Proceedings:
International Conference on
Mango and Date Palm: Culture and Export.
20th to 23rd June, 2005.
Malik *et al.* (Eds), University of Agriculture, Faisalabad.

INCIDENCE OF MANGO MIDGE AND ITS CONTROL IN DIFFERENT MANGO GROWING COUNTRIES OF THE WORLD

Waqar Ahmed, Muhammad Azher Nawaz, Basharat.A.Saleem and Muhammad Asim
Institute of Horticultural Sciences, University of Agriculture, Faisalabad

ABSTRACT

About 260 species of insects and mites have been recorded as minor and major pests of mango. Mango midge *(Erosomya indica)* (Diptera: Cecidomyiidae) has become a major pest of mango and is found in all mango growing countries of the world. Sixteen species of midges are known to attack mango in Asia where this plant is indigenous. The midge infests and damages the crop at three different stages. No definite control measure has yet proved satisfactory; Cultural, Chemical and Biological control have been adopted. Integrated pest management can prove better to control the deleterious pest. The objective of this paper was to review the work done on mango midge and to find out the present situation of this fatal insect in mango growing areas with special emphasize on its control measures.

Keywords: Mango insects, midge, *Erosomya indica*, biological control, bifenthrin.

INTRODUCTION

Mango *(Mangifera indic*a), like most fruit tree crops, is usually attacked by two or three key pests, several secondary pests and a large number of occasional pests in localized areas of mango habitat. Out of 260 species of insects and mites that have been recorded as minor and major pests of mango, 87 are fruit feeders, 127 are foliage feeders, 36 feeds on the inflorescence, 33 inhabit buds and 25 feeds on branches and the trunk (Veerish, 1989). The name midge originates from Old Norse Muggia. Midge is a serious pest of mango in mango growing countries of the world. It was first described by Felt in 1911 from material collected in St. Vincent, West Indies (Whitwell, 1993).

Mango midge *(Erosomya indica)* has gained much attention in the recent past as it has become a major pest in all mango growing areas of the world. The mango gall midge or mango blister midge (*Erosomya mangiferae* Felt.) is a major pest, destroying flowers and up to 70% of fruit set. Similarly the leaf-gall midge (*Procontarinia matteiana*) is a serious pest of mango in Oman. (Sankaran and Mjeni, 1988). It is feared that heavily infested mango trees may produce few inflorescences, resulting in reduced yields of mango fruits. Galled leaves remaining on trees are known to provide reservoirs of anthracnose inoculums (Harris and Schreiner, 1992). At least 16 nominal species of gall midges are known to attack mango in Asia where this plant is indigenous. It is also found in the Caribbean and Brazil with its host. (Harris and Schreiner, 1992).

The objective of this manuscript was to review the work done on mango midge to find out the present situation of this fatal insect in mango growing areas regarding the special emphasize on its control.

DISTRIBUTION

Midge has become a serious pest of mango in all mango growing countries of the world. It was first described by Felt in 1911 from material collected in St. Vincent, West Indies (Whitwell, 1993). Sankaran (1988) described that the insect is found in India, Indonesia, Keneya, Mauritius, Oman, Reunion, South Africa and United Arab Emirates (UAE).

Barnes recognized nine gall midges from mango; two of these, *Asynapta sp*. and *Eryosomya mangifereae,* are from West indies. (Barnes, 1948). *Dasinura mangifereae.* Felt was reported in Hawaii (Anonymous, 1981).

In Oman midge is a serious problem and causes a huge loss to yield; it damages leaves, inflorescence and small developing fruit (Sankaran and Mjeni, 1988).

In Japan, *Procantirinia mangicola* attacks fresh mango leaves and produces circular blister galls, causing the leaves to crinkle (Harris and Schreiner, 1992).

Procontrainia mangicola has been recorded from Guangxi Zhuang Autonomous region, China (Shi, 1980). A gall midge producing circular blister galls on mango leaves was first found in a greenhouse at Tamagusuku Village on Okinawa Island. (Uechi et al., 2002).

Procantirinia mtteiana was probably introduced into Mauritius accidentally in 1909 with mango plants imported from India and with in the next ten years it had spread to almost all the area of the island (D'Emmerez deCharmoy, 1921).

In the Philippines and Taiwan, while working on disease management in mango found anthracnose disease symptoms on old blister midge galls in Tainina, Taiwan, which indicates a possible occurrence of one or more *Procontarinia* species in Tainan (Uechi et al., 2002).

Singh (1960) noted that in India twelve species of midges representing three genera were known to produce different types of galls on mango leaves. Recently, this pest has become very serious in certain pockets of Uttar Pradesh, India causing serious damage to mango crop by attacking both the inflorescence and the small fruits.

The prevalence of mango midge has been recorded since last decade in Pakistan. It is being reported in all mango growing areas specially in Multan, Lodhran, Rahim Yar Khan and even in Faisalabad which is not traditional mango growing area (personal observations). It will be worth mentioning that at Treen Farm Lodhran, various trials are being carried out on Mango midge to study the life cycle as such to devise effective control measures of the deleterious insect.

