

# The practical use of tachinids and their beneficial effect in conjunction with other biological controllers in sugarcane growing in Venezuela

## Abstract

Biological control by tachinid flies (Diptera: Tachinidae) in Venezuela has been highly successful, mainly against sugarcane borers of the genus *Diatraea*. The parasitoid Amazonian fly, *Lydella* (= *Metagonistylum*) *minense* exerted a significant reduction of the percentages of infestation/internodes perforated by sugarcane borers in the plantings areas of Venezuela for more than 50 years, obtaining the consequent economic benefit. After the introduction of the braconid wasp *Cotesia flavipes* (Cameron), it was possible to control all *Diatraea* species, since *L. minense* showed a preference over *D. saccharalis* and a lesser extent over the other species.

**Keywords:** biological control, sugarcane, benefits, tachinids, *Cotesia* displacement, pest population reduction

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## Introduction

Between 1949 and 1951, Box (1952),<sup>1-3</sup> studied the indigenous parasites of *Diatraea* in Venezuela which consisted of 19 species of Hymenoptera, 6 Diptera and 2 Cryptogams plants. He mentions the presence of *Billaea* (*Paratheresia*) *claripalpis* (Wulp), *Myobriopsis* (*Leskiopalpus*) *diadema* (Wiedemann), *Palpozenillia* (*Zenillia*) *palpalis* (Aldrich) y *Jaynesleskia* (*Leskiomima*) *jaynesi* (Aldrich), in different places in Venezuela. The species *B. claripalpis*, *M. diadema*, *P. palpalis* and *J. jaynesi* were reported parasitizing different species of *Diatraea* in different plants and environments.

The history of the introduction and initial success of the Amazonian fly, *Lydella* (= *Metagonistylum*) *minense* in Venezuela, is described by Box (1956)<sup>4</sup> as follows: it was discovered by J. G. Myers parasitizing larvae of *D. saccharalis* in aquatic grasses in the lower Amazon River and at the same time by O. Monte in southern Brazil, also attacking *D. saccharalis*.

Myers considered this parasite very promising in resolving the high infestations of the borer *D. saccharalis* in British Guiana. In a second expedition by Myers with L. C. Scaramuzza in 1933 and after several months of hard work, they sent 6 shipments of a total of 3,000 puparia, which were reproduced in the Georgetown laboratory.

The releases were made in the sugarcane fields of Guiana and the control results were surprising. In view of this successful experience, Box recommended this dipteran for Venezuela and between October 1950 and November 1951, shipments of the Amazonian breed began to be received from Trinidad and Sao Paulo, Brazil sent by L. C. Scaramuzza from Cuba.

Dyar and Heinrich,<sup>5</sup> studied the American Moths of the Genus *Diatraea* and related species. Of the 14 species identified by Box in Venezuela (1948, 1951), 5 were considered important for sugarcane: *D. saccharalis*, *D. impersonatella* Guilding, *D. centrella* (Moschler), *D. busckella* Dyar & Heinrich and *D. rosa* Heinrich.<sup>6-8</sup>

The different technical and scientific studies of various tachinid species, promoted by H. Box, were widely supported by the El Palmar

Sugar Mill in 1953 and the results obtained showed that it was worth, following a biological control program. Between the 60s and 80s of the last century, the Amazon fly was released in all areas of the sugar mills through the production of their own laboratories, being the best example of that the El Palmar Mill where the fields least infested by *Diatraea* in Venezuela were observed, thanks to the perseverance of the people involved.

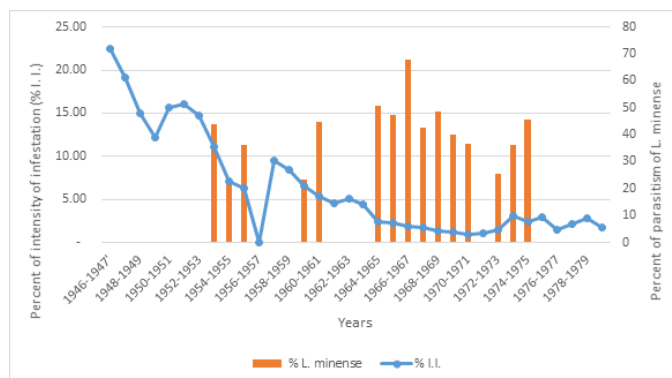
This work shows the success of the Amazonian fly, *Lydella* (= *Metagonistylum*) *minense* in the areas of influence of the Sugar Mills of Venezuela for more than 50 years, observing the reduction of the percentages of infestation or perforated internodes by *Diatraea* spp. (% I.I.), with the consequent economic benefit.<sup>9,10</sup>

After the introduction of the braconid wasp *Cotesia flavipes* (Cameron),<sup>11</sup> it was possible to control all *Diatraea* species, since *L. minense* has preference over *D. saccharalis* and to a lesser extent over the other species.

