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## **Seasonal Occurrence and Consequence of Several Neem Foodstuffs on Hadda Beetle [*Henosepilachna vigintioctopunctata* (Fabr.)] Infesting Brinjal (*Solanum melongena* L.)**

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### **ABSTRACT**

Importance of neem products as insecticide, pesticides and herbicides is well recognized recently use of these products is insecticide in vegetables is being increased rapidly. Studies on seasonal incidence and effect of some neem products on Hadda beetle (*Henosepilachna vigintioctopunctata* Fabr.) infested on Brinjal (*Solanum melongena* L.) were conducted at Allahabad Agricultural Institute-Deemed University, Allahabad during Rabi season 2006. The treatments of some commercial neem products viz. Neem Raj, Neemoria, Neem bark, Garlic, Neem Gold, Neem Seed Kernel Extract (NSKE), Neem leaf, Achook and one insecticide, i.e., Endosulfan were applied. The observation pertaining to the population of Hadda beetle on brinjal were recorded one day before treatments; the observation on the population mortality were recorded at 1, 2 and 5 days after treatments. The beetle population appeared in the 1st week of March (10th standard week) with an average population level of 0.1 beetle/leaf. Hadda beetle population gradually increased and reached peak level of 3.64 per leaf upto 3rd week of April (16th standard week). However, the population declined with maturation of the crop. Endosulfan was the most effective treatment with 100% mortality. All the other treatments were also effective at 5 days after spraying and they were also statistically at par with each other. Declined of beetle population was not much dependent on weather parameters (temperature, wind velocity, rainfall and relative humidity) but was influenced by the maturation of crop. The present study recommends that Endosulfan (0.07%) as the most effective treatment to control Hadda beetle infestation in Brinjal.

**Key words:** Seasonal incidence, brinjal, hadda beetle, endosulfan, neem products, garlic, achook

### **INTRODUCTION**

Brinjal, egg plant or aubergine (*Solanum melongena* L.) is one of the large amounts frequently grown vegetable crops in India. It is adapted to a wide range of climatic conditions. It has a long bearing period when grown under mild climate of southern states but its bearing is shortened under hot summer and cold winter season of Sutlej Ganga alluvial plains of northern India. In hill regions, it is grown only in summer. In addition to India, other major brinjal producing countries are China, Turkey, Japan, Egypt, Italy, Indonesia, Iraq, Syria, Spain and Philippines. India contributes 6,44,3062 metric ton to the worldwide fabrication of brinjal and position second to

China. Brinjal cover 8.14% of the sum vegetable area and produces 9% of sum vegetable fabrication in India (Thamuraj and Singh, 2001). Brinjal fruits are a quite good foundation of calcium, phosphorus, iron and vitamins mainly 'B' group. Brinjal is a high value and labour intensive crop and is cultivated by most of the farmers on small scale in rural areas and it gives better returns over investment to the farmers. There is good demand for brinjal in the domestic market throughout the country round the year. Brinjal (*Solanum melongena* L.) is infested by number of insect pests including Jassid, (*Amrasca biguttata*, *biguttata* (Ishido), Aphid, *Aphis gossypii* (Glover), Hadda beetle, *H. vigintioctopunctata* and shoot and fruit borer *Leucinodes orbonalis* (Guen). During different stages of its growth in most of tropical countries including India, the losses caused by these pests vary from season to season depending upon environmental factors as reported by Gangwar and Sachan (1981). Among these pests the spotted leaf beetle *H. vigintioctopunctata* is the serious pest of the brinjal crop. The damage is caused by the beetles as well as by the grubs by feeding on the upper surface of the leaves. The leaves are eating among the veins sometimes organism totally stripped to the mid tease. The leaves current a lace like appearance, turns brown, dry up and drop off so the plant is absolutely skeletonized. Much work has been done on the control of these pests using insecticides. Most of the chemicals were found to be ineffective owing to the problem of post resurgence and development of insect resistance against these chemicals. India is rich in tree flora, which posses of bioactive compounds. Botanicals derived from neem are traditionally used in Indian pest control operations. They are not only popular but also very effective in certain conditions, most popular being the Indian neem, *Azadiractica indica* A. Juss, Neem products have diverse biological effects on insects. It has oviposition detergent, repellent, insect growth regulator, sterilent, mating disrupter and toxic properties and showed higher antifeedant activity. The rising anxiety for atmosphere security and global exact for pesticides remains free food has evoked eager attention in pest control by employ of the neem foodstuffs. Review of literature indicates that the studies related to insect/pest management in brinjal have been initiated by several workers (Haque *et al.*, 2001; Hassan *et al.*, 2001; Mahmood *et al.*, 2002; Mannan *et al.*, 2003; Ali *et al.*, 2004). The present study was undertaken to examine efficacy of neem products agancused Hadda beetle insect in Brinjal.

