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# STUDIES ON INSECTS' PEST OF OKRA AND IPM PRACTICES'- A REVIEW BY AKKABATHULA NITHISH

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**Abstract**

Okra may be a good representative of the vegetables grown throughout India along with other crops. It stood as an essential vegetable of the tropical countries and most widespread in India. One among the key constraints in okra cultivation is its susceptibility to variety of insects' pest during different phases of its growth. Sucking pest are the most limiting factor for production of marketable fruit yield of okra. Aphid (*Aphis gossypii*), jassid (*Amrasca biguttula biguttula*) whitefly (*Bemisia tabaci*), Red cotton bug (*Dysdercus cingulatus*) and Green stink bug (*Nezara viridula*) etc. were the foremost prominent insects causing damage in okra at various growth stages of the crop. The sucking pests' movement will start when the crop is in vegetative phase. Fruit borer (*Helicoverpa armigera*) and shoot and fruit borer (*Earias vittella*) were the foremost prominent pests causing damage during the reproductive stage and are more active throughout the fruiting stage. To lessen the damage caused by these pests, farmers depend upon the utilization of an huge amount of synthetic insecticides aimed to control the pest, effecting environment, public health and also increase in insecticidal resistance to pest, resurgence in insects which ultimately affecting the interests in the growers. So on beat this problem, it is necessary to adopt IPM strategies which are developing for about eras to minimize the harmful effects of toxic chemical insecticides on atmosphere, eventually upsetting the benefits of the farming community. Numerous bio insecticides are discovered with wide-ranging action besides have the ability to develop as substitutes to toxic pesticides.

**Keywords :** Okra, insects' pest, IPM practices.

## Introduction

Okra is one among the important vegetable crops grown in many countries. India, being largest producer among them is widely grown in West Bengal, Bihar, Gujarat, Odisha, Jharkhand, Haryana, Andhra Pradesh, Assam, Chhattisgarh, Madhya Pradesh, and Telangana. In India, okra is grown to an extent of 0.529 M ha with 61.51 lakh MT production and12.1 tonnes/ha productivity (Anon., 2017). It contributes 5.8 percent of the entire vegetable area and nearly 4 percent of total countries vegetable production. Varieties of insects attacking the crop are one among the factors liable for lower yields in okra. Shoot and fruit borer, jassids, whiteflies, fruit borer, aphids, leaf beetles, Looper, leaf roller, red cotton bug, green stink bug etc. are common insects in okra among which *Amrasca devastans*, *E. vittela, H. armigera* and *B. tabaci*, *Sylepta derogata* are the foremost notorious and major pests which may cause up to 69% yield loss (Dubey *et al*., 1999; Basu, 1995; Lohar, 2001; Rawat and Sahu, 1983). Several types of Scolytid beetles and Lagria beetles which were established in lesser colonies eat away the upper areas of leaves but the injury isn't much serious. Insect pest infestation not only reduces the crop development but also transmits pathogenic diseases (Sheedi, 1980; Dhaliwal *et al*., 1981).Nearly about more than 72 kinds of insect pest are documented in okra (Srinivasa and Rajendran, 2002) among them sucking pest causes substantial harm and losses to okra crop. Among the pests attacking okra, sap sucking insects like aphids,

leafhoppers and whiteflies were described as much severe pests in entire crop growth stages (Channabasavanna 1981; Singh *et al*., 1987). About 16 insect species were found attacking okra in India (Butani and Verma, 1976). Some insects cause serious economic losses by sucking the sap from the plants by piercing the leaves while some insects bore holes on them reducing the photosynthesis in leaves. The holes provide penetration entrance zones to plant pathogens (Pursglove, 1972).

