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# EFFECT OF SOME SYSTEMIC INSECTICIDES ON THE ABUNDANCE OF MAJOR INSECT PESTS AND PREDATORS ASSOCIATED WITH COTTON PLANTS

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**Abstract:** A field experiment was conducted to evaluate the effectiveness of seven systemic insecticides viz. asataf 75SP, admire 200SL, imitaf 20SL, dursban 20EC, chloropyriphos 20EC, actara 25WG and murshal 20EC against different sucking and chewing pests of cotton. The effects of these insecticides were also tested on the abundance of different predator populations. Findings of the study indicated that the chemicals admire 200 SL, actara 25WG and imitaf 20SL were more confident and prudent to control the pests of cotton. But the effects of these chemicals abruptly reduced the abundance of different predator populations. On the other hand, the insecticides: asataf 75SP, dursban 20EC and murshal 20EC showed moderate efficacy on pests and abundance of natural enemies.
**Key words:** Cotton, pests, predator, insecticides

## Introduction

Cotton is a major agricultural crop grows more than 60 countries of the world. It is a very sensitive crop in terms of pest complex and attacked by different insect pests from germination to final picking. There are 162 species of insects have been recorded as pest. Among them 15 species are major due to their occurrence in serious (Bohmfalk *et al*., 1996). The pest complex in cotton includes sap feeders, soft and delicate stem feeders and a large group of lepidopterous insects which cause serious damage to cotton by direct feeding as well as by transmitting various diseases (Abou-Elhagag, 1998). Numerous beneficial insect and arthropod species can be found in cotton fields attacking pest species. Most common predators are big eyed bugs, damsel flies, lady beetles, green lacewings, ants, wasps, spiders and predaceous mites (Anonymous, 1978). These beneficial species attack the egg, immature and adult stages of most pest species. Predatory species are present throughout the field season. Researchers are working to establish economic thresholds and also to establish predator densities at which no action is needed to control pests; because the predators are sufficient to maintain pests below the economic threshold. Cotton growers spray insecticides throughout the season to protect their crops. But this kind of control strategy creates complications in the ecosystem (Frisbie, 1984) which is direct toxic to beneficial insects (Goodland *et al*., 1985). In these circumstances, it is essential to know which predators are most abundant and efficient and when they move to or from the field. The time of peak densities of predators and average densities varies depending on prey availability, growth stage of the cotton plant, predator distributions and many other factors. Augmentation and conservation of natural enemies are of urgent need to reduce the pest population with the minimum disturbance of the environment. Hence, pest status, selection of right insecticides, their right doses is a prime need for application of insecticides in the field. So, the present study was undertaken with seven systemic insecticides to know their impact on the major pests and natural enemies associated with cotton to develop eco-friendly sustainable management packages.

## Materials and methods

The study was performed in the regional cotton research, training and seed multiplication farm, Dinajpur, Bangladesh. The site is situated approximately 25°13' latitude north and 88°23' longitude east and about 37.5 m above from the sea level. The soil was sandy loam with pH 4.5 to 5.5. Previous crop of the plot was sunheamp as a green manure. Irrigation and drainage facilities were readily available in the farm. The Land was prepared at field condition by deep ploughing and harrowing followed by laddering. The field layout was done after final land preparation. The experiment was conducted in randomized complete block design with the cotton variety CB-10. The plot size was 5.4 × 5 m. The spacing between block-to-block and plot-to-plot were 1.5 and 1m and respective footpath was 2 m. Seeds were sown on 3rd August 2006, at the rate of 15 kg /ha in a north-south row. The seeds were sown by hand keeping a distance of 45 cm from plant to plant and row-to-row distance was 90 cm. Necessary intercultural operations such as mulching, weeding and irrigation were carried out properly. Seven insecticides such as asataf 75SP (acephate), admire 200SL (imidachloprid), imitaf 20SL (imidachloprid), dursban 20EC (chlropyriphos), chloropyriphos 20EC (chlropyriphos), actara 25WG (thiomethoxam) and murshal 20EC (carbosulfan) were used for the experiment. Spraying was done by a knapsack sprayer. To estimate the populations of pests and beneficial insects, sampling was carried out from the cotton field in the entire cotton growing season (August to November). It was done by weekly scouting taking 5 plants randomly from each replication. Plants were examined for jassid (*Amrasca bigutulla*), aphid (*Aphis gossypii*), whitefly (*Bemisia tabaci*), american

bollworm (*Helicoverpa armigera*), spotted bollworm (*Earias vittella*), army worm (*Spodoptera littoralis*), pink bollworm (*Pectinophora gossypiella*), thrips (*Thrips tabaci*), bugs (*Dysdercus cingulatus*). Newly growing parts with two fully expanded leaves were examined for sucking pests and beneficial insects, middle parts for army worm and twigs, flowers, squares and bolls for bollworm. During examination of the plant, number of different beneficial insects such as lady beetle, spider and syrphids were recorded. A scouting form was used during estimation of the pests. Data of the different parameters were analyzed statistically and means were separated by Duncan's Multiple Range Test (DMRT).

