OKRA JASSID, *Amrasca biguttula biguttula* (ISHIDA) (HEMIPTERA: CICADELLIDAE) BIOLOGY, ECOLOGY AND MANAGEMENT IN OKRA CULTIVATION

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Abstract

Okra (*Abelmoschus esculentus*) belongs to the family malvaceae is an important horticultural crop globally. It is grown widely in semiarid tropical as well as subtropical regions. Many insect as well as non-insect pest are known to infest the crop resulting in yield reduction. As reported as many as 72 pest species are recorded. Among them is the okra jassid or leafhopper. Okra jassid, *Amrasca biguttula biguttula* (Ishida) (Hemiptera: Cicadellidae), is a well known malvaceous pest worldwide. Okra jassid cause both direct as well as indirect damage to okra and related malvaceous crops by feeding and ovipositing on the leaves by causing hopper burn and curling of leaves, marginal leaves chlorosis and reddening which causes reduction of 50 % yield reduction. They are distributed all around the world wherever malvaceous crops are growing.

Introduction

The Jassid, *Amrasca biguttula biguttula* (Ishida) comprise the family cicadellidae order Hemiptera. It is an insect pest which sucks the plant sap and occurs throughout the crop sowing till harvesting period on okra and cotton growing region. While feeding, they injects toxins into leaves resulting in leaves marginal discoloration, chlorosis as well as reddening. As jassid is very harmful in hot and humid areas, because of the favourable conditions their development is very high. Jassid has become the serious and most destructive pest of all the vegetables as well as other ornamental plants and agronomics crops also. Thus jassids are very harmful pest of okra in india and as well as in other countries also (Dhandapani et al 2003). *Amrasca biguttula biguttula* caused damage from young seedling to mature crops results in 50% yield loss (Halder et al 2016) 40-56 % losses (Krishnnaiah 1980).The pest mostly take rest usually under side of the leaves during day time.

Geographic distribution

Okra jassid is a versatile and widely distributed insect. It has been recorded in India, China, Pakistan, Iran, Syria, Greece, Spain, Argentina, Brazil and USA. It is distributed widely throughout Eastern, Western, Southern, Central Africa and Australia (Rahman et al 2014).
Environment effects on outbreak of okra jassid

Jassid population is controlled by their inherent capability to increase, over the influence of various external environmental parameters. The different environmental factors such as temperature, relative humidity as well as rainfall are considered as an important reason for fluctuation in population. Due to favourable environmental conditions the jassid population is very high in punjab region. Environmental factors are effectual on the existence, growth and development as well as reproductive capacity of jassid. Temperature is the most important environmental factors which insect depend for their management. The diverse environmental parameters affect the development, life cycle, spread, and jassid outbreaks to such extent that they are either forced to acclimatize themselves. The nympha l population build up occur from the second week of seedling emergence. There has been overall reduction in status of jassids on okra after 2001 mainly due to the wider use neonicotinoid seed treatment chemicals. Jassids attain pest status between July-August months, at times threatening the crop stand Iqwal et al (2010). Devi et al (2018) also reported the positive correlation between temperature, rainfall evening relative humidity and evaporation.

Description of life stages

**Biology**

**Egg:** Eggs are curved, greenish -yellow eggs (0.7-0.9 X 0.15 -0.2 mm) are ovisited deeply implanted in the midrib or a large vein on either surface of leaf or in a petiole or young stem but never in the leaf lamina (Vennila et al 2007). Depending on species, 29-60 eggs can be laid singly and they hatch in 4 -11 days.

**Nymph:** Nymphs are flattened, pale yellowish green (Vennila et al 2007), wedge -shaped, 0.5-2.0 mm long, moves diagonally, confined underside of leaves in daytime, however, during night it can be found anywhere on the leaves. The nymphal period varied from 2 to 21 days depending on food availability and temperature. A generation likes 3-4 weeks in the summer jassid is estimated to have 11 generations in a year in India (Iqbal et al 2008).

