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Biological Control in Dominica

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Abstract

Introduction of two tachinid parasitoid species in 1951 for biocontrol of the sugarcane borer resulted in good control. Native and imported parasitoids were evaluated in the 1960s for control of fruit flies and noctuid moths on various fruits in Dominica, but none of them was effective. Several other imports of exotic natural enemies in this period for classical biocontrol of banana weevil, coffee leaf miner and diamondback moth were not successful. Complete island-wide control of the citrus blackfly was obtained after releases of two exotic parasitoids at the end of the 1990s.

11.1 Introduction

Dominica has an estimated population of about 73,900 (July 2017). Its economy was in the past dependent on agriculture, with banana, citrus and mango as main crops, and more recently on ecotourism (CIA, 2017). The material for this chapter mainly originates from Cock (1985) and articles therein.

11.2 History of Biological Control in Dominica

11.2.1 Period 1880–1969

Fruit flies

In the early 1960s during a visit to Dominica, F.D. Bennett reported damage to mangoes, citrus, guava and hog plums (*Spondias mombin* L.) by the fruit fly *Anastrepha obliqua* Macquart (reported as *A. mombinpraeproptans* Sein) and by fruit-piercing noctuid moths (*Gonodonta* spp.). He found the native *Opius anastrephae* Vier. to have parasitized *A. obliqua*. Parasitoids (*Aceratoneuromyia indica* Silvestri, *Doryctobracon crawfordi* (Vier.), *Biosteres longicaudatus* (Ashmead)) were imported from Mexico, via the CIBC station in Trinidad, mass reared and released. Later, in 1964 and 1965, other parasitoid species (*Doryctobracon trinidadensis* (Gah.), *D. cereus* (Gah), *Ganaspis* sp., *Opius bellus* (Gah.) and *Pachycrepoides vindemiae* Rondani) were sent from Trinidad and released. None of these parasitoids exerted sufficient control (Cock, 1985).

Banana weevil

The most important pest of banana in the Caribbean is the banana weevil, or banana borer, *Cosmopolites sordidus* (Germ.). Biocontrol attempts with the predatory beetles *Hololepta*

(= *Leionota quadridentata* (F.) and *Plaesius javanus* Erichs., both sent in the 1950s from Trinidad, failed because the natural enemies did not establish, but a native *Dactylosternum* sp. was found during a survey in the 1970s (Cock, 1985).

Coffee leaf miner

The coffee leaf miner *Perileucoptera coffeella* Guer. is the principal pest of coffee in the Caribbean. An attempt in 1959 to introduce parasitoids failed (Cock, 1985).

Diamondback moth

The diamondback moth *Plutella xylostella* (L.) feeds on leaves of cruciferous plants. It is attacked by a number of local parasitoids, but control is insufficient. *Apanteles (Cotesia) plutellae* Kurd was obtained from India in 1970 and from the Netherlands in 1971; *Diadromus collaris* (Grav.) was obtained from India in 1972. After releases of *A. plutellae* in 1971–1972 and *D. collaris* in 1972 in Dominica, a few adults of *A. plutellae* were recovered (Cock, 1985).

Sugarcane moth borers

Sugarcane is the most important crop in the Caribbean, and sugarcane moth borers *Diatraea* spp. are its most widespread pests, with *Diatraea saccharalis* (F.) as the most important species. In the early 1950s, it was found that 20–30% of cane joints were damaged by *D. saccharalis* over extensive areas. None of the collected larvae were parasitized and two tachinid parasitoids, *Lixophaga diatraeae* (Tns.) and *Paratheresia claripalpis* (Wulp), were introduced from Trinidad and released at the end of 1951 and start of 1952. In 1954, infestation did not exceed 5% and parasitism was high; both parasitoids had apparently become established. The amazon fly *Lydella*

Table 11.1. Overview of biological control activities in Dominica.

