alternanthera sessilis*. It also attacked *Coleus* sp. in shady locations. *Apanteles* sp., *Chelonus* sp. near *striatigena*, and *Trathala flavoorbitalis* were reared from *H. stultalis* but total parasitization was less than 25%.

9. **Hydriris ornatalis** (Duponchel). This species had beed placed in *Antiercta* or *Ercta*.

Larvae of this pyraustid fed on the underside of the leaves of sweet potato, *Ipomoea batatas*, and related plants. The scars made by early instars of *H. ornatalis* were "window panes", sections of leaf from which all but the upper surface had been removed. Later instars skeletonized the leaf. A cocoon of the braconid, *Apanteles* sp., was associated with a *H. ornatalis* head capsule and the ichneumonid, *Trathala flavoorbitalis*, is probably also a parasite of *H. ornatalis* larvae.

10. **Hymenia recurvalis** (F.)

This species is a major pest on Indian spinach, *Amaranthus viridis* (see Singh, 1960). It also attacks many other herbaceous crops and weeds. Larvae of *H. recurvalis* usually fed in exposed situations although they sometimes webbed or rolled leaves. The following parasites were reared: *Apanteles* spp. (possibly including both *A. hymeniae* Wilkinson and *A. marginiventris* (Cresson), the later having been introduced from Hawaii in 1950), *Chelonus* sp. near *striatigena*, and *Trathala flavoorbitalis*. The *Apanteles* spp. were more common than the others but the aggregate larval parasitization was usually between 10 % and 20 %. *Elasmus* sp. had been recorded as a parasite of *H. recurvalis* in Fiji but it was not observed during this study.

11. **Marasmia poeyalis** (Boisduval). Misidentified as *M. venilialis* (Walker), *Cnaphalocrocis medinalis* (Guenée), & possibly, also as *M. trapezalis* (Guenée).

This leaf roller attacked grasses in the following genera: *Brachiaria*, *Digitaria*, *Panicum*, *Paspalum*, *Setaria*, and *Zea*. Unlike most of the leaf rollers studied, *M. poeyalis* pupated inside a special leaf fold rather than within a feeding roll. (The Lantana Leaf Roller, #21, was another with this habit.) Mortality of *M. poeyalis* larvae from parasitization by *Apanteles* sp. and *Elasmus philippinensis* Ashmead averaged about 5% and that attributable to a granulosis virus was about 3%. There was some adult mortality from fungal infections.

12. **Maruca testulalis** (Geyer)

M. testulalis is the most important pest on papilionaceous legumes in Fiji. Its caterpillars were observed on pea, peanut, cowpea, pigeon pea, and various beans. They bored into flowers and pods, as well as stems and shoots. Although extensive collections were made from 3 hosts and several locations, no parasites were reared. The only natural mortality

recorded in Fiji was predation by the eumenid wasp, *Pseudepipona rufipes* (F.).

13. **Myelois pectinicornella** Hampson

During the first 3 months of each year, larvae and pupae of this phycitid were common in the pods of the ornamental tree, *Bauhinia variegata* var. *candida*. Infestation was often so heavy that all the seeds in the pod were destroyed. A low level of parasitization by *Apanteles* sp. was noted in 1963.

14. "**Nacoleia**" **octasema** (Meyrick). A new genus is being described for this species (Munroe, 1963, personal communication).

This is the Banana scab moth (see O'Connor, 1949) but, in Fiji, it also feeds on pandanus fruits. Scab moth ♀♀ first oviposited on banana leaves when a bunch was about to emerge and continued to lay eggs on the bracts and stem of the bunch. Larvae fed on the surface of young fruits and made unsightly scars, especially on the distal "hands", those being the last to stand away from the stem. Pupae were formed within such cryptic locations as the curled edge of an an old leaf. Indigenous parasites of the Scab Moth included: *Trichogramma australicum* Girault from the eggs; *Cremastus* (s. str.) sp. and a tachinid, *Stomatomyia tricholygoides* Bezzi, from the larvae; and *Brachymeria* sp. from the pupae, but none of these native parasites were common or effective. Therefore, various braconids, ichneumonids, tachinids, a bethylid, and an encyrtid have been introduced but only *Chelonus* sp. near *striatigena* (brought from Indonesia during 1960) has been recovered. Rearings and dissections of samples (primarily from areas near liberation sites) showed that parasitization on a bunch sometimes exceeded 70 % but the average (based on collections of 1,910 larvae) was 20.2 %. Ants and earwigs may kill both parasitized and unparasitized scab moth larvae.

