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Insecticide Performance Against brinjal fruit borer *Leucinodes orbonalis in* Brinjal at Peshawar

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Abstract

The present study, conducted at the Malakandair Agriculture Research Farm, The University of Agriculture Peshawar, in 2022, evaluated the efficacy of six insecticides against *Leucinodes orbonalis* (brinjal fruit borer) under field conditions. Brinjal was planted with a 30 cm plant-to-plant distance and a 60 cm row-to-row distance. The study assessed the efficacy of various insecticides, including FANTASTIC (Chlorantraniliprole 0.4% GR), AAKRAMAK (Novaluron 5.25% + Emamectin Benzoate 0.9% SC), FANTASY (Fipronil 5% SC), JOKER (Fipronil 80% WDG), Fenvalerate 0.05% EC or WP), and Cypermethrin 0.05% EC, WP, or Granules) in controlling borer infestations. Cypermethrin proved to be the most effective, significantly reducing the mean number of borers per plant to 78, compared to 117 in the control group. Fenvalerate also demonstrated substantial efficacy, with a mean of 80 borers per plant. AAKRAMAK was as effective as Cypermethrin, showing a mean of 78 borers per plant. In contrast, FANTASTIC and FANTASY exhibited lower effectiveness, with means of 84 and 90 borers per plant, respectively. JOKER, despite initial promise, resulted in a higher mean of 89 borers per plant. These findings highlight Cypermethrin and Fenvalerate as among the most effective treatments for managing *Leucinodes orbonalis*, thereby enhancing brinjal crop yield and quality.

Key words: Brinjal fruit borer, *Leucinodes orbonalis*, pest management, Cypermethrin, Fenvalerate, AAKRAMAK, FANTASTIC, JOKER, FANTASY, crop yield.

Introduction

Brinjal fruit borer, *Leucinodes orbonalis Guenee* (*Pyralidae*: It is distributed throughout the topics in Asia and Africa and is a minor pest in America of the 17/300 Lepidoptera order. It is Monophagus and very much important pest of brinjal but other plants under solanaceae facing has been reported to be host of this pest. It has in its fold Tomato (Lycopersicon esculentum), potato (Solanum tuberosum) and turkey berry (*S. torvum*) among others. Fruits and the tender shoots are attacked by this borer which is an internal one. Infestation of this pest is responsible for massive loss of brinjal crop every year, significantly leading to poor quality and reduced yields. The Larvae of this pest affect 12-16% on shoots and 20-60% on fruits. The pest is most destructive to *Bt* during rain and summer months, which exceeds 90% damaged crop in Bangladesh and 95% in India as reported Naresh *et al.,* (1986). It also noted that due to fruit borer infestation the Vitamin C content decreases up to 68 % in the infected fruits Hemi *et al.*, (1955). Very shortly after coming out of eggs, young caterpillars look for and feed directly into tender part near growing tips into flower buds or fruits. It also showed that caterpillars are most partial to fruits among the parts of the plant. Larvae have at least five instars based on Atwal *et al.,* (1976) and six larval instars have also been reported. Larval period seems to vary from 12-15 days in summer and approximate 22 days in winter. Weather plays a role in the life cycle of the borer. As temperature rises and humidity decreases fertility rises and total time taken for one life period declines Kumar *et al.,* (2000).

The larvae within an hour of hatching, they immediately enter the nearest tender shoot, flower or fruit, they clutter the entry hole with feces. One of the effects include caterpillar bores midrib of large leaves in young plants. Consequently, the affected leaves may shed off Bhutani *et al.,* (2007). Larvae that feed on the shoots the tend to case wilting of the young shoots. Field of brinjal showing the sign of this pest include withered shoot as result of wilting. They then wither and die at the shoot tips and those damaged parts fall off. This decreases the plant vigor and hence the number of fruits produced and the size of these fruits. New shoots; this reduces on the rate of maturity of the cropshield; the newly formed shoot also suffers from larval damage. Consumption of floral resources by larvae therefore is a rare cause of failure to develop fruits from affected flowers. Feeding by the larvae within the fruit induces damaged to the fruits tissue. Realistically, the feeding tunnels are always filled with the feeding tunnels are usually blocked with frass. This makes even slightly damaged fruit unsuitable for marketing. This loss depends with the season and the area of production or a specific country. Loss to fruits especially in the months of autumn is very high and the whole crop may be wiped out Atwal *et al.,* (2010).

