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Major insect pests of Brinjal and their management by never insecticides

Kailash Chaukikar, Sanjay Vaishampayan, Priyanka Gurjarand R. S. Gurjar

[1,2]Department of Entomology,JNKVV, Jabalpur(M.P.),

[3]Dept. of Horticulture (Vegetable Science),RVSKVV- Gwalior, (M.P.)

[4] Dept. of Agriculture Extension RVSKVV, ZARS, Morena (M.P).

Corresponding author*: kailashento@gmail.com

Brinjal (*Solanum melongena*L.) belongs to the family Solanaceae is one of the most important vegetable crop which grown in South-East Asia where hot and wet climate prevails (Thapa 2010). India is the second largest producer of vegetables in the world, next to theChina. It is rich in nutritive value and contains vitamins, proteins, minerals and carbohydrates. *S. melongena* is known to have ayurvedic properties and is good for diabetic patients. It has also been recommended for those suffering from liver complaints. It is available everywhere at reasonable price. Hence, it is known as “poor man’s vegetable” (Wankhede and Kale, 2010).

Brinjalis the most consumingvegetableamong the vegetarian people. It is one of the main sources of cash crop for many farmers (Daniel miller, 2007).

Among the several production constraintsof brinjal, the incidence of insect pests are the most important factors of them.Shoot and fruit borer (*Leucinodes orbonalis),* whitefly (*Bemisiatabaci*), jassid (*Amrascabiguttulabiguttula*) are the major insect pests. The whitefly and jassid are major sucking insect pests of brinjaland its incidence not only results in the loss of plant vigour, but also spreads mosaic virus disease affecting the fruit yield.

Out of these pests, shoot and fruit borer (*L. orbonalis*) is a serious pest ofbrinjal throughout the India. The damage by this insect starts soon after transplanting of the seedlings and continues till theharvest of fruits. The eggs are laid singly on ventral surface of leaves, shoots and flower- buds and occasionally on fruits and calyx. On hatching, the tiny larvae bore in the growing tips of young shoots during their early growth stage and it causes drooping of twigs and later holes in the fruits. The larvae plug the hole with their excreta that also leads to fungal infection. Thereafter, it completes its larval stage within the developing fruits and mature larvae come out from the fruit for pupation. Yellowing and wilting of the affected shoot is the common symptom of attack (Hegde*et al*., 2009). The apparent loss of fruits has been reported to be varying from 20-90 percent in various parts of the country (Raju *et al*., 2007). The infested fruits become unfit for humanconsumption due to loss of quality and hence, loose its marketvalue.

It has been recognizedthat measuring the intensity and abundance as well as distribution of pest in relation to weather parameter help in determining pest succession and appropriate time of action and suitable method of control. Hence, studies on the succession of insect pests play an important role towards the brinjalprouction(Chavan*et al*. 2013).

For propermanaging the insectpests population of brinjal, different methods have been used, but to keep the population below the economic threshold levelchemical control is one of the common practices, many of the insecticides applied are not effective in the satisfactory control of these pest. In India,the highest amount of chemical pesticide is applied in brinjal against the pests. Chemical insecticides are used as the frontline defense sources against insect pests in India. However, their indiscriminate use creates a number of problems like residues causing health hazards, phytotoxicity symptoms like burning of leaves, wilting and chlorosis on plant resulting in reduction of yield.

However, bottleneck in cultivation of brinjal is increased cost of production on management of insect pest complex. The important insect pests are the shoot and fruit borer (*Leucinodesorbonalis*Guenee), Stem borer (*Euzopheraperticella*Ragonot), Leaf roller (*Antobaolivacea* Walker), Leaf beetle (*Henosepilachnavigintioctopunctata* Fabricius), Lacewing bugs (*Urentius echinus* Distant) and Ash weevil (*Myllocerous discolor*Boheman) (Butani, 1984).Among the different insect pests of brinjal, shoot and fruit borer, *L. orbonalis* is the key pest (Saimandir and Gopal, 2012) inflicting sizable damage in almost all the brinjal growing areas (Dutta *et al.,* 2011).Borer infestation reported infestation was 78.66 per cent on top shoots in vegetative phase (Suresh Sing and Tayde, 2017).Due to damage of pest, the fruits become unmarketable and yield losses up to 90 per cent (Baral*et al.,* 2006).Eco-friendly, less costly measures, such as, cropping system approach, botanicals are more advantageous over insecticides, as they fit well in IPM (Prakash *et al.,* 2008).

