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FIELD REARING OF *AMITUS HESPERIDUM* SILVESTRI (HYMENOPTERA: PLATYGASTERIDAE) FOR CONTROL OF CITRUS BLACKFLY *ALEUROCANTHUS WOGLUMI* ASHBY (HOMOPTERA: ALEYRODIDAE) IN TRINIDAD W.I.

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ABSTRACT: *Amitus hesperidum* Silvestri (Hymenoptera: Platygasteridae) was introduced to Trinidad in 2000 in an attempt at classical biological control of the Citrus Blackfly *Aleurocanthus woglumi* Ashby (Homoptera: Aleyrodidae). Following quarantine, *A. hesperidum* were reared in the field in sleeve cages for multiplication and subsequent distribution. Fifty-three sleeve cages were established at six locations in Trinidad, however efforts were concentrated at the Todd's Road Citrus Estate of Caroni (1975) Limited. These sleeves resulted in a yield of 372 insects/sleeve with peak emergence at 56-66 days after the initial release of parasitoids. These results were used to guide the establishment of a further 35 sleeve cages for the production of parasitoids. One hundred participating farmers were trained in the biological control of Citrus Blackfly and provided with batches of 100 parasitoids for release on their farms.

INTRODUCTION

Amitus hesperidum Silvestri (Hymenoptera: Platygasteridae) was introduced to Trinidad in 2000 in an attempt at classical biological control of the Citrus Blackfly *Aleurocanthus woglumi* Ashby (Homoptera: Aleyrodidae). This introduction formed part of an Integrated Pest Management (IPM) approach to managing the pest (Anon, 2000). The release programme involved a period of laboratory rearing in quarantine, followed by field rearing in sleeve cages, open releases and island-wide distribution (White *et al.*, 2001).

The productivity and emergence period of the initial sleeve cages were evaluated, in order to facilitate and streamline later field rearing of *A. hesperidum* for island-wide distribution by citrus farmers.

METHODOLOGY

Six sites, distributed in major citrus growing areas in Trinidad, were selected for field rearing of *A. hesperidum*. Sites were located in Moruga, Caparo Valley, Tableland, Freeport, Penal and Cumuto. Releases were made in June and July 2000.

Orchards that were known to have high populations of Citrus Blackfly were selected. Individual branches were targeted for sleeve cages which had at least 30 hatched egg spirals (1^{st} or 2^{nd} instars), with spirals distributed over several young leaves. Sleeves were prepared of Organza, 40cm x 60 cm and fitted around branches in the field one week before releases were made. On the day of setting up the sleeve, and again two days prior to releasing parasitoids, all leaves were examined and any predators, mites, aphids or insects were removed with a soft brush. Petroleum jelly was applied to the branch below the sleeve as a barrier to ants. A roof/shade of opaque polythene was erected over the sleeve to deflect rain and direct sunshine.

Care was taken to ensure that there was at least 30cm between the sleeve and the polythene to prevent overheating of the sleeve. Releases were made at approximately 5pm. Both male and female parasitoids (10 of each where possible) were placed in each sleeve. The parasitoids used had emerged on the day before the release. At Todd's Road 17 sleeve cages were used. At the other sites cages were established as follows: Cumuto 4, Penal 12, Freeport 8, Tableland 7 and Moruga 5.

Subsequent to the release of parasitoids the sleeves were examined weekly and all contaminants removed as described above. When it was observed that parasitoids had begun to emerge sleeves were visited every 2-3 days and parasitoids collected using aspirators.

Monitoring of field rearing was conducted during the period June – August 2000 at the Todd's Road estate of Caroni (1975) Limited, (Caparo Valley) with 17 sleeve cages, in three fields of Valencia Orange. As the monitoring process proceded it became apparent that the sleeve cages from Todd's Road would satisfy the initial requirements for *A. hesperidum*. As a result, less effort was placed on gathering parasitoids from the other sites. The sleeves at Tableland and Moruga were removed before emergence, so that the parasitoids would disperse naturally.

Following the initial releases, a further 35 sleeve cages were set up at the Todd's Road Estate to produce parasitoids for distribution by farmers. The sleeve cages were established as described above and regular inspections were made to remove contaminants. Fifty-five days after the inoculation, the branches on which the sleeves were placed were removed and housed in an insectary in a large mesh cage. Parasitoids were collected at 2-3 day intervals from these shoots. Parasitoids collected were placed in vials within insulated cups and fed with a drop of dilute honey. The number of parasitoids recovered was recorded.

The parasitoids collected were supplied to farmers for release on their citrus estates. Each farmer received an insulated vial containing 100 parasitoids. To facilitate the transfer of both the insects and techniques, four seminars were held by staff of Central Experimental Station, Ministry of Agriculture, Lands and Food Production. Participants were exposed to the value of the biological control, the parasitoid, and shown how to make the releases. The sessions were planned to coincide with the emergence of parasitoids, and 100 farmers were targeted.

RESULTS

At the Todd's Road site the mean recovery of *A. hesperidum* was 372 ± 133 (2SE) per sleeve cage. There were high fluctuations between cages the highest yielding 1162 and the lowest 15 parasitoids.

The temporal distribution of emergence is illustrated below (Figure 1). The modal emergence time for each sleeve cage appeared to fall into two periods, roughly days 56-59 and days 64-66. This suggestion of a bimodal distribution is mirrored in Figure 1. Ten percent of the parasitoids emerged by day 54, 25% by day 58, 75% by day 66 and 90% by day 79.

At the other sites the yields were much less (Table 1). The main objective of sleeve rearing at the six sites was to gather parasitoids for redistribution to a further 20 sites. Since the sleeves at Todd's Road satisfied the need for parasitoids at this stage, less effort was placed on the other sites and the sleeves were removed to allow any remaining *A. hesperidum* to disperse naturally. In the case of Tableland and Moruga the sleeves were removed before any emergence occurred.