## Results

### Effect on sucking pests

Sucking pests usually cause severe damage of cotton plants. Results obtained from this experiment stated that all the insecticidal treatments showed better performances than the control (water spray). Among the insecticides, asataf 75 SP, dursban 20 EC, chloropyriphos 20EC and marshal 20 EC are not potent enough and inadequately inhibited pest populations (Table1). In most cases, the pests were above ETL. But the insecticides imitaf 20 SL, admire 200 SL and actara 25 WG performed well and significantly reduced the abundance of pest populations.

### Effect on chewing pests

The systemic insecticides used in this study showed significant action on the abundance of chewing pests. Among the insecticides admire 200 SL, imitaf 20 SL and actara 25 WG showed high degree of efficacy against the chewing insects. They are able to stop the massive outbreak of pests and kept them below ETL.

### Effect on predators

The effect of systemic insecticides on the abundance of predators have presented in table 3. Results revealed that the abundance of predators (lady beetle, spiders and syrphids) were significantly higher to the control treatment compared to the treatments of the chemical insecticides. But there were also significant variations among the effect of different insecticides. However, the effect of admire 200 SL, imitaf 20SL and actara 25 WG showed significantly lower abundance of predator in comparison of other insecticides.

**Table 1 Effect of some systemic insecticides on the abundance of sucking pests associated with cotton plant**

| Treatments | Dose/ha | No. of spray | Number of insect pest/plant | | | |
|---|---|---|---|---|---|---|
| | | | Jassid | Aphid | White fly | Thrips |
| Asataf 75SP | 600 gm | 6 | 2.22 b | 1.75b | 5.17 b | 3.58 b |
| Admire 200SL | 200 ml | 3 | 1.25 d | 0.57 d | 1.82 de | 1.75 d |
| Imitaf 20SL | 200 ml | 4 | 1.50 cd | 0.93 c | 2.67 d | 2.58 c |
| Dursban 20EC | 1.4 litre | 6 | 2.08 bc | 1.62 b | 4.00 c | 3.75 b |
| Chloropyriphos 20EC | 1.4 litre | 6 | 2.02 bc | 1.55 b | 4.58 bc | 4.10 b |
| Actara 25WG | 200 gm | 3 | 0.95 d | 0.50 d | 1.42 e | 1.28d |
| Marshal 20EC | 1.4 litre | 6 | 2.20 b | 1.50 b | 4.17 bc | 3.58 b |
| Control (water) | 200 litre | 6 | 8.67 a | 3.00a | 9.67 a | 9.17 a |
| LSD (5%) | | | 0.59 | 0.32 | 1.01 | 0.70 |

Means in a column followed by the same letter(s) are not significantly different by DMRT at $P \leq 0.05$.

**Table 2 Effect of some systemic insecticides on the abundance of chewing pests associated with cotton plant**

| Insecticide | Dose/ha | No. of spray | Number of insect pest/plant | | |
|---|---|---|---|---|---|
| | | | Spotted bollworm | American bollworm | Army worm |
| Asataf 75SP | 600 gm | 6 | 0.42 b | 0.50 b | 0.55 b |
| Admira 200SL | 200 ml | 3 | 0.22 c | 0.24 d | 0.25 c |
| Imitaf 20SL | 200 ml | 4 | 0.22 c | 0.25 d | 0.29 c |
| Dursban 20EC | 1.4 litre | 6 | 0.31 bc | 0.40 c | 0.43 bc |
| Chloropyriphos 20EC | 1.4 litre | 6 | 0.43 b | 0.35 c | 0.50 b |
| Actara 25WG | 200 gm | 3 | 0.22 c | 0.23 d | 0.26 c |
| Marshal 20EC | 1.4 litre | 6 | 0.37 b | 0.35 c | 0.53 b |
| Control (water) | 200 litre | 6 | 0.87 a | 1.02 a | 1.83 a |
| LSD (5%) | | | 0.12 | 0.09 | 0.19 |

Means in a column followed by the same letter(s) are not significantly different by DMRT at $P \leq 0.05$.