**Seasonal incidence and favorable conditions of okra pest**

Insects infesting of okra belongs to 5 orders namely Heteroptera, Coleoptera, Orthoptera, Homoptera and. Lepidoptera. Numbers of several insect pests were higher during the minor season (September-December) than during the major season (April-July). The sap sucking insect pests, aphids and jassids made their appearance from third week when the crop was sown. The incidence of whiteflies appeared on around 30 days crop. Gradually, all the pests reached their peak on 42 days crop. Thereafter, pest populations started declining. The incidence of fruit borer started at initial picking and touched its peak on about ten week old crop, Chaudhary and Dadheech (1989). Yadav *et al.* (2007) stated that attack due to borer features a positive association by means of temperature and negative association with R.H. and rainfall. Slosser *et al*. (1998) described that aphids had rose in August and October months. Patel and Rote (1995), Preetha and Nadarajan (2007), Hegde *et al*. (2004), Anita and Nandihalli (2008) and Gulati (2004) stated that Aphids was highest during the second 15 days of October followed by first and second 15 days of November. Watson *et al*. (2003) reported that, temperature above 30°C rise the level of egg laying above 40°C reduce the lifespan phase of *B. tabaci* to less than 2 weeks. Threhan (1944), Ozgur *et al*. (1990) and Rao *et al*. (1989) reported that high temperature and low rainfall favour the rapid reproduction of the insects. Yadav *et al.* (2007) found direct correlation of maximum temperature and indirect correlation of R.H. with jassids on okra and also found direct correlation of both maximum and minimum temperatures and indirect correlation of evening R.H. with the whitefly on okra. Leafhoppers showed indirect correlation with maximum temperature, minimum temperature and with mean temperature and also with maximum relative humidity and minimum relative humidity whereas direct correlation with rainfall. Whitefly showed indirect association with extreme, least and mean temperature and extreme and least ratio whereas showed direct correlation with rainfall. Aphid showed indirect association with least and mean temperature, rainfall and extreme and least relation whereas showed direct association with extreme temperature. (Yajuvendra Singh et al, 2013). Dhamdhere *et al*. (1984), Devraj and Kumar (1987), and Pareek *et al*. (2001) reported that least temperature, relative humidity and rainfall had a significant indirect association in increase in insects. Fletcher (1919) recorded *A. affaber* occurrence during Dec to Jan on cotton, *Hibiscus cannabinus* Linnaeus and bhendi at Coimbatore. Beeson (1919) observed the commencement of the early progeny of the above species during July then another in September. The seasonal incidence of *A. affaber* on bhendi crop under Coimbatore condition was reported by Subramanian (1959). The weevil was more abundant during raining days from Sep to Dec and occurred only on crops raised in August. Only single generation of insects were reported on okra. Thippeswamy *et al.* (1980) observed highest population of shoot weevil during late sowing cotton crop (August). Sharma *et al.* (2012) described that the periodic existence of *A .affaber* in okra field in the first seven days of Aug and remains within the field up to December. The weevil is more in number during rainy season (August to November) at Samba in north India. Maximum oviposition was observed within the month of August and September with no oviposition after 14$^{th}$ of Oct. Thimmaiah *et al.* (1975) from Dharwad, Karnataka, reported a widespread occurrence of *A. affaber* on cotton and bhendi. The infestation on okra was about 82.66 percent recording more than one grub in each gall. The mites' invasion is regularly detected in the hot and dry spells. Gulati (2004), found a direct

association in mite population and extreme temperature, R.H. and sunshine hrs whereas, it had been negatively associated with least temperature. Gupta *et al*. (1998) reported that rise of relative humidity by one unit result in rise of 0.595% shoot infestation and for each one unit rise in precipitation, there was 0.154% decrease in fruit infestation by *E vittella* while **Sharma** *et al.* (2010) described that the number of insects was indirectly associated with the average temperature and also indirectly associated with rainfall in terms of larvae attack and proportion of plants infested.

**Symptoms and nature of damage by insects**

- **Jassids**

Krishnaiah (1980) found that leafhoppers can cause damage losses of 40 to 56% in okra. Rawat and Sadu (1973) found a decrease about 49.8 and 45.1% in height besides leaves, due to attack of leafhopper. Aphids and leaf hoppers have a tendency to stand as key pest during the initial crop period which decreases the yield by sucking the plant sap and making them weak. Chaudhary and Dadeech (1989) reported that failure to control the jassids in the initial stages can cause yield loss over 54.04%. Nymphs and adults attack during the entire crop period and desap the plant by sucking from lower portions of the leaves. Affected leaves turn yellowish and curl owing to injecting their toxic saliva into plant tissues when feeding (Singh *et al*., 2008).

