



Full Length Article

Host Plants of Cotton Mealybug (*Phenacoccus solenopsis*): A New Menace to Cotton Agroecosystem of Punjab, Pakistan

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ABSTRACT

A new mealy bug (*Phenacoccus solenopsis* Tinsley) appeared recently and has attained the status of a serious pest on a wide range of host plants. It was recorded from 154 plant species including field crops, vegetables, ornamentals, weeds, bushes and trees. Most of these belong to the families Malvaceae, Solanaceae, Asteraceae, Euphorbiaceae, Amaranthaceae and Cucurbitaceae. Economical damage was observed on cotton, brinjal, okra, tomato, sesame, sunflower and China rose with plant death in severe conditions.

Key Words: Cotton; Mealybug; Host range; Pakistan

INTRODUCTION

Cotton plays vital role in the economy of Pakistan being responsible for supplying raw materials to ginneries, textile industries and oil expelling units (Anonymous, 2006). With its extensive cultivation as a monoculture crop, it is attacked by many chewing and sucking insects (Saeed *et al.*, 2007). Among mealybugs, *Ferrisia virgata* Ckll., has been reported earlier as major pest on cotton in Pakistan (Ghouri, 1960). This species has also been recorded from Malvaceous genera like *Abutilon*, *Gossypium*, *Hibiscus* and *Malvastrum* (Ben-Dov, 1994).

Mealybugs are soft bodied insects belonging to family Pseudococcidae of order Hemiptera. About 5000 species of mealybug have been recorded from 246 families of plants throughout the world. Among these, 56 species have been reported from 15 genera of family Malvaceae, including cotton and many other plants of economic importance (Ben-Dov, 1994). A new species of mealybugs, *Phenacoccus solenopsis* Tinsley, appeared on cotton during the year 2005 and attained the status of a serious pest in the cotton growing areas of Punjab and Sindh Provinces of Pakistan. It attacked many other plants including crops, weeds and those of ornamental and medicinal value.

Persistent increase in the population of this mealybug on cotton and other hosts has threatened the economical production of many crops. Chemicals are generally recommended only as a last resort in the integrated package of control measures, while local natural enemies (predators & parasitoids) might take some time to shift on to this new pest. Therefore, keeping in view the prevailing situation, a field survey was conducted during years 2006 and 2007 to record host range of this mealybug on existing flora in

cotton agro-ecosystem. This study will help to identify the plant species playing significant role in carry-over of this pest to cotton and manage it through cultural practices with minimal use of insecticides.

MATERIALS AND METHODS

Flora in cultivated fields, orchards, plant nurseries, rangelands and wastelands were examined fortnightly in cotton agro-ecosystem in a radius of 20 km in Multan district (located at 30°N, 71°E at 123 m elevation). The studies were carried out during 2006 and 2007. Infestation of the mealybug was categorized on the following parameters based on visual observation. During sampling, whole plants of the species under observation were examined for occurrence and infestation levels as described below were followed:

Parameters	Infestation levels
1: Incidental	i: Only a few individuals of the mealybug casually found. ii: No breeding individuals observed.
2: Low	i: All stages of mealybug found in low number. ii: No adverse symptoms observed on the plant.
3: Medium	i: All stages of mealybug found in large number. ii: Wilting and yellowing of plant leaves appeared. iii: Infested plants normally survived.
4: High	i: All stages of mealybug found in very large number. ii: Almost all plant parts covered with mealybug showing white appearance. iii: Excessive leaf and fruit shedding. iv: Most of the plants died in the infested area.

