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A survey on mealybug, *Phenacoccus solenopsis* Tinsley - An emerging threat to cotton based agro-ecosystem in coastal region of West Bengal

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Cotton (*Gossypium hirsutum*) is an important commercial crop in India. It is mainly grown as kharif crop in most of the parts of India. However, it is grown as *Rabi-Summer* crop in the coastal parts of West Bengal to exploit its tolerance to salinity and moisture stress. But in recent years, cotton is suffering from emerging problem of an invasive mealybug. This small sap sucking soft bodied insects cause severe damage to cotton and break out suddenly to a wide range of vegetables, ornamentals and field crops. Mealybug was never considered as major pests of economic importance on cotton in India (APCoAB, 2006) but recently it occurs more than 80 % of the 23.7 million acres of cotton cultivated area in the country (Nagrare *et al.*, 2009). The pink hibiscus mealybug, *Maconellicoccus hirsutus* (Green) was first observed in traces on cotton in a sporadic way in parts of central Gujarat during 2000 (Jhala and Bharpoda, 2008). In the year 2006 mealybug infestation was recorded on *G. hirsutum* in nine cotton growing states of India *viz.*, Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharastra, Tamilnadu, Andhra Pradesh and Karnataka (Dharajyoti *et al.*, 2008) and several parts of Gujarat were badly affected by this mealybug causing very serious economic damage in the tune of 40-50 % yield loss. Suresh and Kabita (2008) recorded solenopsis mealybug, *Phenacoccus solenopsis* (Tinseley) on more than thirty plant species and cotton and parthenium were found to be more preferred hosts. *Phenacoccus solenopsis* is an invasive mealybug originated from USA. Both the species of mealybug, *P. solenopsis* and *M. hirsutus* were found to infest cotton plants of which *P. solenopsis* was predominant and widespread on cotton in almost all cotton growing states of India (Nagrare *et al.*, 2009).

In 2007-08, an unidentified species of mealybug was found to be a serious pest of cotton in the district South 24 Parganas, West Bengal. Interestingly, it has attained the status of serious pest for cotton and other crops (field crops & horticultural crops) in the cotton surrounding fields of coastal region during the year 2008-09 and 2009-10. Therefore, keeping in view the prevailing situation, a field survey was conducted on the infestation of this mealybug and its host range on existing flora in cotton agro-ecosystem in coastal region of West Bengal.

Survey was conducted from the year 2007-08 to 2009-10 in KVK instructional farm of Nimpith Ashram, South 24 Parganas and its surrounding villages. All the crops including field, horticultural and weed crops in cotton based agro-ecosystem have been critically examined to find out different hosts of mealybug infestation. Mealybug populations were collected approximately 5 inch shoots at random from five infested each host plants. All the collected samples were reared on sprouted potato tubers in the laboratory for taxonomic study. The adult female mealybugs were mounted on slides following the standard methods of microscopical examination (Ghose, 1971) and subjected to taxonomic identification based on the morphological characters of adult females as described by McKenzie (1967) and Williams and Granara de Willink (1992). During sampling, whole plants were observed and on visual observation considering the following parameters, infestation of the mealybugs was categorized in three levels *viz.* i) Low (a few mealybugs but no or sporadic colony of mealybugs were found.) ii) Moderate (a. established colony with all instars of mealybugs and adult females with ovisacs was noticed, b. appearance of yellowing of leaves and drying of infested terminal shoots) iii) Severe (a. cottony white appearance due to established colony of mealybugs with large number was noticed on the tender shoots and under side of the leaves, b. excessive yellowing of leaves and drying of infested plant, c. retarded growth of the plant or ultimately died).

A total of 140 colonies of mealybugs were examined and results of the taxonomic study showed that all the samples collected from the surveyed sites comprised of only one mealybug species, the solenopsis mealybug, *Phenacoccus solenopsis* Tinsley. This mealybug species was recorded to infest *rabi* (summer) cotton (var- LRA 5166) for the first time in West Bengal in the year 2007-08. Subsequently, it was recorded to cotton surrounding many other field crops, horticultural crops and weed hosts. Infestation is increasing year after year in terms of economic damage to the crops. Very little or no rain during the active growth period for cotton *i.e.*

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March to first week of May for the last 3 years and prevailing dry period for most of the time during the summer season were the main reason for becoming the pest as an alarming one.

Table 1: Host plants of *Phenacoccus solenopsis* with its infestation levels in cotton agro-ecosystem in coastal region of West Bengal

