

PARASITES OF *NEZARA VIRIDULA*
(HEMIPTERA: PENTATOMIDAE)
AND OTHER HEMIPTERA IN FLORIDA¹

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ABSTRACT

Trichopoda pennipes (Fab.) (Tachinidae) parasitized *Nezara viridula* (L.) adults (72%) and 4th and 5th instars (19%). It was collected from 8 other hosts in 3 hemipterous families. *Trissolcus basalis* (Wollaston) (Scelionidae) parasitized 45% of *N. viridula* egg masses and was collected from 5 other pentatomid hosts. *Hexacladia hilaris* Burks, *Trissolcus* sp., *Telenomus podisi* Ashmead, *Gryon* sp., *Ooencyrtus submetallicus* (Howard), and *Ooencyrtus* sp. were collected in small numbers from *N. viridula*. Adult parasites of 13 additional hemipterans were recorded. An interesting phoretic parasite, *Telenomus* sp., parasitized freshly laid eggs of its host, *Podisus maculiventris* (Say).

The southern green stink bug, *Nezara viridula* (L.), is an important pest of vegetables and row crops in the southeastern United States. In Australia and Hawaii efforts to control this pest by introducing exotic parasites have been encouraging (Debach 1962, Davis 1964). The possibility of introducing additional parasites of *N. viridula* into Florida needs to be evaluated and additional data on the naturally occurring parasites of this bug are needed. In this paper we record parasites and rates of parasitism observed in *N. viridula* and some other Hemiptera in north central Florida. Biological notes on these parasites are included.

METHODS

ADULT AND NYMPH PARASITES. Stink bug adults and nymphs were collected around Gainesville, FL, from okra, cowpeas, mustard, collards, sunflowers, alfalfa, *Crotalaria* spp., and *Indigofera* spp. Bugs were hand collected during visual inspection of plants or by sweeping the plants with a net at irregular intervals, 1974-75, with weekly collections between July and September 1974. Numbers of tachinid eggs on the bugs were recorded. Bugs were maintained at 25°C in groups of 1-12 in quart jars or 1-5 in petri dishes with fresh green beans and small sections of fresh sweet corn as food. Parasite pupae were collected from the rearing containers and maintained at 25°C in petri dishes with a green bean to provide moisture.

EGG PARASITES. Egg masses oviposited by colonized *N. viridula* on filter paper were placed on cellophane tape and fastened to stakes which were placed in stink bug infested okra, cowpeas, soybeans, or *Indigofera* sp. Egg masses were recovered 4-5 days later and held individually in snap-cap vials for host or parasite emergence. Parasites that were encountered on egg masses

¹Florida Agricultural Experiment Station Journal Series No. 1823.

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in the field were collected separately. *Nezara viridula* egg masses 1-72 h old were placed in the field weekly to attract egg parasites 22 July through 27 August and 7 October through 14 January. *Acrosternum marginatum* (P.B.) eggs were placed in the field together with *N. viridula* eggs 8 November through 23 December. Field collected egg masses of other bugs were also held in snap-cap vials for emerging parasites.

An egg mass was considered parasitized if 1 or more parasites emerged or if a parasite was found on the egg mass in the field.

Trissolcus spp. and *Ooencyrtus* spp. were reared in 2 dram shell vials with sponge stoppers covered with wettable cotton at 25°C. Water and honey were added to the cotton; host eggs (*N. viridula* or *A. marginatum*) were supplied twice each week. *Telenomus* spp. were reared at 25°C in quart or gallon jars containing gravid hosts, *Podisus maculiventris* (Say), and food (honey smeared on the container and a water wick for the parasites; green beans and caterpillars for the host bugs). This allowed the parasites to attack the host eggs as soon as they were oviposited.

Voucher specimens from this study have been deposited in the Florida State Collection of Arthropods, Gainesville, FL.

RESULTS

ADULT AND NYMPH PARASITES. Two parasitic species were collected from *N. viridula* adults and nymphs: *Trichopoda pennipes* (Fab.) and *Hexacladia hilaris* Burks (Table 1). *Hexacladia hilaris* was collected only once. *Trichopoda pennipes* commonly emerged from adults and nymphs; the externally deposited eggs of this parasite were observed on 72% of adults and 19% of 4th and 5th instars (Table 1). This parasite also emerged from 8 other hosts in 3 hemipteran families and was collected commonly from *Acrosternum hilare* (Say), *A. marginatum*, and *Leptoglossus phyllopus* L. (Table 1). Externally laid tachinid eggs (apparently *T. pennipes*) were observed on *Murgantia histrionica* (Hahn.) (40%) and on *Anasa* spp. (29%), but only a few pupae were recovered from the former and none were reared from the latter hosts. Several other parasites emerged from the other hemipteran hosts and a total of 6 different parasites emerged from *Euschistus servus* (Say) (Table 1).

