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First report of cotton mealybug *Phenacoccus solenopsis* Tinsley on cultivated jute (*Corchorus olitorius* L.) in India

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With 3 figures

Abstract: A wide spread infestation of mealybug, *Phenacoccus solenopsis* Tinsley was observed on cultivated jute, *Corchorus olitorius* L. (Malvaceae) in many parts of Southern West Bengal, India for the first time in May 2009. The infested fields were surveyed for the pest, extent and nature of damage and its alternate hosts. On the basis of morphology and damage symptoms on the host, it was identified as *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Coccoidea: Pseudococcidae). Subsequently, in 2011 and 2014 again similar kind of damage caused by *P. solenopsis* on jute was observed. This is the first report of the occurrence of *P. solenopsis* on *C. olitorius* causing economic damage.

Keywords: Pseudococcidae – mealybugs – *Corchorus olitorius* – *Phenacoccus solenopsis* Tinsley – Malvaceae

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1. Introduction

Jute, *Corchorus olitorius* L. (Malvaceae) known as “golden fibre” is one of the important natural fibres widely used for various applications. The fibres are long, soft and shiny, with a diameter of 17 to 20 microns. It is a coarser variety of agro-renewable and bio-degradable natural fibre, ligno-cellulosic in nature. The fibres are fully biodegradable and recyclable and thus environment-friendly. It is mainly used for bulk packaging, i.e., sacking, home furnishing, geo-textiles and other diversified products

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(Ghosh et al. 1994). Jute is chemically composed of cellulose, hemi-cellulose and lignin as major constituents (Gordon 1993). Cultivation of jute absorbs as much as 2.4 tons of carbon dioxide for per ton dry fibre production. Growing jute in crop rotations enriches the fertility of the soil for the next crop. These facts make this crop an ideal bast fibre crop with “green” label (Zimniewska et al. 2011). Jute is predominantly grown as a rain-fed annual crop mostly in South Asian countries in multi-cropping strategy in rice-centric crop rotation. India continues its dominance of global jute production, accounting for 66% of the world production. In India current area under jute is 0.79 m ha with production of 1.98 m tonnes (Anonymous 2013). Adoption of high yielding, premature-flower-resistant varieties in jute with judicious crop, soil and pest management practices have played convincing role in doubling the productivity. During the past few decades, the radicle change in the pattern of input use in jute cultivation has experienced gradual shift in relative pest status of many jute pests. Although earlier three species of mealybugs i.e., *Maconellicoccus hirsutus* (Green), *Ferrisia virgata* (Cokerell) and *Pseudococcus filamentosus* var. *corymbatus* Green had been reported to infest jute (Kundu et al. 1959), so far the pest status was negligible with no evidence of economic damage to the crop. Jute is mainly sown just after the first summer after the onset of pre-monsoon rain in India during the months of March–April. In May 2009, there was heavy infestation of mealybug in few pockets in the southern part of West Bengal State of India in 25- to 50-day old jute crop. The devastating effect of the mealybug on jute was investigated which again occurred in the years 2011 and 2014 subsequently.

2. Material and Methods

During May 2009, a survey was conducted on jute and other field crops to find out the devastating damage caused by mealybug in jute (*C. olitorius*), in villages near Basirhat Sub-division (22°68′N, 88°91′E) in North 24 Parganas district of West Bengal State in eastern India to assess the type, extent and causes of mealybug outbreak (Fig. 1). The damage was assessed adopting the modified methodology of Nagrare et al. (2011) in 1–4 scale (1: appear in very few numbers in the topical growing point of the plant, 2: appear in few numbers on topical 4–5 cm portion of the stem, 3: appear in considerable number in the topical 10 cm portion of stem and few leaves, 4: severe infestation in whole plant). The occurrence of the mealybug was in many adjacent jute growing villages also. The mealybug samples from the infested jute and other host plants in the vicinity were collected for further identification.