RESULTS AND DISCUSSION

Phenacoccus solenopsis was recorded from 154 plant

Table I. Host plants of *Phenacoccus gossypiphilous* with its infestation levels in cotton agro-ecosystem in Multan District

Family/Botanical Name	English/Vernacular Name	Status	Infestation
Acanthaceae			
<i>Aphelandra squarrosa</i> Nees	Zebra plant	Ornamental	*
<i>Ruellia squarrosa</i> (Fenzl) Cufod.	Ruellia	Ornamental	**
Amaranthaceae			
<i>Achyranthes aspera</i> Linn.	Devil's horse whip, <i>Puthkanda</i>	Weed	***
<i>Aerua persica</i> (Burm.) Merrill	Aerua	Weed	**
<i>Amaranthus viridis</i> Linn.	Pigweed, <i>Jangli Cholai</i>	Weed	**
<i>Celosia argentea</i> Linn.	Cockscomb	Ornamental	**
<i>Digera arvensis</i> Forsk	Diagra, <i>Tandla</i>	Weed	**
Anacardiaceae			
<i>Mangifera indica</i> Linn.	Mango	Fruit Tree	*
Annonaceae			
<i>Polyalthea longifolia</i> Benth & Hook.	<i>Ula shokh</i>	Ornamental	*
Apiaceae			
<i>Daucus carota</i> Linn.	Carrot, <i>Gajar</i>	Vegetable	**
Apocynaceae			
<i>Nerium indicum</i> Mill.	Oleander, <i>Kaner</i>	Ornamental	*
<i>Plumeria acutifolia</i> Poir.	<i>Gulchin</i>	Ornamental	**
<i>Tabernaemontana coronaria</i> Willd.	<i>Chandna</i>	Ornamental	*
Asclepiadaceae			
<i>Calotropis procera</i> R.Br.	<i>Ak</i>	Weed	*
Asteraceae			
<i>Ageratum conyzoides</i> Linn.	Ageratum	Weed	*
<i>Conyza bonariensis</i> (L.) Cronquist	Hairy fleabane, <i>Loosan booti</i>	Weed	**
<i>Calendula officinalis</i> Linn.	Gul-e-Asharfi	Ornamental	**
<i>Centaurea cyanus</i> Linn.	Cornflower, <i>Pohla</i>	Ornamental	**
<i>Chrysanthemum morifolium</i> Ramat	Chrysanthemum, <i>Gul-e-Daudi</i>	Ornamental	**
<i>Cichorium intybus</i> Linn.	Blue daisy, <i>Chicory, Kashni</i>	weed	**
<i>Cnicus arvensis</i> (Linn.) Hoffm	Cnicus, <i>Laih</i>	Weed	**
<i>Helianthus annuus</i> Linn.	Sunflower	Crop	**
<i>Launia nudicaulis</i> Less	Yellow spurge, <i>Padhkal, Peeli dodhak</i>	Weed	**
<i>Parphenium hysterophorus</i> L.	Lahori booti	Weed	***
<i>Sonchus oleraceus</i> Linn.	Sowthistle, <i>Dodhal</i>	Weed	*
<i>Tagetes erecta</i> Linn.	Marigold, <i>Gainda</i>	Ornamental	**
<i>Taraxacum officinale</i> Linn.	Dandelion	Weed	*
<i>Xanthium strumarium</i> Linn.	Cocklebur, <i>Mohabbat booti</i>	Weed	****
Aizoaceae			
<i>Trianthema portulacastrum</i> Linn.	Horse purslane, carpet weed, <i>Itsit</i>	Weed	****
<i>T. triquetra</i> (crystalline) Rott.	Trianthema	Weed	**
Bignoniaceae			
<i>Tecoma stans</i> Juss.	Tecoma	Ornamental	**
Bombacaceae			
<i>Salmalia malabarica</i> (DC) Schott & Endl.	Silk-cotton tree, <i>Simbal</i>	Tree	*
Boraginaceae			
<i>Heliotropium europaeum</i> Linn.	Heliotrope, <i>Oont-chara, Lani</i>	Weed	**
<i>H. strigosum</i> Willd.	Heliotropium	Weed	**
Caesalpinaceae			
<i>Bauhinia purpurea</i> Linn.	<i>Kachnar</i>	Tree	*
<i>Cassia fistula</i> Linn.	Golden chains, <i>Amaltas</i>	Ornamental	*
Capparidaceae			
<i>Capparis decidua</i> (Forsk.).	<i>Karir</i>	Wild Bush	*
<i>Cleome viscosa</i> Linn.	Dogmustard, <i>Hulhul, Chaskoo</i>	Weed	*
Chenopodiaceae			
<i>Chenopodium album</i> Linn.	White goosefoot, <i>Bathoo</i>	Weed	**
<i>C. murale</i> Linn.	Nettle leaved goosefoot, <i>Krund</i>	Weed	*
<i>Kochia indica</i> Wight	Kochia	Weed	**
<i>Salsola baryosma</i> Dandy	Salsola, <i>Lana</i>	Weed	**
<i>Suaeda fruticosa</i> Forsk.	Suaeda	Weed	*
Combretaceae			
<i>Quisqualis indica</i> Linn.	Rangoon creeper	Ornamental	*
Commelinaceae			
<i>Setcreasea purpurea</i> (Schau.) Boom	<i>Neelum Bale</i>	Ornamental	*