**Adult:** They are about 3.5 mm length, body is elongate and wedge shaped with pale green colour. The black spots are present in forewings as well as vertex (Vennila et al 2007). Adult are very active with sideways movement but hop quickly (Singh et al 2003).

**Host range**

Apart from feeding on okra, the jassid have a very wide range of the host plants, including herbaceous cultivated plants and weeds, chiefly amongst the Malvaceae, Leguminosae and Solanaceae. Jassid is polyphagous insect infesting okra, cotton, brinjal, beans, castor and cucurbits etc and widely distributed. infesting most of the plant. There are about 17 host plant species belong to 8 different families infested by jassid. Rahman et al 2014
Okra jassid damage to okra

Amongst the important sucking insects pest jassid attack and cause heavy loss to okra crop (Iqbal et al 2008). Among the sucking insect pests, jassid as well as whitefly are more severe (Atwal 1994) and transmit plant viral diseases. They sucks the plant sap leads to discoloration of the leaves, loses in yield up to 35-40% can increase up to 60-70 per cent during optimal environment (Sultana et al 2016).

Feeding injury

Okra jassid sucks the plant cell sap resulting in reddening and yellowing of leaves and photosynthetic region reduces. Both nymphal as well as adults incurred damage by injecting its toxic saliva into plant tissues. Maximum damage was reported during mid season reducing yield (Sahita et al 2017).

Plant damages

- Tender leaf become yellowish
- Leaves margin shows curling downwards and reddening
- During severe infestation leaves becomes browning which is typical “hopper burn” symptom
- Leaf margins broke and crumble into pieces when crushed
- The leaves dried up and shed down and stunted growth

Status and nature of damage

This pest can cause more than 50 percent reduction of seed okra yield in some okra genotypes. The nymphal as well as adults of this pest can attack okra leaves at all stages of growing period. Jassid, particularly the older nymphs, feeding on the small veins appear to affect the functioning of the vascular system so that the leaf of edge changes color from dark to pale green, yellow and then red and brown. Nymphs and jassid adults suck plant sap from under surfaces of plant leaves. The affected leaves shown hopper burn symptoms. The whole leaf of susceptible okra varieties can desiccate and shed. The edge of leaves curl downwards if attacked leaves have not fully expanded. Growth of young plants may be completely stopped. They also introduce a toxin that impairs photosynthesis of okra plants. Due to attack of the jassid, the okra leaves became yellow and curled upward. Then the leaves finally turned brown at the tips and dried up. The heavily infested plants failed to bear fruits and the less damaged plants were found to produce different types of fruits.

The infested plants remained stunted in the field. The jassid attacked plants are easily identified by presence of globular, translucent, mucilaginous substances. The exudates were present mostly on the under surface of the leaf, a few in the leaf petiole and stem. The jassid damaged the plants at all stages of their growth. The maximum numbers of exudates were found in the younger leaves than in the older ones.Rahman et al 2014
Incidence and seasonal distribution of okra jassid

The population dynamics of jassid, on okra cv. Azad bhindi-1 in relation to weather factors, during kharif seasons in 2005 and 2006 at Kanpur, Uttar Pradesh, India. Jassid actively started from first week of August on 3-week-old crop in 2005. In 2006, jassid infestation on shoots started from the fourth week of July on 7 leaf-stage until the third week of September (Yadav et al 2007). Highest population of jassid was found in 2005 in September 2nd week on 8 week-old plants (Yadav et al 2005).

The seasonal abundance of jassid, on okra was investigated by Inee et al (2000), in Assam, India in 1998-99. Result signifies that meteorological parameters performed a key role in building up of population of cotton jassid. The population of jassid was highest in the end week of May, 1998 ie, 37.53 nymphs per leaf) and mid of April in 1999 (30.00 nymphs per leaf).

Kumawat et al (2000) found the seasonal incidence of jassid (Amrasca devastans) on Okra crop during kharif 1996 at places such as Rajasthan semi-arid region, India. The invasion of jassid begins from 4th week of July and attained in peak on 2nd as well as 4th weeks of September, respectively.