## MATERIALS AND METHODS

Seasonal incidence and effect of some neem products on Hadda beetle *Henosepilachna vigintioctopunctata* infesting brinjal were carried out during February to May 2006 at Agricultural Research farm at Allahabad Agricultural Institute-Deemed University, Allahabad, Uttar Pradesh. The materials used and various methods employed are presented here under.

**Cultivation of brinjal:** The present study was carried out on a brinjal variety. All the recommended agronomic practices were followed to raise that crop except plant protection measure, which enable the build up of insect pests in a pesticides free environment.

**Preparatory cultivation:** Brinjal prefer fruitful and cavernous soil and fitted with good quality drainage. Agriculture operations that are carried out from the time of harvest of a crop to the sowing of the next crop are known as preparatory cultivation. Before transplanting the brinjal seedling the field was thoroughly ploughed and pulverized with tractor drown cultivator to attain desirable tilth, leveling and formation of plots were done manually, leveling was done with human labour and the field was laid out as per the design.

**Fertilizer management:** Fertilizer were given 100 kg nitrogen, 50 kg phosphorus, 50 kg potash ha<sup>-1</sup>. Half of N and total amount of P and K were all incorporated into the soil and basal dressing, through urea (40% N), single super phosphate (16% P) and Murate of potash (60% K) the remaining half of N was top dressed at 30 days after transplanting.

**Transplanting of seedling:** The correct age of transplanting seedling is necessary for better enlargement and improvement upon transplanting and the healthy seedlings pulled out from well maintained nursery have to be used for transplanting. Thirty days old (seed sowing on 05. 01. 2006) brinjal seedlings were used to raise the crop and planted on 5 Feb. 2006 at 75×60 (cm) spacing in a plot size of 2.00×2.00 m.

**Irrigation, weeding and harvesting:** First irrigation was given at the time of transplanting as light irrigation and subsequent, irrigation was given at 15 days interval. Three weeding were given at 15 days interval. The crop was harvested after 115 days.

Seasonal Incidence of Hadda beetle, field trial to evaluate the efficacy of some neem products and one chemical insecticide, preparation of neem seed kernel suspension (NSKES 5%), preparation of Neem gold (0.000075%), preparation of Achook (0.000375%), preparation of leaf extract (10%), preparation of garlic extract (2%), preparation of Endosulfan solution (0.07%), preparation of Neem bark extract (10%), preparation of Neem raj (0.5%) and preparation of Neemorin (0.5%) was conducted. Detail of the same is as follows:

Variety : NDsB-25  
Design : RBD  
Spacing : 75×60 cm  
Treatment : 10  
Plot size : 2×2 m  
Replication : 3

**Weather data:** Weather data pertaining to maximum and minimum temperature, morning and evening, relative humidity, rainfall, wind velocity and sunshine hours will be collected from meteorological observatory, Allahabad Agriculture Institute Deemed-University, Allahabad. The Hadda beetle population have been correlated with the weather parameters to know their influence on the incidence and population build up.

**Data analysis:** The percentage population reduction in different treatments over control was calculated from post treatment data on hadda beetle population by using modified Abbot's formula (1925). The percentage population reduction value was duly transformed in to the corresponding angular value and was subjected to analysis of variance. Standard error (SE) and CD (Rb) values are calculated.

