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UTILIZATION OF GULAMAN AS SOLIDIFYING COMPONENT IN THE ARTIFICIAL DIET OF THE ASIAN CORN BORER, *OSTRINIA FURNACALIS* (GUENEE)[1]

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ABSTRACT

Gulaman at the rate of 20 g/l distilled water was used as solidifying component in artificial diet of corn borer. Agar based diet was used as standard. No significant differences in its growth and development on the two diets were noted. The oviposition period and fecundity of the female borer reared on agar-based diet and of those reared on gulaman-based diet were comparable. Utilization of gulaman as agar substitute greatly reduced the cost of the artificial diet.

Key words: *Ostrinia furnacalis* (Guenee), Asian corn borer, artificial diet, gulaman, agar, *Gracilaria, Gelidium.*

INTRODUCTION

Continuous mass rearing of the Asian corn borer, *Ostrina furnacalis* (Guenee), is one of the important activities in the testing program for *Bacillus thuringiensis.* Bioassay of any kind of microbial insecticide, like fungus, virus, protozoa, nematode and bacteria (Ignoffo *et al.*, 1982, Dulmage *et al.*, 1976, Wigley and Kalmakoff, 1977) requires use of large number of test insects. In conducting controlled experiments with insecticides, it is necessary to minimize the wide variability encountered in field collected populations so that only natural or acquired level of susceptibility are measured. This is best accomplished using laboratory reared specimens of uniform age and nutritional background (Beards and Leigh 1960). Although purified diet is suitable for nutritional studies, a simple diet is needed for routine rearing (Vanderzant *et al.*, 1962). The suitability of the artificial diet can be demonstrated by comparing the development time, survival rate and pupal weight of larvae reared on diet with those on natural (Johnston and Federici 1982) or already standardized diet.

Artificial diet for the Asian corn borer has already been standardized and used successfully by various researchers (Ceballo and Morallo-Rejesus 1983, Camarao 1976). This diet utilizes agar as solidifying component which is quite expensive because it is imported. On the other hand, gulaman, a locally processed unpurified agar from marine algae of the genus *Gracilaria* or *Gelidium* (Guerrero 1989) has almost similar physical properties as the commercial agar. Gulaman, commonly used as dessert is locally available at a relatively lower price. Furthermore, dehydrated gulaman bars, like agar, can also be stored under ordinary room conditions for long periods of time.

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The study was conducted to determine whether gulaman can be used as solidifying component of artificial diet of the corn borer and to compare its performance when reared on agar and gulaman based diets.

MATERIALS AND METHODS

Determination of the optimum concentration of gulaman

White dehydrated gulaman bars and hydrated gulaman which are both available in the market were used. Artificial diet using agar at the rate of 16 g/l was used as standard. Concentrations tested for the dehydrated gulaman were 14, 16, 18, 20, and 22 g/l. Hydrated gulaman was used at the rate of 150, 200, and 250 g/l. The concentration was not increased since its cost is already almost equal to that of dehydrated gulaman. Both gulaman were cooked in a double boiler for 20 minutes and mixed with the different ingredients of artificial diet in a blender (Table 1). The diets were then poured into sterilized 250 ml bottles and allowed to cool and harden. Initial evaluation of the diet was done using consistency and texture as criteria.

Table 1. The composition of corn borer artificial diet.

INGREDIENTS	AMOUNT
Distilled water	1000.00 ml.
Finely ground opaque corn	96.00 g.
Finely ground soybean	50.00 g.
Brewer's yeast	40.00 g.
Wheat germ	2.00 g.
Ascorbic acid	4.00 g.
Vitamin E (Dohyfral E)	1.50 tab.
Vitamin complex (VI-DAYLIN)	5.00 g.
Casein	10.00 g.
Choline chloride	2.00 g.
Methyl paraben	2.00 g.
Sorbic acid [a] .ty	1.25 ml.
Phosphoric and Propionic acid mixture [b]	1.25 ml.
Aureomycin	0.50 cap.
Formalin 37%	2.50 ml.

[a] 20 g sorbic acid in 100 ml. 95% ethyl alcohol.
[b] 77 ml propionic acid and 7.8 ml phosphoric acid in 100 ml distilled water.

