INEXPENSIVE TECHNOLOGY FOR MASS REARING OF CORN EARWORM HELIOTHIS ARMIGERA (HUBN) ON MODIFIED NOCTUID DIET BEYOND 20TH GENERATIONS

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SUMMARY: The mass rearing of corn earworm Heliothis armigera (Hubn) has carried out upto twenty third generations uninterrupted. The original diet of shorey and Hale has been used after incorporating vitamin mixture, replacement of brewer's yeast with baker's yeast and substitution of lima bean with lobia bean (Asparagus bean).

Key Words: Rearing of Heliothis armigera.

INTRODUCTION

The increasing demand for a large number of laboratory reared insects has necessitated the development of more efficient and economical method of production. The rearing of insects on artifical media rather than on their host plants, is advantageous in variety of investigations.

Heliothis species have been reared on artifical diets by a number of investigators but only few of them could be able to develop satisfactory diet formula for continuous rearing of this insect (1-10).

The objective of the present work is to develop simple inexponsive and satisfactory technique for diet formula with almost all the material and ingredients locally available. Successful rearing of *Heliothis armigera* (Hubn) has already been carried out up to fifteen generation Sheikh *et al.* (2). The present data indicate the result from 16th to 23rd generations.

MATERIALS AND METHODS

Contents and preparation of the medium

The ingredients and quantities used in the preparation of a liter modified shorey and Hale diet are:

Tap water .... 100 ml
Powdered agar 25mg
Bean powder (vigna unguiculata) .... 200 gm
Ascorbic acid .... 11 gm
Sorbic acid .... 1.5 gm
Yeast (Baking granules) .... 10 gm
Methyl-para-hydroxy benzoate .... 3.5 gm
Formaldehyde 10% .... 3 ml
Vitamin mixture .... 2 ml

Agar was dissolved in water and bought to boil on water bath, boiling solution was allowed to stand for about 6 min, then poured into blender already having dry ingredients and mixed for 2-3 min, after that wet ingredients were added along with methyl-para-hydroxy benzoate, the whole mass was throughly blended the diet was then transferred into vials for solidification vitamin mixture preparation in 100 ml sterile distilled water.

Calcium pantothenate .... 2.4 gm
Nicotine acid amide .... 1.2 gm
Riboflavin .... 0.6 gm
Folic acid .... 0.6 gm
Thiamine hydrochloride .... 0.3 gm
Pyredoxine hydrochloride .... 0.3 gm
Biotin .... 0.024 gm
Cynocobolamine (B12)

The ingredients were carefully weighed and held in separate containers. The white ingredients were poured into a flask to which 50 ml of water was added and mixed well. The yellow ingredients were then mixed the mixed with the addition of some water while maintaining constant stering, cynocobolamine was added in the end with the reaming quantity of water.

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Description of rearing apparatus and procedure

Ovi position cage: The dimension of cubical cage measure about one cubic feet, having two opposite sides open, each fitted with a removable square frame. The construction of this cage has been reported by Burton (5, 6) and Sheikh *et al.* (3).

Single capsule vial rearing technique

A standard size (5.3 cm x 2.3 cm) sterile capsule vials were filled nearly with 8 gm of diet while the diet was still semisolid, after solidification a newly hatched 1st instar larva were transfered to the diet and the vial's mouth was closed with sterile cotton wool plug. The vials were placed inverted till the developing larva pupated.

Adult exergence

Pupe collected from capsule vials were placed on a blotting paper in glass jars measuring 9.5x15 cm. The mouth of glas jar was covered with muslin piece (cloth) the emerged adults were collected into capsule vials. Separated sex wise and released into the mating ovi position cages.

RESULTS AND DISCUSSIONS

Table 1 indicates that modified diet supported the healthy growth of *Heliothis armigera* (Hubn) from 16th to 23rd generation.

Larval mortality

The table shows the minimum larval mortality percentage (7.52%) in the 16th generation and maximum larval mortality in the 19th generation (33.59%). The larval mortality percentage seems to have no relation with the increase or decrease in temperature. The variable larval mortality in different generation may be attributed to various factors eg. Larval entanglement in the cotton plug, larval injury during transfer of 1st instar larva to vials. Sutter and Miller (10) reported 96.8% larval survival as against 60.5 - 92.4% recorded during the present studies.

