EFFICACY OF SOME PLANT EXTRACTS AS A TOXICANTS, ANTIFIDANTS OR GROWTH REGULATORS AGAINST *HELICOVERPA ARMIGERA* (HUBNER)

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Abstract: Fourteen plant extracts namely mango ginger rhizome, bergera leaf, calotropis leaf, tulsi leaf, thusa leaf, dhatura leaf, ipomia leaf, neem leaf, garlic leaf, ginger rhizome, bel leaf, harsingar leaf, neem cake and turmeric rhizome were tested for their toxic effect against the gram pod borer, *Helicoverpa armigera* (Hubner). Each extract was tested in three concentrations (100, 500 and 1000 ppm) incorporated in the semisynthetic diet. The mortality was recorded within three days in the higher concentration of thusa and dhatura leaf extracts and neem cake extracts other plant materials were comparatively slower. The mango ginger rhizome, bergera and tulsi leaf extract were the least effective.

Keywords: Growth regulators, Extract, Toxicant

INTRODUCTION

In recent past research work on many plant species for their insecticidal properties and their possible utilization for the insect pest control attracted the attention of Entomologists. This is mainly due to awareness towards of the environment, which is being polluted by the use of synthetic organic insecticides. The possibilities of their utilization for the pest control have attracted attention in last two-three decades. The research work on properties like toxicant, antifeedant and growth regulators of various plant species has been initiated on many insect species of economic importance. In the last two decades crude and refined extracts of different plant parts, particularly of neem has been used against the defoliators and sucking insects.

For extracting the active ingredient solvents like water, ethanol, methanol, acetone, hexane, petroleum ether, chloroform etc. has been used. In the present investigation ethanol extract of common plant materials were tested against the larvae of gram caterpillar, *Helicoverpa armigera* (Hubner).

MATERIAL AND METHOD

The present investigations were undertaken to test the efficacy ethanol extract of plants on the growth and the development of *Helicoverpa armigera* (Hubner) under laboratory condition in the Department of Entomology College of Agriculture, Gwalior (M.P.).

Extracts of the following fourteen plants were tested against control.

SNO.	Extracts	Botanical name
1	Mango ginger rhizome	*Curcuma ameda*
2	Bergera leaf	*Murraya koiningi*
3	Calotropis leaf	*Calotropis gigantia*
4	Tulsi leaf	*Ocimum adscendens*
5	Thusa leaf	*Thusa oxidentalis*
6	Dhatura leaf	*Dhatura fastusa*
7	Ipomia leaf	*Ipomia carnia*
8	Neem leaf	*Azadirachta indica*
9	Garlic leaf	*Allium sativum*
10	Ginger leaf	*Zingibar officinale*
11	Bel leaf	*Aegel marmelos*
12	Harsingar leaf	*Nyctanthus*
13	Neem cake	*Azadirachta indica*
14	Turmeric rhizome	*Curcuma longa*

Ethanol extracts were prepared from the dried powders of the plant materials. The extracts were dried in Petri dishes, at room temperatures and were kept in the incubators at 60^{o}C for complete drying till constant weight was obtained. The dried material was dissolved in known quantity of ethanol for further use. Semi synthetic diet for mass rearing of *Helicoverpa armigera* (Hubner) was prepared with following contents –

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SNO.	Diet constituent	Quantity required (gm)	Purpose
1.	Bengal gram flour	100.00	Basal food
2.	Agar-agar	12.80	Solidification
3.	Yeast tablet	30.00	Digestion of food material
4.	Wessons salt mixture	7.20	All essential nutrients
5.	Sorbic acid	1.00	Preservative
6.	Methyl paraben	2.00	Anti-fungal agent
7.	Choline chloride	0.72	Fat for better growth
8.	Strepomycine (SO_4)	0.04	Antibacterial
9.	Ascorbic acid	3.20	Increased fecundity
10.	Vitamin drops	1.00ml	Better growth
11.	Formalin (40%)	1.00ml	Antiviral
12.	Distilled water	720.00ml	

The plant extracts were mixed thoroughly @ 100, 500 and 1000 ppm of dried power in 50 ml of semi-solid diet and the mixture was poured in ten specimen tubes (5x 3.5 cm) @ 5ml/tube. The specimen tubes were kept open for eight hours to avoid access of moisture. One, two days old larva was released in each specimen tube and was covered with the perforated lid. Ten such larvae were kept for each concentration and for the control. There were three replications for each treatment. Observations on the mortality were recorded 3, 9, 15 and 21 days after released. Data were subjected angular transformation (arc sine), for statistical analysis.