LIFE CYCLE

The flies lay eggs singly on floral parts like tender inflorescence axis, newly set fruit or tender leaves encircling the inflorescence. The eggs hatch within 2-3 days. Upon hatching, the minute maggots penetrate the tender parts where the eggs have been laid and start feeding on them. The floral parts finally dry up and drop. The mature larvae drop down into the soil for pupation. The larval period varies from 7-10 days while pupal period varies from 5-7 days. There are 3-4 overlapping generations of pest over the period from January-March in Northern Hemisphere. Thereafter, as the weather conditions turn unfavorable, the mature larvae undergo diapauses in the soil instead of pupating. They break diapauses on the arrival of favourable conditions in following January. The midge infests and damages the crop in three different stages. The first attack is at the floral bud burst stage. The eggs are laid on newly emerging inflorescence; the adult eggs are normally laid in folds between sepals and petals of the flower buds (Abbas, 1988). Mostly emergence of adults was higher at 24^0C and 60-82% relative humidity than at lower temperatures and relative humidities (Grover, 1986a & 1986b). The larvae makes tunnel in the axis and thus destroys the inflorescence completely. The mature larvae make small exit holes in the axis of the inflorescence and slip down into the soil for pupation. The

second attack of the midge takes place at fruit set. The eggs are laid on the newly set fruits and the young maggots bore into the tender new leaves encircling the inflorescence. The most damaging one is the first attack in which the entire inflorescence is destroyed even before flowering and fruiting. The inflorescence shows stunted growth and its axis bends at the entrance point of the larvae. It finally dries up before flower opening and fruit setting. The midge infests the newly emerged panicles by ovipositing at bud burst stage, and the first instar maggots bore into the growing panicle. Infested panicles have a characteristic right-angled bend, with an exit hole, from which last instar maggots emerge to pupate in the soil. The second generation then infests on very young fruits, which eventually drop before the marble stage. The midge has four larval instars, and field cage traps showed emergence of adults to be in the afternoon. Infestation was noticed at bud-burst stages, at fruit set and on tender leaves of new flushes (Irshad, 2005). The population of the insect is less in the month of January, whereas the infestation increases during the month of February and March; then in April the population decreases (personal communication).

MODE OF DAMAGE

A midge is a tiny dipteran (two-winged) fly, a relative of the mosquito. The adult midge is harmless minute fly which is short lived and dies within 24 hours of emergence after copulation and oviposition. The eggs are normally laid in folds between sepals and petals of the flower (Pena et al., 1998). On hatching maggots bore inside the leaf tissues, and feed with in, resulting in the formation of small raised wart-like galls on leaves. Affected leaves get deformed and drop prematurely. Larval feeding prevents flower opening and consequently development of the fruit. Infested bud develops as long pointed galls, in which pupation occurs (Anonymous, 1981). Singh (1960) pointed out that the injury caused to leaves by heavy oviposition, by the midges and by larval feeding on he tissue inside the galls affected mango trees considerably. In most mango orchards, heavily galled leaves fell to the ground much earlier than usual and most galled leaves remain on trees suffered from anthracnose inoculum. Satoshi Taba detected an anthracnose, *Colletotrichum gloeosporiodes*, from most of the young galled mango leaves on Okinawa Island (Uechi, *et al*., 2002.). Shoots of heavily infested mango trees have almost no inflorescence, resulting in low yields of mango fruit. Such damage is frequently observed in relatively high humidity mango orchards where the under growth is very thick and mango trees are not pruned adequately (Uechi et al., 2002).

CONTROL

Until now no general recommendations have been designed for control of this insect in the mango growing countries. Similarly, no effective insecticide has been screened for this pest any where in Pakistan although some insecticides are being tested to control this fatal insect. Keeping in view its mode of action, life cycle, climatic requirements (Harris and Schreiner, 1992), availability of its natural predators, different control measures are being adopted for its control.

Cultural control

As the larvae pupate in the soil, ploughing of the orchards expose pupating as well as diapausing larvae to sun heat which kills them. In Pakistan at certain places plastic sheet is used to break the life cycle of the midge. The soil below the canopy of plant is covered with the plastic sheet; it prevents the emergence of adults from soil and also prevents the dropping larvae to go into soil for pupation. In this way the life cycle of the mango midge is interrupted and ultimately insect population decreases.

Chemical control

Spraying of 0.05 per cent Fenetrothion or 0.045 percent Dimethoate or 0.04 percent Diazinon at the bud burst stage of the inflorescence has been found effective in controlling the pest population (Irshad, 2005). Foliar application of Bifenthrin @ 70ml/100L of water had given

satisfactory results. The spray is repeated with the interval of 7-10 days, in the flowering season up to pinhead stage of the fruit (personal communication).

