



## LABORATORY EVALUATION OF NEEM SEED EXTRACT AND OTHER PLANT EXTRACTS AGAINST GRAM POD BORER, *HELCOVERPA ARMIGERA* (HÜBNER)

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### ABSTRACT

Water and ethanol extracts of margosa seed, margosa leaf and other plant extracts at 1000 and 2000 ppm concentration were tested against larvae of *H. armigera* under laboratory conditions. Higher concentration of ethanol extract of margosa seed was found most effective in reducing the consumption of food followed by other extracts. The larval mortality among different extract ranged from 10.0 to 35.0 percent as against 5.0 percent in control. Among the plant extracts maximum mortality (40percent) was recorded in higher concentration of ethanol extract of margosa seed followed by night jasmine and datura.

**Key Words:** Anti feedancy, Consumption, Mortality, Pest, Plant extracts

Chickpea, *Cicer arietinum* (L.) is one of the most important Rabi season pulse crops, occupies a unique position in Indian agriculture, and is considered as king of pulses. It is attacked by more than 36 species of insect pests of which, pod borer *Helicoverpa armigera* (Hübner) is a key pest of chick pea. The losses in seed yield of gram due to this pest vary from 10 – 60% under normal weather and from 50-100% under favorable weather condition. [Sithanathan *et al.* (1984) (Ujagir and Khare 1987)] Currently research work on many plant species for their insecticidal properties and their possible utilization for the insect pest control attracted the attention of applied/ agricultural entomologists. During last two decades, crude and refined extracts of different plant parts, particularly of neem have been used against both defoliators and sucking insects. Satyavir (2009) reported that neem (*Azadirachta India A. Juss.*) is one of the most potential multipurpose ecofriendly Tree, of Tropical region which is now widely distributed in many parts of the world. Which is used by farmers all over the world to protect their crops and stored products against insect damage.

### MATERIAL AND METHODS

The investigation was carried out to test the effect of Water and ethanol extracts of plant material on the growth and development of *H. armigera*. The experiment was conducted under laboratory condition, in the department of Entomology, College of agriculture, Gwalior (M.P.) during 2006-07. The five plant material mainly seed and

leaves of margosa (*Azadirachta indica*), night jasmine (*Nyctanthus arbortristis*), forest jasmine (*Chlorodendron enermi*) and datura (*Datura fastuosa*) were collected locally and dried at room temperature. The dried plant materials were grinded to make their powder. Ten gram dried powder of each plant material was kept in 100ml. of respective solvent for 7 days and filtered with the help of filter paper. Then the filtrate was dried. From dried extracts, 10% stock solution in ethanol and water were prepared. 1000 and 2000 ppm concentrations of each extract of ethanol and water were used for the soaking of chickpea seeds for 24 hrs in different extracts. Treated seeds were used as diet for the caterpillars. Standard was maintained with monocrotophos treated seeds, five larvae of third in star were released on the seeds kept in petri dishes. Fresh treated seeds in different extracts were provided in each petri dish at 2 days interval starting from their release. At the timing of changing of seeds observations were recorded on larval mortality, weight of food consumed by the larvae and adult emergence. The data were subjected to angular (arc sign) transformations as the case may be for statistical analysis.

### RESULTS AND DISCUSSION

#### Effect of plant extracts on food consumed by larvae

The foods consumed by the larvae were significantly influenced by different plant extracts of both water and ethanol solvents. Observation recorded at 2 days after release showed that all the plant extracts reduce the