EGG PARASITES. Six species of parasites were collected from *N. viridula* eggs but only *Trissolcus basalis* (Wollaston) was collected consistently. It parasitized ca. 45% of *N. viridula* egg masses placed in the field (Table 2).

Trissolcus basalis had a wide host range and emerged from eggs of 6 pentatomids (Table 2). In the laboratory this parasite was reared in eggs of many additional species of Hemiptera (W. H. Whitcomb, unpublished data). *Trissolcus basalis* parasitized 93% of the eggs in egg masses that it attacked (N = 26). When *N. viridula* and *A. marginatum* eggs were placed side by side in the field in November and December, *T. basalis* parasitized 10 of 65 *N. viridula* egg masses (15.4%) and 5 of 56 *A. marginatum* egg masses (8.9%). *Trissolcus basalis* was maintained in the laboratory for many generations on *N. viridula* and *A. marginatum* eggs.

The parasite here referred to as *Trissolcus* sp. B appears to be an undescribed species. It seems to be common and was collected from eggs of 5 pentatomids (Table 2). In the fall, females of this parasite sometimes were found on *N. viridula* eggs, but parasites emerged from these eggs only once.

TABLE 1. PARASITES EMERGING FROM 14 SPECIES OF HEMIPTERA COLLECTED IN NORTH CENTRAL FLORIDA (ADULTS UNLESS NYMPHS INDICATED).

Hosts	TACHINIDAE*										ENCYRTIDAE*					
	No. hosts held for parasites	% hosts with tachinid eggs	<i>Beskia aelops</i> (Walker)	<i>Cylindromyia binotata</i> (Bigot)	<i>C. euchenor</i> (Walker)	<i>C. fumipennis</i> Bigot	<i>Euclytia flava</i> (Townsend)	<i>Euclytia</i> sp.	<i>Euthera tentatrix</i> Loew	<i>Gymnoclytia unicolor</i> (Brooks)	<i>Hemysda aurata</i> Robineau-Desvoidy	<i>Trichopoda lanipes</i> (Fab.)	<i>T. pennipes</i> (Fab.)	<i>Hexacladia hilaris</i> Burks	<i>H. leptoglossi</i> Burks	<i>H. smithi</i> Ashmead
PENTATOMIDAE																
<i>Acrosternum hilare</i> (Say)	13	31	—	—	—	—	—	—	—	—	—	—	6	—	—	—
<i>A. marginatum</i> (P.B.)	150	—	—	—	—	—	—	—	17	1	—	—	a*	—	—	1
<i>Euschistus servus</i> (Say)	130	—	—	3	9	1	—	—	—	—	—	—	—	—	—	—
<i>Euthyrhynchus floridanus</i> (L.)	10	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—
<i>Murgantia histrionica</i> (Hahn)	150	40	—	—	—	—	—	—	—	—	—	—	5	—	—	—
<i>Nezara viridula</i> (L.) (adults)	1400	72	—	—	—	—	—	—	—	—	—	—	a	1	—	—
— (nymphs)	400	19	—	—	—	—	—	—	—	—	—	—	40	—	—	—
<i>Piezodorus guildinii</i> (Westw.)	40	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—
<i>Podisus maculiventris</i> (Say)	30	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—
<i>Oebalus pugnax</i> (Fab.)	20	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—
<i>Thyanta custator</i> (Fab.)	20	—	—	—	—	—	1	1	—	—	—	—	1	—	—	—

TABLE 1. CONTINUED

Hosts	TACHINIDAE*										ENCYRTIDAE*					
	No. hosts held for parasites	% hosts with tachinid eggs	<i>Beskia aelops</i> (Walker)	<i>Cylindromyia bimotata</i> (Bigot)	<i>C. euchenor</i> (Walker)	<i>C. fumipennis</i> Bigot	<i>Euclytia flava</i> (Townsend)	<i>Euclytia</i> sp.	<i>Euthera tentatrix</i> Loew	<i>Gymnoclytia unicolor</i> (Brooks)	<i>Hemysda aurata</i> Robineau-Desvoidy	<i>Trichopoda lanipes</i> (Fab.)	<i>T. pennipes</i> (Fab.)	<i>Hexacladia hilaris</i> Burks	<i>H. leptoglossi</i> Burks	<i>H. smithi</i> Ashmead
COREIDAE																
<i>Acanthocephala femorata</i> (Fab.)	20	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—
<i>Anasa</i> spp.**	16	29	—	—	—	—	—	—	—	—	—	—	—	—	1	—
<i>Leptoglossus phyllopus</i> (L.)	450	24	—	—	—	—	—	—	—	—	—	—	3	—	—	—
ALYDIDAE																
<i>Alydus eurinus</i> (Say)	10	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—

*Number of parasites collected from respective hosts (adults unless nymphs indicated), or "a" parasites collected routinely but counts are missing.
 ***Anasa armigera* (Say) and *A. andresii* (Guerin) in about equal numbers.