Pupal recovery

The highest pupal recovery (92.48%) was obtained in the 16th generation and the lowest (60.56%) in the 22nd generation. Burton and Perkins (6) reared corn earworm on bean and WSB diets and achieved 86.2% and 92.0% pupation respectively. Dang. *et al.* (7) achieved 75% pupation chilozonellus (swinhoc) on kabuli gram diet.

No pupal mortality was observed in 18th and 19th generation. 11.3% mortality was observed in 16th generation and highest pupal mortality (33.22%) occurred in the 23rd generation. The variation in pupal mortality was due to pupal injury inflicated during the transfer of pupae from diet containing vials to glass jars used for emergence of adults. Howell (8) observed 7.3% pupal mortality when he reared codling moth.

Adult emergence

It is noted from the table that the maximum adults emergence (78.0%) was observed in the 16th generation and minimum emergence (40.1%) was noted in the 23rd generation, Burton and Perkins (6) observed 90% adult emergence of *Heliothiszea* (Boddies) on bean diet.

The percentage yield from larvae to adults was the highest (81.1%) in the 16th generation while the lowest yield was obtained (37.8%) in the 23rd generation. However in most of the generations the net yield remained above 63%. Similar results were obtained by Adkinson *et al* (4), Dange *et al.* (7) and Sutter and Miller (10).

Egg production per female

The egg production per female in the 18th generation was minimum ie 571.6 at the highest temperature range

Table 1

S. No	No. of Generations	Total Larvae Reared Larva/Vial	Larval Mortality %	Pupal Recovery %	Pupal Mortality %	Adult Emergance Out of Total Pupae.	Yield from Larva to Adult	Average Egg Production Per Pemale	Temp (°F)
1	16	625	7.52	92.48	11.36	78.8	81.12	2713.33	81-94
2	17	400	14.5	85.52	14.25	69.75	71.25	1158.6	2-95
3	18	434	30.87	69.12	NIL	16.35	69.13	571.66	82-95
4	19	646	33.59	66.40	NIL	47.83	66.41	2591.62	78-92
5	20	594	18.85	81.14	18.85	62.28	62.30	3600.45	78-92
6	21	440	11.36	88.63	21.81	66.82	66.83	2092.5	80-94
7	22	639	9.38	60.56	32.39	59.46	59.33	1820.83	80-93
8	23	304	28.94	76.64	33.32	40.13	37.84	690.75	80-94

82-95°F while the maximum egg production 3600 was obtained in the 20th generation at the lowest temperature 78-92°F. Results clearly indicate that the egg production is adversely affected at higher temperature.

Hence it is concluded that the modified noctuid diet tested during the course of these studies is most suitable for mass rearing of corn earworm *Heliothis armigera*.

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REFERENCES

1. Rafi Sheikh M, Khaique Ahmed, Feroza Khalique : A Bean contaning diet for mass rearing of pectinophora gossypiella saunders. Pak J Sci Ind Res, 19: 77-79, 1976.

2. Rafi Sheikh M, Dilnawaz Sheikh, Baqir S, Shyum Naqvi : Mass rearing of corn Earworm Heliothis armigera (Hubn) on modified Noctuid diet. J Zoology 21:115-121, 1989.

3. Rafi Sheikh M : Final sech. Report project No PK. ARS-146 grant No FG-Pa, 317. P.L. 480 programme of USDA, 1982.

4. Adkinson PL, Vanderjant ES, Bull DL, Allison WE : A wheat germ diet for rearing pectinophora gossypilla (Sounders)) J Econ Entomol, 53:758, 1960.

5. Burton RL : A low cost artificial diet for the corn earworm. J Econ entomol, 63:169, 1970.

6. Burton RL, Perkins WD : WSB, A next laboratory diet for corn earworm and fally army worm. J Econ Entomol, 65:385, 1972.

7. Dang K, Anad M, Jotwani MG : Artificial diet for the rearing of chilo zonellus (swinehoe). Indian J Entomol, 32:130, 1970.

8. Howell JF : Rearing the codling moth on a soya, wheat germ, starch medium. J Econ Entomol, 637, 1972.

9. Shorey HH, Hale RL : Mass rearing of larvae of Nine noctuid species on a simple artificial medium. J Econ Entomol, 58:522, 1964.

10. Sutter GR, Miller E : Rearing eunoa auxiliaris on artificial diet. J Econ Entomol, 65:717, 1971.

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