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Integrated management of green peach aphid *Myzus persicae* Sulzer (Hemiptera: Aphididae)

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Abstract
Green Peach Aphid (*Myzus persicae*) is a polyphagus pest that infects primarily peach including vegetable crops, sunflower, tobacco, sugar beet, and fruit crops. It is cosmopolitan in distribution. It is primarily green in color, but may be pale-brown to pinkish. Depending upon the environment and climatic condition, adults are alate as well as apterous at different time of year. Integrated management is the best method for management of Green Peach Aphid. Removal of crop residue and weed host is the best cultural practices. Aphids suck up sap from young leaves and flower buds. Infested leaves curl downward and may turn brown and die. When infestations are heavy, aphid damage can reduce plant vigor, size and yield, and may kill the plants. Different predators, parasitoids, microbial organisms, botanical pesticides can be used for management. Integrated management of Green Peach Aphid includes cultural practices; use of predators, parasitoids, biocontrol agents, botanical pesticides, and chemical pesticides. Farmers have own indigenous knowledge on this pest control. Effective chemical pesticides can be used as last resort for control.

Keywords: green peach aphid, integrated management, polyphagus, predators, parasitoid

1. Introduction

1.1 Taxonomy and Morphology

Myzus persicae, initially known as *Aphis persicae* was first described by Sulzer in 1776 AD. The name *M. persicae* as applied here refers to a complex of sibling species and host plant races, including the tobacco-adapted form, described by Blackman (1986) [1] as a separate species, *M. nicotanae*.

Phylum: Arthropoda
Class: Insecta
Order: Hemiptera
Suborder: Sternorrhyncha
Superfamily: Aphidoidea
Family: Aphididae
Genus: *Myzus*
Species: *persicae*

The green peach aphids are usually green in color but may be pale brown to pinkish ranging from 1.6 to 2.4 mm long with piercing-sucking mouthparts and antennae. Aphids are usually wingless. Adult appears as alate and apterous forms at different times of the year depending upon the environment and climatic condition. The alate have a characteristic dark sclerotic patch on the mid abdominal dorsum. Nymphs are slightly smaller than the adult but similar in shape. They are pale yellow-green with three, dark lines on the abdomen (Blackman and Eastop, 1984) [2]. The immature females are pink or red and males are yellowish in colour (Blackman and Eastop, 1985) [2] whereas wingless adults are variable in color; whitish green, pale yellow-green, grey green, mid-green, dark green, pink or red.

Distinguishing characters of the *M. persicae* are the convergent inner faces of the antennal tubercles in dorsal view, and the very slightly clavate siphunculi, which are usually dark-tipped and about as long as the terminal process of the antenna.

1.2 Life-Cycle

M. persicae is heteroecious holocyclic (host alternating, with sexual reproduction during part of life cycle) between *Prunus* (usually peach) and summer host plants. The life cycle varies often 10 to 12 days for a complete generation, and with over 20 annual generations reported in mild climates. Where suitable host plants cannot persist, the aphid overwinters in the egg stage on *Prunus* spp. In the spring the eggs hatch and the nymphs feed on flowers, young foliage, and stems. After several generations, winged female aphids from overwintering *Prunus* spp. deposit nymphs on summer hosts. In cold climates, adults return to *Prunus* spp. in the autumn, where mating occurs, and eggs are deposited. All generations except the autumn generation culminating in egg production are parthenogenetic (non-sexual).

It over-winters in form of black, shiny eggs on the bark of *Prunus* spp. peach, plum, apricot or cherry trees.

1.2.1 Eggs: Eggs are deposited on *Prunus* spp. trees. The eggs measure about 0.6 mm long and 0.3 mm wide, and are elliptical in shape. Eggs initially are yellow or green, but soon turn black.

1.2.2 Nymphs: Immature aphids are called nymphs. They are pale yellowish-green in color with three dark lines on the back of the abdomen that are not present on the adult. In Hawaii there are four nymphal stages. Nymphal development is completed in 6 to 11 days.

1.2.3 Adults: The wingless adult aphids vary in color from green to pale yellow. Winged adults are green with black or dark brown markings on their abdomens. Adults are small to medium sized aphids from 1/25 to 1/12 inch long and their antennae are 2/3 as long as the body. Adult females give birth to approximately 50 nymphs.

1.3 Host plants

It is polyphagous pest, peach being its primary host. Most of the vegetables crops, tobacco, sugar beet, sunflower and many fruit crops are infected by green peach aphids. During the winter season, most of the fruit trees are infested and most of the herbaceous vegetables are infested by the aphid during summer. Summer hosts include many economically important plants. Green peach aphid is economically most important pest of potato in world.

