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NATURAL ENEMIES OF CRANBERRY FRUITWORM, 
ACROBASIS VACCINII, (LEPIDOPTERA: PYRALIDAE) 
in Michigan highbush blueberries

Douglas A. Murray1, Robert D. Kriegel2, James W. Johnson3, 
and Angus. J. Howitt4

ABSTRACT

A two-year study was conducted in Michigan highbush blueberries to determine the complex of parasitoids attacking cranberry fruitworm, Acrobasis vaccinii. Eight parasitoid species and one fungal pathogen were collected. Parasitism of collected hosts ranged from 6.6% to 28.1%. The more common larval parasitoid encountered was Campoletis patsuietorum (Hymenoptera: Ichneumonidae). The more common parasitoid recovered from fruitworm hibernacula was Villa lateralis (Diptera: Bombyliidae). This study documented six unreported natural enemies of cranberry fruitworm, including C. patsuietorum; V. lateralis; Diadegma compressum (Hymenoptera: Ichneumonidae); Compsilura concinnata (Diptera: Tachinidae); Memorilla pyste (Diptera: Tachinidae); an undescribed Microtypus species (Hymenoptera: Braconidae); and a fungal pathogen, Paecilomyces near farinosus. This is the first known host association for the undescribed Microtypus species, and increases the known parasitoid complex of cranberry fruitworm to 17 species.

Cranberry fruitworm, Acrobasis vaccinii Riley, (Lepidoptera: Pyralidae) is a serious direct pest in cultivated blueberry plantings, destroying as much as 50% of the crop (Pritts et al. 1992). Fruitworm damage can be more severe in cranberry bogs, with larval damage exceeding 80% in some untreated fields (Maxwell & Morgan 1951). This pest is distributed throughout North America, impacting fields from Nova Scotia to Florida and westward to Wisconsin and Texas (Neunzig 1986). Following its accidental introduction in the early 1920s, cranberry fruitworm also became established in the Pacific Northwest (Crowley 1954).

Throughout most of its range, A. vaccinii has one generation per year. In Michigan, flight begins in late May or early June and lasts up to eight weeks. Eggs are laid on the fruit, usually in the calyx cup. Cranberry fruitworm larvae feed internally and require multiple blueberries to complete development. Each larva webs several blueberries, thereby rendering an entire cluster unmarketable. Developed larvae drop to the ground to spin overwintering cocoons (hibernacula) in the soil near the base of bushes. Pupation occurs in the spring.

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Cranberry fruitworm populations in Michigan blueberry plantings are controlled by petal-fall applications of azinphosmethyl, phosmet, carbaryl, and methomyl. Insecticidal applications could be reduced by identifying indigenous biological control agents present in blueberry fields. Information about the identity and abundance of such natural enemies could provide an impetus for the use of more selective chemicals or other strategies to conserve, or augment, beneficial insects. For example, in Massachusetts, inundative release of the hymenopterous parasitoid, *Trichogramma* to control *A. vaccinii* was evaluated (Simser 1995).

The objective of this report was to document the parasitoid complex attacking cranberry fruitworm on highbush blueberry in Michigan. This research was part of a larger study to investigate the biology and control of *A. vaccinii* in commercial blueberry fields (Murray 1990).

**MATERIALS AND METHODS**

Host collections were made during 1986 and 1987 at two cultivated blueberry fields in Southwest Michigan. The Douglas site was a 1.6-ha., mature highbush blueberry field (*Vaccinium corymbosum* cv. Jersey) located at the southern edge of Douglas, MI (T3N, R16W, Sec. 21). The planting was part of the Douglas Farm unit of the Trevor Nichols Research Complex (Mich. State Univ. Agric. Exp. Stn.). The Holland site was a 4 year, 0.7-ha. commercial blueberry planting north of Holland, MI (T6N, R16W, Sec. 27) with bushes ca. 1 m in height.

During spring 1986, cranberry fruitworm hibernacula were collected ca. 15 times from the Douglas site to provide specimens for pheromone isolation and identification (McDonough et al. 1994). Records of natural enemies were kept for two collections during late April and early May. Hibernacula were collected by removing soil around each bush (5 x 30 cm radius). Forty eight bushes were sampled on each date. Each sample was sifted through three screens (3.2, 1.6, and 0.04 mm mesh). Hibernacula accumulating in the middle tray were examined for parasitoids. The end of each cocoon was cut and the pupa removed to determine its identity. Parasitoid pupae were incubated individually in test tubes at ambient temperature until emergence.