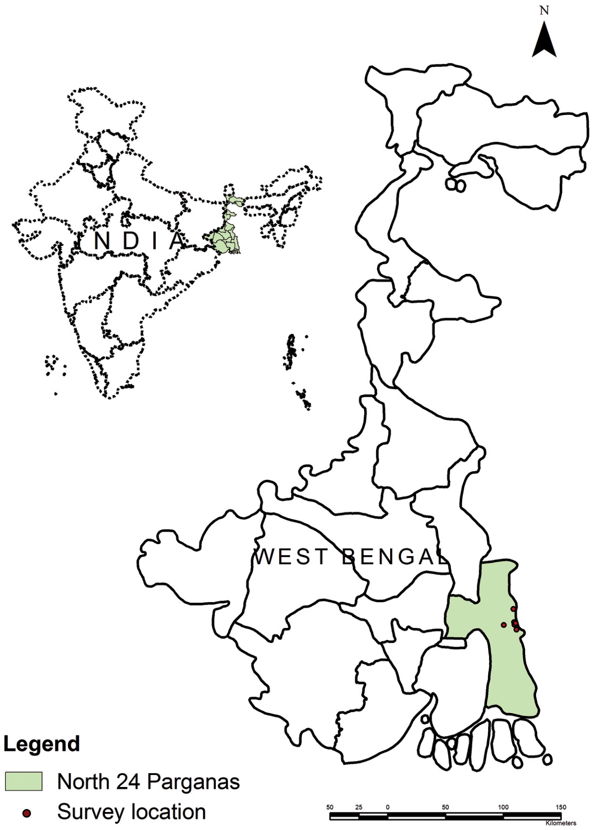

Fig. 1. The map of the study area.

3. Results

Uniform infestation of mealybug was observed in all the jute (Cv. JRO 524) fields in the sampled area which were to the extent of 60–80% plant damage in 1–4 scale. The crop was of 40–65 day-old in the survey area. Although during the time of sampling, few plants showed the symptoms of withering of the terminal foliage, later on growth of most of the mealybug infested plants was supressed and died pre-maturely due to intense de-sapping by the crawlers (Fig. 2). Other plants observed to be the hosts in that area were eggplant (*Solanum melongena*), okra (*Abelmoschus esculentus*), sesamum (*Sesamum indicum*) and *Parthenium hysterophorus* grown in the vicinity of the area surveyed. In few fields, 30–35 day old plants were uniformly infested. The infestation mainly as congregated mass of adults and crawlers in the terminal shoots adhering to the stem and ventral surface of succulent leaves.

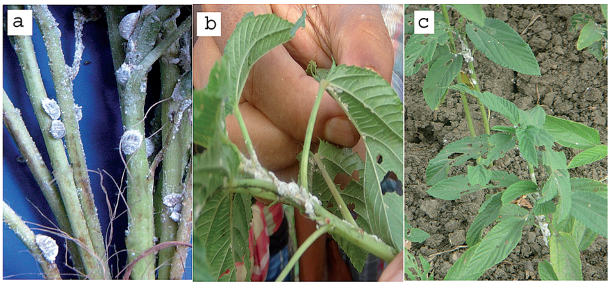

Fig. 2. *Phenacoccus solenopsis* infestation on (a) basal, (b) terminal part of the jute, *Corchorus olitorius* plants and (c) on the infested crop in the field.

The morphological features of the mealybug specimen collected were studied by the mealy bug taxonomist (Dr. S. Suresh, Professor of Entomology, TNAU, Coimbatore, India). Adult female of *P. solenopsis* generally has paired dark spots and/or stripes dorsally which are covered with a powdery, waxy secretion with six pairs of transverse, dark bands that are located cross the pro- to meta-thoracic segments. A series of waxy filaments extend from around the margin of the body with the pair of terminal filaments longest. The ovisac is composed of fluffy, loose-textured wax strands (McKenzie 1967, Kosztarab 1996). Adult females ranged from 2 to 5 mm long and 2 to 4 mm wide. It usually has short lateral wax filaments and slightly longer terminal wax filaments (less than a half as long as the body). The adult females of *P. solenopsis* have usually paired black dorsal markings (Culik & Gullan 2005) (Fig. 3). The mealybug cultures have biparental species (Hodgson et al. 2008). On the basis of adult female morphology and other features, the mealybug specimen collected from cultivated jute, *C. olitorius* was identified as *P. solenopsis*.

Fig. 3. Adult female of *P. solenopsis*.