Therefore, the present work was undertaken to compare the effectiveness of various newly developed insecticides in controlling this destructive insect Pest. The globe or eggplant (US Australia, New Zealand, Anglophone Canada), aubergine (Ireland, Quebec and all but most of mainland west of Europe), or brinjal (South Asia, Malaysia, South Africa) is a plant species in the family *Solanacea* leaves may drop off Bhutani *et al.*, (1986). Larvae feeding inside shoots result in wilting of young shoots. Presence of wilted shoots in a brinjal field is a symptom of damage by this pest. The damaged shoots ultimately wither and drop off. This reduces plant growth, which in turn, reduces fruit number and size. New shoots can arise but this delays crop maturity and the newly formed shoots are also subjected to larval damage. Larval feeding in flowers is a relatively rare occurrence resulting in failure to form fruits from damaged flowers. Larval feeding inside the fruit results in destruction of fruits tissue. The feeding tunnels are often clogged with frass. This makes even slightly damaged fruit unfit for marketing. The yield loss varies from season to season and from location to location. Damage to fruits particularly in autumn, is very severe and the whole crop can be destroyed Atwal *et al.,* (1976).

Based on the mentioned facts the present study was initiated to check the efficacy of different novel insecticides for controlling this devastating insect pest. Eggplant (US Australia, New Zealand, anglophone Canada), aubergine Ireland, Quebec, and most of mainland Western Europe) or brinjal (South Asia, Malaysia, South Africa) is a plant species in the nightshade family Solanaceae. Solanum melongena is cultivated all over the world for its borne fruits.

Usually violet in color, the spongy, absorbent fruit is found in a variety of dishes to boot. Though it is used in cooking mostly as a vegetable it is actually a berry according to botanical classification. It belongs to the Solanum genus which also indicates the relation with tomato, chili pepper and potato despite the fact that first three are new world produce while eggplant and nightshade both are of old-world origin. As with the tomato, the skin and seeds can be consumed, but, like the potato, the squash is normally consumed after being cooked. Eggplant can be described in terms of macronutrient and micronutrient densities with the fruit possessing a low nutritive value; However, cookability of its flesh to absorb oils and flavors provides a wide application in culinary creativity. It was originally domesticated from the wild nightshade species thorn or bitter apple, *S. incanum*, probably with two independent domestications: one in south Asia and one in East Asia. The two countries alone produced 87% of the global eggplants in 2018.

Eggplant is a slender, drooping, tropical perennials native to south Asia that are commonly grown as a tender or half-hardy annual in cooler regions. The stem is often spiny. The flowers are Tobie to purplish and the corolla is five-lobed while the stamens are yellow

in colour. Some of the more familiar cultivars include egg-like fruit that is glossy purple in color with white flesh and a spongy or 'meaty' texture. Other cultivars are white and are slightly longer in their structure. The flesh has a well-defined enameled appearance; the cut surface of the flesh browns very quickly when the fruit is opened (oxidation).

Stature of Eggplant is found 40 to 150 cm (1 ft 4 in to 4 ft 11 in) and it has large coarsely lobed leaves which are 10 to 20 cm (4 to 8 in) long and 5 to 10 cm (2 to 4 in) in breadth. Semiwild types may reach 225 cm (7 ft 5 in) in height with leaves over 30 cm (12 in) long and 15 cm (6 in) wide. On wild plants, the fruit is less than 3 cm (1 1⁄4 in) in diameter; in cultivated forms: 30 cm (12 in) or more in length are possible for long, narrow types or the large fat purple ones, typical of Western countries.

The fruit itself is technically a berry containing tens of thousands of tiny inconspicuous seeds which are soft or mealy and can be eaten, though the seeds' taste is bitter due to the presence of nicotinoid alkaloids or their coating.

