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REVIEW PAPER

PSYLLIDS AND THEIR MANAGEMENT

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ABSTRACT : Psyllids are economically important as pests of several horticultural crops and also as biocontrol agents of weeds. *Diaphorina citri*, *Apsylla cistellata* and *Heteropsylla cubana* are the predominant psyllid pests in India. Asian citrus psylla, *D. citri* is one of the major threats to citrus cultivation not only as a pest but also as a vector of citrus greening, while *A. cistellata* is a gall inducer affecting panicle emergence in mango. *Heteropsylla cubana* infests *Leucana leucocephala*, an important fodder and agroforestry crop. Systemic insecticides like imidacloprid against *D.citri* and dimethoate against *A. cistellata* were reported effective. Bioagents of *D.citri* are *Mallada boninensis*, *Cheilomenes sexmaculata* and eulophid parasitoid, *Tamarixia radiata* while *Curinus coerulus* is an efficient predator of *H.cubana*. A brief account on these pests and management strategies are presented.

Key words: Psyllidae, citrus, *Leucana leucocephala*, mango shoot gall, vector.

INTRODUCTION

Psyllids are phloem feeding insects which belong to series Sternorryncha of suborder Homoptera. The group comprises over 3000 species in 235 recognised genera, distributed worldwide from the Arctic Circle to the subantarctic islands of New Zealand with its greatest diversity in tropical and south temperate regions (Hollis, 2002). Superfamily Psylloidea comprises 6 families *viz*., Psyllidae, Calophyidae, Phacopteronidae, Homotomidae, Carsidaridae and Triozide. Majority of psyllids are free living and 15 % of known species are gall inducers. Adult psyllids resemble minute cicadas, ranging in length from 1–10 mm. They have two pairs of membraneous wings held roof-like over the body, the forewings usually of a harder constituency than the hindwings. Psyllidae comprises pestiferous species like *Diaphorina citri* Kuwayama, *Trioza erytrae* (Del Guercio), *Bactericera cockerelli* (Sulc.) etc. They cause damage not only by direct feeding but also as vectors of deadly diseases like citrus greening. Though many of them are pests, a few species are biocontrol agents of weeds and are widely exploited in some countries like Australia. *Arytinnis hakani* Loginova and *Arytainilla spartiophila* (Foerster) are the two examples for the same. In India, there are three psyllid species which assumed pest status, *viz*., *Diaphorina citri* in citrus, *Apsylla cistellata* Buckton in mango and *Heteropsylla cubana* Crawford in subabul which are discussed below.

Asian Citrus Psylla, *Diaphorina citri* Kuwayama

It is a major pest of citrus and attacks new flushes of all the seasons (Dorge *et al.*, 1968). It is also known to inject certain toxin while feeding

on the flushes which causes die back. In addition to direct feeding damage to plants, it is also an efficient vector of the bacterium, *Candidatus liberibacter asiaticus* which causes greening disease of citrus leading to slow death (Pluke *et al*., 2008). It is widely distributed in South-east Asia (Walter *et al.*, 1989), Mauritius, Brazil (Lin *et al.*, 1973, Aubert and Quilici, 1984, Hoy and Nguyen, 1996) and South America (Bergmann 1985). In India it is a serious insect pest in Maharashtra, Pubnjab, Haryana, Himachal Pradesh, Coorg area of Karnataka and and North eastern hilly region (Dorge *et al*., 1968; Bindra, 1969; Randhawa and Srivastava, 1986; Das *et al.*, 2007). It is known to infest host plants other than citrus like curry leaf (*Murraya koenigii*) and orange jasmine (*M. paniculata*). Curry leaf is the most preferred host with high rate of fecundity and short duration of life cycle. The pest completes 9-10 or even up to 16 overlapping generations in a year (Hussain and Nath, 1927, Khan *et al*., 1989). The favourable temperature range is 22-29^{O}C and is not found above 1300-1500 m MSL (Aubert *et al*., 1986). It is most active on spring and after monsoon flushes but winter and temperature nearing 40^{o} C is detrimental for their population build up. Moderate showers wash away the population. However following dry days witness rapid buildup of the pest (Shivankar and Rao, 2005). During winter heavy mortality of pest i.e. about from 53% in July to 98% in December, occurs; the eggs fail to hatch and 58% of the hatched nymphs fail to develop into adults (Mangat, 1966). Heavy and prolonged flushing coupled with low temperature and high humidity favours psylla outbreak (Shivankar and Rao, 2005). Central India witnessed its severe outbreak during the year 1960-1962,1998 -99, 2002-2005 and 2006-07.