Table I. Continued

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Convolvulaceae			
<i>Convolvulus arvensis</i> Linn	Bindweed, <i>Lehli</i>	Weed	***
<i>C. pluricaulis</i> Chois.	Convolvulus	Weed	*
<i>Coscuta reflexa</i> Roxd.	<i>Akas Be, Nils tar</i>	Weed	*
<i>Cressa cretica</i> Linn.	Cressa	Weed	**
<i>Ipomoea cairica</i> Linn.	<i>Ishq paicha</i>	Ornamental	*
<i>Jacquemontia petantha</i> (Jacq.) G.Don	Jacquemontia	Ornamental	*
Cruciferae			
<i>Coronopus didymus</i> Linn. Smith	Swine cress, <i>Nak sari, Jangli Halon</i>	Weed	*
Cucurbitaceae			
<i>Citrullus colocynthis</i> Schrad.	<i>Tumma, Kor tumma</i>	Weed	**
<i>C. lanatus</i> (Thumb) Mansf.	Watermelon	Vegetable	**
<i>Cucumis tetragona</i> Roxb.	<i>Chibbar</i>	Weed	**
<i>Lagenaria siceraria</i> (Molina) Standl.	Gourd, <i>Kaddu</i>	Vegetable	**
<i>Lufa cylindrica</i> (Linn.)	Sponge gourd, <i>Tori</i>	Vegetable	*
<i>Momordica charantia</i> Linn.	Bitter gourd, <i>Karela</i>	Vegetable	*
Cyperaceae			
<i>Cyperus rotundus</i> Linn.	Sedge grass, Nut rass, <i>Deela, Motha</i>	Weed	*
Euphorbiaceae			
<i>Acalypha wilkesiana</i> Muell. Arg.	Acalypha	Ornamental	**
<i>Croton sparciflorum</i> Morong	<i>Croton</i>	Ornamental	***
<i>Euphorbia hirta</i> Linn	Red spurge, snake weed, <i>laal dodhak</i>	Weed	**
<i>E. cotinifolia</i> L.	<i>Lal Jhari</i>	Ornamental	*
<i>E. prostrata</i> Ait.	<i>Hazar Dani</i>	Weed	***
<i>Jatropha integerrima</i>	<i>Jatropha</i>	Ornamental	*
<i>Phyllanthus niruri</i> Linn.	<i>Phyllanthus</i>	Weed	**
<i>Ricinus communis</i> Linn.	Castor plant	Tree	*
Fabaceae			
<i>Cyamopsis tetragonoloba</i> (Linn.) Taub.	<i>Guara</i>	Crop	**
<i>Dalbergia sissoo</i> Roxb.	<i>Shisham</i>	Tree	*
<i>Medicago polymorpha</i> L.	Dur clover	Weed	**
<i>M.denticulata</i> Willd.	Maina	Weed	**
<i>Melilotus parviflora</i> Desf.	Yellow sweet clover <i>Zard Senji</i>	Weed	*