## RESULTS AND DISCUSSION

**Seasonal incidence of hadda beetle:** The correlation between the incidences of hadda beetle population with weather parameters are presented in Table 1. The incidence of hadda beetle on brinjal during 2006 commenced from 30 days after transplanting i.e., 1st week of March (10th standard week) with an average population level of 0.10 beetles per leaf. The beetles

Table 1: Correlation between Hadda beetle (*Henosepilachna vigintioctopunctata*) population and weather parameters

Std. week	Date	Mean hadda beetle population	Temperature °C		Relative humidity (%)		Rainfall (mm)	Wind velocity (km h <sup>-1</sup> )	Sunshine (h day <sup>-1</sup> )
			Min.	Max.	6.30 am	6.00 pm			
Feb.									
8	19-25	0.00	13.7	34.8	70	25	0	3.00	10.1
9	26-4	0.00	15.1	33.8	77	26	0	3.00	4.8
March									
10	5-11	0.00	15.3	31.3	83	42	7.5	2.87	4.94
11	12-18	0.84	15.5	30.1	89	40	11.6	2.40	7.00
12	19-25	0.96	15.4	35.2	66	17	0.6	2.58	9.40
13	26-1	1.20	16.9	37.2	63	16	0	2.33	8.90
April									
14	2-8	0.96	18.3	40.5	57	13	0	1.80	9.30
15	9-15	0.88	20.7	41.1	61	15	0	2.03	8.40
16	16-22	3.64	18.8	36.3	68	32	28.2	3.85	7.20
17	23-29	2.04	22.8	39.8	66	33	0	2.04	8.80
May									
18	30-6	1.88	25.5	40.2	89	35	6.4	4.05	8.20
19	7-13	1.36	25.5	36.8	68	38	0	3.68	7.10
		r =	0.340179773	0.203749629	-0.14492	0.142769	0.663103	0.475646	-0.08003
		t =	0.9600	0.6026	-0.4792	0.4310	1.6572	1.2778	-0.25594
			NS	NS	NS	NS	NS	NS	NS

Abbreviations used: NS: Non-significant, r: Replication, t: Treatment

population gradually increased and reached peak level of 3.64 per leaf 76 days after transplanting i.e., 3rd week of April (16th standard week). Thereafter, declined trend was observed and population of beetle reached its lowest level of being an average of 0.40 beetles per leaf during 2nd week of May (19th standard week). The incidence of the beetle was observed from 1st week of March till second week of May (2006). The pre-ponderance of the beetle might be due to congenial temperature prevailed during the study which ranged from 30.1-41.1°C and relative humidity to 61-89%, precipitation (28.2 mm) received during the time might have accounted for declined population trend of spotted leaf beetle.

Studies on correlation of brinjal hadda beetle population with weather parameters revealed that beetle population exhibited non-significant positive correlation with maximum and minimum temperature ( $r = 0.3401$  and  $0.2037$ ), wind velocity ( $r = 0.4756$ ), rainfall ( $r = 0.6631$ ) and afternoon relative humidity ( $r = 0.1427$ ). However, morning relative humidity ( $r = -0.1449$ ) and sunshine h day<sup>-1</sup> ( $r = -0.0800$ ) showed non-significant negative correlation. Thus, the studies indicated that the beetle population increased with minimum and maximum temperature, afternoon humidity, rainfall and wind velocity but decreased with morning relative humidity and sunshine h day<sup>-1</sup>.

Bhagat and Munshi (2004) conducted a field study on host preference of spotted leaf-eating beetle *H. vigintioctopunctata* (Fabr.) on six commercial cultivars of brinjal (auberginim, *Solanum melongena*), namely Pusa purple long, Pusa purple round, Pusa Hybrid-6, Pusa-Kranti, Supriya and Nisha, were evaluated in May for susceptibility to the spotted leaf-eating beetle, *H. vigintioctopunctata* under open choice conditions in Jammu and Kashmir, India. There was a steady increase in infestation, level from 27 standard week on ward and it reached a peak between 32 and 33 standard week in all the cultivars after which the count declined steadily.

The highest middling inhabitants (19.33 grubs and adults/5 plant) was recorded in Pusa purple long. Based on the seasonal occurrence of the pest, Pusa purple long was categorized as the most vulnerable though all others were categorized as vulnerable cultivars.

