PARASITOIDS REARED FROM SPECIES OF *ANASTREPHA* (DIPTERA: TEPHRITIDAE) IN VALLE DEL CAUCA, COLOMBIA.

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ABSTRACT

Parasitoids associated with 8 species of Anastrepha were recovered from host fruits that belonged to 9 species of plants in the Cauca Valley, Colombia. These parasitoids were identified and quantified. The most common parasitoid was *Doryctobracon zeteki*, which was associated with the *species A. leptozona*, *A. serpentina*, *A. nunezae* and *A. striata* recovered from *Pouteria caimito, Chrysophyllum cainito* and *Campomanesia lineatifolia* host fruits.

Key Words: *Anastrepha*, *Doryctobracon*, parasitoids, Valle del Cauca, Colombia

RESUMEN

Se identificaron y cuantificaron las especies de parasitoides asociadas a 8 especies de *Anastrepha* obtenidas de frutos pertenecientes a 9 especies de plantas del Valle del Cauca, Colombia. *Doryctobracon zeteki* fue la especie de parasitoide más frecuente y estuvo asociada a las especies *A. leptozona, A. serpentina, A. nunezae* y *A. striata* obtenidas de los frutos de *Pouteria caimito*, *Chrysophyllum cainito* y *Campomanesia lineatifolia.*

Knowledge of fruit fly natural enemies is of vital importance for biological control programs. Some programs have failed because of the absence of basic information in taxonomic, morphologic and biologic aspects of the parasitoids (Wharton 1989 in Canal-Daza et al. 1994).

Studies have been done in many countries of the New World on whether to make inventories of native parasitoids or to evaluate only the introduced ones. In Mexico Aluja et al. (1990) recorded fruits parasitized by fruit flies, especially by *A. ludens* (Loew), *A. obliqua* (Macquart), *A. striata* Shiner and *A. serpentina* (Weidemann). In these cases the most common parasitoid was *Diachasmimorpha longicaudata* (Ashmead). Jirón & Mexzon (1989) recognized 8 species of parasitoids from the 11% of fruits that were infested with 5 species of Anastrepha in 135 locations in Costa Rica. In Brazil, Canal-Daza et al. (1994) obtained 3 families of parasitoids (Braconidae, Eucoilidae and Pteromalidae) from samples of 11 species of fruit trees where *Anastrepha* species were developed; 93% of them belonged to Braconidae.

Some contributions have been made in Colombia. Olarte (1980) reported *Psidium guajava* L. attacked by *A. striata*, which was attacked by *Utetes (Bracanastrepha) anastrephae* (Viereck). Portilla et al. (1993) identified 3 species of parasitoids; *Doryctobracon. crawfordi* (Viereck), *O. anastrephae*, and *Microscapis* sp.; apparently associated *with Ceratitis capitata* (Wiedemann) and *A. fraterculus* in *Coffea arabica* L. in the Department of Nariño (Colombia). The inventory of parasitoids of fruit flies used in biological control includes 82 species, of which the majority were braconids (Wharton 1989).

It has been possible to colonize and mass-rear some parasitoid species; this has permitted introduction and release in other countries to reduce Anastrepha populations. Species like *Diachasmimorpha longicaudata*, *Doryctobracon crawfordi*, *Ganaspis pelleranoi* (Brethes), *Biosteres giffardi* (Silvestri), *B. vandenboschi* (Fullaway) and *Aceratoneuromyia indica* (Silvestri) have been imported and released in the U.S.A., Mexico, Costa Rica, Brazil, Peru and Argentina to control *Anastrepha suspensa* (Loew), *A. ludens* and *A. fraterculus*. Of these, *D. longicaudata* and *D. crawfordi* have established in many countries of America (Aluja 1994).

In Florida (U.S.A.), 15 parasitoid species (representing 4 families) have been imported to control the Caribbean fruit fly (*A. suspensa*). These parasitoids coexist with generalist native species that also attack this fly. In this case, *Diachasmimorpha longicaudata* released, most frequently especially during the periods when A. suspensa populations decreased because of host absence (Baranowski et al. 1993).

During a project directed to determine the diversity of species of *Anastrepha* in some localities of the Department of Valle del Cauca, 26 species of *Anastrepha* were recovered from different host plants and also caught in McPhail traps. Also, in this manuscript the results about the *Anastrepha* parasitoids found in fruits are presented.

Materials and Methods

Study Area

Many fruits were collected from about 13 municipalities of the Department of Valle del Cauca, but only the samples obtained from the municipalities of Buenaventura, Jamundí, La Cumbre and Yumbo were considered in this study, in which at least one parasitoid was recovered besides the *Anastrepha* fruit fly.