Mahmood at el (1990) studied the abundance of the Cicadellidae, jassid on okra in Pakistan in year 1986-1987. In June pest appear and stayed active throughout crop season. Of all the environmental factors the main significant factor was temperature. Positive correlation was observed between highest and lowest temperature with regard to density.

In another study, Mahmud at el (1988) reported that phonology of the Cicadillidae, jassid on okra in Pakistan. The pest population observe below the economic threshold level for around five weeks after germination. The population, crossed the threshold level in early June and remained same till late August. Peak population of the pest is in late July (27.8 individuals/ leaf).

Senapati and Khan (1978) observed that the highest population of okra jassid appeared from November to February. Pawar et al (1996) reported that sowing done on 15th May and 1st June had a lesser incidence of Amrasca devastans with a good outputs of marketable fruits (22.9 q/ha). Atwal et al (1969) reported that the population reached its peak in August and September ranged between 28.2-30 °C.

Ali et al (1991) conducted an experiment in 3 consecutive kharif and rabi seasons in Joydebpur, Bangladesh to investigate the influence of plant age on the abundance of jassid. Cicadellid populations remained below the economic threshold level of one insect/leaf for up to 35 days of plant age in kharif and 65 days of plant age in rabi. Most of the cicadellids were found in 35 to 75 days old plants in kharif and 65 to 130 days old plants in rabi season. Plants growth in the kharif season was more vulnerable to insect attack than plant grown in the rabi season (Yadav et al 2008).

Tomar and Rana (1994) reported that among the sowing dates, 20 February and 5 march for spring sow in and 2 April and 5 June for rainy season sowing gave the least incidence of jassid nympha (Yadav et al 2001).
Monitoring

Nymphs and adults can be observed on the leaves undersides. Nymphs tend to move sideways when disturbed, adults can fly readily and both nymphs and adults follow aggregated distribution (Shivalingaswamy et al 2002). Sharma et al (1997), observed the biology of jassid (Amrasca) on okra variety; pusa swani revealed that the insect had an incubation period of 6.27 days. 91.9 per cent was jassid egg hatchability and nymphal have five instar with the duration of 1.5, 1.1, 1.2, 1.5 and 2.0 days. Mean pre-mating, pre-observation, oviposition and post-oviposition period were 2.55, 3.45, 16.57 and 3.90 days respectively. The average fecundity was 17.5 eggs per female. 21-30 days were the adult life span. The females dominated over males in numbers in the field.

Field inspection

The insects are sample weekly interval after the emergence till the crop has six true leaves and represent as jassid/plant. The adult as well as nymphs should be check under side of the leaves. Monitoring of the insect should be done from the underside of the leaves from 20-30 plants per 50 ha of crop. Checking the symptoms from tip damage which appear as extensive blackening of the small leaves within the terminal. Adults are highly mobile and nymphs are very small so counts may vary with the time of day. The damage potential also varies with crop vigour and temperature. For seedlings to six true leaves the threshold is 80% reduction in leaf area and 10 jassids/plant (adults and nymphs).

Management tactics

Efficacy of indigenous plant materials: Several indigenous plant materials have been used to control these jassid in our country and others parts of world. Investigations are needed to surface with appropriate indigenous plant materials on every crop, especially the vegetables which consumed daily in maximum scale. There is a knowledge gap on the uses of plant materials for the effective controlling of okra jassid.