Larvae were sampled from the Holland site during the last week of June 1986 by searching the entire field for damaged fruit clusters. Damaged clusters were held over sand in 11.4 liter containers to permit larvae to complete development and spin hibernacula. Hibernacula were removed and examined for parasitoids. All parasitoids were incubated individually in cork stoppered test tubes until they emerged.

Between 1–10 June 1987, developing fruit at the Douglas site were examined for *A. vaccinii* eggs. Eggs that were black and apparently parasitized were placed in petri dishes (60 x 15 mm) and stored at ambient temperature until host or parasitoid emergence.

Voucher specimens of all parasitoid species collected during this study were deposited at the Center for Arthropod Diversity Study, Department of Entomology, Michigan State University, East Lansing, MI.

**RESULTS**

Sampling of hibernacula from the Douglas site in 1986 yielded a diverse set of natural enemies. The first sample of 213 hibernacula produced 19 parasitoids. Seventeen individuals were *Villa lateralis* (Say) (Diptera: Bombyli-
idae) and two were *Compsilura concinnata* (Meigen) (Diptera: Tachinidae). A second sample of 136 hibernacula contained nine parasitoids. All were *V. lateralis*. During mass rearing of over 1,000 field collected hibernacula for pheromone isolation studies, four additional parasitoids were identified: *Diacodexis compressum* (Cresson) (Hymenoptera: Ichneumonidae), *Bassus usitatus* Gahan (Hymenoptera: Braconidae), *Memorilla pyste* (Walker) (Diptera: Tachinidae), and an undescribed species of *Microtypus* (Hymenoptera: Braconidae). The *Microtypus* species represents the first known host/parasite association between these species (Dr. Scott Shaw, personal communication).

The sample of 278 larvae collected in June 1986 from the Holland site included 78 ichneumonid parasitoids (28.1% parasitism). Eighty percent of these parasitoids were *Campoletis patsuikeorum* Viereek. The remainder were *Cryptus albitarsis* (Cresson).

Of 175 eggs collected from the Douglas site during June 1987, 9.7% (17/175) were parasitized. Several minute Hymenoptera emerged but escaped before being identified. Individuals that were examined microscopically prior to their escape appeared to be *Trichogramma*.

One fungal pathogen was encountered repeatedly during the course of this study. This soil borne fungus, *Paecilomyces near farinosus* (Holm ex. S. F. Grey), attacked larvae within hibernacula (Murray 1990). In four field samples collected during spring 1986, between 6% to 21% (mean=14.8%) of cranberry fruitworm hibernacula were infected.

**DISCUSSION**

During this study, eight parasitoids and one pathogenic fungus were collected. The parasitoids included three ichneumonids, two braconids, two tachinids, and a bombyliid (Table 1). Of these, two species had been recorded previously as parasitoids of cranberry fruitworm (*C. albitarsis* and *B. usitatus*). *Cryptus albitarsis* was previously reported as a parasitoid of overwintering cranberry fruitworm larvae in New Brunswick, Canada, by Maxwell & Morgan (1951). Cranberry fruitworm was listed as a host of *Bassus usitatus* in the Hymenoptera catalog of North America (Musesbeek et al. 1951, Krombein et al. 1979).

Six parasitoids collected during this study had not been recorded as attacking cranberry fruitworm, including *C. patsuikeorum*, *D. compressum*, *V. lateralis*, *C. concinnata*, *M. pyste*, and *Microtypus* sp., increasing the known parasitoid complex for cranberry fruitworm to 17 species. For the undescribed *Microtypus* species, this report was the first recorded host/parasite association.

The bee fly, *Villa lateralis*, has been reported as parasitizing five other Lepidoptera species including *Synanthedon exitiosa* (Say) (Snapp & Thomson 1943), *Filatima persicaeella* (Murt.) (Ingerson 1918), *Agrotis orthogonia* Morr. (Pack 1930), *Euxoa ochrogaster* (Gn.) (King & Atkinson 1928), and *Plathypena scabra* (F.) (Sherman 1920, Brimley 1921). Hull (1973) observed *V. lateralis* ovipositing on open soil. One characteristic these host species share is that their larvae or pupae are found at or just beneath the soil surface. Although we do not know when *V. lateralis* parasitizes *A. vaccinii*, these observations suggest that cranberry fruitworm larvae are attacked after they leave their host plant to burrow into the soil.

The tachinid flies, *C. concinnata* and *M. pyste*, are generalists, primarily attacking immature Lepidoptera. *Compsilura concinnata* was imported into the United States from Europe as a biological control agent of the gypsy moth, *Lymantria dispar* (L.) (Culver 1919). It has since been reared from nearly 200
Table 1. Parasitoids of cranberry fruitworm, *Acrobasis vaccinii* Riley.