English/ Vernacular name	Botanical name	Family	Status	Infestation levels 2007-08	2008-09	2009-10
Mango	*Mangifera indica* Linn.	Anacardiaceae	Fruit/Tree	-	+	+
Tagor, Crape jasmine	*Tabernaemontana coronaria*	Apocynaceae	Ornamental	-	-	+
Nayantara, Periwinkle	*Vinca rosea*	Apocynaceae	Ornamental	-	-	+
Palm, Palmyra palm, Tal tree	*Borassus flabellifer*	Arecaceae	Fruit/ Plantation crop	-	+	+
Helencha	*Enhydra fluctuans* Lour	Asteraceae	Weed	-	+	+
Sunflower	*Helianthus annuus* Linn.	Asteraceae	Field Crop	-	+	++
Parthenium	*Parthenium hysterophorus* Linn.	Asteraceae	Weed	+	+	+
Marigold, Gainda	*Tagetes erecta* Linn.	Asteraceae	Ornamental	-	+	+
Silk cotton/ Simul	*Salmalia malabarica* (DC) Schoot & Endl.	Bombacaceae	Tree	+	+	+
Ban mula, Wild radish	*Raphanus raphanistrum* Linn.	Brassicaceae	Weed	-	+	+
Ban kalmi	*Ipomoea marginata*	Convolvulacea	Weed	-	+	+
Pumpkin	*Cucurbita moschata* Linn.	Cucurbitaceae	Vegetable	-	+	++
Croton	*Croton sp.* Morong	Euphorbiaceae	Ornamental	-	+	+
Ban tulsi	*Croton bonplandianum*	Euphorbiaceae	Weed	-	-	+
Tulsi, Basil	*Ocimum sanctum*	Lamiaceae	Aromatic and Medicinal	-	-	+
Groundnut	*Arachis hypogea*	Leguminaceae	Field Crop	-	-	+
Cowpea	*Vigna sinensis*	Leguminaceae	Vegetable	-	+	+
Okra, Bhindi, Ladies' finger	*Abelmoschus esculentus* L.	Malvaceae	Vegetable	-	++	+++
Desi cotton	*Gossypium hirsutum* Linn.	Malvaceae	Field Crop	+	++	+++
China rose, Jaba	*Hibiscus rosa sinensis* L.	Malvaceae	Ornamental	+	++	++
Banana	*Musa sp*	Musaceae	Fruit and vegetable	-	+	+
Nine O'clock, Office Time	*Portulaca sp*	Portulacaceae	Ornamental	-	-	+
Rose	*Rosa indica* Linn.	Rosaceae	Ornamental	-	+	+
Rangan, Ixora, Jungle geranium	*Ixora coccinea*	Rubiaceae	Ornamental	+	+	++
Sapota	*Manilkara zapota* Linn.	Sapotaceae	Fruit/Tree	-	+	+
Chilli, Lanka, Mirchi	*Capsicum sp.*	Solanaceae	Vegetable/ spice	-	+	+
Tomato	*Lycopersicon esculentum* (L.) Mill.	Solanaceae	vegetable	-	+	++
Brinjal, Baingon, Begun	*Solanum melongena* L.	Solanaceae	Vegetable	-	++	+++

Note: Incidence: - = Nil, + = Low, ++ = Moderate, +++ = Severe

Phenacoccus solenopsis was recorded from 28 plant species of 19 families comprising 3 field crops, 6 vegetable crops, 8 ornamental plants, 1 medicinal plant, 5 fruit crops tree^{-1} and 5 weed hosts (Table 1). Among field crops, summer cotton, sunflower and ground nut were found as preferred hosts of this mealy bugs. Infestation was appeared for the first time in the year 2007-08 in cotton and was extended to cotton surrounding field crops like sunflower and groundnut in the year 2008-09 and 2009-10 respectively. But, during that period, other surrounding field crops like *boro* paddy and green gram were free from this dreadful pest attack. Besides field crops, significant level of infestation was recorded from china rose, *Hibiscus rosa sinensis* in the year 2007-08. In that period very little infestation

was also recorded from some non-commercial crops like parthenium weed, *Parthenium hysterophorus;* rangan, *Ixora coccinea* and simul, *Salmalia malabarica*. The pest harbors in these alternative hosts round the year.

Moderate to severe infestation of this mealybug was also recorded on vegetables grown along with cotton in the surrounding fields. First infestation was observed in Summer Okra in the year 2008-09 which later became very serious for this crop. At that time infestation was also observed to the crops belonging to the family solanaceae and cucurbitaceae.

The infestation level was medium in okra but low in tomato, chilli, brinjal and pumpkin. But, it was wondered that the pest status was turned from low to medium and medium to severe respectively in the next year *i.e.* 2009-10. Though low level of *P. solenopsis* infestation was found in ban kalmi, *Ipomoea marginata* whereas, no incidence was found in another important Convolvulus crop sweet potato, *Ipomoea batatas*. However, it has attained as a pest of so serious importance in the year 2009-10, during summer and dry period for the crop like cotton, okra and brinjal that most of the plants died in the infested field. It corroborates with the findings of Arif *et al.* (2009) who also recorded infestation of *P. solenopsis* from 154 plant species belonging to the family malvaceae, solanaceae, asteraceae, euphorbiaceae etc. with severe economic loss due to plant death of cotton, brinjal, okra, China rose and some other crops in Pakistan.

In the present investigation level of infestation and spread of this mealy bug in this coastal region were not more rapid and regular in rainy and winter season. Suresh and Kabita, (2008) also reported that maximum temperature and sunshine hours had a positive influence while relative humidity and rainfall had a negative influence on the population build up of this mealybug. Wide host range and prevailing long dry period may cause wide spread of infestation of this invasive mealybug as well as may cause severe crop damage in future.

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