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TITLE

Studies on the dispersal, potential and natural population density of the *Heliothis* complex over some areas of Northeastern Mexico, (part of a coordinated programme on the ecology and behaviour of the *Heliothis* complex as related to the sterile-male technique)

FINAL REPORT FOR THE PERIOD

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ALGAE AND MAIZE OPAQUE - 2 TWO SUITABLES AND ECONOMICAL PROTEIN
SOURCE FOR REARING Heliothis virescens F.

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Final Report

ABSTRACT

The algae Spirulina Geitleri J. Toni and the variety of maize - opaque-2 were excellent substitutes for casein, soybean and wheat germ which are used as protein source in the mass rearing of the Heliothis complex and other insects under laboratory conditions. Opaque-2 is very rich particularly in lysine and tryptophan. The algae is rich in lysine, tryptophan, alanine, tyrosine, etc., and B-vitamins, its price is about 70% cheaper compared with -- other sources of protein tested. Larval and pupae weight were higher (no significant) when reared on diets containing Spirulina and opaque-2. The life cycle and reproduction of moths from larvae reared on the check diet and Spirulina and opaque-2, diets were comparable.

INTRODUCTION

In the meeting on the Heliothis complex held in Monterrey, Mexico, in April 1974, sponsored by the IAEA/FAO, it was concluded that one of the most important goals in the Sterile Insect Technique, was to develop low price diets without affecting behavior competitiveness and reproduction of the insect. With this idea in mind a serie of tests in which different constituents in different proportions were provided to larvae of Heliothis virescens, and their effect on weight and reproduction were studied. The results obtained with opaque-2* and the algae Spirulina that happen to be the most promising one are here reported.

MATERIALS AND METHODS

In all bioassays about 1000 ml of each diet was prepared with a liquifier-blendor. The diet was dispensed into 3/4 oz clear plastic cups, closed with cardboard lids, 24 hours later 100 cups/diet were infested with one 1st-instar larvae/cup. Each larval was considered a replicate, and the entire larval cycle was spent in the same cup. A total of 400 larvae were tested per each -- diet that appeared to be the most promising one.

The formulation used as check is shown in Table 1. The B-vitamin solution indicated here, contains standard concentrations of the following vitamins" Niacin, Ca pantothenate, Folic Acid, -

* Opaque-2 a variety of maize rich in tryptophan and lycine.

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Riboflavin, Thiamine, Pyrodoxine, B₁₂ and Biotin. Except in those containing spirulina in which the amount was reduced to 1/3.

The spirulina was obtained from the Chemical Company that -- produces this algae in the Texcoco Lake, Mexico, and is actually being tested in human and fish consumption. The maize -- opaque-2 was kindly provided by CIMMYT (wheat and corn breeding international center).

Larvae were reared under a daily photo period of 14 hours at -- 27± 1°C. The effect of diets in insect development was determined by weighing a total of 40 one-day old pupae per treatment.

Adults reared from diets tested were placed by single pairs in 1-quart wide-mouth mason jars, provided with cheescloth covers and resting sites and fed with a 5% sucrose solution. Fecundity and fertility was determined from the eggs oviposited during 5 days after the first eggs have been laid.

RESULTS AND DISCUSSION

Larvae reared on diets lacking, casein, wheat germ or B-vitamins reached up to the third instar.

There were not significant differences in pupae weight, adult emergences fecundity and fertility of the moths when the soybean flour and wheat germ were substituted by 24 gms. of spirulina. - In a latter test the same treatment was repeated but the standard amount of B-vitamin solution was reduced to 1/3, without affecting the development of the varvae, and fecundity and fertility of the adults (Table 2). These results agree with those reported by Guerra (personal communication), who also states -- that the mating frequency was greater in moth reared on diets -- containing spirulina.

As is shown in Table 3, spirulina is very rich in aminoacids -- and vitamins. The total protein content (including all known essential aminoacids), comparing with those used on standard diets is as follow: Spirulina 70%, Nutrisoy 50%, Wheat Germ 32%. Besides Spirulina is rich in B-vitamins, allowing insects to complete all the development stages when small amounts of - wheat germ and vitamins are added. Guerra (personal communication) states that spirulina has a digestibility of 80% , a -- protein efficiency of 80%, and a net protein utilization of 87% in comparison with casein. To these advantages we have to add that spirulina is about 70% cheaper that semi-artificial conditions. Unfortunately Spirulina is not available as the other sources of protein, thereby a serie of tests were ran, using the

maize opaque-2 as protein source, and the results compared - with the check diet and with maize sold in the local market .96 gr./1000 ml. of diet were used in each case. As is shown in Table 2, pupae weight, eggs/day and egg hatchability was - higher in those larvae reared in diets containing opaque-2. - From these results, we may conclude that we can substitute --- opaque-2 for wheat germ decreasing the costs.

From the results here reported it appears that the algae spirulina and opaque-2, are very promising one in the development of very simple an inexpensive larval diets to rear the Heliothis - complex.

TABLE No.1Formulation used as check diet for mass rearing of Heliothis virescens.

H ₂ O	3000	ml
KOH (4M)	18	ml
Nutrisoy	242	g
Wheat germ	108	g
Salt Wetson	36	g
Sucrose	44	g
MP	5.4	g
Sorbic Acid	3.25	g
Ascorbic Acid	14.5	g
Aureomyein	9.1	g
B-vitamins	12	ml
Choline chloride (15%)	25	ml
Formaldehyde (10%)	40	ml
Agar	55	g

TABLE No.2

Affect of protein content of different diets on the pupae weight, eggs/female/day, and egg hatchability, of Heliothis virescens - reared under laboratory conditions.

Source of Protein	Pupae Weight mg.	Eggs/Female/Day/ <u>1</u> /	Eggs Hatchability %
Maize opaque-2	332	67	55
Corn (Sold in - local market)	278	42.5	30
Casein	314	37	22
Spirulina	404	55	50
Check (nutrisoy)	305	37.1	22

1/ 5 Day Average.

TABLE No.3

Aminoacid and vitamin content of the algae *Spirulina Geitleri*

Mg/100 Gm Day Weight			
Aminoacid		Vitamins	
Lysine	4.53	Thiamine	3.9
Threonine	5.14	Riboflavine	4.0
Valine	6.56	Niacin	10.7
Isoleucine	6.02	Ca pantothenic	1.2
Leucine	8.65	Pyradoxine	1.3
Phenilalanine	4.40	Folic acid	0.6
Methionine	2.45	Inositol	34.0
Tryptophan	1.61		
Histidine	1.58		
Arginine	6.45		
Aspartic acid	9.29		
Glutamic acid	13.28		
Serine	5.29		
Proline	3.63		
Glicine	4.92		
Alanine	7.54		
Tyrosine	4.54		
Cysteine	0.96		