<i>Sesbania sesban</i> (Linn.)	Common Gaint, <i>Jantar</i>	Crop	**
<i>Trigonella polycerata</i> Linn.	<i>Trigonella</i>	Weed	**
Gramineae			
<i>Cynodon dactylon</i> Pres.	Bermuda Grass. <i>Khabal, Talla</i>	Weed	*
<i>Echinochloa colonum</i> (Linn.) Link.	Deccan grass, <i>Swanki</i>	Fodder crop	*
<i>Eleusine indica</i> (Linn.) Gaertn.	Goose grsss, <i>Madhana Ghas</i>	Weed	*
<i>Eragrostis minor</i> Host.	<i>Eragrostis</i>	Weed	*
Labiatae			
<i>Coleus blumei</i> Benth.	Common coleus	Ornamental	*
<i>Mentha longifolia</i> (Linn.)	Wild Mint, <i>Jangli Podeena</i>	Weed	*
<i>M. piperata</i> Linn.	Cultivated Mint	Vegetable	**
<i>Ocimum basilicum</i> Linn.	<i>Niazboo</i>	Ornamental	*
<i>Salvia officinalis</i> Linn.	<i>Salvia</i>	Ornamental	*
Liliaceae			
<i>Asparagus sprengeri</i> Regel.	Asparagus	Ornamental	*
<i>A. plumosus</i> Baker	Asparagus Fern	Ornamental	*
Lythraceae			
<i>Lagerstroemia indica</i> Linn.	Crepe myrtle	Ornamental	*
<i>Lawsonia inermis</i> Linn.	<i>Henna, Mehndi</i>	Ornamental	*
Malvaceae			
<i>Abelmoschus esculentus</i> Linn.	Okra, <i>Bhindi</i>	Vegetable	**
<i>Abutilon indicum</i> Sweet	Mallow, <i>Kanghi</i>	Weed	****
<i>A. muticum</i> Sweet	Indian Mallow, <i>Kanghi</i>	Weed	****
<i>Gossypium arboreum</i> Linn.	<i>Desi cotton</i>	Crop	***
<i>G. hirsutum</i> Linn.	American cotton	Crop	****
<i>Hibiscus mutabilis</i> Linn.	Cotton rose	Ornamental	****
<i>H. rosa-sinensis</i> Linn.	China rose, <i>Gurhal</i>	Ornamental	****
<i>Malva parviflora</i> Linn.	Small Mallow, <i>Sonchal</i>	Weed	**
<i>Malva viscus arboreus</i> Cav.	Turk's cap	Ornamental	**
<i>Malvastrum coromandelianum</i> (Linn.) Garcke	<i>Malvastrum</i>	Weed	***
Meliaceae			
<i>Azadirachta indica</i> A. Juss.	<i>Neem</i>	Tree	*
<i>Melia azedarach</i> Linn.	Persian lilac, <i>Bakain, Derek</i>	Tree	*

