



Review

The invasive mealybug *Phenacoccus solenopsis* Tinsley, a threat to tropical and subtropical agricultural and horticultural production systems – A review



Babasaheb B. Fand^{a,*}, Sachin S. Suroshe^b

^a School of Atmospheric Stress Management, ICAR– National Institute of Abiotic Stress Management, Malegaon, Baramati, Pune 413 115, Maharashtra, India

^b Biological Control Laboratory, Division of Entomology, ICAR– Indian Agricultural Research Institute, New Delhi 110 012, India

ARTICLE INFO

Article history:

Received 16 June 2014

Received in revised form

2 December 2014

Accepted 3 December 2014

Available online 20 December 2014

Keywords:

Aenasius bambawalei

Biological control

Invasive mealybug

Natural enemies

Tropics and sub-tropics

ABSTRACT

Originating from USA and co-evolved with numerous food plants, the mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) has become a highly invasive and polyphagous pest. It is reported damaging >200 plant species from about 24 countries of tropical and subtropical regions of the world. The average length of *P. solenopsis* life cycle range between 28 and 35 days and it can complete about 8–12 generations in a year, inflicting significant yield losses to cotton (*Gossypium hirsutum* Linn.) and other economically important crops. The devastating outbreaks of *P. solenopsis* on cotton causing 30–60% yield losses have been reported from India and Pakistan during 2005–2009 and since then the pest has received worldwide attention as an invasive species of quarantine importance. About 28 species of natural enemies including 12 predators and 16 multiple parasitoids of *P. solenopsis* have been reported throughout its range, but only an Encyrtid species *Aenasius bambawalei* Hayat has been instrumental in controlling *P. solenopsis* natural populations in a range of 30–60%. Due to the highly polyphagous nature and the ability to oviposit on a wide range of host plants, *P. solenopsis* has huge potential to invade new areas and to adapt to a wide range of ecological situations. This clearly indicates that *P. solenopsis* can pose a serious threat to agricultural and horticultural production, especially in tropics and subtropics where the temperatures are expected to increase under projected climate change. There is a need for undertaking adaptive strategies against this pest to lessen the yield losses and safeguard the interest of crop growers.

© 2014 Elsevier Ltd. All rights reserved.

1. Introduction

Certain anthropogenic changes to agro-ecosystems such as crop intensification, habitat fragmentation and climate change coupled with liberalisation of international agricultural trade policy have led to frequent emergence of new or invasive insect-pests in economically important agricultural and horticultural crops. The mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) is one such recent example causing 30–60% yield losses in cotton (*Gossypium hirsutum* Linn.) during 2005–09 in India and Pakistan (Dhawan et al., 2007; Jhala et al., 2008; Nagrare et al., 2009). Based on initial reports of its occurrence from New Mexico (Tinsley, 1898a,b) and Texas (Fuchs et al., 1991), *P. solenopsis* is

presumed to originate in North America. The pest was first found outside the continental USA in the 1980s in South America, the Caribbean Islands and Central America (Williams and Granara de Willink, 1992). From 2005 onwards, *P. solenopsis* was reported infesting cotton in Asia, especially in Pakistan (Abbas et al., 2005) and India (Jhala et al., 2008) which are considered as the major cotton growing hubs of South Asia. So far, *P. solenopsis* has been reported damaging >200 plant species of 55 different families from about 24 countries (Abbas et al., 2005, 2010; Vennila et al., 2010a; Nagrare et al., 2011; Arif et al., 2012). The pest is likely to spread to other parts of the world in near future due to the predicted temperature increase, and might pose increased threats to the agricultural and horticultural production systems in tropical and sub-tropical parts of the world (Fand et al., 2013, 2014a,b,c). This review summarizes the documented reports on global distribution, bio-ecology, host range, natural enemy fauna and management of *P. solenopsis*.

* Corresponding author. Tel.: +91 2112 254057; fax: +91 2112 254056.
E-mail address: babasahebfind@gmail.com (B.B. Fand).

Table 1
History of global distribution and spread of *P. solenopsis*.