RESULT AND DISCUSSION

Efficacy of fourteen plant extracts was tested against the larvae of *Helicoverpa armigera* (Hubner). Three concentrations viz. 100, 500 and 1000 ppm of each plant product were tested by mixing them in the artificial diet. The results are described here with-

Toxic effect on the larvae

The data on the mortality of the larvae were recorded 3, 9, 15 and 21 days after release of the larvae. The mortality recorded at different intervals was as under-

Three days after release

Significantly higher mortality was recorded in all the treatment as compared to untreated control. Among various plant materials the maximum plant mortality was recorded in Thusa and Dhatura leaf extracts, which was significantly higher than the rest of the treatments. The mortality in neem cake extract was the next to Thusa and Dhatura leaf extracts and was also significantly higher than the rest of the treatments except neem, Bel and garlic leaf extracts. The lowest mortality was recorded in Mango ginger rhizome extract, which was significantly lower than the rest of the treatments except Bergera leaf extract.

The interaction between plant extracts and their concentrations was also found significant. Significantly higher mortality was in 500 and 1000 ppm of Thusa and Dhatura extracts, 1000 ppm of neem cake, Garlic and Bel leaf extracts. Significantly lower mortality was recorded in 100 ppm of Tulsi leaf extract, which was however, at par with all the three concentration of mango ginger rhizome extract and 100ppm of Bergera leaf extract. The effect of other combination was intermediate. (Table1). Choadhary (1992) reported more mortality in case of dhatura in comparison to neem. Thusa leaf extract has not been tested on the pest so far. Kulat *et al.* (1998) also reported formulation of garlic to be uneffective against Helicoverpa armigera on pigeon pea. The ineffectiveness may be due to the low concentration of the product in the formulation used.

Table 1. Effect of different plant products and their concentrations on the mortality of *Helicoverpa armigera* (3 days after release)

SNO.	Treatment	Per cent larval mortality in concentration of			Mean
		100 ppm	500 ppm	1000 ppm	
1.	Mango ginger rhizome	10.0 (15.30)	10.0 (15.30)	10.0 (15.30)	10.0 (15.30)
2.	Bergera leaf	10.0 (15.30)	20.0 (26.07)	10.0 (15.30)	13.3 (18.89)
3.	Calotropis leaf	20.0 (26.07)	50.0 (45.00)	33.3 (39.15)	34.4 (36.74)
4.	Tulsi leaf	03.3 (06.74)	30.0 (33.00)	60.0 (50.85)	31.1 (30.20)
5.	Thusa leaf	50.0 (45.00)	100.0 (89.09)	100.0 (89.09)	83.3 (74.39)
6.	Dhatura leaf	50.0 (45.00)	100.0 (89.09)	100.0 (89.09)	83.3 (74.39)

7	Ipomia leaf	40.0 (39.15)	30.0 (33.00)	60.0 (50.85)	43.3 (41.00)
8.	Neem leaf	50.0 (45.00)	80.0 (63.93)	70.0 (57.00)	66.7 (55.31)
9.	Garlic leaf	40.0 (39.15)	60.0(50.85)	90.0 (74.70)	63.3 (54.90)
10.	Ginger rhizome	60.0 (50.85)	50.0 (45.00)	80.0 (63.93)	63.3 (54.90)
11.	Bel leaf	30.0 (33.00)	70.0 (57.00)	90.0 (74.70)	63.3 (54.90)
12.	Harsingar leaf	50.0 (45.00)	50.0 (45.00)	70.0 (57.00)	56.7 (49.00)
13.	Neem cake	40.0 (39.15)	70.0 (57.00)	100.0 (89.09)	70.0 (61.75)
14.	Turmeric rhizome	40.0 (39.15)	50.0(45.00)	80.0(63.93)	56.7 (49.36)
	Mean	35.2 (34.56)	55.0 (49.59)	68.1 (59.28)	52.8 (47.81)
	Control	-			10.0 (9.46)