15. **Piletocera xanthosoma** (Meyrick)

In 1962, U. S. D. A. plant quarantine officials reported that this nymphuline pyraustid was damaging ginger exported from Fiji to Canada and the United States. Under moist conditions, its larvae bored deeply into the rhizomes, producing large amounts of yellowish frass. In the laboratory, incubation and pupation each took about 1 week but the larval period was from 5–7 weeks. No parasites have been noted.

16. **Prophantis** sp. I. W. B. Nye (1962, personal communication) plans to describe this species from Fiji and Queensland material. It has previously been misidentified as *Thilptoceras octoguttalis* (Felder).

This pyraustid was a destructive borer on gardenia, damaging both flowers and shoots. Pupation took place within a pocket formed by attaching a cut-out piece of leaf to the underside of another leaf. In one sample, 5 out of 9 had been parasitized by an indigenous *Chelonus* sp. (near *C. vitiensis* Turner), but the average parasitization was about 20 %.

17. **Sphenarches caffer** Zeller

This species, variously classed as an alucitid, pterophorid, or even orneodid, was observed on 2 hosts in Fiji, bottle gourd, *Lagenaria vulgaris*, and cocoa, *Theobroma cacao*. On the former, its hirsute larva made small "shot-holes" but on the latter it left fine "lace-work." The naked but spiny pupae were attached by a caudal thread to the leaf in either case.

The plumed wings of the adult were brown. No parasitization was recorded in Fiji, although parasites are known in India and the Sudan.

18. **Striglina navigatorum** Felder. Misidentified as *S. superior* Butler.

Rather than rolling the edge of a leaf, the stocky caterpillar of this thyridid cut a crescent and fed within the cone thus made. Damage was heaviest during the months of June and July. The following trees, representing several families, were hosts: *Cassia fistula*, *Erythrina lithosperma*, *Heritiera littoralis*, *Inocarpus fagiferus* (=*edulis*), *Pometia pinnata*, and *Pongamia pinnata* (=*glabra*). The common bean, *Phaseolus vulgaris*, has also been recorded as a host. Two of the larvae on *Erythrina* leaves had been parasitized by *Apanteles* sp.

19. **Susumia exigua** (Butler). Misidentified as *M. venilialis* and confused with *M. poeyalis*.

The rice leaf roller was discussed in an earlier note (Hinckley, 1963). Eggs were laid on the leaf tips. Larvae and pupae were found within rolled rice leaves. Larval parasitization by *Trathala flavoorbitalis* averaged 35% on SE Viti Levu but was lower on the "dry side." *Apanteles* sp. and *Microchelonus* (ex *Chelonus* or *Chelonella*) *blackburni* (Cameron) were much less common than *Trathala*. *Brachymeria ?fijiensis* has been reared from *S. exigua* pupae and *Trathala* cocoons.

20. **Sylepta derogata** (F.)

A large leaf roller, *S. derogata* was reared from cone-shaped rolls on 4 species of *Hibiscus*. Neither during this study nor previously in Fiji were larval parasites recorded although the pupal parasites, *Brachymeria ?fijiensis* and *Echthromorpha agrestoria*, have been recorded here and many parasites of various stages elsewhere. Records of pupal parasitization by *Brachymeria obscurata* (Walker) refer to laboratory rearings of material from Hawaii.

21. **Syngamia haemorrhoidalis** Guenée

One of the lantana defoliators introduced into Fiji, this leaf roller has not been very effective in controlling the weed. Only a few leaves are damaged by *S. haemorrhoidalis* on each lantana bush. In 1 sample of 10, 2 larvae had been parasitized by the apparently parthenogenetic ichneumonid, *Horogenes* sp. Another parasite, *Elasmus* sp. near *philippinensis*, has also been reared from a *S. haemorrhoidalis* caterpillar. The failure of *S. haemorrhoidalis* to control lantana appears to be correlated more with high rainfall than high parasitization.

22. **Tatobotys biannulalis** (Walker)

The larvae of this nymphuline pyraustid were found scavenging in debris at the base of rice stools, and they probably feed in similar situations in various grasses. Pupation took place within a frass-covered cocoon at the stem base. Adults killed by fungi were often seen but no larval or pupal parasites were observed.

23. **Terastia subjectalis** Lederer. Previously known as *T. meticulosalis* Guenée in Fiji. Reidentified by Munroe (1963, personal communication).

