The Great Lakes Entomologist

Volume 29
Number 2 - Summer 1996 *Number 2 - Summer 1996*
Article 4

June 1996

Natural Enemies of Cranberry Fruitworm, *Acrobasis Vaccinii*, (Lepidoptera: Pyraudae) in Michigan Highbush Blueberries

Dogulas A. Murray
Murray Pest Management

Robert D. Kriegel
Michigan State University

James W. Johnson

Angus J. Howitt
Michigan State University

NATURAL ENEMIES OF CRANBERRY FRUITWORM, *ACROBASIS VACCINII*, (LEPIDOPTERA: PYRALIDAE) IN MICHIGAN HIGHBUSH BLUEBERRIES

Douglas A. Murray[1], Robert D. Kriegel[2], James W. Johnson[3], and Angus. J. Howitt[4]

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 patsuiketorum* (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. patsuiketorum*; *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.

[1]Murray Pest Management, 45670 64th Av., Paw Paw, MI 49079.

[2]Department of Entomology, Rm. 243 Natural Science Bldg., Michigan State University, East Lansing, MI 48824-1115.

[3]Merck AgVet, 317 East Elm St., Mason, MI 48854.

[4]Professor emeritus, Michigan State University.

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 corymbosm* 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 × 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: *Diadegma 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 patsuiketorum* 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 (Musesbeck et al. 1951, Krombein et al. 1979).

Six parasitoids collected during this study had not been recorded as attacking cranberry fruitworm, including *C. patsuiketorum*, *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.

Taxon	Lifestage Attacked	Species Distribution [1]	Previous Citations with Cranberry Fruitworm as a Host
BOMBYLIIDAE			
Villa lateralis (Say) [2]	pupa?	throughout North America	
TACHINIDAE			
Compsilura concinnata (Meigen) [2]	larva	Quebec south to Connecticut, west to Ontario & Michigan, Pacific Northwest	
Memorilla pyste (Walker) [2]	pupa	throughout North America, Caribbean	
BRACONIDAE			
Bassus usitatus Gahan [2]	pupa	Massachusetts, Michigan	Muesebeck & Walkley 1951, Marsh 1979
Bracon mellitor Say	larva	continental U.S., Mexico and Hawaii	Marsh 1979
Microtypus sp.[2]	pupa	Michigan	
Phanerotoma franklini Gahan	egg	Canadian maritime provinces south to Florida, west to Illinois and Texas	Franklin & Morse 1914, Franklin 1915, Maxwell & Morgan 1951, Muesebeck & Walkley 1951, Marsh 1979, Brodel & Roberts 1985
ICHNEUMONIDAE			
Campoletis patsuiketorum Viereek [2]	larva	U.S. transition zone	
Cryptus albitarsis (Cresson) [2]	larva	throughout North America	Maxwell & Morgan 1951
Diadegma compressum (Cresson) [2]	pupa	southern California, Maine, Michigan, S. Dakota, Texas, Utah, and Virginia	
Diadegma parviforme (Viereck)		Mass., south to Miss., west to southern British Columbia and Texas	Carlson 1979
Enytus eureka (Ashmead)		British Columbia to S. California	Carlson 1979
Orgilus lateralis (Cresson)		Quebec south to Florida, west to Ontario and Texas, California, Mexico	Van Driesche & Brodel 1987
Pristomerus austrinus Townes & Townes	egg	North America from Atlantic coast to 100°W longitude	Franklin 1915, Townes & Townes 1951, Carlson 1979
Pristomerus spinator (F.)	egg	Mass. south to Florida, California, Hawaii, Central America, Brazil	Carlson 1979
TRICHOGRAMMATIDAE			
Trichogramma minutum Riley	egg	throughout North America	Franklin 1915, Peck 1951, Van Driesche & Brodel 1987
Trichogramma pretiosum Riley	egg	southern Canada, U.S. except for Southwest and deep South	Franklin 1950, Van Driesche & Brodel 1987, Simser 1995

[1] Distribution for each species from any host (Muesebeck et al. 1951, Hull 1973, Arnaud 1978, and Krombein et al. 1979).
[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

We thank John Nelson and the Michigan Blueberry Growers Association for their support during this study. Sincere thanks to the staff at Trevor Nichols Research Complex (Matt Daley, Dr. David Biddinger, and Janis Howard) for their assistance in conducting this work. Without their efforts this research would not have been possible. We acknowledge "The Center for Insect Identification" and the following researchers for their assistance in identifying parasitoids of cranberry fruitworm: Dr. Lloyd Knutson (Bombyliidae), Dr. Scott R. Shaw (Braconidae), Dr. Henry Townes (Ichneumonidae), and Dr. Monty Wood (Tachinidae). Finally, thank you to Dr. Neal Evenhuis for providing last minute host association information for *Villa lateralis*.

LITERATURE CITED

Arnaud Jr., P. H. 1978. A host-parasite catalog of North American Tachinidae (Diptera). USDA Miscell. Pub. No. 1319. 860p.

Brimley, C. D. 1921. The bee flies of North Carolina (Bombyliidae, Dip.). Ent. News. 32:170–172.

Brodel, C. F., and S. L. Roberts. 1985. The cranberry fruitworm. Cranberry Experiment Station Publication. East Wareham, MA.

