

SOYA, A SUBSTITUTE INGREDIENT FOR CASEIN IN THE CODLING MOTH LARVAL REARING MEDIUM

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In the wheat germ — casein larval diet of the codling moth, *Cydia pomonella* (L.), casein was replaced with soya using 0, 50, 100 and 200 g soya per treatment formulation. The results evaluated on the basis of larval survival, pupal recovery, pupal size and duration, adult emergence, oviposition and egg hatch showed that 100 g soya was the best combination. These results suggest that soya could be a good substitute for casein.

Key words: Codling moth, soya, larval diet, casein, larval survival, pupal recovery, adult emergence.

INTRODUCTION

Rearing the codling moth on semisynthetic diets had the disadvantage of being expensive and for this reason various ingredients have been tested to make the diet more economical and simple. The more expensive ingredients were agar, vitamins, casein, sugar, and ascorbic acid. Brinton *et al* [1] were able to substitute wood pulp and wheat flour for agar. Howell [2] used another less expensive colloid, wheat starch, in place of agar. Still further substitutions are needed to replace expensive materials with cheaper products.

Our objective was to evaluate the substitution of defatted soya for casein, since soya is 6 times less expensive. The investigation reported here deals with different levels of soya combination and their effect on larval rearing of codling moth *Cydia pomonella* (L.).

MATERIALS AND METHODS

Preparation of diet. The various ingredients used in this larval diet are formulated in Table 1. The diet was prepared according to the method of Howell [3]. When the diet was prepared, then about 280 ml of diet was poured into 450 ml plastic cups and allowed to gel at room temperature.

When the medium was just perceptibly warm and no longer sticky, it was coated with a paraffin spray [4]. Each diet container was then seeded with 20 neonate larvae obtained from our stock culture. After seeding, the containers were covered with muslin cloth that was further covered

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on the top with a plastic lid having been punched with a 3 cm dia hole. The seeded containers were held in a rearing room maintained at $25 \pm 1^\circ$ with $54 \pm 2\%$ of R.H and a 16 hr photophase. Larval survival was recorded. Cocoons containing pupae were collected and caged in 13 x 20.2 cm. polyethylene bags [5] for subsequent adult emergence,

Table 1. Composition of wheat germ larval diet with levels of soya meal for rearing the codling moth.

Ingredients	Composition of diet No.			
	1	2	3	4
Water (ml)	1700	1700	1700	1700
Agar (g)	45	45	45	45
Soya meal (g)	—	50	100	200
Casein (g)	63.0	—	—	—
Sucrose (g)	48	48	48	48
Wheat germ (g)	54	54	54	54
Apple pulp (g wet wt)	54	54	54	54
Alphacel (cellulose powder) (g)	9	9	9	9
Mineral salts (Wessons formulation)	36	36	36	36
Formaldehyde (ml)	0.7	0.7	0.7	0.7
Nipagen (g)	2.7	2.7	2.7	2.7
(Methyl <i>p</i> -hydroxybenzoate)				
Sorbic acid (g)	2.5	2.5	2.5	2.5
Benlate (g)	0.6	0.6	0.6	0.6
(Benonyl (methyl 1-butyl-carbonyl)-2 benzimidazolecarbamate)				
Vitamin stock (g) (Howell, 1971)	18	18	18	18
Ascorbic acid (g)	7.5	7.5	7.5	7.5

Table 2. Effect of various levels of soya, in wheat germ larval diet, on larval survival, pupal recovery, pupal size, pupal duration, adult emergence, fecundity and fertility of codling moth, *Cydia pomonella* (L.)

Treat- ments	Larval survival	Pupal recovery	Pupal size/ wt. (mg)	Pupal duration (days)	Adult emer- gence (%)	Eggs/♀	Egg hatch (%)
0	59.7 b	50.8 a	11.2 b	42.4 b	64.9 a	54.0 b	55.8 b
50	65.2 b	52.8 a	12.6 b	39.9 b	69.6 a	70.5 b	64.6 ab
100	81.6 a	61.8 a	15.4 a	33.7 a	82.9 a	106.3 a	80.3 a
200	75.3 a	58.2 a	13.5 ab	36.1 ab	72.5 a	74.5 b	66.1 ab

Each value is a mean of 3 generations.

Means followed by the same letters are not significantly different at the 5 % levels of significance (Duncan's New Multiple Range Test).

mating and oviposition. The experiment continued upto three generations. The data obtained for larval survival, pupal recovery, pupal size and duration, adult emergence, fecundity and fertility were subjected to ANOVA and DMR test.

RESULTS AND DISCUSSION

The results on the effect of various levels of soya in the wheat germ diet, on larval survival, pupal recovery, pupal size and duration, adult emergence, fecundity and fertility of codling moth (Table 2) indicate that the per-

centage of larval survival was significantly higher in 100 and 200 g soya treatments than in 50 and 0 g (casein only) levels. The percentage of pupal recovery was not significantly different. The pupal size was significantly higher while pupal duration was significantly reduced in 100 g soya treatment. Oviposition and egg hatch were also significantly higher in this treatment.

Our results with regard to moisture balance, mold control, diet consistency and insect development are in full conformity with Howell's observations [3,6].

It is concluded from our results that casein can be easily replaced by a cheaper ingredient like soya without any drastic effect on the insect development and yield and the cost of diet can be reduced upto 6 times provided 100 g of soya are used per formulation.

REFERENCES

1. F.E. Brinton, M.D. Proverbs and B.E. Carty, Can. Entomol., **101**, 577 (1969).
2. J.F. Howell, J. Econ. Entomol., **65**, 636 (1972).
3. J.F. Howell, J. Econ. Entomol., **63**, 1148 (1970).
4. J.F. Howell, J. Econ. Entomol., **60**, 289 (1967).
5. L.D. White and R.B. Hutt, J. Econ. Entomol., **64**, 551 (1971).
6. J.F. Howell, J. Econ. Entomol., **64**, 631 (1971).