Botanicals

Spraying of neem oil, neem seed, neem leaf extract, neem seed kernel extract against jassid, aphids, whiteflies as well as thrips were very successful. Along with this some of the plant products like Annona squamosa L., Chrysanthemum spp. and Rotenone spp were also utilizes as an insect repellents as well as antifeedants for controlling the insect pest which attacks various crops (Hugar et al 1990). Neem, green chilli as well as garlic extract mixed with water in the ratio of 1:2 for managing jassid and aphid (Kanvarjibhai et al 1993). Thomas et al (1994) reported the hot water extraction of highly pungent chilli along with few bits of asafetida were effective for managing leafhopper and mite pests. For controlling jassid crushed garlic bulbs dipped in kerosene for 24 hours and mixed with ground chilli with soap solution and sprayed the crop for effective control of jassid (Thomas et al 1995). Vijayalakshmi et al (1996), found an effective against jassid,
aphids and whiteflies by spraying neem and garlic extract alone and in combination along with additional plant extracts viz., garlic, chilli, ginger, neem, tobacco and even cow urine. Vijayalakshmi et al (1997) used extracted neem and ginger extract alone as well as in combination along with other plant with cow urine were injurious to jassid, thrips as well as whitefly. (Kasyapa et al 1998) also reported that solution of chilli with garlic and neen seed kernel extract (NSKE) spray were the common practices for pest management. Sridevi et al (1998) also reported NSKE (5%) effectively in reduces the population of jassid in sunflower. Lakshmanan et al (2001) also carried out such experiment and found neem oil and neem seed kernel extract alone or in combination along with garlic bulb extract, kerosene, chilli and other extracts effectively managed jassid, whiteflies, thrips and tetranychid mites which infested a number of crops.

Biological

Jassid predators viz., the spider, Lycosa pseudounnulatai (Blackwall) in rice ecosystem (Krishnaiah et al 1984), Chrysoperla (Yadav et al 1990), C. carnea and C. septumpunctata (Kaethner 1991; Ravikumar et al 1999), predatory mites Amblysieus spp (Guddewar et al 1994).

The population of different predatory in okra ecosystem, spiders, Chrysopids, Apanteles sp. and Coccinellids were the most dominant (Rosaiah et al 2001). Smitha et al (2002) and Balikai et al 2004) found the plant extracts were safer to the predators and other natural enemies as compare to the chemicals.

Chemical control

Kumar et al (1989) evaluated the critical time in application of insecticides for control of Amrasca devastans on okra an found that application of insecticide 21-42 days after germination resulted in the lowest infestation of insect pests and the highest benefit-cost ratio. Babu et al (2000) found the efficacy of imidacloprid 200 SL persisting for 23 and 31 days against aphids and leafhopper, respectively in chilli ecosystem. Atachi et al (1989). Rana et al (2006) conducted experiments during kharif 2003 and 2004, in Karnal, Haryana, India, showed that admire 200 SL at 2 ml as well as thiamethoxam and carbosulfan each at 2g/kg seed were quite effective in controlling jassid and whitefly. Okra seed yield was higher in treatments. And it was cost effective and minimized quantity of insecticid in a very significant level. Gandhi et al (2006) showed that insecticidal seed treatment is an alternative method to spray and granular applications. Lal et al (2005) carried out investigation to evaluate four (5, 9, 18, 36, g/kg) doses of Admire (imadacloprid treatments against sucking pests of okra. Studies revealed that seeds yield of all the treatments, except highest dose (36g/kg) of Admire treatment gave excellent results. Dey et al (2005) conducted filed experiment during the 1998 and 1999 to evaluate the efficacy of imidacloprid 70WS, Admire 200SL, against jassid, Aphis gossipie and Bemisia tabaci of okra and their natural enemies. Admire 20SL was applied as foliar spray at 20 and 40 days after sowing. It was effective against jassid and others sucking pests, admire 200 SL had significant effect in controlling jassid. (Anonymous 2005)
Summary

The best treatment in terms of percent reduction of jassid population due to application of different management practices and by studying biology of jassid we can decreased the jassid infestation. In case of relationship between percent of jassid infestation and yield of okra among different management practices, it was shown that negative correlation was observed between the parameters i.e., the yield of okra decreased with the increase of incidence of jassid infestation.

Conclusion

Jassid causes tremendous crop yield losses to the okra cultivation. Various management method has been effectively incorporated and control the population of jassid. The efficacy of various botanicals should also incorporate in order to have maximum management. However, further study is needed in different locations of India for accuracy of the results. Since different environmental factors are also effecting the population of the jassid.

References


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