## Production of the Amazonian fly through the use of artificial diets

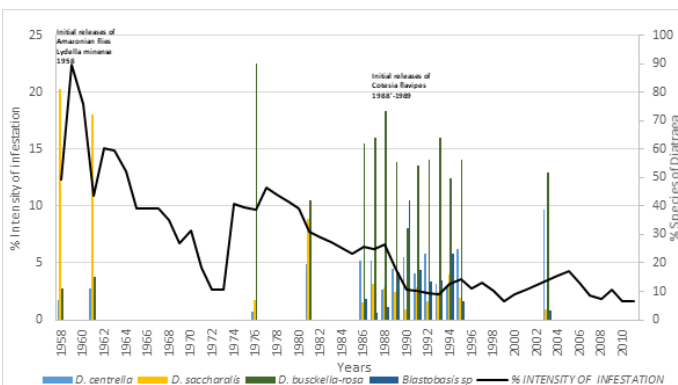
In 1975, the Integrated Control Service laboratory (SERCOIN) was inaugurated in Acarigua, Portuguesa State, a company that undertook the production the Amazonian fly for the state Sugar Mills (CENAZUCA), using breeding technology through artificial diets, proposed by King et al.<sup>12,13</sup> and successively modified.<sup>14,15</sup>

As an example of the effect of the Amazonian fly in the Sugar Mill El Palmar area, between 1953 and 1980, the % I.I. was dropped from 14.7% to 1.7%, and the percentage of average parasitism ranged between 22 and 68% (Figure 1). These results were achieved thru the release of 1,492,075 Amazonian flies.<sup>9</sup> This trend continued through the years, until Servicio Biológico, C.A.<sup>16</sup> and the Fundación Azucarera para el Desarrollo, la Productividad y la Investigación (FUNDACAÑA) introduced *C. flavipes*, since 1988 and 1999, respectively, thus reducing the infestations to a minimum level.



**Figure 1** Effect of the parasitism of *L. minense* and percent of intensity of infestation since the initial releases. Central El Palmar, (Aragua State)

In the sugar mill Azucarera Rio Turbio (Figure 2), it can be seen that *L. minense* lowered the percentage of *D. saccharalis* from 81% to 15.63% between 1959 to 1981 and in the same period the % I.I. dropped from 22.4 to 7.73. Practically since the introduction of *C. flavipes* in 1988,<sup>11</sup> *C. flavipes* prevailed over *L. minense*, and the effect of both parasitoids was important, reducing the % I.I. from 15.04 to 1.68 between the years 1962 and 2011, which translated into a benefit-cost of 41.25:1, (with the investment of 1 dollar in biological control, 41.25 benefit in sugar was recovered). In total, 4,090,245 *L. minense* were released from 1951 to 1999 and 115,334 gr. of *C. flavipes* (approximately 115,334,000 wasps) from 1988 to 2011, with a recovery of 157,345.23 MT of sugar.<sup>17-19</sup>



**Figure 2** Percent of intensity of infestation and species of sugarcane borers. Azucarera Rio Turbio (Lara State).

## Discussion

The success was obtained through the biological control of sugarcane borers using releases of *L. minense* and later of *C. flavipes*, and an organized monitoring system in which the % I.I., and the percentage of parasitism in the different species were observed. Also, thanks to the establishment of the laboratory of the sugar mill El Palmar.

Since the 50's of the last century, the production of these parasitoids was always available. From this beginning, laboratories were established in all the sugar mills and institutions such as the Instituto para el Fomento de la Produccion Azucarera (IFPA)<sup>20</sup> and private groups such as Servicio Biológico C.A., and FUNDACAÑA, companies that developed a mass production for the breeding of the hosts thru artificial diets and thus reach mass productions of the parasitoids, which allowed constant releases on a large scale. In this

way, it has been possible to have a very important benefit-cost in the sugarcane industry in Venezuela.

## Acknowledgements

None

## Conflicts of interest

The authors declare that there are no conflicts of interest.