[illegible]

TABLE 2. CONTINUED

Hosts	Source	No. egg masses	% egg masses parasitized	<i>Trissolcus basalis</i> (Wollaston)	<i>Trissolcus</i> sp. B	<i>Trissolcus</i> sp. E	<i>Telenomus podisi</i> Ashmead	<i>Telenomus</i> sp. #2	<i>Telenomus</i> sp. #4	<i>Telenomus</i> sp. #5	<i>Gryon</i> n. sp.	<i>Ooencyrtus submetallicus</i> (Howard)	<i>Ooencyrtus</i> sp. D	<i>Amastratus</i> sp.
	Lab	71	3	2	—	—	—	—	—	—	1	—	—	—
	2-XII													
	3-II													
<i>Piezodorus guildinii</i>	Field	4	50	1	—	—	1	—	—	—	—	—	—	—
(Westw.)														
<i>Podisus maculiventris</i>	Field	22	91	4	2	—	12	3	1	—	3	—	—	1
(Say)														

*Number of parasitized egg masses.

It appears to be an important parasite of *Acrosternum* spp., *M. histrionica*, and *Alcaeorrhynchus grandis* (Dall.). When *N. viridula* and *A. marginatum* egg masses were placed side by side in the field in November and December, *Trissolcus* sp. B parasitized 10 of 56 *A. marginatum* egg masses (17.9%). It was also found on 5 of 65 *N. viridula* egg masses (7.7%). This parasite was reared for ca. 10 generations on *M. histrionica* eggs.

The parasite here referred to as *Gryon* sp. G also appears to be an undescribed species. This parasite was not reared from *N. viridula* eggs, but 1 female was found on a field-exposed egg mass. Females also were found on 2 field collected egg masses (Table 2).

Telenomus podisi Ashm. was collected from 4 *N. viridula* egg masses (Table 2), but less than 10% of these eggs were parasitized. It was the most common parasite of *P. maculiventris* eggs (Table 2). We were unable to propagate *T. podisi* on 1-24 h-old eggs of *N. viridula*, but 1 generation was reared on eggs of *P. maculiventris*.

The parasite here referred to as *Telenomus* sp. 2 appears to be an undescribed species. It was reared only from *P. maculiventris* eggs. Females were found on the bodies of 6 gravid *P. maculiventris* females (phoretic behavior). On 1 occasion, 3 of 4 female *P. maculiventris* collected in a soybean field had phoretic parasites. When these parasites were added to a cage containing *P. maculiventris*, they mounted gravid females and remained on their bodies for several days. They would cling to different parts of the body, changing positions occasionally, but were most frequently found on the pronotum. They were observed on male bugs only momentarily. At times the host would perform thrashing and rubbing movements which sometimes dislodged the parasites. When the host oviposited, the parasite dismounted and oviposited in the freshly laid eggs. The parasites did not mount a gravid *Podisus fretus* Olsen or a gravid *Euthryhynchus floridanus* (L.). They appeared to oviposit in *E. floridanus* eggs, but neither host nor parasite emerged from the eggs. *Telenomus* sp. 2 was reared for 3 generations on *P. maculiventris* eggs. Individual parasites survived only 5-6 days. They did not parasitize 1-24 h-old eggs of *N. viridula*, *A. marginatum*, or *M. histrionica*. A field-collected female *P. maculiventris* with a phoretic parasite oviposited 22, 17 and 30 eggs on successive days. Of these eggs, 22, 17 and 15 were parasitized. The sex ratio of parasites emerging from the first egg mass was 1 ♂:10 ♀.

The parasite here referred to as *Ooencyrtus* sp. D is not readily refferable to any described species. This parasite emerged from field-exposed and field-collected eggs of *N. viridula* and *Alcaeorrhynchus grandis*. It developed readily in *N. viridula* eggs but it was collected infrequently.

Ooencyrtus submetallicus (Howard) was collected only from field-exposed *N. viridula* eggs. This parasite was reared for more than a year on *N. viridula* and *A. marginatum* eggs and also from eggs of *Anasa* spp., *E. servus*, *M. histrionica*, *Acanthocephala femorata* (Fab.), and *E. floridanus*. The sex ratio of parasites emerging from 8 *N. viridula* egg masses varied from 1 ♂:5 ♀ to 1 ♂:3.5 ♀. Unmated females produced only male progeny.