- **Whitefly**

Both nymphs and adults damage the leaves by sucking the sap. As a result the leaves are curled and dried up. Plants infected with whiteflies are stunted in growth. Whiteflies in addition accountable for transmitting yellow vein mosaic virus.

- **Aphids**

Aphids are also considered as the chief insects of okra. Aphids attack many plants range belonging to 46 families. Both nymph and adult are invade different plant parts for sucking. Heavily infested leaves turn to yellowish in colour, get deformed, curled and dry up causing yield losses. They have ability in transmitting viral diseases on several plant hosts besides causing direct losses (Butani and Verma, 1976).

- **Flea beetles**

Flea beetles were very destructive to the flower, leaf and fruit, and the attack is severe on leaves. Beetles bored numerous holes on leaves by feeding on equally the upper and the lower sides of the leaves.

- **Blister beetles**

The blister beetles occur generally at the time of flowering stage. The adults attack on the flowers and young fruits and feed on them. Their numbers, however, reduced considerably after formation of fruits.

- **Epilachna beetles**

Grubs and adults impart a skeletonized or lacy appearance to leaves by consuming on the fresh matter of the leaf leaving veins and veinlets. Sometimes the leaves were completely eaten but their numbers reduced after flowering. As leaves shrivel and turn brown colour, severely attacked crop looks in to a dusty appearance.

- **Cotton stainer**

Nymphs and adults pierce and sucked sap from the fruits and leaves causing shriveling of both the pods and leaves.

- **Cotton leaf roller**

The newly emerged larvae roll the leaf and eat away the green tissue during initial stage and eats up much of the leaf as it grows. Severe attack indicates the occurrence of more leaf rolls and therefore such plants are ultimately stunted in growth.

- **Red spider mite**

Red spider mite has expected the status one of the key insects' pest causing crop damage loss of 17.45% in okra (Sarkar *et al.,* 1996). Both nymphs and adults were found in large colonies on underside of leaves cause damage by feeding on the lower surface of the leaf. On close examination of the lower leaf surface, mites smaller than a pin point may be seen. Attached leaves have characteristic blotches which become whitish then brown patches appear. Later the entire affected leaf become discolored and dried up. Under severe infestation, the top canopy of the plantis covered by webbing of mites. Mites attacked leaf curled up rapidly, become mottled, hard, and crisp and finally drop off. The mite infested plants are often recognized by the characteristic mottling symptom on the leaf lateral surfaces.

- **Mealy bug**

Damage is caused by both adults and nymphs by sucking from leaves, floral parts, fruits, also occasionally from the stems of plants even. Bugs profoundly suck the sap from the plant and make it fragile, delicate and responsible for yellowing, withering and drying of plants. Under much severity, sooty mould grows on honey dew released by bugs which decreases the photosynthesis in plants. Bugs infested fruits have less marketability.

- **Thrips**

Adults and nymphs suck the sap from flower buds and leaves as a result leaf margins are slightly curled up in affected leaves and therefore the leaf blades are having irregular surfaces. If infestation happens during flowering phase, such attacked flowers can wilt or fade. If population is high leaves could also be distorted.

- **Shoot and fruit borer**

In India *Earias insulana* and *Earias vittella* attack shoot and fruits of okra besides *Earias vettelle* has been identified as the key pest in other countries (Gapud, 1993). The larvae eat away smooth and developing tissues particularly terminal buds of main stem, and fruits, which in due course fall off. Brownish small caterpillars feed the contents by boring into the topmost fresh shoots and makes tunnels downwards through the main axis, resulting in shoot wither, droops down, wilt and dry. After boring the fruits, they feed within the fruits completing the growth inside the shoots and then in fruits. The infested plant bears smaller with deformed pods.

- **Shoot weevil**

The weevils lay their eggs in the nodal axil. The young tender plants are more vulnerable for attack. The grubs bore into tip of shoots and leaf axils due to which young plants are died. In severity, tunneling reaches the lowermost part of the main which stem results in breaking of the tree branches. Affected plants exhibit withering of shoot tips initially and future, holes with excreta can be noticed in the leaf petiole and shoot tip. The affected portion with fresh excreta is the sign of the existence of the grubs (Bhuvaneswari, 2006).