Year of occurrence	Country	Host plants	Family	Reference (s)
1897	USA (New Mexico)	Creeping spiderling (<i>Boerhavia spicata</i> Choisy); California caltrop [<i>Kallstroemia californica</i> (S.Wats.) Vail]	Nyctaginaceae; Zygophyllaceae	Tinsley 1898a,b
1966	Hawaiian Islands	Jute or Mallow (<i>Corchorus olitorius</i> L.)	Malvaceae	Kumashiro et al., 2001
1985	Panama	–	–	Williams and Granara de Willink, 1992
1990	USA (Texas)	Cotton (<i>Gossypium hirsutum</i> L.)	Malvaceae	Fuchs et al., 1991
1992	Ecuador	–	–	Williams and Granara de Willink, 1992
1992	Caribbean Islands (Cuba, Dominican Republic)	–	–	Williams and Granara de Willink, 1992
2000	Caribbean Islands (Barbados and Jamaica)	–	–	Watson and Chandler 2000
2001	Galapagos Islands	–	–	Causton et al., 2006
2001	Sierra Leone	–	–	EPPO 2013; CABI 2014
2002	Brazil	Tomato (<i>Lycopersicon esculentum</i> L.)	Solanaceae	Culik and Gullan 2005
2002	Chile	Sweet pepino [<i>Solanum muricatum</i> (Ait.)]	Solanaceae	Larrain 2002
2003	Argentina	False ragweed (<i>Ambrosia tenuifolia</i> Spreng)	–	Granara de Willink 2005
2004	Netherlands	Green house plants	–	Jansen 2004
2005	Pakistan (Sindh, Punjab, Baluchistan, Multan)	Cotton (<i>Gossypium hirsutum</i> L.) (>154 plant species of vegetables, weeds and ornamentals)	Malvaceae	Abbas et al., 2005, 2010
2005	India (Andhra Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan and Tamil Nadu)	Cotton (<i>Gossypium hirsutum</i> L.) (>194 plant species belonging to 52 plant families including field crops, vegetables, weeds and ornamentals)	Malvaceae	Dhawan et al., 2007; Tanwar et al., 2007, 2011; Jhala et al., 2008; Bhosle et al., 2009; Nagrare et al., 2009, 2011; Suresh et al., 2010; Vennila et al., 2010a; 2011
2007	United Kingdom	Menthe (<i>Mentha</i> sp. L.)	Lamiaceae	U.K. Plant Health Interception and Outbreak chart 2007
2007	Vietnam	Ornamentals	–	Nguyen and Huynh 2008
2007	Ghana	Weed (<i>Amaranthus</i> sp. L.)	Amaranthaceae	EPPO 2013
2008	Guatemala	–	–	Hodgson et al., 2008
2008	Cayman Islands	–	–	Hodgson et al., 2008
2008	Colombia	–	–	Kondo et al., 2008
2008	Nigeria, Benin, Cameroon (Africa)	China rose, <i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Akintola and Ande 2008; Hodgson et al., 2008
2008	Guangdong	Cotton (<i>Gossypium hirsutum</i> L.)	Malvaceae	Wang et al., 2009; Wu and Zhang 2009; EPPO 2013
2008	Taiwan	–	–	Hodgson et al., 2008; Abbas et al., 2008; EPPO 2013
2008	China	Cotton (<i>Gossypium hirsutum</i> L.)	Malvaceae	Wang et al., 2009, 2010; Wu and Zhang 2009
2009	Thailand	–	–	Abbas et al., 2008; EPPO 2013
2009	Sri Lanka	Ornamentals, vegetables	–	Prishanthini and Vinobaba 2009; EPPO 2013
2010	Australia, Cambodia, Indonesia	Cotton (<i>Gossypium hirsutum</i> L.)	Malvaceae	Charleston and Murray 2010

2. Origin and distribution

P. solenopsis was first described by Tinsley (1898a,b) from specimens collected from infested roots and stems of weeds *Boerhavia spicata* Choisy and *Kallstroemia californica* (S. Watson) Vail, within the nests of ants *Solenopsis geminata* (Fabricius) and from the roots of *Atriplex canescens* (Pursh) in New Mexico, USA. However, first report of *P. solenopsis* damaging cotton crop came from Texas, USA (Fuchs et al., 1991). Thus, *P. solenopsis* is considered as native of North America (Williams and Granara de Willink, 1992; Ben-Dov, 1994; Watson and Chandler, 2000; Miller, 2005). Presently, the pest is distributed over a wide range of agro-ecological zones in more than 24 countries worldwide (Table 1), where it causes significant crop losses and is considered the most damaging mealybug species in the developing world.

P. solenopsis, which had not previously been documented from India (Varshney, 1985), was first reported infesting cotton in *kharif* (rainy) season of 2005–06 from North-Western parts of Gujarat State (Jhala et al., 2008). It has since spread rapidly to the neighboring cotton growing states of the country. The pest is now found in all nine major cotton producing states viz., Punjab, Haryana, Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Andhra Pradesh, Karnataka and Tamil Nadu (Table 2) (Nagrare et al., 2009). Besides

cotton, *P. solenopsis* infests other crops of economic importance such as okra (*Abelmoschus esculentus* Linn.), chilli (*Capsicum annum* Linn.), brinjal (*Solanum melongena* Linn.), tomato (*Solanum lycopersicum* Linn.), pomegranate (*Punica granatum* Linn.), guava (*Psidium guajava* Linn.), grapes (*Vitis vinifera* Linn.), ornamentals like china rose (*Hibiscus rosa-sinensis* Linn.), as well as various weeds (Tanwar et al., 2007, 2011; Nagrare et al., 2009, 2011; Vennila et al., 2010a). This pest has been a major focus of researchers because of its invasiveness and rapid spread across the regions within a short period of time.

3. Biosystematics

3.1. Taxonomy and nomenclature

This mealybug species was first described by Tinsley (1898a,b) and it was named as *Phenacoccus solenopsis* by Ferris (1950). Further, the taxonomic description of this mealybug based on the morphology of adult female has been provided by many workers from different parts of the world (Ferris, 1950; McKenzie, 1967; Williams and Granara de Willink, 1992; Kosztarab, 1996; Granara de Willink et al., 2007; Hodgson et al., 2008). The present taxonomic position of *P. solenopsis* is as shown in taxonomic tree below:

Download English Version:

<https://daneshyari.com/en/article/4505845>

Download Persian Version:

<https://daneshyari.com/article/4505845>

[Daneshyari.com](https://daneshyari.com)