4. Discussion

During the recent past, some of the mealybug species posed threat to many crops in India causing extensive yield loss. Important among which are *P. solenopsis* in cotton, *Paracoccus marginatus* Williams and Granara de Willink in papaya and *Maconellicoccus hirsutus* Green in grape (Muniappan et al. 2009) Devastating outbreak of *P. solenopsis* has been recorded on cotton during the year 2008 that attained the status of serious pest in wide range of agricultural and horticultural crops in India (Gautam et al. 2010). It was described originally from New Mexico, USA in 1898, where it was widespread on ornamental and fruit crops. Later it has a wide geographical distribution with its origin in Central America (Fuchs et al. 1991, Williams & Granara de Willink 1992) followed by reports of the Caribbean and Ecuador (Ben-Dov 1994), Chile (Larrain 2002), Argentina (Granara de Willink 2003), Brazil (Mark & Gullan 2005). As such this species has established in Afrotropical, Australasian, Nearctic, Neotropical and Oriental regions.

In 2006, *P. solenopsis* emerged as a serious pest in India infesting cotton in Northern and Western parts recorded on 56 plant species belonging to 27 families (Dhawan 2007). *P. solenopsis* has been described as a serious and invasive pest of cotton in Pakistan and India (Hodgson et al. 2008). Kumar et al. (2009) also reported as many as 50 hosts in field, vegetable, fruit, ornamental and plantation crops and weeds. The *Solenopsis* mealybug has been recorded on 202 host plant species that include field crops, ornamentals, trees and vegetables throughout the world including many states of India (Cabi 2014). So far, three species of mealybugs *i.e. Maconellicoccus hirsutus, Ferrisia virgata* and *Pseudococcus filamentosus* var. *corymbatus* had been reported to infest jute (Kundu et al. 1959). On the basis of these information, this is the first report of *P. solenopsis* on cultivated jute, *C olitorius* as it has not been documented earlier.

In 2011 and 2014 again similar kind of damage caused by *P. solenopsis* on jute, *C. olitorius* was observed in Southern parts of West Bengal State. An insight into the weather parameters during 2004–2014 indicated that during January to May in 2009, 2011 and 2014 indicated that there was an increase in the maximum and minimum temperature and decrease in rainfall and number of rainy days during the post-sowing growth period of the crop. Similar climatic condition consisting of more number of non-rainy days coupled with slight increase in mean temperature by 1–2 °C prevailing during the years of mealybug occurrence coincides with early growth phase of jute plants making the condition conducive for establishment of mealybug population. The activity of mealybug, *P. solenopsis* is favoured under high temperatures condition. The severity is primarily governed by abiotic factors, most importantly positive and negative correlation of temperature and rainfall respectively with field infestation (Dhawan et al. 2009). The sensitivity of changing temperature and humidity conditions on shortening the developmental period of *P. solenopsis* indicated the suitability of tropical condition on quickening the generations (Vennila et al. 2010). The warm and dry conditions during summer may be the pre-disposing factor for mealybug outbreak on jute.

In India, *P. solenopsis* has recently been noted on wide variety of hosts and in cotton it almost appeared in wide area. We now record *P. solenopsis* first time in cultivated jute, *C. olitorius*. In the past, particularly in USA (till 1990) later into other continents and countries, *P. solenopsis* evidenced its spread in to new hosts. Most noteworthy are the recent repeated infestation of *P. solenopsis* on jute in West Bengal for three years which tends to indicate that it is not simply a coincidence of collection and identification effort but a clear trend of host and geographic expansion of the pest regulated by favourable climatic conditions.

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References

Ben-Dov, Y. (1999): A Systematic Catalogue of the Mealybugs of the World. – Intercept Limited, Andover, UK.

Cabi (2014): Invasive Species Compendium of Databases, Maps, Images on *Phenacoccus solenopsis*. – http://www.cabi.org/isc/datasheet/109097.

Culik, M.P. & Gullan, P.J. (2005): A New Pest of Tomato and Other Records of Mealybugs (Hemiptera: Pseudococcidae) from Espirito Santo, Brazil. – Zootaxa **964:** 1–8.

Dhawan, A.K., Singh, K., Anand, A. & Sarika, S. (2009): Distribution of Mealybug, *Phenacoccus solenopsis* Tinsley in Cotton with Relation to Weather Factors in South-Western Districts of Punjab. – Journal of Entomological Research **33:** 59–63.

Dhawan, A.K., Singh, K., Saini, S., Mohindru, B., Kaur, A., Singh, G. & Singh, S. (2007): Incidence and Damage Potential Of Mealybug, *Phenacoccus solenopsis* Tinsley, on Cotton in Punjab. – Indian Journal of Entomology **34:** 110–116.