<table>
<thead>
<tr>
<th>Taxon</th>
<th>Lifestage Attacked</th>
<th>Species Distribution ¹</th>
<th>Previous Citations with Cranberry Fruitworm as a Host</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOMBYLIIDAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Villa lateralis</em> (Say) ²</td>
<td>pupa?</td>
<td>throughout North America</td>
<td></td>
</tr>
<tr>
<td><strong>TACHINIDAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Compsilura concinnata</em> (Meigen) ²</td>
<td>larva</td>
<td>Quebec south to Connecticut, west to Ontario &amp; Michigan, Pacific Northwest</td>
<td>Muesebeck &amp; Walkley 1951, Marsh 1979</td>
</tr>
<tr>
<td><em>Memorilla pyste</em> (Walker) ²</td>
<td>pupa</td>
<td>throughout North America, Caribbean</td>
<td></td>
</tr>
<tr>
<td><strong>BRACONIDAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bassus usitatus</em> Gahan ²</td>
<td>pupa</td>
<td>Massachusetts, Michigan</td>
<td>Muesebeck &amp; Walkley 1951, Marsh 1979</td>
</tr>
<tr>
<td><em>Bracon mellitor</em> Say</td>
<td>larva</td>
<td>continental U.S., Mexico and Hawaii</td>
<td>Marsh 1979</td>
</tr>
<tr>
<td><em>Microtypus</em> sp.²</td>
<td>pupa</td>
<td>Michigan</td>
<td></td>
</tr>
<tr>
<td><em>Phanerotoma franklini</em> Gahan</td>
<td>egg</td>
<td>Canadian maritime provinces south to Florida, west to Illinois and Texas</td>
<td>Franklin &amp; Morse 1914, Franklin 1915, Maxwell &amp; Morgan 1951, Muesebeck &amp; Walkley 1951, Marsh 1979, Brodel &amp; Roberts 1985</td>
</tr>
<tr>
<td><strong>ICHNEUMONIDAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Campoietis patsuiketorum</em> Viereek ²</td>
<td>larva</td>
<td>U.S. transition zone</td>
<td>Maxwell &amp; Morgan 1951</td>
</tr>
<tr>
<td><em>Cryptus albitarsis</em> (Cresson) ²</td>
<td>larva</td>
<td>throughout North America</td>
<td></td>
</tr>
<tr>
<td><em>Diadegma compressum</em> (Cresson) ²</td>
<td>pupa</td>
<td>southern California, Maine, Michigan, S. Dakota, Texas, Utah, and Virginia</td>
<td>Carlsoon 1979</td>
</tr>
<tr>
<td><em>Diadegma parviforme</em> (Viereek)</td>
<td></td>
<td>Mass., south to Miss., west to southern British Columbia and Texas</td>
<td>Carlsoon 1979</td>
</tr>
<tr>
<td><em>Enytus eureka</em> (Ashmead)</td>
<td></td>
<td>British Columbia to S. California</td>
<td>Van Driesche &amp; Brodel 1987</td>
</tr>
<tr>
<td><em>Orgilus lateralis</em> (Cresson)</td>
<td></td>
<td>Quebec south to Florida, west to Ontario and Texas, California, Mexico</td>
<td></td>
</tr>
<tr>
<td><em>Pristomerus australis</em> Townes &amp; Townes</td>
<td>egg</td>
<td>North America from Atlantic coast to 100°W longitude</td>
<td>Franklin 1915, Townes &amp; Townes 1951, Carlson 1979</td>
</tr>
<tr>
<td><em>Pristomerus spinator</em> (F.)</td>
<td>egg</td>
<td>Mass. south to Florida, California, Hawaii, Central America, Brazil</td>
<td>Carlson 1979</td>
</tr>
<tr>
<td><strong>TRICHOGRAMMATIDAE</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Trichogramma pretiosum</em> Riley</td>
<td>egg</td>
<td>southern Canada, U.S. except for Southwest and deep South</td>
<td></td>
</tr>
</tbody>
</table>


² Parasitoids collected during the present study.
species of Lepidoptera in North America (Doane & McManus 1981). The majority of host records for *M. pyste* are within the families Pyralidae and Tortricidae (Arnaud 1979). Including the data here, *M. pyste* has been reported as a larval parasitoid from seven of ten North American species of *Acrobasis*. This tachinid has also been recorded from three tortricid moths found in Michigan highbush blueberry plantings, *Choristoneura rosaceana* (Harris), *Sparganothis sulfureana* (Clemens), and *Argyrotaenia velutinana* (Walker) (Arnaud 1979).

**ACKNOWLEDGMENTS**

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**LITERATURE CITED**