DISCUSSION

The southern green stink bug, *N. viridula*, has 2 important parasites in north central Florida: *Trichopoda pennipes*, which parasitizes adults and

nymphs, and *Trissolcus basalis*, which parasitizes eggs. Both parasitize a variety of other hosts and are well known parasites of *N. viridula*. These 2 species were introduced as bio-control agents of *N. viridula* in Australia and Hawaii (Debach 1962, Davis 1964). The other parasites collected from *N. viridula* in Florida appear to be only incidental and they probably have other primary hosts which were not identified in this study. They were usually collected in October and November on laboratory eggs placed in the field (Table 2). At this time most native hemipterans were probably in reproductive diapause so the laboratory produced eggs would be the only hemipteran eggs available in the field.

Drake (1920) reported that ca. 6% of *N. viridula* in Gainesville were killed by *Sarcodexia sternodontis* (Townsend) (Sarcophagidae). We did not collect this parasite. Miller (1928) reported collecting *Telenomus megacephalus* Ashm. (= *Trissolcus basalis*) from 30 of 35 *N. viridula* egg masses and from *E. servus* and *E. floridanus* egg masses collected near Lake Alfred, FL. Other infrequently collected parasites of *N. viridula* were also reported by Drake (1920) and Miller (1928).

The eggs of the 2 predaceous pentatomids, *Podisus maculiventris* and *Alcaeorrhynchus grandis*, were heavily parasitized. A total of 7 species of parasites emerged from *P. maculiventris* eggs and only 2 of 21 egg masses were unparasitized. Two species of parasites emerged from *A. grandis* eggs and only 1 of 6 egg masses produced any host nymphs. This situation deserves further study. The occurrence of phoretic parasites in Hemiptera has been reported only in Africa and Sumatra (Clausen 1976).

Our observations on *Ooencyrtus submetallicus* differ from those of Wilson and Woolcock (1960). They studied *O. submetallicus* obtained from the West Indies and reported that it reproduced by thelytokous parthenogenesis (unmated females produce only female offspring). The Florida strain reproduced by arrhenotokous parthenogenesis (unmated females produce only male offspring). Legner and Bay (1965) collected *O. submetallicus* from pupae of *Hippelates pusio* Loew (Diptera: Chloropidae) in Puerto Rico. The biology, host relationships, and taxonomy of this parasite need further study.

ACKNOWLEDGEMENTS

Tachinid parasites were identified by C. W. Sabrosky, Systematic Entomology Laboratory, USDA-SEA. The hymenopterous parasites were identified by E. E. Grissell, Florida State Collection of Arthropods now at Systematic Entomology Laboratory, USDA-SEA, and C. F. W. Muesebeck, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

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**ATOPOPHLEBIA FORTUNENSIS, A NEW GENUS
AND SPECIES FROM PANAMÁ
(LEPTOPHLEBIIDAE: EPHEMEROPTERA)**

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ABSTRACT

Atopophlebia fortunensis, a new genus and species of the Leptophlebiidae is described from the mountains of western Panamá.

A collection of mayflies from Panamá donated by Dr. Charles W. O'Brien to Florida A&M University contains 2 male imagos of a new genus and species of Leptophlebiidae. The specimens were collected in median elevation tropical wet forest near the summit of Cerro Fortuna in Chiriquí Province.

In the following description, the venational terminology is that given in Peters and Edmunds (1970). Each segment of the fore legs of the male imago is compared to the length of the fore tibia and expressed as a ratio, while the length in millimeters of the fore tibia is given in parentheses.

I thank Drs. Charles W. and Lois B. O'Brien and Mr. George B. Marshall for the specimens and Drs. William L. Peters and Manuel L. Pescador and Mrs. William L. Peters for their useful suggestions on the preparation of this paper. This research was supported by a research project (FLAX 79009) of SEA/CR, USDA, to Florida A&M University, William L. Peters, Research Leader.

Genus *Atopophlebia* Flowers, NEW GENUS

(Fig. 1-10)

MALE IMAGO: *Length:* body, 9.1-9.7mm; fore wings, 9.3-9.9mm. Eyes (Fig. 8-9 separated on meson of head by slightly less than width of median ocellus, upper portion of eyes oval, on short stalk; lower portion of eyes 7/10 length of upper portion, dorsally contiguous with upper portion; width of lateral ocelli 2/5 width of upper portion of eye. *Wings* (Fig. 1-3): maximum