**Table 1: Effect of plant extracts on Food consumed by larvae of *H. armigera***

| S. No.       | Solvent/plant<br>Extracts | Concentration<br>(ppm) | Food Consumed (g) by larvae in days after release |       |       |       |       |
|--------------|---------------------------|------------------------|---|-------|-------|-------|-------|
|              |                           |                        | 2   | 4     | 6     | 8     | 10    |
| WATER        |                           |                        |   |       |       |       |       |
| 1            | Margosa Seed              | 1000                   | 0.209   | 0.460 | 0.686 | 0.893 | 1.022 |
| 2            | Margosa Leaf              | 1000                   | 0.209   | 0.469 | 0.702 | 0.916 | 1.026 |
| 3            | Night Jasmine             | 1000                   | 0.211   | 0.475 | 0.720 | 0.924 | 1.059 |
| 4            | Forest Jasmine            | 1000                   | 0.222   | 0.479 | 0.771 | 1.018 | 1.108 |
| 5            | Datura                    | 1000                   | 0.275   | 0.488 | 0.776 | 1.036 | 1.116 |
| 6            | Margosa Seed              | 2000                   | 0.160   | 0.347 | 0.494 | 0.614 | 0.822 |
| 7            | Margosa Leaf              | 2000                   | 0.169   | 0.351 | 0.519 | 0.644 | 0.852 |
| 8            | Night Jasmine             | 2000                   | 0.171   | 0.371 | 0.524 | 0.646 | 0.860 |
| 9            | Forest Jasmine            | 2000                   | 0.174   | 0.378 | 0.549 | 0.674 | 0.901 |
| 10           | Datura                    | 2000                   | 0.183   | 0.383 | 0.559 | 0.709 | 0.909 |
| ETHANOL      |                           |                        |   |       |       |       |       |
| 11           | Margosa Seed              | 1000                   | 0.184   | 0.409 | 0.589 | 0.716 | 0.922 |
| 12           | Margosa Leaf              | 1000                   | 0.188   | 0.411 | 0.619 | 0.721 | 0.928 |
| 13           | Night Jasmine             | 1000                   | 0.193   | 0.426 | 0.659 | 0.740 | 0.967 |
| 14           | Forest Jasmine            | 1000                   | 0.197   | 0.432 | 0.661 | 0.826 | 0.976 |
| 15           | Datura                    | 1000                   | 0.209   | 0.453 | 0.664 | 0.873 | 1.019 |
| 16           | Margosa Seed              | 2000                   | 0.093   | 0.185 | 0.320 | 0.406 | 0.576 |
| 17           | Margosa Leaf              | 2000                   | 0.108   | 0.234 | 0.332 | 0.409 | 0.622 |
| 18           | Night Jasmine             | 2000                   | 0.119   | 0.245 | 0.334 | 0.418 | 0.714 |
| 19           | Forest Jasmine            | 2000                   | 0.125   | 0.248 | 0.343 | 0.453 | 0.752 |
| 20           | Datura                    | 2000                   | 0.155   | 0.309 | 0.468 | 0.563 | 0.782 |
| 21           | Monocrotophos             | 0.036%                 | 0.081   | 0.081 | 0.081 | 0.081 | 0.081 |
| 22           | Untreated (control)       |                        | 0.328   | 0.567 | 0.782 | 1.076 | 1.187 |
| S.E. (m) ±   |                           |                        | 0.010   | 0.038 | 0.041 | 0.054 | 0.070 |
| C.D. (at 5%) |                           |                        | 0.028   | 0.107 | 0.115 | 0.154 | 0.197 |

consumption of food by larvae significantly over control. Minimum consumption of food (0.081 g) was recorded in monocrotophos treated food which found significantly less than rest of the treatments except higher concentration (2000 ppm) of ethanol extracts of margosa seed and leaf. Among plant extracts minimum food consumption (0.093g) was recorded in higher concentration of ethanol extract of margosa seed followed by margosa leaf. Whereas maximum and significantly higher food consumption (0.275g) was recorded in lower concentration of water extracts of datura than rest of the treatments.

At four days after release, among the plant extracts minimum food consumption (0.185g) was recorded in higher concentration of ethanol extracts of margosa seed than rest of the treatments. On the other hand maximum consumption (0.488g) was recorded in lower concentration of water extract of datura which found significantly higher

than all the tested extracts in higher concentration except water extract of datura. At six days after release, among the plant extracts minimum food consumption (0.320g) was recorded in higher concentration of ethanol extract of margosa seed than rest of the treatments except higher concentration of ethanol extracts of margosa leaf, night jasmine and forest jasmine. Whereas significantly higher consumption of food (0.776g) was recorded in lower concentration of water extracts of datura then rest of the plant extracts.