This large borer was quite common in stems and pods of *Erythrina* spp., stunting growth and reducing seed production. On 2 occasions, cocoons of an *Apanteles* sp. were recovered

from stem tunnels.

24. **Tirathaba trichogramma** (Meyrick). Sometimes placed in *Coleoneura*.

The coconut spike moth, a galleriid, has been implicated as a possible source of premature nut-fall in Fiji. Its larvae bored into the flowers and "spikes" (spadices) of coconut and other palms. Their feeding on ♂ flowers was presumably inconsequential but they could be detrimental when they fed on ♀ fruits, especially those more than 1/3 mature. Eggs and pupae of *T. trichogramma* were found in the fibrous sheath at the frond base or in similar situations (Paine, 1935). Indigenous parasites recorded included: the trichogrammatid, *Trichogramma nanum* (Zehntner), on eggs; the braconid, *Meteorus trichogrammae* Wilkinson on larvae; and both *Echthromorpha tirathabae* Perkins and *E. agrestoria*, as well as the chalcidid, *Antrocephalis renalis* Waterston, from pupae. One egg parasite, the scelionid *Telenomus tirathabae* Ferrière; and 3 larval parasites, *Apanteles tirathabae* Wilkinson, the ichneumonid, *Devorgilla* (ex *Nemeritis*) *palmaris* (Wilkinson), and the tachinid "*Erycia*" (provisional generic placement) *basifulva* Bezzi, have been successfully introduced. *Telenomus* and "*Erycia*" are credited with a reduction of coconut spike moth damage, the former killing about 30% of the eggs and the latter parasitizing about 40% of the surviving larvae, but it is still not clear how effective they are and how much premature nut-fall was attributable to *T. trichogramma* prior to their introduction.

DISCUSSION

Pyraloid larvae can often be serious pests in Fiji. Those doing significant damage to crops of economic importance include *M. testulalis* on many pulses, *N. octasema* on banana, *C. binotalis* on English Cabbage, *H. recurvalis* on Indian spinach, and *S. derogata* on Fijian spinach (*Hibiscus manihot*). *T. subjectalis* on *Erythrina lithosperma*, an important cocoa shade tree, and *Prophantis* sp. on gardenia can, by their boring, severely stunt the growth of their hosts. Further evaluation of the damage caused by 2 other pyraloids, *S. exigua* on rice and *T. trichogramma* on coconut, may show that they are sometimes of economic importance. The only beneficial pyraloids considered in this paper are *S. haemorrhoidalis*, lightly damaging lantana, and *H. stultalis*, heavily defoliating a minor amarantaceous weed.

For the 24 species covered in this study, larval locations fell into 4 categories, characterized by varying degrees of concealment and protection. Some were feeding on an unrolled leaf, usually on the underside but otherwise unprotected. Others were clustered within a plant but at least partially exposed; the clustering was most noticeable during the early instars, the larger larvae being more dispersed. The 3rd category, by far the largest, included those species which fed within leaf rolls of various forms. Finally, there was a heterogenous group of boring caterpillars feeding within flowers, fruits, stems, and roots.

In Table 1, these larval locations are shown in relation to the growth forms of the host plants. In general, there did not appear to be any correlations between certain larval locations and specific growth forms.

In Table 2, the larval locations are analyzed in relation to parasite records. *Chelonus* (s. lat., including *Microchelonus*) spp. attacked hosts in all categories but an even wider range would be expected since wasps in this genus oviposit in the eggs of their hosts and should not be influenced by larval location. The various species of *Apanteles* had the

Table 1. Larval locations and host plant forms.

	Larval locations			
	Exposed on leaf	Clustered in plant	Rolled leaf	Bored hole
Plant Forms				
Grass		*T. biannulalis*	*M. poeyalis* *S. exigua*	
Herb	*H. recurvalis*	*C. binotalis* *N. octasema*	*H. diemenalis* *H. stultalis* *S. navigatorum*	*A. catalaunalis* *M. testulalis* *P. xanthosoma*
Vine	*A. candidialis* *H. ornatalis* *S. caffer*		*D. indica* *H. diemenalis*	*M. testualis*
Shrub	*S. caffer*		*C. plagioleuca* *H. diemenalis* *S. haemorrhoidalis* *S. derogata*	*M. testulalis* *Prophantis* sp.
Tree		*N. octasema*	*A. rebeli* *C. plagioleuca* *H. diemenalis* *S. navigatorum*	*M. pectinicornella* *T. subjectalis* *T. trichogramma*

Table 2. Larval locations and parasite records.