## References

- Box HE. Notes on the genus *Diatraea* guilding (Lepid.,Pyral.). Introduction and Parts I, II and III. *Boletín de Entomología Venezolana*. 1948;7(1/2):59.
- Box HE. New species and records of *Diatraea* guild from northern Venezuela (Lepid.,Pyral.) *Bull Ent Res*. 1955;42(2):379–398.
- Box HE. Informe preliminar sobre los taladradores de la caña de azúcar (*Diatraea* spp.) en Venezuela. (Reimpreso del boletín técnico no. 1 de la división de entomología). Ministerio de agricultura y cría. Dirección de agricultura. Maracay. Venezuela. *Boletín Técnico*. 1952;2:72.
- Box HE. The biological control of moth borers (*Diatraea*) in Venezuela. Battle against Venezuela's cane borers. Part 1. Preliminary investigations and launching of a general campaign. Sugar, 1956;51(5).
- Dyar HG, Heinrich C. The American moths of the genus *Diatraea* and allies. *Proc U.S Nat Mus*. 1927;71(2691):1–48.
- Box HE. Investigaciones sobre los taladradores de la caña de azúcar (*Diatraea* spp.) en Venezuela. Informe de progreso durante 1947–1949. (Reimpreso del Boletín Técnico No. 2 de la División de Entomología, Sección de la Caña de Azúcar). Ministerio de Agricultura y Cría. Dirección de Agricultura. *Boletín Técnico*. 1952;3:39.
- Box HE. Investigaciones sobre los Taladradores de la Caña de Azúcar (*Diatraea* spp.) en Venezuela. El Proyecto del Combate Biológico. Informe del Progreso durante 1949–1951. División de Entomología y Zoología. Sección de la Caña de Azúcar. M.A.C. *Boletín Técnico*. 1952;5:52.
- Guagliumi P. Los insectos de la caña de azúcar en el Valle del Río Turbio. Los Taladradores. Ministerio de Agricultura y Cría. Dirección de Agricultura. División de Investigación. *Boletín*. 1957;66:50.
- Ferrer FR. Sinopsis histórica sobre el control biológico de *Diatraea* spp. en Venezuela. En: Memorias II Seminario sobre los problemas de la Candelilla y el Taladrador en caña de azúcar y pastos. Barquisimeto. Venezuela. 1984:253–287.
- Ferrer, F. Biological control of agricultural pests in Venezuela: historical achievements of Servicio Biológico (SERV BIO). *Rev Cien Ambien*. 2012.
- Linares B, Ferrer FR. Introducción de *Cotesia flavipes* (Cameron) (Himenóptera: Braconidae) para el control de *Diatraea* spp. (Lepidóptera: Pyralidae) en Venezuela. *Revista Caña de Azúcar*. 1990;8(1):5–11.
- King EC, Martin DF, Miles LR. Advance in rearing of *Lixophaga diatraeae*. (Dip: Tachinidae). *Entomología*. 1975;20:307–311.
- King EC, Morrison RK, Ferrer FR. Producción de tachinidos y trichogrammatidos y sus huéspedes para el control de Artrópodos plagas por Aumentación, con énfasis en los lepidópteros barrenadores de la caña de azúcar. 1977:95–132.
- Ferrer FR. Producción de la mosca amazónica mediante técnicas adaptadas a las condiciones locales. En II Seminario sobre los problemas de la Candelilla y el taladrador en caña de azúcar y pastos. Barquisimeto Venezuela. 1984;291–316.
- Ferrer F, Guedez E. Production costs of amazon fly *Metagonistylum minense* townsend (diptera: tachinidae) and *Cotesia flavipes* cameron (hymenoptera: braconidae) in Venezuela. *Caña de Azúcar*. 1990;8(2):59–73.

16. Ferrer F. Biological control of agricultural pests in Venezuela: the historical achievements of the biological service company (SERVBIO). *Environ Sci.* 2021;55(1):327–344.
17. Fuentes S, Ferrer YY, Salas J. El control biológico en Cuba y Venezuela, Un avance hacia la Agricultura Agroecológica. 2012.
18. Briceño SHR. Éxitos históricos de taquinidos y braconidos en el control de , *Diatraea* en caña de azúcar cultivada en América. *Rev Per Ent.* 1996;39:85–90.
19. Hensley SD. Management of sugarcane borer populations in Louisiana, a decade of change. *Entomophaga.* 1971;16:133–146.
20. Costa A. Actividades de la sección de entomología del instituto para el fomento de la productividad azucarera (IFPA) desde su iniciación en noviembre de 1963 hasta el 31 de agosto de 1965. *Boletín del instituto para el fomento de la productividad azucarera.* Año II, 1965;8:47.