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The cotton mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) as a new insect pest on tomato plants in Egypt

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Abstract: Recently, the mealybug *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) was recorded as a new pest on tomato plants (*Lycopersicon esculentum* Mill) growing in Egypt. The mealybugs specimens were collected from tomato plants in the Qalyoubia governorate during summer season of 2014. The mealybug was identified as *P. solenopsis* based on the morphological characters and taxonomic key of this species. This study represents the first record of *P. solenopsis* as a new insect pest attacking tomato plants in Egypt.

Key words: *Lycopersicon esculentum*, mealybug, *Phenacoccus solenopsis*

Introduction

In less than a century, tomato (*Lycopersicon esculentum* Mill) (Family: Solanaceae) has become a major world food crop. Today, tomatoes are grown commercially in 159 countries. The major producers of tomatoes, in 2009 were China, the United States, India, Turkey, Egypt, Italy, and Iran. In Egypt, the tomato is considered one of the most important vegetable crops for fresh consumption and processing (Abd El-Ghany 2011). According to FAO-STAT, in 2012, Egypt ranked as one of the top producers of tomatoes (8,625,219 t were produced). The cultivated area of tomato in Egypt increased considerably during the last two decades. In 2011, the total cultivated area, and productivity of tomato in Egypt, was estimated by 505,823 feddan, yielding 805,3701 tons with an average of 15.92 tons/feddan (Anonymous 2011). According to the last estimates from the Egyptian Ministry of Agriculture and Land Reclamation in 2013, the tomato acreage increased to 16.636 tons/feddan with a total yield of 8,571,050 tons from a total area of 515,225 feddan (Anonymous 2012). Tomato plants are subjected to infestation with several insect pests: cutworms, aphids, cabbage loppers, whiteflies, tomato fruit worms, and flea beetles (Ibrahim 2007; Abd El-Ghany 2011).

Mealybugs (Hemiptera: Pseudococcidae) are important insect pests worldwide (Williams 1985; Williams and Granara de Willink 1992; Miller *et al.* 2005; Hodgson *et al.* 2008; Abbas *et al.* 2009; Khuhro *et al.* 2012). The genus *Phenacoccus* currently contains about 180 species and is one of the largest genera in the Pseudococcidae (Ben-Dov 1994). The cotton mealybug *Phenacoccus solenopsis* was originally described from the USA in 1898. Until 1992, this insect was known only in the USA, where it was widespread (Ben-Dov 2004). *Phenacoccus solenopsis* was reported in Central America, the Caribbean, and Ecuador (Fuchs *et al.* 1991; Williams and Granara de Willink 1992). The cotton mealybug *P. solenopsis*, is a polyphagous insect feeding on more than 200 plant species. There are plant species assigned to approximately 60 families. The insect has a preference for Asteraceae, Euphorbiaceae, Fabaceae, Malvaceae and Solanaceae. As an important insect pest, this insect has an economic and environmental impact. Large populations of mealybugs cause general weakening, defoliation, and death of susceptible plants. Indirectly, it may also damage plants by serving as vectors of plant diseases. Moreover, the honeydew excreted by the mealybugs causes growth of sooty moulds and other secondary infections that decreases photosynthesis and reduces the marketability of plant products. The cotton mealybug *P. solenopsis*, has a wide geographical distribution with its origin in Central America (Fuchs *et al.* 1991; Williams and Granara 1992), the Caribbean, Ecuador (Ben-Dov 1994), Chile (Larrain 2002), Argentina (Granara de Willink 2003), and Brazil (Culik and Gullan 2005). *Phenacoccus solenopsis* was described as a serious and invasive pest of cotton in Pakistan and India (Hodgson *et al.* 2008) and on *Hibiscus rosasinensis* (L.) in Nigeria (Akintola and Ande 2008). In Egypt, the occurrence of *P. solenopsis* infestation was recorded on weed plants by Abd-Rabou *et al.* (2010).