- **Fruit borer**

After hatching from eggs the newly emerged larvae eat away leaves for certain time and then bore into the developed fruits by hanging their bodies outside the fruit.

**IPM in okra**

Sardana *et al.* (2005) evaluated impact of IPM programmes to lessen pest infestation on okra and tested different IPM modules including bio-intensive, cultural and chemical treatments provided optimum control of pests. Al-Eryan *et al.*, (2001), Bindu *et al*., (2003), Paulraj and Ignacimuthu, (2005) reported bio agents and extracts of neem to be eco-friendly choices for regulatory of insects in okra. Botanical insecticides like Neem pesticides, microbials like *Bacillus thuringiensis*, *Metarrhizium anisopliae*, *Beauveria bassiana* and *Verticillium lecanii* and bio agents like spiders, *Chrysoperla* and *Trichogramma* should be integrated for financial control of insect in okra (Arora *et al*., 1996 and Abro *et al*., 2004). According to Kumar and Singh (2002) variety Arka Anamika harbored lesser population of jassids with minimum leaf injury. Broad usage of insecticides resulted in issues like pest resistance, resurgence, pesticide residues, destruction of beneficial fauna and environmental pollution (Adilakshmi *et al*., 2008).

**Role of botanicals**

Botanical insecticides are broad spectrum in nature for pest controlling and much of them are safe to use, unique in action and should be easily processed for using. Plant extracts, commonly called botanicals are secondary plant products synthesized by plants to safeguard them from pests, herbivores and diseases. Extracts from many plants are using to guard cultivated crops from insect pest attack. Three of the effective known plants with pest control properties are *Azadirachta indica, Lantana camara* and *Melia azedarach*. Leaf extracts of *Lantana camara* are shown to exhibit antimicrobial, fungicidal, insecticidal and nematicidal activities. Begum *et al*., (2000) reported that allelopathic compounds exist within the flowers, stem, leaves and roots of the plant. As per Dua *et al* (2003) these phytochemicals shows adverse effects on microorganisms, plants, and insects. Baidoo *et al*., (2017), evaluated the effect of ethanolic compounds of roots and leaves of *Lantana camara* in managing sucking pest of okra. Schmutterer, (1990) described that neem products have insecticidal, repellent, antifeedant, sterilising and growth inhibition effects against several insects spices. Treatment with neem oil alone and or in mixture with chemical insecticides for shoot and fruit borer reduces its damage (Samuthiravelu and David 1991, Sardana and Kumar 1989). Chitra *et al.* (1993) found reduction in okra shoot and fruit borer infestation by applying leaf extract of *Argemon mexicana* (0.10%), *Azadirachta indica* (0.10%) and Neemguard (0.50%). Temurde *et al.* (1992) reported that extract of neem leaf with mixing cypermethrin or fenvalerate gave better result in controlling okra shoot and fruit borer than did extract alone. Hajeri *et al*. (2007) described that neem based formulation achook as effective insect repellent causing reduction of whitefly population. Borkar *et al*. (2012) reported that neem oil 1 % amalgamated with insecticides is effective treatment for reducing whitefly population. Patel *et al*., (1990) found that Vilayati mehendi (*Clerodendrum inerme*) was very effective in minimizing the losses due to root-knot nematodes in okra. Neem oil-cake for soil amendment @ 1.5 t/ha in okra (Reddy and Khan, 1990), yellow mustard de-oiled cake @ 2.5t/ha in tomato and okra (Singh and Sitaramaiah, 1971), showed effectiveness in defending the crop against root-knot nematodes.

**Role of bioagents**

Beneficial insects or the **natural enemies** were considered as **farmers' friends**. Various beneficial organisms can help the farmer to retain pest under check and stop them from causing economic damage. So as to see the damage initiated by insects and for producing quality crop, it become necessary to control the insects at appropriate time with suitable measures because increase of the insects has been found as favoured by ecological elements. Spiders are general predators present in agro ecosystem feeding on phytophagous insects. Predatory spiders and coccinelids are the

foremost important defenders for insects of okra fields (Mishra and Mishra, 2002). Kumar *et al*. (2004) describe the predatory potential of spiders against insect pest and recorded 13 types of spiders in okra crop. Kubar *et al*. (2006) witnessed various spider species in okra crop feeding on phytophagous insects. Aphidophagous predators like *Chellomonos lunata*, *Chellomonos vicina*, *Coccinella septumpunctata* and *Menochilus sexmaculata* are recognized as key regulating factors in managing aphids. They also prey on mites, whiteflies, small insects and eggs of insects etc. The parasitoids of hymenoptera order, *Aenasius bambawalei* is extremely active against mealy bug and about 70-80% parasitization has been documented in some places.