Figure in parentheses are arc sign transformed value

	SEM	C.D (at 5 %)
Control Vs Treatment	(3.14)	(8.84)
Extract	(2.53)	(7.13)
Concentration	(1.17)	(3.30)
Interaction bet-n extract & concentration	(4.39)	(12.36)

Nine days after release

Significantly higher mortality was recorded in all the treatments in comparison to the control. Amongst the extracts, significant higher mortality was recorded in Thusa leaf extract which was significantly higher than the rest of the plant extract except, Dhatura and Neem leaf extract. The lowest mortality was recorded in Bergera leaf extract, which was significantly lower than the rest of the treatments, except mango ginger rhizome. The mortality in the 100, 500 and 1000 ppm was 52.6, 72.1 and 84.3 per cent had significant differences among themselves. The interactions between the concentrations of plant extracts were also significant. Significantly higher mortality was recorded in 500 and 1000 ppm of Thusa and Dhatura leaf extract, along with 1000 ppm of garlic and neem leaf extracts. The lowest mortality was recorded recorded in 100 ppm of Bergera and Tulsi leaf extract, which was significantly lower than the rest of the combinations of the treatments, except in 100 ppm of mango ginger rhizome, garlic, Bel leaf and 1000ppm of Bergera leaf extract (Table 2). Kulkarni (1998) observed that the effectiveness of almost all the extracts increased with the increased concentration in the artificial diet which is natural. Prbhakar *et al.* (1986) observed that the growth regulator activity of neem at 200, 2000 and 20000 ppm in of *Trichoplusia ni* and *Spodoptera exigua.*

Table 2. Effect of different plant products and their concentrations on the mortality of *Helicoverpa armigera* (9 days after release)

SNO.	**Treatment**	**Per cent larval mortality in concentration of**			**Mean**
		100 ppm	**500 ppm**	**1000 ppm**	
1.	Mango ginger rhizome	40.0 (39.15)	50.0 (45.00)	50.00 (45.00)	46.7 (43.04)
2.	Bergera leaf	30.0 (33.00)	50.0 (45.00)	40.0 (39.15)	40.0 (39.72)
3.	Calotropis leaf	50.0 (45.00)	80.0 (63.93)	80.0 (63.93)	70.0 (57.62)
4.	Tulsi leaf	30.0 (33.00)	60.0 (50.85)	80.0(63.93)	56.7 (49.26)
5.	Thusa leaf	60.0 (50.85)	100.0 (89.09)	100.0 (89.09)	86.7 (76.34)
6.	Dhatura leaf	56.7 (48.85)	100.0 (89.09)	100.0 (89.09)	85.6 (75.68)
7	Ipomia leaf	70.0(57.00)	50.0 (45.00)	90.0 (74.70)	70.0 (58.90)
8.	Neem leaf	90.0 (74.70)	90.0(74.70)	80.0 (63.93)	86.7 (71.11)
9.	Garlic leaf	40.0 (39.15)	70.0 (57.00)	100.0 (89.09)	70.0 (59.80)
10.	Ginger rhizome	60.0 (50.85)	70.0(57.00)	90.0 (74.70)	73.3 (60.85)
11.	Bel leaf	40.0 (39.15)	90.0 (74.70)	90.0 (74.70)	73.3 (62.85)
12.	Harsingar leaf	60.0 (50.85)	60.0 (50.85)	90.0 (74.70)	70.0 (58.80)
13.	Neem cake	60.0 (50.85)	80.0(63.93)	100.0 (89.09)	80.0 (67.96)
14.	Turmeric rhizome	50.0 (45.00)	60.0 (50.85)	90.0 (74.70)	66.7 (56.85)
	Mean	52.6 (46.96)	72.1 (61.36)	84.3 (71.42)	69.7 (59.91)
	Control				13.3 (21.15)

