REDUCTION OF COST FOR MASS PROPAGATING *CATOLACCUS GRANDIS* BY THE USE OF ARTIFICIAL DIET

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Abstract

An artificial diet for propagating the wasp ectoparasitoid, Catolaccus grandis (Burks) was developed; it has been submitted to the U.S. Patent Office for disclosure. Based on quotations from Sigma chemical company, ingredient costs for this diet were $ 7.94 and $ 7.40/1000 female parasitoids for liquid and solid diets, respectively. Substitution of less refined ingredients in the solid diet reduced the cost to $ 5.45/1000 female parasitoids. Performance of these diet-reared parasitoids in the field was as good or better than the parasitoids reared on the defined diet or boll weevil larvae. Projected cost of parasitoids mass propagated on diet purchased in bulk is expected to be at least one-half (near $ 2.50/1000 females) the cost of parasitoids propagated small scale in the laboratory. Consequently, at the maximum (3,000 females/acre), the cost for the diet-propagated parasites would be about $ 7.50/acre.

Introduction

Catolaccus grandis (Burks) has shown its efficacy controlling the boll weevil (*Anthonomus grandis grandis* Boheman) in cotton fields in the Lower Rio Grande Valley of Texas (Summy et al. 1994, 1995, Morales Ramos et al. 1994; King et al. 1995, and Coleman et al. 1996).

In vivo mass propagation of this ectoparasitoid has been reported (Morales-Ramos et al. 1992b), but it is expensive (Robinson et al. 1995). Consequently, an artificial diet for *in vitro*-mass propagation has been developed (Rojas et al. 1996). Nevertheless, the *C. grandis* chemical defined artificial diet is still too expensive. The objective of this work was to reduce the cost of diet ingredients to make the *in vitro*-mass propagation of *C. grandis* economically competitive.

Materials and Methods

Diets. Fatty acids, mineral salts, carbohydrates, and vitamins used in *C. grandis* chemically defined artificial diet were modifications to those amounts reported by Thompson (1975). Protein source and amino acid amounts were determined by High Performance Liquid Chromatography (HPLC) (Morales et al. 1995). To further reduce ingredient costs of this artificial diet (Rojas et al. 1996) a series of natural products were analyzed. Amino acids were analyzed by HPLC-Waters FMOC and OPA modified methods. Carbohydrates were analyzed by HPLC-Waters method. Fatty acids were analyzed by Gas Chromatography (Williams H., Unpublished method). Mineral salts and vitamins were analyzed by HPLC-Dionex system.

Evaluation of parasitoid fitness. Females reared in the different diets and in boll weevils (control) were individually evaluated according to the method reported by Morales-Ramos & Cate (1992). The data was statistically analyzed by ANOVA (SAS Institute 1988). Mean differences between the 3 groups and control were analyzed by LSD and Duncan's multiple range tests at $\alpha = 0.05$ level of significance.

Results and Discussion

Table 1 shows that the use of substitutes reduced the price of the solid diet by about 50 %. Additionally, based on economy of scale, purchase of dietary ingredients in bulk directly from the producer should reduce the cost of the diet at least by one-half (Table 1).

Nevertheless, Table 2 shows that the females reared on the diet containing substitutes have a significantly lower mean weight when compared to those reared in weevils (control); but their performance in the field was not significantly different (Morales et al. 1995, Coleman 1996-These Proceedings).

Table 3 also shows that the percent yield of parasitoids and sex ratio are optimized by the use of the solid diet (10 females: 1 male) (Rojas et al. 1996) and no changes in these parameters were observed by the inclusion of substitutes to the diet.

Based on these data, these modifications to the solid diet enhance the economic feasibility of mass propagating and augmentatively releasing *C. grandis* to biologically control the boll weevil.

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Table 1. Artificial diet ingredient cost.

Diet[1]	Price[2]
Solid	7.40
Substitutes	5.45
Projected bulk	2.50

[1] Sigma chemicals
[2] To produce 1000 females

Table 2. Comparison of weights (mg) of female *C. Grandis* pupae reared in 3 different diets and *in vivo*.

Diet	n	$x \pm s$
Control	224	5.5 ± 0.52 a
Liquid	125	4.4 ± 0.23 b
Solid	204	4.2 ± 0.49 b
Substitutes	224	3.9 ± 0.26 b

Means with the same letter are not significantly different at $\alpha = 0.05$.

Table 3. Economical analysis for the production of *C. Grandis* in an *in vitro* system.

Diet	% Yield	sex ratio[3]	Cost [4]
Control [1]	50	4:1	165.00
Liquid [2]	50	10:1	7.94
Solid [2]	95	10:1	7.40
Substitutes [2]	92	10:1	5.45

[1] Sources cheaper than Sigma chemicals
[2] Sigma chemicals
[3] Females : males