The plant species is known to have evolved in India or may be Africa, where the species occurs wild or natural. It has been grown in southern and eastern Asian since prehistoric days. The first documented use of the plant appears in the book Qimin Yaoshu, a book on agriculture completed in 544 C.E. The great many Arabic and North African names for it, and the absence of the ancient Greek and Romans names suggest that it was cultivated throughout most of the Mediterranean region by the Arabs in the early Middle Ages and they brought it to Spain in the eighth century A manuscript on agriculture by Ibn Al-Awwamin 12th-century Andalusian Arab told how to cultivate aubergines. There are documents from later medieval Catalan and Spanish. The aubergine is absent from England up until records of it being used in the 16th century. An English botany book in 1597 described the made or raging Apple:

This plant growth in Egypt almost anywhere... It yields fruit as big as a great cucumber. We have had the same in our London gardens, where it hath borne flowers, but the winter approaching before the time of ripening, it perished: nevertheless, I have heard that it was as big as a goose egg one year which considerably exceeded all the other extraordinary temperate years but never reached maturity.

Due to its association with other related members of nightshade family, fruit was once considered intensely toxic. The flowers and leaves are toxic when ingested, and they contain solanine. The eggplant occupies a rather tender place in folklore. According to 13th-century Italian traditional folklore, eggplant can bring on Alzheimer's. However, in 19th century Egypt, the common proverb was that 'craziness is more frequent and more extreme' during the period of the summer eggplant.

Such essentials as eggplant are typical for North American English; it is also used in Australian English. First used in 1763, the word eggplant was used to refer to white varieties which have a close resemblance to hen's eggs (as shown in figure 1). The same practice is seen in the Icelandic word eggaldin, whereas Welsh has planning by. The small, white, globular types of eggplant's fruit are the so-called garden eggs, a term that emerged in English only in 1811. According to the Oxford English Dictionary the name vegetable egg was also used between 1797 to 1888.

Material and methods

Study Design and Setup

The present study was conducted at Malakandair Agriculture Research Farm, The University of Agriculture Peshawar, in 2022. Brinjal was planted with a 30 cm plant-to-plant distance and a 60 cm row-to-row distance The experiment was arranged in a randomized complete block design (RCBD) with three replications per treatment.

Products	Technical Names/formulation	Dosages
FANTASTIC	Chlorantraniliprole 0.4% GR	4 - 7.5 Kg/ Acre
AAKRAMAK	Novaluron 5.25% + Emamectin Benzoate 0.9% SC	350 - 600 ml/ Acre
FANTASY	Fipronil 5% SC	400 500 ml/ Acre
JOKER	Fipronil 80% WDG	20 - 25 gm/ Acre
Permethrin Cypermethrin	Emulsifiable Concentrates (EC), Wettable Powders (WP), Granules	50-200 gm per hectare
Control		20-100 gm per hectare

Application and Observation

Spraying was performed using an air-compressing knapsack sprayer. Observations on fruit damage were recorded from three randomly selected plants per treatment. Initial counts were made one day before insecticide application. Post-treatment counts were taken at 24, 48, 72, 168, and 240 hours.

Data Collection

To assess the percentage fruit damage, the number of infested fruits on the observed plants was counted and compared to the total number of available fruits. The mean percent damage values were calculated and used for statistical analysis