Collection of Parasitoids

Fruit were collected in plastic, 15 × 12 cm containers that held a mixture of humid sawdust and sieved river sand that had been sterilized. Each container was covered with white muslin and held at a temperature of + 24°C and 70% R. H. The pupae that were formed were removed and transferred to emergence containers that had the same mixture. When the imagos of *Anastrepha* and parasitoids were obtained the mixture in the container was sieved to quantify the number of larvase the number of pupae viable, that formed parasitoids. The parasitization calculation was based on the number of adult flies produced and not on the number of larvae, due to high mortality different from parasitism.

All emerged flies and parasitoids were maintained in vials filled with 70% alcohol until identified. The *Anastrepha* species were identified with the authors' knowledge and the literature available. Some determinations of parasitoids were made by P.M. Marsh and A.S. Menke (Systematic Entomology Laboratory of USDA). *Phaenocarpa* sp. (Braconidae) was identified by Dr. R. A. Wharton (Dept. of Entomology, Texas A & M. University, College Station). Percent of parasitism was calculated following the formula of Baranowski et al. (1993), number of parasitoids emerged/number of parasitoids + number of flies × 100. When more than one parasitoid specimen/pupae was obtained, only one was considered because the formula implies that when parasitism occurs, each parasitoid will replace a pupa; this is not valid for all species that parasitize *Anastrepha* fruit flies.

The specimens were deposited in the Museum of Entomology at the Universidad del Valle (Department of Biology, Cali-Colombia).

Results and Discussion

From 447 different fruits we obtained 1759 *Anastrepha* flies and 204 parasitic larvae (Table 1). *Anastrepha* was not recovered from 10 of the plant species. From *Garcinia madruno* (Kunth) Hammel, *Inga* spp., *Spondias purpurea* L., *Averrhoa carambola* L., *Coffea arabica* and *Sysigium malaccense* (L) flies were produced but no parasitoids.

No correlation was observed between number of flies per fruit host and percent of parasitism ($r = 0.26$; $p = 0.51$) (Table 2). Apparently parasitism is mainly influenced by fruit characteristics, the available alternate hosts and the environment. In *Quararibea cordata* Vischer fruits, a high number of *A. nunenzae* Steyskal per fruit (18.8) was observed, but only 3.5% parasitism. In other samples of this fruit that were

Table 1. Larval / pupal Parasitoids In Species Of *Anastrepha* And Fruits That They Attack, Present At Four Municipalities Of The Department Of Valle Del Cauca, Colombia.[1-4 = buenaventura: 1, Sombrerillo; 2, Cisneros; 3, Sacarias; 4, Anchicayá; 5 = la Cumbre (Pavas); 6 = jamundí (Chagres); 7 = yumbo (Mulaló)]

Parasitoids	Species of Anastrepha	Fruit host
Braconidae *(Opinae)*		
Doryctobracon zeteki	serpentina	*Chrysophyllum cainito* and *Pouteria caimito* (1)
	striata	*Campomanesia lineatifolia* Ruiz et. Pav. (1)
	leptozona	*P. caimito* (3,4
	nunezae	*Quararibea cordata* (6)
	striata	*C. lineatifolia* (1), *Psidium guajava* (2)
D. areolatus		
	leptozona	*P. caimito* (4,1)
	coronilli	*Bellucia pentamera* (3)
	pickeli	*Manihot esculenta* (6)
	obliqua	*Mangifera indica* (7)
Opius sp.	leptozona	*P. caimito* (1)
Phaenocarpa sp.	distincta	*Inga edulis* (3)
Eucoilidae		
Aganaspis sp.	leptozona	*P. caimito* (1)
Proctotrupoidea		
sp. indeterminate	obliqua	*M. indica* (7)
Hymenoptera		
sp. indeterminate	striata	*Psidium guajava* (5,2)

TABLE 2. PERCENT OF PARASITISM SEEN IN FRUITS OF NINE SPECIES OF PLANTS AFFECTED WITH *ANASTREPHA* SP. AT FOUR MUNICIPALITIES OF THE DEPARTMENT OF VALLE DEL CAUCA (COLOMBIA).

Speciesof fruit	Number Fruit	Number Flies / Fruit	Number Parasitoid/Fruit	% Parasitism
Q. cordata	19	18.80	0.68	3.5
C. caimito	49	4.73	0.78	14.1
B. pentamera	41	1.20	0.15	10.9
P. guajava	72	6.01	0.17	2.7
Inga edulis	1	6.00	10.0	62.5
M. esculenta	32	0.09	0.03	25.0
M. indica	17	3.12	0.41	11.7
C. lineatifolia	64	0.73	0.47	39.0
P. caimito	152	3.80	0.56	12.8
Total	447	3.93	0.46	10.4

colonized in the same way with flies at different locations, no parasitoids were observed; this may be because the husk thickness does not permit a high rate of parasitism. The low frequency of parasitoids in *Anastrepha* species that attack *P. guajava* (2.7%), is strange. Our observations in the Valle del Cauca are similar to those of Olarte (1980) in Santander (Colombia).