Carlson, R. W. 1979. Ichneumonidae, pp. 315–739. *In*: Krombein, K. V., P. D. Hurd Jr., D. R. Smith, and B. D. Burks (Eds.). Hymenoptera of America North of Mexico, Synoptic catalog. Smithsonian Institution Press: Washington, D.C.

Crowley, D. J. 1954. Cranberry growing in Washington. Wash. Agric. Exp. Sta. Bull. 554. 30p.

Culver, J.J. 1919. A study of *Compsilura concinnata*, an imported tachinid parasite of the gipsy moth and the brown-tail moth. U.S. Dept. of Agric. Bull. No. 766.

Doane, C. C., and M. L. McManus (Eds.). 1981. The gypsy moth: research toward integrated pest management. U.S. Dep. Agric. Bull. No. 1584. p. 350.

Franklin, H. J., and F. W. Morse. 1914. Report on experimental work in connection with cranberries. Mass. Agric. Exp. Sta. Bull. 150. 68p.

Franklin, H. J. 1915. Report of cranberry substation for 1914. Mass. Agric. Exp. Sta. Bull. 160. 117p.

Hull, F. M. 1973. Bee flies of the world: The genera of the family Bombyliidae. Smithsonian Institution Press: Washington, D.C., p. 369–374.

Ingerson, H. G. 1918. Striped peach worm. Bull. USDA. 599:1–14.

King, K. M., and N. J. Atkinson. 1928. The biological control factors of the immature stages of *Euxoa ochrogaster* Gn. (Lepidoptera, Phalaenidae) in Saskatchewan. Ann. Entomol. Soc. Amer. 21:167–188.

Krombein, K. V., P. D. Hurd Jr., D. R. Smith, and B. D. Burks (Eds.). 1979. Hymenoptera of America North of Mexico, Synoptic catalog. Smithsonian Institution Press: Washington, D.C.

Marsh, P. M. 1979. Braconidae, pp. 144–294. *In*: Krombein, K. V., P. D. Hurd Jr., D. R.

Smith, and B. D. Burks (Eds.). Hymenoptera of America North of Mexico, Synoptic catalog. Smithsonian Institution Press: Washington, D.C.

Maxwell, C. W., and G. T. Morgan. 1951. Life-history studies of the cranberry fruitworm, *Mineola vaccinii* (Riley), in New Brunswick (Lepidoptera: Pyralidae). Entomol. Soc. Ont. Ann. Rep. 82:21–25.

McDonough, L. M., A. L. Averill, H. G. Davis, C. L. Smithhisler, D. A. Murray, P. S. Chapman, S. Voerman, L. J. Dapsis, and M. M. Averill. 1994. Sex pheromone of cranberry fruitworm, *Acrobasis vaccinii* Riley (Lepidoptera: Pyralidae). J. Chem. Ecol. 20(12):3269–3279.

Murray, D. A. 1990. The biology, behavior, and control of *Acrobasis vaccinii* (Lepidoptera: Pyralidae) in blueberries in southwest Michigan. M.S. Thesis. Mich. State Univ. East Lansing, MI 48824. 96p.

Muesebeck, C. F. W., K. V. Krombein, and H. K. Townes. 1951. Hymenoptera of America north of Mexico, Synoptic catalog. USDA Agric. Mongr. #2.

Muesebeck, C. F. W., and L. M. Walkley. 1951. Braconidae, pp. 90–184. *In*: Muesebeck, C. F. W., K. V. Krombein, and H. K. Townes. Hymenoptera of America north of Mexico, Synoptic catalog. USDA Agric. Mongr. #2.

Neunzig, H. H. 1986. The Moths of America North of Mexico. Fascicle 15.2 Pyraloidae: Pyralidae (part): Phycitinae (part-Acrobasis and allies). Wedge Entomol. Res. Foundation. p.12–24.

Pack, H. J. 1930. Notes on miscellaneous insects of Utah. Bull. Utah Agric. Exp. Sta. 216:1–30.

Peck, O. 1951. Chalcidoidea. pp. 410–594. *In*: Muesebeck, C. F. W., K. V. Krombein, and H. K. Townes. Hymenoptera of America north of Mexico. Synoptic catalog. USDA Agric. Mongr. #2.

Pritts, M. P., and J. F. Hancock (eds.). 1992. Highbush blueberry production guide. Northeast Regional Agricultural Engineering Service: Ithaca, N. Y. 200p.

Sherman, F. 1920. The green clover worm (*Plathypena scabra* Fabr.) as a pest on soy beans. J. Econ. Ent. 13:295–303.

Simser, D. 1995. Parasitism of cranberry fruitworm (*Acrobasis vaccinii*; Lepidoptera: Pyralidae) by endemic or released *Trichogramma pretiosum* (Hymenoptera: Trichogrammatidae). Great Lakes Entomol. 27(4):189–196.

Snapp, O. I., and J. R. Thomson. 1943. Life history and habits of the peachtree borer in the Southeastern states. Tech. Bull. USDA. 854:1–24.

Townes, H., and M. Townes. 1951. Ichneumonidae, pp. 184–409. *In:* Muesebeck, C. F. W., K. V. Krombein, and H. K. Townes. Hymenoptera of America north of Mexico. Synoptic catalog. USDA Agric. Mongr. #2.

Van Driesche, R. G., and W. Brodel. 1987. Potential for increased use of biological control agents in Massachusetts cranberry bogs. Mass. Agric. Exp. Sta. Bull. 718:35–44.