## Discussion

The moderate temperature, high humidity and cloudiness conditions of the environment during the cotton growing season encourage the growth of the pest populations (Ram and Pathak, 1987). Kabir and Khan (1980) stated that the sucking pests prefer the soft and tender parts of the crop. In the month of October and November, the cotton plants are in juvenile stage which offers maximum food and good

habitat for all types of sucking and chewing pests. So, crop needs systemic insecticides to combat the worsen situation (Atwal and Dhaliwal, 2005). The results of the present study with the systemic insecticides

**Table 3 Effect of some systemic insecticides on the abundance of predators associated with cotton pest**

| Treatments | Dose/ha | No. of spray | Number of predator/plant | | |
|---|---|---|---|---|---|
| | | | Leady beetle | Spider | Syrphids |
| Asataf 75SP | 600 gm | 6 | 3.08 b | 3.00 b | 2.75 bcd |
| Admira 200SL | 200 ml | 3 | 2.08 c | 1.85 c | 2.03 de |
| Imitaf 20SL | 200 ml | 4 | 2.17 c | 1.98 c | 2.28 cde |
| Dursban 20EC | 1.4 litre | 6 | 3.08 b | 3.00 b | 3.08 bc |
| Chloropyriphos 20EC | 1.4 litre | 6 | 3.50 b | 2.82 b | 3.42 b |
| Actara 25WG | 200gm | 3 | 1.29 c | 1.90 c | 1.88 e |
| Marshal 20EC | 1.4 litre | 6 | 3.23 b | 3.08 b | 3.25 b |
| Control (water) | 200 litre | 6 | 8.00 a | 8.23 a | 7.33 a |
| LSD (5%) | | | 0.69 | 0.61 | 0.81 |

Means in a column followed by the same letter(s) are not significantly different by DMRT at $P \leq 0.05$.

showed their enthusiasm in reduction of pests. Findings of the study indicated that the systemic insecticides such as admire 200SL, actara 25WG and imitaf 20SL are confident and prudent enough to control the sucking pests of cotton. These insecticides also suppressed the bollworms and showed toxic effect on the predators. These findings are in agreement with Dahiya and Singh (1982) who reported that the systemic insecticides were successful in killing the sucking pests of cotton. The insecticides imitaf 20 EC, confidor 70 WS, actara 25 WG, and mixture of ripcord and confidor are successful on the bioassays of sucking pests of cotton (Hossain *et al*., 2003). The systemic chemicals; asataf 85 WS, dursban 20 EC, marshal 20 EC, gaucho 70 WS, cruiser 70 WS and actara 25 WG greatly reduced the sucking pest populations of cotton (Hossain *et al*., 2004). The systemic insecticides used in the present study have some actions on chewing pests. In fact, all insecticidal treatments showed significant effects over the control. This happens probably due to high profile systemic toxicity of the insecticides that have profound action on small and tiny larvae of the chewing pests.

Conservation of natural enemies in the cotton field is of urgent need. But insecticides affect the behaviour and biology such as fecundity of the predators. There is a positive correlation between preys and pest populations (Wilson *et al*., 1998). Toxicity of chemical highly influences this relationship by killing preys and predators. So, it shows a clear correlation between the predators and toxicity of insecticides. Nurindah and Bondra (1988) stated that the insecticides have some adverse effects on predatory insects. The beneficial insect fauna (lady beetle, syrphids and spider) were adversely affected when systemic insecticides were applied to kill the cotton pests (Khattak *et al*., 2004). Pietrantonio and Benedict (1999) observed that systemic insecticides were potent to suppress the insect pests of cotton but the predators were highly affected. Similar results were found in the current study. Toxicity of the insecticides is the prime factor for deterrence of the predators. That might hampered the reproductive and survival potential of the predators.

Threshold spray usually justifies the use of control measures and resulted more profit (Ali and Karim, 1990). In the present study systemic insecticides were applied in the threshold level to avoid unnecessary burden of the environment. As a result predators were abundant in the field. Considering the different parameters, the response of the systemic insecticides; asataf, dursban and marshal showed moderate but significantly higher performances than control. On the other hand, admire, actara and imitaf resulted excellent performances for protection of cotton pests. Therefore, application of these products in the threshold level might uphold a positive impact to control the sucking and chewing pests of cotton.

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