The 35 sleeve cages for mass production of *A. hesperidum* yielded 8420 parasitoids (mean = 240) over a 25 day period. Excised branches were not housed individually so the variability between sleeve cages was not determined. The yield was 15% short of what was targeted, but the numbers were supplemented with parasitoids from a laboratory colony and all participating farmers were satisfied.

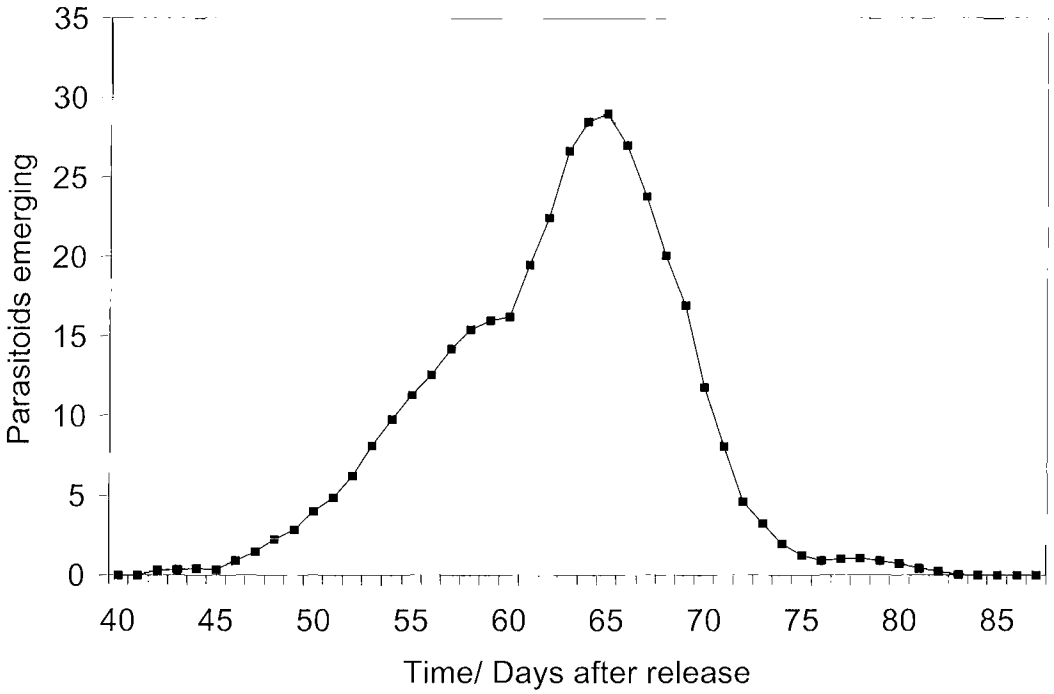

Figure 1. Temporal distribution of *A. hesperidum* from sleeve cages in citrus fields, Todd's Road, June-August 2000.

Table 1. Sleeve cage recovery of *A. hesperidum* from six sites in Trinidad, July- August 2000.

Site	Number of Sleeves	Mean Yield	SEM	Remarks
Todds Road	17	372	66.5	Effort Concentrated here
Cumuto	4	142.8	58.6	Collected on 4 occasions
Penal	12	19.0	6.8	Collected on 4 occasions
Freeport	8	10.9	5.3	Collected on 2 occasions
Tableland	7			Sleeves removed before parasitoid emergence
Moruga	5			

DISCUSSION

Field rearing of *A. hesperidum* within sleeve cages was highly successful. The roofs/shades appeared to be important to the success of the sleeve cage not only as shade but to prevent wetting of the sleeve during rainfall. Sleeves poorly sheltered from rain developed high levels of sooty mould and produced fewer parasitoids. Collection of parasitoids was not possible from wet sleeves as the insects got stuck to the mesh. As such, collections were made after dew had dried off.

Regular cleaning of contaminants was also very important. During initial cleaning it was usual to remove larvae of Coccinellids, Neuropterans, ants, mites and fungi. Some eggs or small larvae were invariably missed and at subsequent inspections had to be removed.

When collecting *A. hesperidum*, the disturbance appeared to stimulate further immediate emergence. This was beneficial as *A. hesperidum* adults live for a few days only, and a delay of even one day is a significant portion of their longevity. Upon entering the field all sleeves were shaken before beginning collection, so as to avoid having to await emergence.

The yield of each cage is dependent on several factors unrelated to the fecundity of the parasitoid. These factors include, the number of available blackfly at the appropriate stage for parasitism, the stress that the parasitoids were exposed to during transfer, the microclimate within the sleeve (whether shaded or un-shaded), any parasitoids escaping during inoculation, and level of sanitation within the sleeve. For these reasons no attempt has been made to present the sleeve cage yield per female introduced.

A. hesperidum parasitises first and second instar nymphs. The developing parasitoid remains dormant while the blackfly completed its development up to the pupal stage. At this time the parasitoid development continues, eventually killing the blackfly. As a result, the period of peak parasitoid emergence in the sleeves is probably more dependent on the age structure of the blackfly population than on the development rate of the *A. hesperidum*. In the case of the initial 17 sleeves the hint of a bimodal distribution is probably due to parasitism of different instars of blackfly.

The 35 sleeves for farmer participatory releases yielded less than expected. The yield may have been influenced by the transfer of the branches into the insectary. Collection of the entire sleeve however was useful as delays in collection due to transport or weather can be avoided and the parasitoids can be delivered in a shorter period. Despite the drying of the excised branch, parasitoids were able to emerge for at least over three weeks.

ACKNOWLEDGEMENTS

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