There is an urgentneed to replace the insecticides withsome newer insecticideswith lesser dose of few grams per hectare maintaining high toxicity to insect pests. Emamectin benzoate (avermectins-microbial insecticides), Imidacloprid (neo-nicotinyl group insecticide), Indoxacarb (oxadiazine group), Lambda-cyhalothrin (fourth generation synthetic pyrethroid) are broad spectrum insecticides and reported to be effective and economical in controlling the insect- pests of brinjal(Chandan, 2018).

standard of 80% reduction of BSFB The insecticides against shoot and fruit borer of brinjal. The insecticides screened were Takumi (Flubendiamide) 20% WG @ 200,375 and 500 g/ha, Emamectin benzoate 5SG @ 220g/ha, indoxacarb 14.5SC@ 517g/ha, thiodicarb 70WP@ 1000g/ha and spinosad 45SC @ 180ml/ha against brinjal shoot and fruit borer. The results revealed that Takumi (Flubendiamide) 20%wG @ 500g/ha was found to be most effective insecticides which minimized the shoot and fruit damage as compared to untreated check (Biswas *et al.,* 2007). Dutta *et al.,* (2007) the insecticides provided sufficient field control of the pest, *i.e.*, more than a population over control. Although Proclaim 5 SG (Emamectin benzoate) showed moderate level at efficacy providing 62.8% reduction of BFSB population over control. It is concluded that this pest might have developed resistance against the tested insecticides.Wankhede (2009) three sprays at 15day interval of Emamectin benzoate (Proclaim 5 SG; 200 g/ha) was most effective in reducing the shoot damage by the brinjal shoot and fruit borer (*Leucinodesorbonalis*Guenee) with mean shoot damage 4.89 per cent which was at par with novaluron (Rimon 10EC; 250 g/ha) (5.29%) and diflubenzuron (Dimilin 25 WP; 200 g/ha) (6.44%), the latter being at par with *Bacillus thuringiensis* var. kurstaki (Btk) (500 g/ha), all being significantly lower than untreated control with 10.86 per cent shoot damage.Latif *et al.,* (2010) evaluated nine insecticides such as Azadirachtin 0.03 EC, Abamectin 1.8 EC, Flubendiamide 24 WG, Chlorpyriphos 20 EC, Cartap 50 SP, Carbosulfan 20 EC, Thiodicarb 75 WP, Cypermethrin 10 EC, and Lambda- cyhalothrin 2.5 EC belonging to different chemical groups were tested against eggplant shoot and fruit borer in laboratory and field. Lambda-cyhalothrin and chlorpyriphosreduced shoot and fruit infestation of eggplant and protected higher yield as compared to control.Kalawate and Dethe (2012) the insecticides like Spinosad (56.25 and72.90 g *a.i.*/ha) and Emamectin benzoate (56.25 and 12.5 g *a.i.*/ha) was studied in comparison to Cypermethrin (50 g *a.i.*/ ha). The results revealed that the application of Spinosad was found moderate affordable against whitefly.Shirale*et al.,* (2012) conducted field experiments to evaluate the efficacy of Chlorantraniliproale 18.50% SC (Coragen), Flubendamide 39.35% SC (Fame), Indoxacarb 14.50% SC (Avaunt), Chlorfenapyr 10% SC (Intrepid) and Spinosad 45% SC (Spintor) against brinjal fruit and shoot borer, *Leucinodesorbonalis*(Guenee). Chlorantraniliprole 18.50% SC and Flubendamide 39.35% SC proved their superiority over other insecticides in reducing infestation of *L. orbonalis* and resulted in higher yield.Shaikh *et al.,* (2014) the insecticides Spiromesifen, Diafenthiuron and Triazophos as most effective treatments against the jassids and whitefly; Imidacloprid, Profenophos and Cartap hydrochloride as mediocre, while Clothianidin, Thiamethoxam and Thiacloprid were least effective.Gaurkhede*et al.,* (2015) the insecticidesacetamiprid 20 SP @ 0.004 per cent proved to be effective in lowering down the whitefly population (0.99 whiteflies/leaf), which was closely followed by Flonicamid 50 WG @ 0.02 per cent (1.10 whiteflies/ leaf), fipronil 5 SC @ 0.015 per cent (1.11 whiteflies/leaf), dinotefuran 20 SG @ 0.008 per cent (1.20 whiteflies/ leaf) and imidacloprid 30.5 SC @ 0.005 per cent (1.34 whiteflies/ leaf).Kalawate*et al.,* (2012) spinosad (56.25, 72 and 90 g a.i. ha) and (5, 6.25 and 12.5 g a.i. ha) was studied in comparison to cypermethrin (50 g a.i. ha) and self- formulated neem seed extract (5 %). From the study cypermethrin at 50 g.a.i/ ha was found effective (13.10 % fruit damage) with highest yield (16.3 t/ ha) followed by spinosad at 72 g.a.i /ha (13.34 % fruit damage with yield of 15.68 t/ ha) over control (27.62 % fruit damage with yield of 12.96 t/ ha).Sharma *et al.,* (2012) determined that three sprays of chlorpyriphos + cypermethrin @ 0.01 % active substance (a.s.) at 15 days interval was found to be most economical, resulting in minimum shoot (2.15 %) and fruit (12.95 %) infestation, followed by alphamathrin @ 0.01 % a.s. with a highest marketable yield of