Ramzan *et al.* (1990) carried out a field studies on comparative development and seasonal abundance of hadda beetle, *H. vigintioctopunctata* (Fabr.) on various solaneous fruit plants in Ludhiana, India in June 1976. The coccinellid finished its life cycle most rapidly on *Solonom nigrum* 22.4 days and the maximum numbers of the pest were establish on *S. xanthocarpum*, reaching a highest of 526.3/10 plants in March.

Veeravel and Baskaran (1994) studied on the existence of interspecific competition between *Aphis gossypii* and *H. vigintioctopunctata* adults was observed in brinjal (aubergine) at different densities in potted plant. The aphids were able to eliminate the coccinellid from the plant within about 4-8 weeks. Significant intraspecific competition within aphid population was seen at densities of 60 and above per plant.

Parjhar *et al.* (1997) studied the development of *H. vigintioctopunctata* (Fabr.) on 6 solanaceous plants tested for suitability as food plants for *H. vigintioctopunctata*, brinjal (aubergine) and potato shown to be superior and duration of larval development. The other plants tested were makoi (*Solonom nigram*) Jharpata (*Nicandra physatoides*), ashwagandha (*Cucithania samnifera*) and tomato.

Raju and Maheswar (2004) conducted a study of natural enemies associated with spotted leaf beetle *H. vigintioctopunctata* infesting aubergine *Tetrastichus* spp., recorded 37.6-38.8% egg parasitization during Nov. and December, while Mexican Bean Beetles (*Pediabius fovealatus*) recorded 52.50% pupal parasitization during Dec. in addition, *Rhynocoris fuscipes* consumed about 4 grubs and 2-3 adults per day.

**Bio-efficacy of endosulfan and commercial neem products:** The bio-efficacy of endosulfan and commercial neem products are depicted in Table 2.

**One day after spraying:** The data on present population reduction of the beetle over control on 1st day spraying revealed that all the treatments were significantly superior to control. Among all the treatments highest percent reduction of the beetle in endosulfan (52.44%), followed by NSKE (51.57) (Table 2) Several other reports also showed that endosulfan (51.57%) effective insecticide against Hadda beetle. Similarly, Rajendran (1998), Thanki and Patel (1991) and Sangama *et al.* (1991) also proved that endosulfan was most effective insecticide in reducing its population. The percent reduction after 1 day spraying of endosulfan was statistically at par with Neem Raj and NSKE. Treatments like Neemoria and Garlic were statistically at per in reducing the spotted leaf beetles population. The treatments i.e., Achook, Neem leaf, Neem gold and Neem bark were found to be least effective among the other treatments. The efficacy of plant products and insecticide at 1 day after spraying were found to be in the following order:

$$T_3 > T_7 > T_1 > T_2 > T_4 > T_5 > T_6 > T_8 > T_9$$

**Third day after spraying:** The data on percent population of the beetle over control on 3rd day after spraying revealed that all the treatments were significantly superior to control. Among all the treatments highest percent reduction in the population was recorded in endosulfan (67.90%) followed by neemoria (64.30%). Treatment like neemoria NSKE, achook were found to be at par with endosulfan. No significant variance in percent mortality of spotted leaf beetles was observed

among Neem leaf (52.99 %), Neem gold (51.32%) and Neem bark (46.00%). Among the treatments, Neem bark (46.00 %) was found to be least effective in reducing Hadda beetle population (Table 2). The efficacy of neem products and insecticide 3 days after spraying were found to be in the following order:

$$\underline{T_5 > T_7 > T_9 > T_8 > T_4 > T_6 > T_3 > T_1}$$

**Fifth day after spraying:** Among the treatments, once again endosulfan (0.07%) recorded the highest reduction of larval population with 100% mortality. The next effective treatment was Neemoria (0.015%), with 87.81% larval reduction, NSKE (5%) was the third effective treatment with 86.20% of reduction of larval and also significantly superior over rest of the treatments. The treatments that followed in descending order of efficacy are Neem leaf (10%) with 84.13%, Achook (0.000375%) with 80.04%, Garlic with 78.47% and Neem raj (0.03%) with 68.24%, beetles reduction over the control. The least effective treatment schedule was Neem bark (10%) with 63.94% larval reduction over control (Table 2).

$$\underline{T_5 > T_7 > T_9 > T_8 > T_4 > T_6 > T_3 > T_1}$$

Jeyarajan and Babu (1990) reported that the antifeedant activity of neem seed extracts was tested against 4th instar larvae and adults of *H. vigintioctopunctata* in the laboratory. Nem-75 at 1000 ppm was the best antifeedent for larvae, followed by Nemidin, NK-100 had the greatest antifeedent activity against adults.