Figure in parentheses are arc sign transformed value

	SEM	C.D (at 5 %)
Control Vs Treatment	(3.23)	(9.09)
Extract	(2.60)	(7.33)
Concentration	(1.20)	(3.40)
Interaction bet-n extract & concentration	(4.51)	(12.70)

Fifteen Days After Release

Significant higher mortality was again observed in thusa and dhatura leaf extract with no significantly differences between them. Dhatura leaf and neem leaf extracts were at par with each other. The lowest mortality was in mango ginger rhizome extracts, which was significantly lower than in other treatments, except bergera and tulsi leaf extracts. The mortality in the other treatments was intermediate. Among concentrations significantly higher mortality was observed in 500 and 1000 ppm with no significant differences between them. Significantly lower mortality was recorded in 100 ppm. The interactions between plant extracts and their concentrations were also found significant. Significantly higher mortality was observed in 500 and 1000 ppm of thusa and dhatura leaf extracts and 1000 ppm of garlic leaf extract in comparison to the rest of the combinations. The lowest mortality was recorded in 100 ppm tulsi leaf extract which was significantly lower than the rest of the combinations except 100 ppm of bergera and bel leaf extract and 500 ppm of ipomia and all three concentrations of mango ginger rhizome extracts (Table 3).

Table 3. Effect of different plant products and their concentrations on the mortality of *Helicoverpa armigera* (15 days after release)

SNO.	Treatment	Per cent larval mortality in concentration of			Mean
		100 ppm	**500 ppm**	**1000 ppm**	
1.	Mango ginger rhizome	50.0 (45.00)	50.0 (45.00)	50.0 (45.00)	50.0 (45.00)
2.	Bergera leaf	60.0 (50.85)	60.0 (50.85)	40.0 (39.15)	53.3(46.95)
3.	Calotropis leaf	60.0 (50.85)	80.0 (63.93)	90.0 (74.70)	77.8 (63.83)
4.	Tulsi leaf	30.0 (33.00)	60.0 (50.85)	80.0 (63.93)	56.7 (49.26)
5.	Thusa leaf	70.0 (57.00)	100.0 (89.09)	100.0 (89.09)	90.0 (78.39)
6.	Dhatura leaf	60.0 (50.85)	100.0(89.09)	100.0(89.09)	86.7 (76.34)
7	Ipomia leaf	70.0 (57.00)	50.0 (45.00)	90.0(74.70)	70.0 (58.90)
8.	Neem leaf	90.0 (74.70)	90.0(74.70)	80.0 (63.93)	86.7 (71.11)
9.	Garlic leaf	60.0(50.85)	70.0 (57.00)	100.0(89.09)	76.7 (65.65)
10.	Ginger rhizome	70.0 (57.00)	70.0 (57.00)	90.0 (74.70)	76.7(62.90)
11.	Bel leaf	50.0 (45.00)	90.0 (74.70)	90.0 (74.70)	76.7 (64.80)
12.	Harsingar leaf	70.0(57.00)	60.0(50.85)	90.0(74.70)	73.3(60.85)
13.	Neem cake	60.0(50.85)	80.0(63.93)	100.0(89.09)	80.0(67.96)
14.	Turmeric rhizome	50.0(45.00)	70.0(57.00)	90.0(74.70)	68.9(52.26)
	Mean	60.7(52.35)	73.8(62.21)	85.0 (72.61)	73.1(62.16)
	Control				13.3(21.15)

Figure in parentheses are arc sign transformed value

	SEM	**C.D (at 5 %)**
Control Vs Treatment	(3.16)	(8.92)
Extract	(2.55)	(7.19)
Concentration	(1.18)	(3.38)
Interaction bet-n extract & concentration	(4.43)	(12.46)

Twenty one days after release

Twenty one days after release, significantly cumulative mortality was observed in the different treatments in comparision to the control. The maximum mortality was recorded in neem leaf extracts, which was significantly higher than the rest of the plant extracts, except thusa and dhatura leaf extract. The minimum mortality was recorded in bergera leaf, mango ginger rhizome powder extracts which was significantly less than the rest of the extracts, except tulsi and ipomia leaf extracts. The mortality in other treatments was intermediate.