Comparison of the performance of *O. furnacalis* reared on gulaman and agar-based artificial diets

White gulaman bars were chopped into small pieces using a blender and used at the rate of 20 g/l. Twenty grams of gulaman was cooked in 500 ml distilled water

for 20 minutes with occasional stirring. It was mixed with the different components of artificial diet previously mixed in 500 ml distilled water and blended for 5 minutes. Artificial diet using agar at the rate of 16 g/l was used as standard. Twelve ml of the diet were then poured into disinfected 30.0 ml plastic containers and allowed to cool and harden. Ten newly hatched larvae were reared in each experimental diet. The larvae were confined individually in a plastic container with perforated plastic cover. There were 5 replicates per treatment. The larval duration and percentage survival were noted. The mean weight of 4 pupae per replicate was determined, replicated 3 times. The total pupal period was also recorded. The adults were paired in 8.0 cm x 20 cm x 20 cm plastic container with screen cover and fed with 10% honey solution saturated in a cotton wad. The sides of the containers were lined with wax paper for oviposition. The oviposition period, fecundity, life span of adults and egg hatchability were noted. Two trials were conducted.

RESULTS AND DISCUSSION

The optimum concentration of the dehydrated gulaman for mass rearing of corn borer was found to be 20.0 g/l distilled water (Table 2). Hydrated gulaman was not used due to unsatisfactory results in terms of consistency.

Table 2. Initial evaluation of the 2 forms of gulaman as solidifying agent for corn borer artificial diet.

Concentration (g/l d.H_2O)	Consistency	Texture
Agar (control)		
16	firm	smooth
Dehydrated gulaman		
14	too soft	smooth
16	soft	smooth
18	quite firm	smooth
20	firm	smooth
22	firm	smooth
Hydrated gulaman		
150	too soft	smooth
200	too soft	smooth
250	soft	smooth

The performance of *O. furnacalis* reared on gulaman and agar-based artificial diet is shown in Table 3. No significant differences were noted between the different parameters. The life cycle of the insect in the second trial was slightly longer than in the first trial. This can be attributed to the differences in the rearing conditions during the experiment. The first trial was conducted under controlled conditions (Temp. 25-28^{0}C)while the second trial was conducted under ordinary room conditions since the insectary can not be used due to some mechanical problems.

Routinary mass rearing using gulaman-based artificial diet gave satisfactory results. Continuous mass rearing of the insects for 7 generations showed that gulaman can be used as solidifying component of corn borer artificial diet and

therefore can be utilized as agar substitute. This would mean considerable savings since gulaman is much cheaper than agar. Agar is currently sold at P1,200.00 per kilo while gulaman is P550.00 per kilo (approximately 100 bars, P5.50 per bar). Furthermore, gulaman is readily available locally.

Table 3. Growth and development of *O. furnacalis* on agar-and gulaman-based artificial diets.

Parameters	First Trial		Second Trial	
	Agar	Gulaman	Agar	Gulaman
% survival (egg to adult)	80.00	86.00	82.00	88.00
Larval period (days)				
Male	19.07	19.33	20.05	20.70
Female	20.95	21.32	22.09	22.75
Pupal period (days)				
Male		6.17	6.70	6.60
Female	7.25	7.17	7.19	7.08
Pupal weight (mg)				
Male	55.74	56.73	63.23	60.83
Female	86.42	86.91	88.42	86.35
Adult longevity				
Male	3.25	2.92	3.52	3.5
Female	7.00	6.83	7.01	7.10
Oviposition period (days)	2.67	2.72	3.10	3.20
Fecundity (ave. no. of eggmasses/female)	8.50	7.60	8.60	8.40
Egg stage (days)				
Incubation period	3.00	3.00	3.00	3.00
Total life cycles(days)				
Male	33.53	31.42	33.27	33.60
Female	36.32	38.32	39.29	39.43
% Hatchability	90.00	89.00	95.00	93.00

Gulaman as agar substitute for corn borer artificial diet indirectly reduces the production cost of *B. thuringiensis* since the spores and δ-endotoxin have to be bioassayed before formulation. The cost of mass rearing the test insect is reduced using gulaman instead of agar.

SUMMARY AND CONCLUSION

The optimum concentration of gulaman as solidifying component for corn borer artificial diet was 20 g/l. The performance of *O. furnacalis* reared on gulaman-based diet was comparable with those reared on agar-based diet. No significant differences in terms of survival rate, larval and pupal duration, pupal weight, adult longevity, fecundity, oviposition period, incubation period and hatchability were noted.

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