Biological control

Biological control has great potential as a tactic for regulating pest populations in integrated pest management programs in mango orchards; however, it will be difficult for biological control alone to reduce a pest from an economic to a completely non economic status for pests attacking fruit. Biological control should be highly effective for indirect pests. Some of their natural enemies have been recorded. In a survey of parasitoids of cecidomyiid pests of mango in India, Grover (1986a) found that *platygaster* sp., *systasis* sp. and *Eupelmus* sp. were associated with *Dasineura* sp. and *Tetrastychus* sp. was associated with *Eryosomya indica* and worked as natural enemies and predators. An external parasitoid, the pteromalid *Pirens* sp., was found attacking *Procystiphora mangifereae* (Felt). Predators of the cecidomyiid included *Formica* sp.; *Oecophila spp.* and *Camponotus spp.* (Pena et al., 1998). Attempts for biological control of the midge in Oman are under way by introducing promising parasites from India. A survey of infested areas in 1983 showed that the pest is free of the natural enemy in Oman. From India several parasitoids have been introduced, species so far released in Oman include *Chrysonotomyia pulcherrima, Chrysonotomyia spp.* (Sankaran and Mjeni, 1988) *Inostemma oculare and Inostemma ormyrus* sp. But the problem is still there. The larvae of *A. viridigallicoal* are parasitized by *Torymus sp.* and *Prodecatoma sp.* Some parasitoid wasps are also known to attack *Procontarinia spp.* in India (Srivastava, 1997).

CONCLUSION

As the insect is found in mango ecosystem and damages the crop up to 70%, so it is controlled by using different methods. By adequate cultural practices its population can be controlled, for this purpose ploughing of the soil below the canopy is done but it has some complications, the root system of the plant is damaged seriously. To handle the situation plastic sheet is used to break the life cycle of the insect, at the same time the sheet is costly and can not be practiced on commercial scale; it causes hindrance in different cultural operations. Insecticides are used to control the insect; they reduce the environmental hazards. There are promising parasitoids available naturally in the mango growing area which should be reared artificially and then used for insect control.

The pest should be controlled by adopting the integrated pest management. First the insect population should be checked by cultural and biological means if there is need then chemicals should be used to control the insect.

REFERENCES

Abbas S.R., Verghese, A. and Fasih, M. 1988. Studies on the Mango Inflorescence Midge, *Erosomya indica* Grover. Proc. 2nd International Symposium on Mango. Acta Horticulturae 231:593-596.

Anonymous.1981. Plant Pest News 1. U.S. Dep. Agric., U.S.A.

Barnes, H.F. 1948. Gall Midges of Economic Importance: Gall Midges of Fruit, Vol. 3. Cosby Lockweek and Sons, London, UK.

D'Emmerez de Charmoy. 1921. Notes on insects accidentally introduces in the island of Mauritius. Bull . Ent. Res. 11:171-177.

Grover. 1986a. Integrated control of midge pests. Cecidol. Int. 7:1-28.

Grover, P. 1986b. Population fluctuation of *Erosomya indica* and *Dasineura amaramanjarae* and co-related extent of damage. Cecidol. Int. 7:43-57.

Harris, K.M. and Schreiner, I.H. 1992. A new species of gall midge (*Diptera cecidomyiidae*) attacking mango foliage in Guam, with observations in its pest status and biology. Bull. Entomol. Res. 82:41-48.

Irshad, G. 2005. Mango from Multan. Available at ww.geocities.com/irshadgardezi/mango.html. Date of visit: 1st June, 2005.

Pena, J.E., Mohyuddin, A.I. and Wysoki, M. 1998. A review of the pest management situation in mango agro-ecosystems. J. Phytoparasitica 26(2): 1-20.

Sankaran, T. and Mjeni, A.M. 1988. Recent Studies on the mango leaf-gall midge *Procontarinia Matteiana* Kieffer and Cecconi (Dip. Cecidomyiidae) and its parasites in India and on prospects for biological control of the pest in Oman. Proc. 2nd International Symposium on Mango. Acta Horticulturae 231: 587-592.

Singh, L.B. 1960. The Mango. Leonard Hill (Books) Ltd., London.

Shi, D.S. 1980. A new species of gall midges affecting young leaf of mango (Diptera: Cecidomyiidae). *Entomotaxonomia* 2: 131-134.

Srivastava, R.P. 1997. Mango Insect Pest Management. International Book Distributing Co., New Delhi.

Uechi, N., Kawamura, F., Tokuda, M. and Yukawa, J. 2002. A mango pest, *Procontainia mangicola* (Shi.) comb. Nov. (Diptera: Cecidomyiidae) recently found in Okinawa, Japan. J. Appl. Entomol. 37(4): 589-593.

Veerish, G.K. 1989. Pest problems in mango – world situation. *Acta Hortic.* 231: 551-565.

Whitwell, A.C. 1993. The pest/predator/parasitoid complex on mango inflorescences in Dominica. Acta Hortic. 341: 421-432.