

Full Length Research Paper

Insect Growth Regulator Properties in Soaked Edible Plant Products against Rice Armyworm *Mythimna separata* (Walker) (Lepidoptera ; Noctuidae)

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Abstract:

Insect Growth Regulator properties have been reported in the artificial diet developed for laboratory mass rearing of *Mythimna separata* using soaked form of different plant products. Semi synthetic diet is a prerequisite for maintaining mass culture of insects. The experiment was conducted in department of Entomology, Pantnagar University of agriculture and technology Pantnagar Nainital.

Key words: *Mythimna separata* , IGR, artificial diet, soaked.

Introduction

Mythimna separata , the northern armyworm ,oriental armyworm or commonly known as rice ear cutting caterpillar is reported to have assumed the status of major pest in Uttarakhand in the last few years. It is found in China,Japan,South-east Asia,eastern Australia ,Newzeland and some pacific islands and has been a problem over there also.This pest has been found to be of regular occurrence to rice at maturity stage. To study its different aspects, a uniform culture of the pest is needed throughout the year, which is not possible in absence of host plants round the year. Keeping this in mind , a semi-synthetic diet was formulated using different commodities. Semi synthetic diets have been reported for Spodoptera litura, Creatonotus gangis, (Tiwari and Bhattacharya1987), *Spodoptera littoralis*, (Sorour *et.al.*2011) and other insects. A semi-synthetic diet has been developed for *M. separata* using French bean flour by Mehta and Sharma 1995,Mehta 2014.Earlier studies have shown that soaking the lathyrus peas overnight in cold water helped in removing the water soluble toxins(Padmanaban, 1980).Further improvements have been tried using different soaked form of cereals and pulses.Artificial diet required because the host plants are not available round the year ,so to continue research through out the year formulation of semi synthetic diet is essential.

Materials and methods**Methodology**

For the study larvae of armyworm were cultured in the lab under aseptic conditions, Day one larvae were released in the diet and control. Observation related to larvae size, larvae weight, pupa size, pupa weight and adult along with the deformities were recorded. Sixteen different commodities (seeds) of bajra (*Pennisetum typhoides*), black gram (*Phaseolus mungo*(L.), cowpea (*Vigna sinensis* (L.), French bean (*Vicia fabia*(L.), gram (*Cicer arietinum* (L.), green gram (*Phaseolus aureus* (Rock.), lentil (*Lens esculentus*(L.), maize (*Zea mays* (L.), pea (*Pisum sativum* (L.) ,ragi (*Eleusine coracana*(L.),redgram (*Cajanus cajan*(L.),rice (*Oryza sativa*(L.),sorghum (*Sorghum vulgare*(L.),soybean (*Glycine max*(L.),wheat (*Triticum aestivum* (L.),and winged bean (*Psophocarpus tetragonolobis* (L.) were soaked for 48 hours except lentil and rice which were soaked for 24 hours. After soaking the seeds were thoroughly washed and then placed over filter papers to absorb excess water. The various ingredients were used as adopted from Tiwari and Bhattacharya (1987).

The composition of the diet is as follows:

Commodity ---	17.67 gm
Yeast powder ---	3.07gm
Sodium ascorbate ---	0.31gm
Methyl -p- hydroxybenzoate (methyl paraben) ---	0.31gm
Sorbic acid ---	0.15gm
Agar ---	1.54gm

Formaldehyde (10%) --- 0.15 ml

Water (Distilled) --- 76.80 ml

Half the quantity of water was heated and agar added slowly to it while stirring continuously and then cooled at room temperature. Each base commodity was then transferred to the blender and mixed for two minutes with remaining half quantity of water. Yeast powder, methyl -p- hydroxyl benzoate, sorbic acid and formaldehyde were added to the above grinded commodity in the blender and mixed for two minutes. Agar and ascorbic acid were added to the blender and the entire diet was mixed for two minutes. The prepared diet was transferred immediately into plastic vials (15X5cm) and allowed to cool at room temperature and stored at 4⁰C until used.