**Role of insecticides**

Chemical pesticides have to be applied used based on the recommendation of CIB & RC (www.cibrc.gov.in) as a last alternative. Sinha and Sharma (2007) recorded that the spraying thiamethoxam 25 WG @ 20 g a.i. per hectare at 30 days of sowing was best in leaf hopper control and also spraying thiamethoxam 25 WG @ 25 g a.i. per hectare showed effective control at 50 days after sowing against leafhoppers in okra. Sinha and Sharma (2008) found that spraying thiamethoxam 25 WG @ 20 g a.i. per hectare at 15 days interval effectively reduced the jassid population in okra. Sinha *et al*. (2007) concluded that foliar application of thiamethoxam @ 20 g a.i. per hectare at 15 days interval was best in reducing the leaf hopper population. Bhalala *et al*. (2006) reported that foliar applications of thiamethoxam 25 WG at fortnightly interval at two higher doses (50 and 37.5 g a.i./ha) showed higher effectiveness in controlling sucking pests of okra. Mishra and Senapati (2003) found thiamethoxam 25 WG @ 50 g a.i. per hectare gave significant control over jassids in okra when sprayed at an interval of 15 days. Subhadra *et al.* (2002) found thiamethoxam @ 25 g a.i./ha as best insecticide against okra leaf hopper when sprayed at 15 days interval. Pathan *et al*. (2010) found that need based (ETL) spray of thiamethoxam 25 WG @ 0.0125% was best and protected the okra crop from sucking insects. Mitalilal *et al*. (2005) reported that imidacloprid at 40 g a.i. per ha was effective treatment in decreasing the jassid population in okra. Bhargava and Bhatnagar (2001) found that seed treatment with imidacloprid 600 FS at 9 ml/kg seeds and 70 WP at 10 g/kg seeds was found to be efficient for jassids. Rohini *et al* (2012) described that thiamethoxam 5 SG @ 0.2 pram per litre was best against whiteflies. Such outcomes were reported by Mohansundaram and Sharma (2011) by using thiamethoxam 25 WG. Raghuraman and Ajanta (2011) found that imidacloprid 17.8 SL @ 80 gm a.i./ha had significantly inhibited whiteflies due to which the yield in okra is increased. Leeuwen *et al*. (2006) observed spinosad as effective insecticide against whitefly nymphs at doses of 2 mg active ingredient per plant. Ghoshal *et al*. (2013) found that thiamethoxam 25 WG was effective against aphid in okra. Gavkare et al. (2013) found that, thiamethoxam was the foremost toxic insecticide against green peach aphid *Myzus persicae*. Mishra (2002) declared that thiamethoxam at @ 25 g a.i. /ha when sprayed after 40 and 60 days of sowing effectively manage the aphid incidence in okra. Anitha and Nandihalli (2009) applied thiamethoxam 25 WG @ 0.2 gm/l as foliar spray and registered highest fruit yield. Similarly, Venkataravanappa *et al*. (2012) found that thiamethoxam 25 WG gave highest fruit yield in okra.

**Conclusion**

It is needed to conclude that IPM practices provide operative managing actions on the insects' pest complex of okra on large scale. IPM in okra is an appropriate tool of wise use of bioagents, botanicals and lastly the synthetic chemical insecticides. Moreover, IPM could also be suggested as a virtuous substitute for the solely chemical dependent agriculture. Botanicals give effective control just like the synthetic insecticides and can remain encouraged overcoming the issues related to insecticides.

The incorporation of bio insecticides in IPM technology is additionally gaining importance during current days. Hence more studies on IPM practices on okra crop against insects must be explored.

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