The winter (primary) host of *M. persicae* is almost invariably *Prunus persica* (peach), including var. *nectarina*; sometimes *P. nigra* in USA, and possibly *P. tenella*, *P. nana*, *P. serotina*, *P. americana* and peach-almond hybrids. It is not clear whether the sexual part of the life cycle is completed on species other than *P. persica* and *P. nigra*. Green peach aphid feeds on hundreds of host plants in over 40 plant families including Brassicaceae, Solanaceae, Poaceae, Leguminosae, Cyperaceae, Convolvulaceae, Chenopodiaceae, Compositae, Cucurbitaceae and Umbelliferae in the world (Cloydon *et al*., 1998).

1.4 Feeding Damage

It is cosmopolitans in distribution. Aphid infestations commonly begin in small scattered areas over the field. Aphids are found primarily on the underside of the leaves, where they suck sap from the plant. Green peach aphids favor mature lower leaves while potato aphids are found primarily on terminal leaves and young stems. Aphids suck up the leaves and flower buds. Infested leaves curl downward and may turn brown and die. When infestations are heavy, aphid damage can reduce plant vigor, size and yield, and may kill the plants.

The most important vectors of potato viruses are aphids, and especially *M. persicae* (Eastop 1977) Nymphs and adults are equally capable of virus transmission. Some of the important viral diseases, transmission through aphids are potato leaf roll virus and potato virus Y. The yield loss due to the potato leaf roll virus and potato virus (PVY) has been reported to be 20-50% and 40-80% respectively (Nagaich and Agrawal, 1969) [8] in India. The yield losses due to PYV raised up to 95% with sever infection in Bangladesh Potatoes are subject to more than 30 virus diseases. The viruses are transsmited by mechanical through wounds, by a biological intermediary, or both depending upon the virus species. Thirteen potato viruses are transmitted by aphids.

1.5 Management

1.5.1 Cultural Practices

Among the cultural control methods recommended against *M. persicae* are early sowing; weed management optimum dose of nitrogenous fertilizer and the use of certified seeds, known to be virus-free for seed potatoes. In potatoes, spraying sprout inhibitor is practised, to decrease emergence of infested volunteer plants which could serve as reservoirs of infection for the following year's crop. This aphid develops on crop and non-crop hosts. Thus it is important to remove crop residues and weed hosts prior to planting new crops (CABI, 2005) [3].

1.5.2 Biological control

1.5.2.1 Parasitoids and predators

Every single organism in nature has natural enemy. Hundreds of natural enemies have been recorded, principally lady beetles (Coleoptera: Coccinellidae), flower flies (Diptera: Syrphidae), lacewings (Neuroptera: mainly Chrysopidae), parasitic wasps, and (Hymenoptera: Braconidae) to keep them below threshold level. The intensive use of broad-spectrum insecticides contributes to reduce the presence of aphids' natural enemies (Oetting, 1985).

In India and South Asian regions, coccinellids *Adonia* spp., *Coccinella* spp., *Hippodamia* spp. and *Scymnus* spp. *Coccinella septempunctata* and *Chilomese sexmaculata*, (Raj, 1989; Gupta and Yadava, 1989) and syrphid larvae *Episyrphus balteatus*, *Ischiodon scutellaris*, *Metasyrphus corollae* and *Scaeva pyrastri* (Kumar *et al*., 1987) are the most important predators.

1.5.2.2 Microbials

***Beauveria bassiana* Balsm.**

Beauveria bassiana is found naturally on some plant and in the soil. It needs warm, humid weather for spread and infection. It causes muscardine disease. Jeong *et al*., (2001) [7] documented that *Beauveria bassiana* is effective against aphid both in green house and open field condition. Strains of the fungus *Beauveria bassiana* provide good control of aphids, including green peach aphids (CABI, 2005) [3]. *Beauveria bassiana* generally infects the insect through the integument. *Beauveria bassiana* produces mycotoxins, such as beauvericin, in culture media. Toxic compounds rapidly debilitate the insect after invasion of the hem lymph which disturbs the physiology of insect (Roberts, and Yendol, 1981) [16].

***Metarhizium anisopliae* Metsch**

Metarhizium anisopliae Metsch (family Moniaceae and class Deuteromycetes) is a facultative insect pathogen that has some ability to survive in the soil when not infecting a host insect.. *Metarhizium anisopliae* is a recognized pathogen of more than 200 insect species, including several major pests (Roberts, and Hajek, 1992) [16], host of the species are member of many families of beetles, Lepidopteran, bugs, wasps, flies, cicadas, aphids and ants. Infection generally takes place through the integument. The cuticle is penetrated with the aid of enzymes secreted at the apex of the penetrate hyphae. Penetrate hyphae give *rise* to hyphal bodies before death of the host. Hyphal bodies become distributed throughout the body cavity and give rise to secondary hyphae that result into death of insect.