Management

a) Monitoring using yellow sticky trap.

b) Chemical control using dimethoate @ 1.25 ml or imidachloprid @ 0.3 ml or quinalphos @ 1.0 ml or acephate @ 1g or thiometan @ 0.8 ml at bud burst stage. Second spray should follow after 10-15 days.

c) Extracts of botanicals like *Vitex nigundo*, *Acorus calamus*, etc. can also be used.

d) Biological control: Predators like *Mallada boninensis* Okamoto and *Cheilomenes sexmaculata* (Fabricius) and host specific parasitoid, *Tamarixia radiata* (Waterston) are effective in bringing down the psylla population.

Mango shoot gall psylla: *Apsylla cistellata* Buckton

It is a serious pest of mango in northern India (Singh, 2000). Adults are brownish black in colour with membranous wings (Mathur, 1975). It is reported from Uttar Pradesh, Bihar and Terrai regions of northern India. It has a single generation per year. Adult females lay eggs into the midrib of leaves in March – April. They prefers mature trees which are bearing to lay eggs and trees of less than 5 years old are not attacked. Eggs hatch after 200 days. Five nymphal instars are present and nymphal period is 140 days. Adults may live up to 30-72 h (Raman *et al*., 2009; Singh, 2005). It causes the formation of shoot galls in place of buds. Galls are modified axillary and apical buds. Feeding effect of neonate nymphs which remain in egg case induces the modification of buds to galls. Second instar nymph migrates to the already formed gall. Loss depends on the number of eggs laid; 500 eggs in all leaves result in induction of 52 galls and reduce panicle emergence by 21%. Heavily infested tree yielded only 5 kg fruit against a normal yield of 300 kg. Infested shoots had high auxin level and low phenolic content (Singh, 2005; Kumar *et al.*, 2007)

Management

a) Tolerant varieties: Makaram, Chinnaswarnarekha, Mulgoa, Delhi, K.O-11.

b) Spraying of dimethoate (0.03%) during 2nd fortnight of July followed by two more sprays at 10 days interval.

c) Bark pasting using dimethoate.

d) Bark injection using dimethoate @ 0.3 ml a.i./ cm circumference.

e) Spraying 2,4-D @ 150 mg/l for autocidal control of nymphs (Singh, 2005; Kumar *et al.*, 2007).

Subabul psyllid: *Heteropsylla cubana* Crawford

It is a major pest of *Leucaena leucocephala*, a tree grown for fodder and fuel wood. It is native to Central and South America. It invaded subabul plantations in India in 1988 (Gopalan *et al*., 1988). Adults are aphid-like, winged and light green to yellow in colour. Nymphs are similar to adults in appearance except they are smaller, wingless. Host plants other than subabul are *L. trichodes, L. pulverulenta, L. diversifolia, L. salvadorensis* and *Samanea saman* (Nair, 2001). Adults and nymphs desap the terminal leaves, buds and flowers of host plants. Repeated attacks cause wilting, defoliation, branch dieback or death of host trees. Measures aimed at controlling the leucaena psyllid have primarily concentrated on the development of resistant leucaena varieties and the use of biological control agents. Biological control agents for the leucaena psyllid include the predators, *Curinus coeruleus* and *Olla v-nigrum* (Coleoptera: Coccinellidae), and the parasitoids, *Psyllaephagus yaseeni* (Hymenoptera: Encyrtidae) and *Tamarixia leucaenae* (Hymenoptera: Eupelmidae) (FAO, 1998).

Future thrust

a) Mass multiplication of parasitoid *Tamarixia radiata* against citrus psylla.

b) Feasibility of utilization of insect pathogens like fungus in managing the psyllids.

c) Identification of semiochemicals of citrus psylla, *Diaphorina citri* and its feasibility of application.

d) Identification and characterization of biotypes of citrus psylla with the aid of molecular tools.

e) Development of biointensive modules of IPM to manage mango shoot gall psylla in northern India.

f) Exploration for natural enemies of mango shoot gall psylla.

g) Development of pest forecasting system by combining the available data on bionomics and biology of psyllid pests and weather parameters which may be responsible for its build up.

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