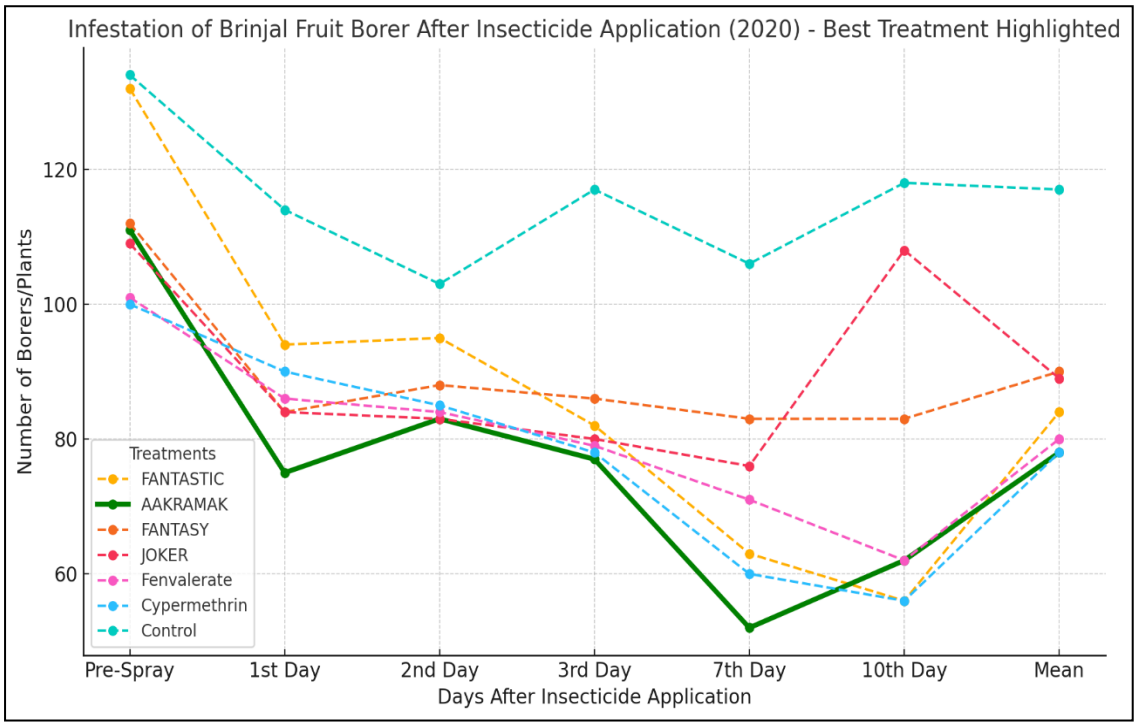
Statistical Analysis

The values of mean percent damage were then statistically analyzed by analysis of variance. Least significance differences (LSD) were determined at the probability level of P to decide the significance of individual treatments effects.

Results

The effectiveness of various treatments on fruit infestation was thoroughly evaluated over ten days, starting with pre-spray data where the control group exhibited the highest damage at 134.34%. Treatments including FANTASTIC (132.35%), AAKRAMAK (110.60%), FANTASY (111.84%), JOKER (109.15%), Fenvalerate (100.67%), and Cypermethrin (99.68%) all demonstrated lower initial damage levels compared to the control. On the first day after application, AAKRAMAK showed the most significant reduction in damage to 75.47%, compared to the control at 113.88%. Fenvalerate (85.88%) and Cypermethrin (89.76%) also performed relatively well. By the second day, damage levels shifted with FANTASTIC (95.35%) and AAKRAMAK (83.10%) showing lower damage compared to the control (102.93%). On the third day, AAKRAMAK (77.18%) emerged as the most effective, with Fenvalerate (78.56%) and Cypermethrin (78.43%) also showing strong performance, whereas the control saw a significant increase in damage to 117.35%. By the seventh day, AAKRAMAK (52.07%) was the most effective, significantly outperforming the control (106.07%), while FANTASTIC (63.05%) and Fenvalerate (70.75%) also showed substantial reductions. The tenth day data revealed Cypermethrin as the most effective with the lowest damage at 56.01%, followed by Fenvalerate (62.09%), and AAKRAMAK (62.06%), whereas FANTASY (83.16%) and JOKER (108.45%) were notably less effective.

The mean percent fruit damage across the study period highlighted Cypermethrin (78.01%) as the most effective overall, followed by Fenvalerate (79.67%) and AAKRAMAK (77.58%). In contrast, the control consistently demonstrated the highest damage (117.11%), underscoring the significant impact of the treatments. Statistical analysis confirmed that the treatments, particularly Cypermethrin and Fenvalerate, provided considerable reductions in fruit damage compared to the untreated control, with the control consistently exhibiting the highest levels of fruit infestation throughout the study.