Table I. Continued

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Menispermaceae			
<i>Tinospora cordifolia</i> (DC.) Miers	<i>Glo</i>	Ornamental	*
Mimosaceae			
<i>Acacia leucophloea</i> Willd.	Reru, <i>Pahari keekar</i>	Tree	*
<i>A. modesta</i>	<i>Phulai</i>	Tree	*
<i>Albizia lebbek</i> Benth.	<i>Siris</i>	Tree	*
Moraceae			
<i>Broussonetia papyrifera</i> Vent.	Paper Mulberry	Tree	*
<i>Ficus bengalensis</i> Linn.	Banyan, <i>Bar</i>	Tree	*
<i>F. carica</i> Linn.	Turkish Fig	Fruit Tree	*
<i>F. infectoria</i> Roxb.	<i>Pilkhan</i>	Tree	*
<i>Morus alba</i> Linn.	Mulberry, <i>Toot</i>	Tree	*
Myrtaceae			
<i>Eucalyptus camadulensis</i> Dehnh.	Eucalyptus	Tree	*
<i>Melaleuca leucadendron</i> Linn.	Bottle brush	Ornamental	*
Nyctaginaceae			
<i>Boerhaavia repens</i> Linn.	Boerhaavia	Weed	*
<i>Bougainvillea glabra</i> Chois.	Bougainvillea	Ornamental	*
Oleaceae			
<i>Jasminum cuspidatum</i> Rottl.	Jasmine	Ornamental	*
<i>J. sambac</i> (Linn.) Ait.	<i>Motia</i>	Ornamental	*
Oxalidaceae			
<i>Oxalis corniculata</i> Linn.	Creeping wood sorrel, <i>Khatti Booti</i>	Weed	**
Palmae			
<i>Phoenix dactylifera</i> Linn.	Date palm	Fruit Tree	*
Pedaliaceae			
<i>Sesamum indicum</i> Linn.	Sesame, <i>Til</i>	Crop	**
Piperaceae			
<i>Piper betle</i> Linn.	Betel leaf, <i>Paan</i>	Crop	*
Polygonaceae			
<i>Polygonum barbatum</i> Linn.	Polygonum	Weed	*
<i>P. glabrum</i> Willd.	Polygonum	Weed	**
<i>Rumex dentatus</i> Linn.	Curlydock, Jangli Palak	Weed	**
Portulacaceae			
<i>Portulaca greandiflora</i> Hook	Gul Dupehri	Ornamental	***
<i>Portulaca oleracea</i> Linn.	Common Indian purslane, <i>Kulfa, Loonak</i>	Weed	**
Primulaceae			
<i>Anagallis arvensis</i> Linn.	Villybooti	Weed	**
Punicaceae			
<i>Punica granatum</i> Linn.	Pomegranate, <i>Anaar</i>	Fruit Tree	*
Rhamnaceae			
<i>Zizyphus mauritiana</i> Lamk.	<i>Ber</i>	Fruit Tree	*
Rosaceae			
<i>Rosa indica</i> Lind.	Rose	Ornamental	*
Rubiaceae			
<i>Gardenia jasminoides</i> Ellis	<i>Alyar</i>	Ornamental hedge	**
<i>Hamelia patens</i> Jacq.	Scarlet Bush	Ornamental	***
Rutaceae			
<i>Citrus aurantium</i> Linn.	<i>Khatta</i>	Fruit Tree	*
<i>C. sinensis</i> Osbeck	<i>Malta</i>	Fruit Tree	*
Salvadoraceae			
<i>Salvadora oleoides</i> Decsn.	<i>Vann, Peelu</i>	Tree	*
Solanaceae			
<i>Capsicum frutescens</i> Linn.	Red chilly	Vegetable	**
<i>Cestrum diurnum</i> Linn.	<i>Din ka Raja</i>	Ornamental	***
<i>C. nocturnum</i> Linn.	Night Jasmine, <i>Raat ki Rani</i>	Ornamental	***
<i>Datura metel</i> Linn.	Thomapple, <i>Datoora</i>	Weed	***
<i>Lycopersicon esculentum</i> (Linn.) Mill.	Tomato	Vegetable	**
<i>Nicotiana plumbaginifolia</i> Viv.	Wild tobacco, <i>Giddar tambaku</i>	Weed	*
<i>N. tabacum</i> Linn.	Common tobacco	Crop	**
<i>Physalis alkakengi</i> Linn.	<i>Mamola</i>	Weed	**
<i>Solanum surratense</i> Burm.	<i>Kandiari Booti</i>	Weed	***
<i>S. melongena</i> Linn.	Brinjal, <i>Baingan</i>	Vegetable	****
<i>S. nigrum</i> Linn.	Black nightshade, <i>Mako</i>	Weed	***
<i>S. tuberosum</i> Linn.	<i>Potato</i>	Vegetable	**
<i>Withania somnifera</i> Dunal	Winter cherry, <i>Aksen</i>	Weed	****