Biocontrol agent / exotic (ex), native (na)	Pest / crop	Type of biocontrol ^a /since	Effect /area under biocontrol ^b	Reference
<i>Opius anastrephae</i> / na	Fruit flies, citrus etc.	NC	Insufficient control	Cock 1985
<i>Aceratoneuromyia indica</i> / ex		CBC / 1960s	Insufficient control	
<i>Biosteres longicaudatus</i> / ex		CBC / 1960s	Insufficient control	
<i>Doryctobracon crawfordi</i> / ex		CBC / 1960s	Insufficient control	
<i>Doryctobracon trinidadensis</i> / ex		CBC / 1960s	Insufficient control	
<i>D. cereus</i> / ex		CBC / 1964–1965	Insufficient control	
<i>Ganaspis</i> sp. / ex		CBC / 1964–1965	Insufficient control	
<i>Opius bellus</i> / ex		CBC / 1964–1965	Insufficient control	
<i>Pachycrepoideus vindemiae</i> / ex		CBC / 1964–1965	Insufficient control	
<i>Dactylosternum</i> sp. / na	Banana weevil, banana	NC	Insufficient control	Cock 1985
<i>Hololepta quadridentata</i> / ex		CBC / 1950s	No control / not established	
<i>Plaesius javanus</i> / ex		CBC / 1950s	No control / not established	
<i>Cotesia plutellae</i> / ex		Diamondback moth, vegetables	CBC / 1970–1971	No control / established
<i>Diadromus collaris</i> / ex	CBC / 1972		No control / not established	
<i>Lixophaga diatraeae</i> / ex	Sugarcane borers, sugarcane	CBC / 1951–1952	Complete control / 2,500 ha	Cock 1985
<i>Paratheresia claripalpis</i> / ex		CBC / 1951–1952	Complete control / 2,500 ha	
<i>Lydella minense</i> / ex		CBC / 1951–1952	No control / not established	
<i>Encarsia opulenta</i> / ex	Citrus blackfly, citrus	CBC / 1997–1998	Complete control / 250 ha	Lopez <i>et al.</i> 2009
<i>Amitus hesperidum</i> / ex		CBC / 1997–1998	Complete control / 250 ha	
<i>Eucelatoria bryani</i> / ex	Armyworms, many crops	CBC / 1972	No control / not established	Cock 1985
<i>Trichogrammatoidea armigera</i> / ex		CBC / 1972	No control / not established	
<i>Euplectrus platyhypenae</i> / ex		CBC / 1982	No control / not established	
<i>Telenomus remus</i> / ex		CBC / 1982	Insufficient control / established	

^aType of biocontrol: ABC = augmentative, CBC = classical, NC = natural, ConsBC = conservation biological control

^bArea of crop harvested in 2016 according to FAO (<http://www.fao.org/faostat/en/#data/qc>)

(= *Metagonistylum*) *minense* (Town.) was also introduced but did not become established. Up to the 1980s, biocontrol of *D. saccharalis* with the tachinids had been successful (Cock, 1985).

Armyworms

In the region, five species of *Spodoptera* and two species of *Heliothis* are of economic importance and attack a wide range of crops. The armyworm

parasitoids *Eucelatoria bryani* Sabrosky and *Trichogrammatoidea armigera* Nagaraja had been imported from Trinidad and were released in 1972, followed by *Euplectrus platyhypenae* Howard and *Telenomus remus* Nixon in 1982. It seems that only *T. remus* established (Cock, 1985).

Dominica as provider of natural enemies

Dominica also served as a source of natural enemies during this period. The following species were sent to other Caribbean Islands and Kenya (Cock, 1985): *Tetrastichus gala* Walker to St Lucia (1938); *Mirax insularis* Mues. to St Lucia (1938) and Kenya (1962); and *Brachyufens* sp. to Jamaica (1958).

11.2.2 Period 1970–2000

Some of the introductions of natural enemies made during this period have been mentioned above, as they were related to biocontrol programmes started before 1970.

Citrus blackfly

Citrus blackfly *Aleurocanthus woglumi* (Ashby), native to Asia, was first found in 1913 in Jamaica and subsequently spread over the Caribbean, including Dominica, where it was first recorded in 1969 but serious pest problems only began to appear in 1994 (FAO, 2000). Releases of two species of parasitoids, *Encarsia opulenta* Silvestri and *Amitus hesperidum* Silvestri, originating from the US Department of Agriculture Plant Protection Center in Mission, Texas, were made at a citrus orchard in May 1997 as part of a classical biocontrol programme that linked researchers from Texas and agricultural officials at the Ministry of Agriculture in Dominica. Parasitoids were recovered from parasitized blackfly pupae at the site of release. Because of this positive result, releases with material obtained from

Texas were made at other sites up to May 1998. Later, locally collected parasitoids were released all over the island. Levels of parasitism, based on samples of 40 citrus leaves with parasitized citrus blackfly pupae per orchard, ranged between 7% and 99%. Substantial to complete control of blackfly was achieved within 1.5 years in all regions, currently with complete control island-wide. Lopez *et al.* (2009, p. 497), during post-release surveys in 2000 and 2001, concluded that citrus blackfly populations were 'low to non-existent in 50 of 51 field sites examined' and that '*E. perplexa* and *A. hesperidum* have kept citrus blackfly populations under effective biocontrol in Dominica'.

Dominica as provider of natural enemies

A shipment of parasitized citrus blackfly material was sent from Dominica to St Kitts in 1998, where emerging *A. hesperidum* and *E. opulenta* were released.

11.3 Current Situation of Biological Control in Dominica

Natural enemies that were introduced, released and did establish in previous periods are still supposed to be present. In particular, classical biocontrol of pests in sugarcane and of citrus blackfly in citrus is successful (Table 11.1). No information could be obtained about current biocontrol activities in a recent literature search.

11.4 New Developments of Biological Control in Dominica

No information could be obtained in a recent literature search. Also no reliable estimate of areas under biocontrol could be obtained.

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