Fuchs, T.W., Stewart, J.W., Minzenmaye, R. & Rose, M. (1991): First record of *Phenacoccus solenopsis* Tinsley in Cultivated Cotton in the United States. – Southwestern Entomologist **1:** 215–221.

Gautam, R.D., Gautam, S., Suroshe, S.S. & Saxena, U. (2010): Simple Technique Based on Taxonomic Character for Distinguishing the Cotton Mealybugs (Pseudococcidae: Homoptera). – Journal of Entomological Research **34:** 79–84.

Ghosh, P., Samanta, A.K. & Das, D. (1994): Effect of Selective Pre-Treatments and Different Resin Post-Treatments on Jute/Viscose Upholstery Fabric. – Indian Journal of Fibre and Textile Research **19:** 277

Gordon, J. (1993): Handbook of Textile Fibres: Natural Fibres (V Edition). – Merrow Publishing Company Ltd., England.

Granara De Willink, M.C. (2003): Nuevas citas y huéspedes de Phenacoccus para la Argentina (Hemiptera: Pseudococcidae). – Revista de la Sociedad Entomológica Argentina **62:** 80–82.

Hodgson, C.J., Abbas, G., Arif, M.J., Saeed, S. & Karar, H. (2008): *Phenacoccus solenopsis* Tinsley (Sternorrhyncha: Coccoidea: Pseudococcidae), an Invasive Mealybug Damaging Cotton in

Pakistan and India, with a Discussion On Seasonal Morphological Variation. – Zootaxa **1913:** 1–35.

Kosztarab, M. (1996): Scale Insects of Northeastern North America: Identification, Biology, and Distribution. – Virginia Museum of Natural History, 650 pp., Martinsville, Virginia.

Kumar, R., Pal, V., Jat, M.C., Monga, D. & Jat, S.L. (2009): Studies on Mealybug, *Phenacoccus solenopsis* Tinsley on Transgenic Cotton. – Indian Journal of Entomology **71:** 125–129.

Kundu, B.C., Basak, K.C. & Sircar, P.B. (1959): Jute in India – monograph. – Indian Central Jute Committee, Calcutta, India.

Larrain, S.P. (2002): Insect and Mite Pest Incidence on Sweet Pepinos, *Solanum muricatum* (Ait.) Cultivated in the IV Region, Chile. – Agricultura-Tecnica **62:** 15–26.

Mark, P.C. & Gullan, P.J. (2005): A New Pest of Tomato and other Records of Mealybugs (Hemiptera: Pseudococcidae) from Espirito Santo, Brazil. – Zootaxa **964:** 1–8.

Mckenzie, H.L. (1967): Mealybugs of California with Taxonomy, Biology, and Control of North American species (Homoptera: Coccoidea: Pseudococcidae). – Berkeley, 526 pp., California.

Muniappan, R., Shepard, B.M., Watson, G.W., Carner, G.R., Sartiami, D., Rauf, A. & Hammig, M.D. (2009): First Report of the Papaya Mealybug, *Paracoccus marginatus* (Hemiptera: Pseudococcidae), in Indonesia and India. – Journal of Agricultural and Urban Entomology **25:** 37–40.

Nagrare, V.S., Kranthi, S., Rishi Kumar Dharajothi, B., Amutha, M., Deshmukh, A.J., Bisane, K.D. & Kranthi, K.R. (2011): Compendium of Cotton Mealybugs (Technical Bulletin). – Central Institute for Cotton Research, p. 42, Nagpur, India.

Vennila, S., Deshmukh, A.J., Pinjarkar, D., Agarwal, M., Ramamurthy, V.V., Joshi, S., Kranthi, K.R. & Bambawale, O.M. (2010): Biology of the Mealy bug, *Phenacoccus solenopsis* on Cotton in the Laboratory. – Journal of Insect Science **10:** 1–15.

Williams, D.J. & Granara De Willink, M.C. (1992): Mealybugs of Central and South America. – CAB International, Wallingford, UK.

Zimniewska, M., Wladyka-Przybylak, M. & Mankowski, J. (2011): Improvement of quality bast fibre for diversified utilisation. – In: Singh, B., Lutfar, L.B., Rahman, M.S. & Ferdous, S. (eds.): Proceedings of International Seminar on Strengthening of Collaboration for Jute, Kenaf, and Allied Fibres Research and Development, Dhaka, 8–9 June 2011, International Jute Study Group, 189–195, Dhaka, Bangladesh.

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