At eight days after release, all the plant extracts except lower concentration of water extracts of night jasmine, forest jasmine and datura reduced the consumption of food by larvae significantly over control. Among the plant extracts, minimum food consumption (0.406g) was recorded in higher concentration of ethanol extract of margosa seed than rest of the treatments except higher

concentration of ethanol extracts of margosa leaf, night jasmine, and forest jasmine. Meisner *et al.* (1981) reported cent per cent antifeedancy against *Spodoptera litura* with 10 ppm *Azadirachtin* and 50 per cent against *Earias insulana* with *Azadirachtin* used with artificial diet. At ten days after release, all the plant extracts except lower concentration (1000 ppm) of water extracts of all the tested plant material and higher concentration (2000 ppm) of ethanol extract of datura reduced the consumption of food by larvae significantly over control. Among the plant extracts, minimum food consumption (0.576g) was recorded in higher concentration of ethanol extract of margosa seed which found significantly less than rest of the treatments. Maximum food consumption (1.116g) was recorded in lower concentration of water extract of datura (Table-1). It is clear from Table-1, that the ethanol extracts of margosa seed was found most effective to other plant extracts. Singh *et al.* (2005) evaluated four plants-product-modules against *H. armigera*. Insecticidal standard check (three sprays of Quinolphos 25EC at 2000ml/ha) gave minimum fruit damage (14.73%) and maximum production (558.33 q/ha). Among the plant products modules. M-3 (URO-1 10% (Kamdenu), NSKE 10% and Datura leaf extract 10%) was the best with the production of 495.89 q/ha and fruit damage of 24.67%.

#### Effect of plant extracts on larval mortality

Significant higher mortality was recorded in seed treated with monocrotophos (0.036%) than rest of the treatments. Among plant extracts maximum mortality was recorded in higher concentration of ethanol extract of margosa seed followed by margosa leaf, lower concentration of ethanol extract of margosa seed and higher concentration of water extract of margosa seed. Ali Niazee *et al.* (1997) reported that 1 per cent aqueous solution of neem insecticide produced 100 percent larval mortality within 48 hour of treatment. At lower concentrations of 0.1 and 0.01 per cent after 48 hours mortality rates were reduced. Dangi *et al.* (2009) reported that *Azadirachtin* @ 1.5 ml/l was found most effective against red pumpkin beetle which gave 59.22, 59.3 and 60.86, 58.81 percent mortality after two sprays during 2003 and 2004 respectively. On the basis of induced mortality over control margosa seed and leaf found more toxic against *H. armigera* in comparison to other plant extracts (Table-2). The high larval mortality caused by margosa seed and margosa leaf might be due to the increased concentration of *Azadirachtin* in the seed and leaves. Sundararajan and Kumuthaklavalli (2001) tested aqueous leaf extracts of *Gnidia glauca* and *Toddalia asiatica* for their antifeedant activity against the sixth instar larvae of *H. armigera* by applying the aqueous leaf extracts at various concentrations (0.2, 0.4, 0.6, 0.8 and 1.0%) on