	Larval locations			
	Exposed on leaf	Clustered in plant	Rolled leaf	Bored hole
Larval Parasites				
BRACONIDAE				
Chelonus	*H. recurvalis*	*C. binotalis* *N. octasema*	*D. indica* *H. diemenalis* *H. stultalis* *S. exigua*	*Prophantis* sp.
Apanteles	*H. ornatalis* *H. recurvalis*	*C. binotalis*	*D. indica* *H. diemenalis* *H. stultalis* *M. poeyalis* *S. navigatorum* *S. exigna*	*M. pectinicornella* *T. subjectalis* *T. trichogramma*
ICHNEUMONIDAE				
Cremastus	*H. ornatalis* *H. recurvalis*	*N. octasema*	*A. rebeli* *D. indica* *H. diemenalis* *H. stultalis* *S. exigua*	
other genera			*D. indica* *S. haemorrhoidalis*	*T. trichogramma*
ELASMIDAE				
Elasmus	*H. recurvalis*		*C. plagioleuca* *M. poeyalis* *S. haemorrhoidalis*	
TACHINIDAE		*N. octasema*	*H. diemenalis*	*T. trichogramma*
NONE	*A. candidialis* *S. caffer*	*T. biannulalis*	*S. derogata*	*A. catalaunalis* *M. testualis* *P. xanthosoma*

widest host range but the classification of these ubiquitous wasps is still so confused that it is not clear whether certain species are most apt to attack pyraloid hosts in a particular niche. The generally low parasitization percentage by *Apanteles* may be related to the fact that hyperparasitization of *Apanteles* larvae is quite frequent in Fiji. *Cremastus* (s. lat., including *Trathala*) spp. and other ichneumonids were, with their long ovipositors, able to attack pyraloid larvae in all the cryptic situations. However, *Elasmus*, possibly because of its smaller size and shorter ovipositor, was recovered only from *H. recurvalis* and 3 leaf-rollers. Tachinid parasites were generally scarce but records from countries other than Fiji show that they can successfully attack hidden pyraloids of many genera, so their sparsity in Fiji may be related more to high rainfall than the inaccessibility of hosts.

Egg parasitization by *Trichogramma* spp. has been recorded in Fiji only for *N. octasema* and *T. trichogramma* but it undoubtedly occurs on other pyraloid hosts, as well as sphingids, noctuids, etc. *Telenomus tirathabae* was reported only from the coconut spike moth but other species of *Telenomus* have been reared from eggs of noctuids and chrysopids in Fiji. Pupal parasitization by *Brachymeria* was recorded only from the banana scab moth and 5 leaf rollers. This, and the limited record of *Echthromorpha* parasitization, reflects the lack of pupal collections.

Further collecting would remove some pyraloids from the group of 6 for which there are no records of egg, larval, or pupal parasitization in Fiji. Nonetheless, one point should be emphasized: in Fiji, parasitization of pyraloid larvae is generally low. *Trathala flavo-orbitalis*, contributing 35% to the mortality of *Susumia exigua*, represented the most effective larval parasite observed during this study. The 40% parasitization of *Tirathaba trichogramma* by "*Erycia*" *basifulva* was the only previous record of larval mortality at a comparable level. If more effective larval parasites of pyraloids occur in areas other than Fiji, their introduction should be attempted. Surveys in countries with rainy climates might discover tachinids which would be particularly useful in controlling *Crocidolomia binotalis*, *Hymenia recurvalis*, *Maruca testulalis*, *Nacoleia octasema*, *Susumia exigua*, and/or *Sylepta derogata*.

REFERENCES

Hinckley, A. D. 1963. The rice leafroller, *Susumia exigua* (Butler), in Fiji. J. Econ. Ent. **56** (1): 112–13.

Lever, R. J. A. W. 1945. The larger cabbage moth, *Crocidolomia binotalis* Zell. Agr. J., Fiji **16** (1): 9–10.

O'Connor, B. A. 1949. The banana scab moth, *Nacoleia octasema* Meyr., and its control. *Ibid.* **20** (3): 84–86.

Paine, R. W. 1935. The control of the coconut spike moth (*Tirathaba trichogramma* Meyr.) in Fiji. Fiji Dept. Ag. Bull. 18, 30 pp.

Singh, S. R. 1960. The Hawaiian beet web-worm (*Hymenia recurvalis* F.), a serious pest of Indian spinach (*Amaranthus viridis* L.). Ag. J., Fiji **30** (1): 35–38.