According to this author, considering the scarcity of *U. anastrephae* and *D. crawfordi* in this plant species, they have an insignificant effect on *A. striata* populations. In this study, specimens *of D. areolatus* (Szepligeti) associated with *A. striata* were observed in this crop, which also coincide with species observed by Canal-Daza et al. (1994) in the state of Amazonas (Brazil).

For *Mangifera indica* L. it is necessary to process a larger number of samples from different areas. The parasites observed came from fruits strongly attacked by *A. obliqua* (3.2 / fruit). When flies were not abundant parasitoids did not occur. The parasites were represented by 7 species classified in 3 families: Braconidae (4 species), Eucoilidae (1 species), Proctotrupoidea, (1 species) and one species that has not been identified to date.

At locations that had Anastrepha infested fruits and parasitoids, parasitism varied from 2.7% in P. guajava to 62.5% in *Inga edulis* Mart., but this last value is not reliable because of the size of the sample (Table 2).

Although the number of fruits sampled must be considered, it is evident that the Buenaventura locations had the largest frequency and diversity of parasitoids observed (Table 1). However, this was influenced by the *Pouteria caimito* Radlk. samples; 5 species of parasitoids were observed in this fruit. The most common species was *Doryctobracon zeteki* (Muesebeck) (69%). This species, besides being a parasitoid of *A. leptozona*, was also associated with *A. serpentina*, *A. striata* and *A. nunenzae*. In other fruits, *D. aereolatus, Aganaspis* sp. and *Opius* sp. were present at 15%, 13% and 3%, respectively. In other municipalities like Dagua, La Cumbre and Jamundi, which are located in an area with less precipitation, samples of the same species did not yield any parasitoids, even though there was abundant *A. leptozona* and *A. serpentina* emergence.

The second species in importance was *D. areolatus*; besides being a parasite of *A. leptozona* Hendel in *P. caimito*, it was also found in association with other species of *Anastrepha* such as *A. pickeli* Lima, *A. striata*, *A. obliqua* and *A. coronilli* Carrejo y G. This species is considered the most abundant parasitoid and also the one with the widest distribution in Costa Rica, where it is a parasitoid of *A. obliqua*, *A. striata*, A. *distincta* Greene and *Anastrepha* species that attack *Chrysophyllum cainito* L. fruits (Jirón & Mexzon 1989).

In Florida (U.S.A.), after this species was introduced, it was recovered from *A. suspensa* pupae (Baranowski et al. 1993). According to Canal-Daza et al. (1994), this species is distributed in Mexico, Costa Rica, Panamá, Trinidad, Colombia, Venezuela, Brasil and Argentina, having these hosts*: A. bahiensis* Lima, *A. benjamini* Kima, *A. bistrigata* Bezzi, *A. consobrina* (Loew), *A. fraterculus*, *A. leptozona, A. ludens*, *A. montei* Lima, *A. obliqua*, *A. pickeli*, *A. pseudoparallela* (Loew), *A. serpentina*, *A. striata*, *A. sororcula* Zucchi, *A. suspensa*, *C. capitata* and *Rhagoletotrypeta* sp.

Aganaspis was represented by 13 parasitoids that colonized *A. leptozona* (in *P. caimito*) in the municipality of Buenaventura. *Phaenocarpa* sp. was recovered only from *A. distincta* obtained *from I. edulis* at the same municipality. Apparently it caused a high percent of parasitism in this area but this should be confirmed with a larger number of fruits. According to R. Wharton (Dept. of Entomology, Texas A & M University College Station, personal communication) it was not possible to determine to which of the two neotropical species of this genera it belongs because it is poorly described. Canal-Daza et al. (1994) reported *P. anastrephae* attacking A. *obliqua* in Brasil.

There are many parasitoid species of Tephritidae in the genus *Opius*. *Opius* sp. was not very frequent during this study; the few specimens that were recovered were associated with *A. leptozona* in *P. caimito* in Buenaventura, and it represented only 2.8% of the parasitoids.

According to Canal-Daza et al. (1994) the species *Opius bellus* Gahan has been reported for Costa Rica, Belize, Panamá, Trinidad, Venezuela, Brasil and Argentina, associated with some *Anastrepha* species and other Tephritidae. This distribution suggests that it is also in Colombia.

The species of Proctotrupoidea has not yet been identified; it was found only in one of the processed mangos, and although it was abundant, it seems not to be important because of its small size and the frequency with which it appeared in the fruit. It is a group for which no specialist is known.

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