**Table 2: Effect of plant extracts on larval mortality and adult emergence**

| S. No.  | Solvent/Plant Extracts | Larval mortality (%) | Adult emergence (%) |
|---------|------------------------|----------------------|---------------------|
| WATER   |                        |                      |                     |
| 1.      | Margosa Seed           | 25.0 (30.78)*        | 45.0 (38.85)*       |
| 2.      | Margosa Leaf           | 20.0 (26.56)         | 55.0 (47.89)        |
| 3.      | Night Jasmine          | 10.0 (13.28)         | 85.0 (73.55)        |
| 4.      | Forest Jasmine         | 15.0 (19.92)         | 80.0 (66.91)        |
| 5.      | Datura                 | 10.0 (13.28)         | 80.0 (66.91)        |
| 6.      | Margosa Seed           | 30.0 (32.90)         | 35.0 (36.06)        |
| 7.      | Margosa Leaf           | 25.0 (29.73)         | 45.0 (41.83)        |
| 8.      | Night Jasmine          | 15.0 (19.92)         | 75.0 (63.75)        |
| 9.      | Forest Jasmine         | 20.0 (26.56)         | 70.0 (57.11)        |
| 10.     | Datura                 | 15.0 (19.92)         | 70.0 (57.11)        |
| ETHANOL |                        |                      |                     |
| 11.     | Margosa Seed           | 30.0 (32.90)         | 35.0 (36.06)        |
| 12.     | Margosa Leaf           | 25.0 (29.73)         | 45.0 (41.83)        |
| 13.     | Night Jasmine          | 10.0 (13.28)         | 80.0 (66.91)        |
| 14.     | Forest Jasmine         | 25.0 (29.73)         | 70.0 (57.39)        |
| 15.     | Datura                 | 15.0 (19.92)         | 75.0 (63.75)        |
| 16.     | Margosa Seed           | 35.0 (36.06)         | 25.0 (29.73)        |
| 17.     | Margosa Leaf           | 30.0 (32.90)         | 45.0 (36.06)        |
| 18.     | Night Jasmine          | 15.0 (19.92)         | 75.0 (60.27)        |
| 19.     | Forest Jasmine         | 25.0 (29.73)         | 65.0 (53.94)        |
| 20.     | Datura                 | 15.0 (19.92)         | 70.0 (57.11)        |
| 21.     | Monocrotophos          | 100.0 (90.00)        | 0.0 (0.00)          |
| 22.     | Untreated (control)    | 5.0 (6.64)           | 95.0 (76.22)        |
|         | S.E. (m) ?             | (8.87)               | (16.98)             |
|         | C.D. (at 5%)           | (25.08)              | (48.02)             |

\* Figures in parentheses indicate arc sin value

young tomato leaves. Over 50% larval mortality was observed at higher concentrations (0.8 and 1.0%) of the aqueous extracts. Among the two aqueous leaves extracts tested, *T. asiatica* showed a higher rate of mortality (86.1%) at 1.0% concentration. A reduction in the rate of food consumption and growth was observed in the larvae of *H. armigera* after 48 hour of treatment with both aqueous extracts.

#### Effect of plant extracts on adult emergence

The adult emergence in different plant extracts ranged from 25 to 85% as against 95% in control. Gita Bali (2009) reported concentration relationship of the two promising volatile substances *Azadirachta indica* and *Datura alba* at different concentration. viz. 0.5%, 1.01, 2.01 and revealed that *Azadirachta indica* caused slight sterility without any significant adverse effect on adult emergence. Lowest

adult emergence was recorded in higher concentration of ethanol extract of margosa seed followed by higher concentration of water extract of margosa seed and lower concentration of ethanol extract of margosa seed (Table-2). This indicates that margosa seed was most effective against *H. armigera* followed by margosa leaf which affects the development of the pest. Dhingra *et al.* (2002) found that Neem (*Azadirachta indica*) oil micro emulsion to be more bioactive than its macro emulsion against *H. armigera*. It reduced the larval and pupal weight gain, pupal development and adult emergence, and increased the larval mortality, larval-pupal intermediates and the pupal deformity in the 3<sup>rd</sup> instar treated-larvae of the insect. Its relative effectiveness in inhibiting adult emergence compared to the macro emulsion (1.0) was 1.68. The effect was generally dose-dependent in the emulsions. Rathore (2003) reported neem seed kernel to be most effective with regards to larval mortality and larval weight followed by Harsingar, Biskhapara and Chinese glory. There were no adult formations in monocrotophos due to the total mortality of the larvae. Gupta *et al.* (1998) reported increase in abnormal adult emergence and death during the pre-pupal and pupa stage with increasing NSP concentration. These results are in agreement with the findings of Breuer and Schmidt (1990) reported that when the larvae of *Spodoptera frugiperda* were allowed to feed until pupation on an artificial diet to which methanolic extract of *Melia azadarach* had been added, food intake was low, growth retarded, larval development prolonged, pupal weight reduced, and morphogenetic effects were observed in the larvae, pupae and adult.

#### ACKNOWLEDGEMENT

The first author is thankful to the Department of Entomology, Jawaharlal Nehru Agriculture University for providing necessary facilities for doing this work as M.Sc. Student.

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