87.77 q/ha. Maximum marketable yield was received from the treatment with alphamathrin, but due to high costs involved in the use of this chemical, it took second place. Three sprays of NSKE @ 5 ml/l recorded a maximum of shoot (3.91 %) and fruit (24.49 %) infestation, respectively.Jyoti and Basavanagoud (2012) sprays of emamectin benzoate 5 S G @ 0.2 ml and spinosad 45 SC @ 0.1 ml/l were found to be most effective in reducing shoot infestation (14.6% and 16.9%) and fruit infestation (9.0% and10.9%), respectively as compared to untreated check (39.2 % and 39.3 %). Highest marketable fruit yield was recorded in emamectin benzoate (158.51 q/ha) and spinosad (153.51 q/ha). Whereas, untreated check recorded lowest marketable fruit yield of 83.93 q/ha.Dattatray*et al.,* (2012) the lowest fruit damage of 8.8 per cent (number basis) and 8.4 per cent (weight basis) in the plots sprayed with chlorantraniliprole 18.5%SC with high yield (528.5q/ha), followed by flubendiamide 39.35 % SC where fruit damage of 10.9 and 10.4 per cent (number and weight basis) with yield (451.2q /ha) was observed and untreated control plots showed damage of 22.5 and 43.1 per cent on number basis and 20.6 and 40.9 per cent on weight basis, respectively with yield of 244.5q/ha.Anil and Sharma (2010) the total number of drooping shoots was minimum in emamectin benzoate (4.17) followed by endosulfan (6.83). In terms of reduction in fruit infestation, emamectin benzoate (0.002 %) was highly effective followed by endosulfan (0.05 %), agrospray oil (0.2 %) and spinosad (0.0024 %). However, cost benefit ratio was highest in agrospray oil (0.2 %) followed by lambda cyhalothrin (0.004 %).Sharma and Tayde (2017) Three applications of seven insecticides viz Neem oil 0.15 EC, Spinosad 45 SC, Emamectin benzoate 5 SG, *Beauveriabassiana*2x108 CFU, *Verticilliumlecanii*2x108 CFU, *Metarhiziumanisopliae*2x108 CFU, Cypermethrin 10 EC were evaluated against shoot and fruit borer, *Leucinodes orbonalis*. Minimum per cent of shoot infestation, fruit infestation and B:C ratio were recorded in cypermethrin (check) with (6.69%, 9.33% and 1:8.01) followed by spinosad (13.2%, 10.66% and 1:7.63) < Emamectin benzoate (14.03%, 14.60% and 1:7.54) < Neem oil (16.96%, 15.79% and 1:6.01) <*Beauveriabassiana*(17.92%, 20.12% and 1:.501) <*Metarhiziumanisopliae*(20.43%, 20.88% and 1:5.06) <*Verticilliumlecanii*(*Lecanicilliumlecanii*) (24.74%, 23.43% and 1:4.84) < untreated control (25.34%, 32.15% and 1:3.73) respectively.Tripura *et al.,* (2017) The treatments *viz.* chlorantraniliprole 18.5 SC (0.4ml/l), spinosad 45 SC (0.5ml/l), chlorfenapyr 10 SC (2ml/l), indoxacarb 14.5 SC (1ml/l), *Bacillus thuringiensis* (*Bt*) (2g/l), azadirachtin 0.03EC (5ml/l), *Metarhiziumanisoplae*(2.5g/l), *Beauveriabassiana*(2.5g/l), chlorpyriphos 20EC (2.5 ml/l) were applied thrice at fifteen days interval starting from initiation of BSFB infestation. Mean shoot infestation was minimum in chlorantraniliprole plots (6.32%) followed by spinosad, chlorfenapyr, indoxacarb. Among bio-pesticides, *Beauveria* and *Bt*were found effective treatments in reducing shoot infestation. Chlorantraniliprole recorded lowest fruit infestation (8.25%) and highest marketable fruit yield (250.30q/ha) followed by spinosad and chlorfenapyr.

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