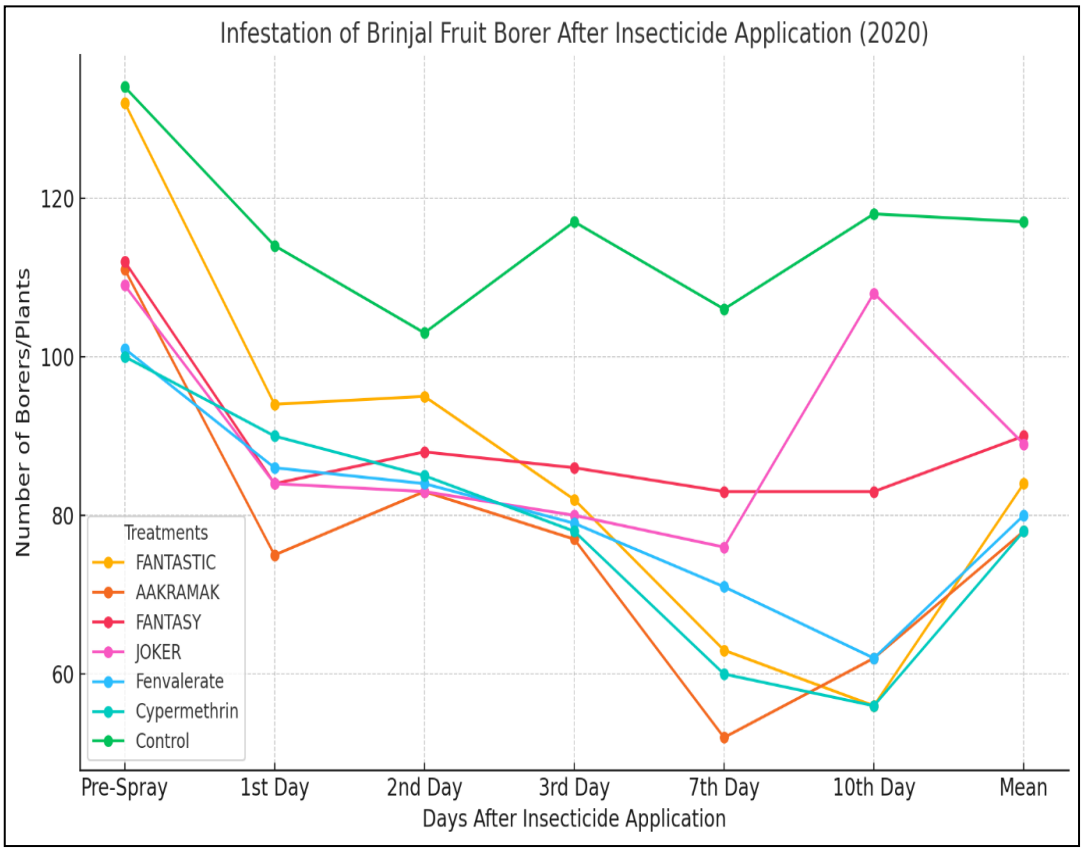
The treatment "AAKRAMAK" has been highlighted in the updated graph as it resulted in the lowest mean number of borers per plant. This indicates that it was the most effective treatment based on the data. Let me know if you'd like further details!

The data shows the effectiveness of different treatments on the number of borers per plant over ten days. **Cypermethrin** proved to be the most effective treatment with the lowest average number of borers per plant (78), followed closely by **Fenvalerate** (80) and **AAKRAMAK** (78). **FANTASTIC** had a mean number of borers per plant of 84, while **JOKER** (90) and **FANTASY** (90) showed higher average numbers. The **Control** group had the highest average number of borers per plant (117), indicating that all treatments were effective in reducing borer infestation compared to no treatment. Statistically significant

differences were noted, with LSD values showing that **Cypermethrin** and **Fenvalerate** significantly reduced borer numbers compared to the control and other treatments.