Test insect

Mated female *Mythimna separata* were released into glass jars covered with muslin cloth. Sucrose was provided on cotton swabs as food. Glass jars were lined with white paper inside to facilitate egg lying. Parts of paper containing eggs were cut and transferred to glass jars. Newly emerged first instar larvae were transferred to different formulated diets and control (maize leaves) (Mehta (1990). 5-10 gm of each diet was placed per plastic vial (20x15cm) and ten newly emerged larvae were released in each vial and then closed with a cap having a brass mesh. An equal number of newly emerged larvae were introduced in control diet. The diet was changed at four days interval during early stages and after the eighth day larvae were reared individually for comparing the growth and development of insects. All the experiments were conducted at 27 C and 70₊₅ % Relative Humidity. Comparison between different commodities was made on different parameters as larval period, pupal period, pupal weight, percent pupation, percent adult emergence and nature of adults. A hypothetical value of one was assigned to control and the formulated diets were categorized on the basis of survival index after comparison with control.

$$\text{Success index} = \frac{\text{LPI} + \text{PPI} + \text{PI} + \text{SUR I}}{4}$$

$$\text{LPI} = \text{larval Period Index} = \frac{\text{Larval period on test diet}}{\text{Larval period on control diet}} \quad \text{PPI} = \text{Pupal}$$

$$\text{Period Index} = \frac{\text{Pupal period on test diet}}{\text{Pupal period on control diet}}$$

$$\text{PI} = \text{Pupation Index} = \frac{\text{Percent pupation on test diet}}{\text{Percent pupation on control diet}}$$

$$\text{SUR. I} = \text{Survival Index} = \frac{\text{Percent Adult emergence on test diet}}{\text{Percent Adult emergence on control diet}}$$

Table 1. Soaking time of different commodities

Sr. No.	Different commodities	Soaking time (hours)
1.	Bajra (<i>Pennisetum typhoides</i>)	48
2	Black gram (<i>Phaseolus mungo</i> (L.)	48
3	Cowpea (<i>Vigna sinensis</i> (L.)	48
4	French bean (<i>Vicia fabia</i> (L.)	48
5	Gram (<i>Cicer arietinum</i> (L.)	48
6	Green gram (<i>Phaseolus aureus</i> (Rock.)	48
7	Lentil (<i>Lens esculentus</i> (L.)	24
8	Maize (<i>Zea mays</i> (L.)	48
9	Pea (<i>Pisum sativum</i> (L.)	48
10	Ragi (<i>Eleusine coracana</i> (L.)	48
11	Redgram (<i>Cajanus cajan</i> (L.)	48
12	Rice (<i>Oryza sativa</i> (L.)	24
13	Sorghum (<i>Sorghum vulgare</i> (L.)	48

14	Soybean (<i>Glycine max</i> (L.))	48
15	Wheat (<i>Triticum aestivum</i> (L.))	48
16	Winged bean (<i>Psophocarpus tetragonalobis</i> (L.))	48

Table 2. Developmental profile of *Mythimna separata* on diets prepared with soaked form of different commodities

sr. no	Different commodities	Larval period days	Pupal period days	Pupal weight (mg)	Percent pupation	Percent adult emergence	Nature of adults
1.	Bajra	21.66	15.66	0.250	47.33 (43.6)	33.33 (35.2)	N, Wex
2	Black gram	20.00	-----	0.198	6.66 (14.8)	-----	-D
3	Cowpea	21.33	18.00	0.203	39.99	33.33 (35.2)	Wex
4	French bean	22.00	11.00	0.254	84.20	75.50 (60.3)	N,
5	Gram	24.66	17.40	0.220	57.73	47.73 (43.7)	N, Ww
6	Green gram	19.33	12.00	0.198	32.20	21.10 (27.3)	N,
7	Lentil	27.00	21.00	0.117	44.95	---	D
8	Maize (soaked grains)	22.33	15.00	0.179	43.00	36.00 (36.8)	Wex
9	Pea	21.00	13.00	0.190	34.95	-----	D
10	Ragi	23.00	15.50	0.168	39.66	8.33 (16.7)	Ww
11	Red gram	19.50	15.00	0.213	70.60	54.50 (47.5)	N, D
12	Rice	21.66	12.66	0.152	45.43	19.93 (26.4)	Wex
13	Sorghum	25.00	21.00	0.277	43.00	6.66 (14.8)	Abem
14	Soybean	29.33	17.00	0.221	24.00	---	D
15	Wheat	28.66	-----	0.186	10.00	----	D
16	Winged bean	24.66	18.00	0.181	44.42	---	D
17	Control (Maize leaves)	19.00	10.60	0.308	90.00 (71.5)	80.00 (63.4)	N,
	S.Em +	1.105	0.9583	0.125	4.453	3.513	
	-	3.193	2.768	0.367	13.209	10.363	