1.5.2.3 Botanical pesticides

Botanical pesticides provide one of the alternatives to combat pest problems. It has been reported that more than 2000 plant species content toxic principles which are effective against insects. It has been found that there are 324 plant species available in Nepal so far having some kind of pesticidal properties (Neupane, 2000) [10]. The efficacy of some of botanical like neem leaf extract, neem seed kernel, china berry, ageratum fresh flower, justicia green leaves have been tested against aphids (Neupane, 2000) [10].

Neem (*Azadirachta indica*, Ajuss.)

Neem (*Azadirchta indica*) has been used traditionally by farmers for pest control in the Indian sub-continent for centuries. It is reported that in general neem extracts and products have a very low toxicity to non-target organisms (e.g. mammals, fish, pollinators and parasitoids), while these are effective against a wide range of pests. The

compounds isolated from the neem plant manifest their effects on the target organisms in many ways, e.g. as anti-feedants, growth regulators, repellents, toxicants and chemosterilants. Scientist has been found that neem derivatives can repel over 120 species of insects including pests of store grains (Thapa, 1994) [19]. Formulations of neem are easily available in the market. But the efficacy of these products against vegetable insects has not been tested and ascertained in Nepal.

Plasma Neem oil is widespread and cost effective means of pest control. It is effective against insecticide-resistant pests, environmentally compatible, non-toxic to mammals and birds, and does not affect beneficial insects. Plasma Neem oil is now in use in all major agricultural regions of the world. Neem oil could control the larval population significantly. Rawat (2006) [15] reported that margosom reduced the population of mustard aphids significantly.

Derrisom

Derries plant, *Derris elliptica*, (Lamk) extract with rotenone insecticidal property is effective in controlling insect pests (Neupane, 2000) [10]. Gyawali (2002) [6] has reported Derisom (Karanjin 2% E. C.) @ 1-2 ml/l have effective bio pesticide for the management of aphids. Derrisom is a formulated product manufacture from *Derris indica* by agrilife, Hyderabad, India. It is a bioacaricide, bio fungicidal and bio insecticide. Derrisom with Karanjin insecticidal property is effective in controlling insect pest and can be used against aphid control.

1.5.3 Indigenous Knowledge

Animal urine (cattle) is being common practice of farmer of different districts of Nepal. Farmers are using animal urine against aphid, thrips and caterpillars. Urine are kept in sunny area for two weeks and then diluted with water in the ratio of 1:2 is found effective against these pest.

Neupane (2005) [12] revealed that cow urine (6-7liter collected 72 hour earlier) grinded product mixed with 250 g of ginger, 250 g chili, 200-240 g soap and 50-60 l of water applied after filtration were giving good result of control against *aphis* sp, *Helicoverpa armiger*, pod borers and others soft bodies insects.

1.5.4 Chemical pesticides

The effective pesticide for the control of aphids mentioned by pesticide registration office of Nepal are endsulfan, chloropyriphos, dimethoat, malathion, monocrotophos, oxydemeton methyl, quinalphos, triozophos, carbamates, delta methrine, fenevalerate, imidachloprid. Present study has shown that Endosulfan is most toxic for aphid control and exhibited maximum crop yield than rest of the insecticides. The highest seed yield of 745kg/ha was obtained in Endosulfan sprayed treatment with 94% aphid mortality followed by Dimethoate spayed treatment (670kg/ha) with 93% aphid mortality. This insecticide is effective for the management of aphid due to its persistence nature on the crop.

2. Conclusion

In modern agriculture, importance of integrated management of insect pest has been already realized. Green Peach Aphid is an economically important polyphagus insect. Its primary host is peach. In addition, it infects many vegetable crops, cash crops, and fruit crops. It is ubiquitous. It attacks young leaves, twings and flower buds, where it suck up sap. On heavy infestation, plant loses vigor, turn brown, and eventually die. These are alate aw well as apterous at different periods of year depending upon climatic conduction. Coccinellids adults and syrphid larvae are important predators worldwide. *Beauveria bassiana* Balsm and *Metarhizium anisopliae* Metsch are widely used microbial agents. Farmers are traditionally using extract of neem (*Azadirachta indica* Ajuss) and formulation of fermented cow urine. Farmer's indigenous knowledge play vital role for pest management.

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