Table I. Continued

Table I. Continued

Tiliaceae			
<i>Corchorus antichorus</i> Raensch	Bah Phali	Weed	**
<i>C. trilocularis</i> Linn.	Wild Jute	Weed	**
<i>Grewia asiatica</i> Linn.	Falsa	Fruit Plant	*
Verbenaceae			
<i>Lantana camara</i> Linn.	Tickberry, Lantana, <i>Phulbakri</i>	Ornamental	***
<i>Clerodendron inerme</i> Gaert.	Gardenia	Ornamental hedge	**
<i>Duranta repens</i> Linn.	<i>Duranta</i>	Ornamental hedge	**
<i>Verbena officinalis</i> Linn.	Verbena	Weed	*
Zingiberaceae			
<i>Elettaria cardamomum</i> Maton	Cardamom, <i>Chhoti elaichi</i>	Bush	*
Zygophyllaceae			
<i>Fagonia cretica</i> Linn.	<i>Jawansa</i>	Weed	**
<i>Tribulus terrestris</i> Linn.	Puncture Vine, <i>Bakhra</i> , <i>Gokhru</i>	Weed	**

Infestation : * = Incidental ** = Low *** = Medium **** = High

species of 53 families comprising 20 field and horticultural crops, 45 ornamentals, 64 weeds and 25 bushes and trees (Table I). Plants from Malvaceae, Solanaceae, Ficoidae, Amarantaceae, Asteraceae, Convolvulaceae, Euphorbiaceae, Verbenaceae and Zygophyllaceae were generally found as preferred hosts of this mealybug. Among these, *Hibiscus rosa-sinensis*, *H. mutabilis*, *Abutilon* spp. (Malvaceae), *Lantana camara* (Verbenaceae); *Withania somnifera* (Solanaceae), *Convolvulus arvensis* (Convolvulaceae), *Euphorbia prostrata*, *Croton sparciflorum* (Euphorbiaceae) and *Achyranthes aspra* (Amaranthaceae) harboured this pest round the year and acted as a persistent source of spread of the mealybug to cotton and other crops. High infestations on *Solanum melongena*, *S. nigrum*, *Datura metel* (Solanaceae), *Xanthium strumarium* (Asteraceae), *Trianthema* spp. (Aizoaceae), *Chenopodium album* (Chenopodiaceae) and *Tribulus terrestris* (Zygophyllaceae) may help in the dissemination of this pest during summer, whereas *Celosia argentia* (Amaranthaceae), *Calendula officinalis* (Asteraceae), *Cestrum nocturnum* (Solanaceae) and *Asparagus* spp. (Liliaceae) served as winter hosts of the mealybug. Other plants were either less preferred or the mealybug was found incidentally in very low numbers for shorter durations.

Insecticides belonging to different groups have been recommended against cotton mealybug (Saeed *et al.*, 2007), however, main reliance on insecticides may result in resistance, resurgence, environmental hazards and discontinuation of their use (Sparks *et al.*, 1996; Mascarenhas *et al.*, 1996 & 1998). Vast host range of cotton mealybug requires attention for alternate control measures. Information regarding biological parameters of insects and their host preference for feeding and oviposition are very important to develop alternate strategies effective for its control like other important insects (Greenberg *et al.*, 2001 & 2002; Azidah & Sofian-Azirun, 2006). Step-wise approach based on these biological parameters with relevance to their ecology host range and preference for feeding may serve as an effective tool for their quantitative analysis (Scriber & Slansky, 1981).

Diversity of hosts suggested that the cotton mealybug may attack many more plants with the passage of time. Therefore, effective manipulation of weeds and ornamental plants, adopting crop rotation and quarantine measures etc. will be of high significance, while devising integrated management strategy for this pest.

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