Significantly higher mortality was observed with the increased in the concentrations. The interactions between the extracts and their concentrations were also found significant. Total mortality in 500 and 1000 ppm of thusa, dhatura and bel leaf extracts, 500 ppm of neem leaf extracts 1000 ppm of garlic and neem cake extract was significantly higher than the rest of the treatments. The lowest mortality was recorded in 100 ppm of tulsi leaf extracts, which was significantly lower than the rest of the combinations, except 500 ppm of ipomia leaf extracts. The mortality in the rest combinations of treatment was intermediate (Table 4). Ali Niazee *et al*. (1997) recorded in effective plant materials high mortality occurred in higher dose of 1000 ppm except in mango ginger rhizome powder and bergera leaf powder.

Table 4. Effect of different plant products and their concentrations on the mortality of *Helicoverpa armigera* (21 days after release)

SNO.	Treatment	Per cent larval mortality in concentration of			Mean
		100 ppm	500 ppm	1000 ppm	
1.	Mango ginger rhizome	60.0 (50.85)	60.0(50.85)	60.0(50.85)	60.0(50.85)
2.	Bergera leaf	60.0(50.85)	60.0(50.85)	60.0(50.85)	60.0(50.85)
3.	Calotropis leaf	60.0(50.85)	80.0 (63.93)	90.0 (74.70)	76.7 (63.16)
4.	Tulsi leaf	40.0(39.15)	60.0(50.85)	80.0 (63.93)	60.0(50.85)
5.	Thusa leaf	70.0 (57.00)	100.0(89.09)	100.0(89.09)	90.0(74.70)
6.	Dhatura leaf	70.0(57.00)	100.0(89.09)	100.0(89.09)	90.0 (74.70)
7.	Ipomia leaf	70.0(57.00)	50.0 (45.00)	90.0 (74.70)	70.0 (57.00)
8.	Neem leaf	90.0 (74.70)	100.0(89.09)	90.0 (74.70)	93.3 (79.49)
9.	Garlic leaf	60.0(50.85)	70.0(57.00)	100.0(89.09)	76.7 (65.64)
10.	Ginger rhizome	70.0(57.00)	80.0 (63.93)	90.0(74.70)	80.0 (65.20)
11.	Bel leaf	60.0(50.85)	100.0(89.09)	100.0(89.09)	83.3 (71.54)
12.	Harsingar leaf	70.0(57.00)	70.0 (57.00)	90.0(74.70)	76.7 (62.89)
13.	Neem cake	60.0(50.85)	90.0 (74.70)	100.0(89.09)	83.3 (71.54)
14.	Turmeric rhizome	70.0(57.00)	70.0(57.00)	90.0 (74.70)	76.7 (62.89)
	Mean	**65.7(54.80)**	**77.9(66.24)**	**87.1(74.22)**	**76.9(65.09)**
	Control				**13.3(21.15)**

Figure in parentheses are arc sign transformed value

	SEM	C.D (at 5 %)
Control Vs Treatment	2.87	8.06
Extract	2.31	6.51
Concentration	1.06	3.01
Interaction bet-n extract & concentration	4.00	11.27

REFERENCES

AliNiazee, M.T., Amin- Alhumeyri and Saeed, M. (1997). Laboratory and field evaluation of a neem insecticides against *Archips rosanus* L. *Canadian Entomologist*. **129** (1) : 27-33.

Chaudhry , M.I. (1992). Efficacy of botanical pesticides against *Plecoptera reflexa* (Guen). *Pakista J. of Forestry* **42** (4) : 199-202.

Kulat, S.S., Nimbalkar, S. A., Nandanwar, V. N. and Hiwase, B. J. (1998). Effect of mixture of plant pproducts against pigeon pea pod borer, Helic*overpa armigera* (Hubner). *J. Soils and Crops*. **8** (1) : 109-110.

Kulkarni, N. (198). Feeding deterrents of plant extracts against popular defoliator *Clostera cupreata* (Butt.). *Insect Environment* **3** (4) : 98.