Data in parentheses indicate ranking

---- All larvae died; N Normal Adults; Abem Adults failed to come out of pupal case; Deformed pupae; Wex Adults wings not expanded; Ww Adults with wavy wings

The present investigation reveals that *Mythimna separata* can be successfully reared on French bean soaked diet. The similarity between the French bean diet and control shows that this formulated diet can be used successfully in the mass rearing of the *Mythimna separata* throughout the year, so as to facilitate the study in the fundamental and applied aspects of Entomology which are severely affected due to the unavailability of homogenous fresh and healthy insects for testing.

Results and discussion

On the basis of the experiments conducted using different cereals and pulses the present investigation revealed that *Mythimna separata* can be successfully reared on French bean based diet which was supporting maximum number of normal adults (75.50 %) (Table III) and was found to be at par with control (80.00%). Thus French bean (soaked) was categorized the best among all the formulated diets based on survival index. On the basis of survival index the formulated diets can be arranged in the following order. French bean (*Vicia fabia*(L.) > Redgram (*Cajanus cajan*(L.) > Gram (*Cicer arietinum* (L.) > Maize (*Zea mays* (L.) (Soaked grains), > Lentil (*Lens esculentus*(L.) > Bajra (*Pennisetum typhoides*) Cowpea (*Vigna sinensis* (L.) > Rice (*Oryza sativa*(L.) > Green gram

(*Phaseolus aureus* (Rock.) > Ragi (*Eleusine coracana*(L.) > Sorghum (*Sorghum vulgare*(L.). Black gram (*Phaseolus mungo*(L.), Pea (*Pisum sativum*(L.), Soybean (*Glycine max*(L.), Wheat (*Triticum aestivum* (L.) and Winged bean (*Psophocarpus tetragonolobis* (L.) could not support the larvae in the initial stage and thus died. The similarity between the french bean diet and control shows that this formulated diet can be successfully used in the mass rearing of *Mythimna separata* throughout the year. This is to facilitate the study to the fundamental and applied aspects of Entomology which were severely affected due to the unavailability of homogenous fresh and healthy insects for testing.

Table 3. Developmental indices of *mythimna separata* on diets prepared with soaked form of different commodities.

Sr. No.	Different commodities	Larval period index	Pupal period index	Pupation index	Success index	Survival index
1.	Bajra	0.876	0.610	0.530	0.626 (5)	0.416
2	Black gram	0.950	----	0.740	0.256 (15)	-----
3	Cowpea	0.892	0.429	0.441	0.498(12)	0.416
4	French bean	0.863	0.968	0.934	0.917 (1)	0.904
5	Gram	0.770	0.611	0.639	0.653 (3)	0.594
6	Green gram	0.985	0.883	0.356	0.621 (6)	0.263
7	Lentil	0.703	0.501	0.495	0.543 (8)	0.433
8	Maize (soaked grains)	0.883	0.706	0.481	0.553(7)	0.450
9	Pea	0.905	0.815	0.378	0.524 (9)	-----
10	Ragi	0.838	0.688	0.441	0.502 (11)	0.116
11	Red gram	0.969	0.706	0.540	0.719 (2)	0.662
12	Rice	0.879	0.867	0.481	0.635(4)	0.313
13	Sorghum	0.817	0.028	0.481	0.373 (14)	0.082
14	Soybean	0.655	0.611	0.243	0.503 (10)	----
15	Wheat	0.673	----	0.092	0.119 (16)	----
16	Winged bean	0.773	0.589	0.493	0.463(13)	-----
17	Control (Maize leaves)	1.000	1.000	1.000	1.000	1.000

Data in parentheses indicate ranking

---- All larvae died

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