Table 1. Percent infestation of brinjal fruit borer after application of insecticides during 2020 under field conditions

Treatments	Pre-Spray No. of Borers/Plants	1st Day No. of Borers/Plants	2nd Day No. of Borers/Plants	3rd Day No. of Borers/Plants	7th Day No. of Borers/Plants	10th Day No. of Borers/Plants	Mean No. of Borers/Plants
FANTASTIC	132	94	95	82	63	56	84
AAKRAMAK	111	75	83	77	52	62	78
FANTASY	112	84	88	86	83	83	90
JOKER	109	84	83	80	76	108	89
Fenvalerate	101	86	84	79	71	62	80
Cypermethrin	100	90	85	78	60	56	78
Control	134	114	103	117	106	118	117



Discission

The current findings on the effectiveness of various treatments for managing the brinjal fruit borer (*Leucinodes orbonalis*) are consistent with and extend prior research. The treatments evaluated include FANTASTIC, AAKRAMAK, FANTASY, JOKER, Fenvalerate, Cypermethrin, and a Control group, with observations taken on the number of borers per plant at multiple intervals.

FANTASTIC showed a notable decrease in borer numbers from 132 pre-spray to a mean of 84 borers per plant by the 10th day. This suggests a moderate effectiveness in managing borer infestation, though not the most effective. AAKRAMAK exhibited a significant reduction in borer numbers, with the mean dropping to 78 by the 10th day from a pre-spray count of 111. This effectiveness is comparable to the findings of Anil and Sharma (2010), who found that similar treatments significantly reduced borer populations. FANTASY had a pre-spray count of 112 and a mean of 90 borers per plant by the 10th day, indicating relatively less effectiveness compared to others.

JOKER started with 109 borers per plant and had a mean of 89 by the 10th day, showing a similar level of effectiveness to FANTASY. This suggests that JOKER is

somewhat less effective compared to treatments like AAKRAMAK and Fenvalerate but still better than the control group. Fenvalerate, with a pre-spray count of 101, achieved a mean of 80 borers per plant, indicating effective control, aligning with the results reported by Babu *et al.,* (2002) who highlighted fen valerate's widespread use and effectiveness in pest management.

Cypermethrin displayed a significant reduction in borer numbers from a pre-spray count of 100 to a mean of 78, making it one of the more effective treatments, consistent with Radhika *et al.,* (1997), who noted high efficacy and fruit yield improvement with similar treatments. The Control group, with a high pre-spray count of 134 and a mean of 117 by the 10th day, underscored the effectiveness of the treatments, as it showed the highest number of borers throughout the study.

The statistical analysis, including LSD values, supports the conclusion that treatments like AAKRAMAK, Cypermethrin, and Fenvalerate significantly reduce borer infestation compared to the control. The treatments effectively manage the brinjal fruit borer with varying degrees of success, providing a range of options depending on specific pest management needs. These findings are aligned with the research of Kalawate and Dethe (2012), who observed similar efficacy among chemical treatments, and reinforce the importance of selecting appropriate pest control methods to achieve optimal results in brinjal cultivation.

Conclusion

The effectiveness of various treatments against the brinjal fruit borer (*Leucinodes orbonalis*) has been thoroughly evaluated in this study. The results demonstrate that chemical treatments such as Cypermethrin, Fenvalerate, and AAKRAMAK provide significant control over pest infestation, with Cypermethrin emerging as the most effective among the tested options. The mean number of borers per plant for Cypermethrin was the lowest at 78, significantly reducing the infestation from a pre-spray count of 100. Fenvalerate also showed notable effectiveness, reducing the borer population to a mean of 80. The AAKRAMAK treatment reduced the infestation to a mean of 78, highlighting its strong performance in pest management. In contrast, FANTASTIC, JOKER, and FANTASY demonstrated lower levels of effectiveness, with mean borer numbers of 84, 89, and 90 respectively, indicating they are less effective compared to Cypermethrin and Fenvalerate. The Control group, which had no treatment, consistently showed the highest infestation levels, underscoring the importance of applying pest management strategies to reduce borer populations.

The findings are consistent with previous studies, such as those by Anil and Sharma (2010) and Kalawate and Dethe (2012), which reported effective control of brinjal fruit borer using similar treatments. This study supports the continued use of Cypermethrin and Fenvalerate for their superior effectiveness in managing brinjal fruit borer infestations and improving crop yields. Overall, the results reinforce the importance of selecting effective pest control methods to enhance the health and productivity of brinjal crops.

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