Umapathy and Baskaran (1991) reported that the efficacy of fluvalinate (30, 50 and 70 g a.i. ha<sup>-1</sup>), fenvalerate (110 g a.i. ha<sup>-1</sup>), cypermethrin (55 g a.i. ha<sup>-1</sup>), monocrotophos (400 g a.i. ha<sup>-1</sup>), quinolphos (313 g a.i. ha<sup>-1</sup>) and carbaryl (1000 g a.i. ha<sup>-1</sup>) for the control of *H. vigintioctopunctata* on aubergine was studied in Tamil Nadu, India, during July-October 1985. Sangama *et al.* (1991) studied that endosulfan was sprayed on aubergine at 0.5 and 1.0 kg a.i ha<sup>-1</sup>

Table 2: Bio-efficacy of endosulfan and some commercial neem products against Hadda beetle (*Henosepilachna vigintioctopunctata*) after spray

Treatment	Neem products	Pre-treatment population	Reduction over spray (%)		
			1 DAT	3 DAT	5 DAT
T <sub>1</sub>	Neem raj	2.20	48.76	50.96	68.24
T <sub>2</sub>	Neemoria	1.66	35.90	64.30	87.81
T <sub>3</sub>	Neem bark	2.44	26.04	46.00	63.94
T <sub>4</sub>	Garlic	1.88	37.71	55.77	78.47
T <sub>5</sub>	Endosulfan	3.11	52.44	67.90	100.00
T <sub>6</sub>	Neem gold	1.22	30.76	51.32	75.12
T <sub>7</sub>	NSKE	1.11	51.57	62.20	86.20
T <sub>8</sub>	Neem leaf	2.55	29.22	52.99	84.13
T <sub>9</sub>	Achook	3.55	31.05	59.54	80.04
T <sub>10</sub>	Control	2.88	0.00	0.00	0.00
		F-test	S	S	S
		S.Ed (±)	4.51	5.37	6.90
		C.D. (p = 0.05)	9.48	10.28	12.51

Abbreviations used: DAT: Days after treatment, CD: Critical Difference, NSKE: Neem Seed Kernel Extract, S: Significant

at fruit formation stage in Bihar, India in 1987, Residues persisted for 15 days and the half lives was 4.59 and 4.08 days for the 2 dosages, resp with corresponding safety intervals of 15.97 and 14.89 days.

Nagia *et al.* (1992) studied that nine insecticides were evaluated in the laboratory at 26°C, 70% pH and Line Distance 12:12 against larval adults of *H. vigintioctopunctata* on aubergine, carbaryl, quinolphos, endosulfan, cypermethrin, deltamethrin and fenvalerate were effective against larvae of *H. vigintioctopunctata*.

Rajendran (1998), conducted field study in 1993-94 in Tamil Nadu with egg plants (aubergine), the effects of neem (*Azadirachta indica*) oil on the fecundity and egg hatchability of *H. vigintioctopunctata* were examined, neem oil 2% +endosulfan 0.035% reduced oviposition by 74.7% egg hatchability was also reduced.

## CONCLUSION

Studies on the seasonal incidence of *Henosepilachna vigintioctopunctata* showed that the pest appeared on the 1st week of March (10th standard week) and gradually increased and reached peak level (3.62 beetle/leaf) during the 3rd week of April (16th standard week).

Studies on correlation of brinjal hadda beetle population with weather parameters revealed that beetle population increased with minimum and maximum temperature, afternoon humidity, rainfall and wind velocity but decreased with morning relative humidity and sunshine h day<sup>-1</sup>.

Studies on the evaluations of Bio-efficacy of endosulfan and commercial neem products showed that endosulfan was most effective treatment (100% mortality). Endosulfan (0.07%) as the most effective treatment to control Hadda beetle infestation in Brinjal.

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