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Fig. 1. Photographs showing the infestation of *Phenacoccus solenopsis* on tomato plants: A – adult and nymphs of *P. solenopsis* on stem and leaves of the tomato plant (photo: Dr. Samah Sayed); B – photograph showing *P. solenopsis* infesting the apical region of a tomato plant, and a magnified view of an adult female located at the top corner of the photo (photo: Dr. Nesreen Abd El-Ghany); C – adult female of *P. solenopsis* and infested tomato plants. Seen are the infested stem, flower, and based buttons of the fruit (photo: Dr. Nesreen Abd El-Ghany); D – deformation and distortion symptoms of the infested tomato plant (photo: Dr. Nesreen Abd El-Ghany); E – heavy *P. solenopsis* infestation associated with twisting and curling of the terminal region of stems (arrow) and appearance of leaf wrinkling and puckering (head arrow) (photo: Dr. Nesreen Abd El-Ghany); F – noticeable damage of the tomato plant due to large populations of *P. solenopsis* nymphs and adults causing plant death (photo: Dr. Nesreen Abd El-Ghany)

Materials and Methods

Mealybug specimens were collected from various tomato plants at Qaha Research station (Plant Protection Research Institute) from June to August 2014, to identify the species present in this area. Mealybug specimens were collected when noticed on plants during the fieldwork of the first and third authors. The specimens were identified by the second author at the Scale Insect Department, Plant Protection Research Institute, Agriculture Research Center, the Ministry of Agriculture. Mealybug specimens were slide-mounted for identification using the method outlined in Williams and Granara (1992). Identification of the genus was carried out using the key of the Pseudococcidae family (Hemiptera: Coccoidea) according to Mohammad and Moharum (2012).

Results and Discussion

The present study represents the first record in Egypt, of tomato plant infestations by the cotton mealybug. The mealybug specimens were collected from the tomato fields in the Qaha Research Station during the 2014 summer season. The mealybug was identified as *P. solenopsis* Tinsley (Hemiptera: Sternorrhyncha: Coccoidea: Pseudococcidae) using Mohammad and Moharum (2012) taxonomic key. Different photos of *P. solenopsis*, and photographs of the infestation on tomato plants are illustrated in figure 1. The cotton mealybug *P. solenopsis* has not been previously noted as a pest of tomato in Egypt. The occurrence of *P. solenopsis* infestation in Egypt was recorded only on weed plants by Abd-Rabou *et al.* (2010). So, the present study is the first published record of tomato as a new host for *P. solenopsis* in Egypt.

The cotton mealybugs were reported on different host plant species worldwide including, field crops, vegetables, ornamentals, weeds, bushes and trees (Williams and Granaram 1992; Ben-Dov 1994; Larrain 2002; Granara de Willink 2003; Culik and Gullan 2005; Hodgson *et al*. 2008; Aheer *et al*. 2009; Arif *et al*. 2009; Abbas *et al*. 2010; Beltra and Soto 2011). The mealybugs were reported on 28 host plant species comprising 10 families in Sri-Lanka. This includes the major field crops of the Malavaceae, Solanaceae and Amaranthaceae families (Prishanthini and Vinobaba 2011). As mentioned before, this study represents the first evidence of the occurrence of the cotton mealybug *P. solenopsis* on tomato plants as a new host in Egypt, for this insect pest. Further reports on the occurrence of *P. solenopsis* have been documented on tomato plants from several countries. For example, *P. solenopsis* was first identified in a sample of tomato plants (*Solanum lycopersicum* L.) collected in October 2003 in the city of Vitória, in Brazilian state Espírito Santo (Culik and Gullan 2005).

The mealybug infestation attacking tomato plants was initially noticed in 19 June 2014. Adults and nymphs of this pest weaken the plants by sucking sap from the leaves, stems, roots, and fruits of the plant. A magnified view of the mealybug *P. solenopsis*, showing its morphological character is illustrated in figure 1A and B. Morphologically, the adult female of *P. solenopsis* is wingless, the oval-shaped body often quite large (5 mm), somewhat rounded in lateral view, covered with white hydrophobic mealy wax filaments (18 short lateral and slightly longer terminal wax filaments). There are paired dark spots and/or stripes on the thorax and abdomen, which appeared as dark longitudinal lines. The adult male is blackish brown in color, about 1 mm long with a single pair of transparent wings. Male pupas are covered in a loose white silky cocoon. Two abdominal filaments of white wax projections occur at the end of the body. The adult male has no feeding mouthparts and causes no damage.

The infestation of *P. solenopsis* was observed on all parts of the tomato plants during the fieldwork of the present study (Fig. 1). The infestation appeared on stems, leaves, and sites where the metabolism is accelerated, such as the terminal bud, based buttons, and flowers (Fig. 1B and C). Similar findings were described by Osborne (2005), Culik and Gullan (2005), and Silva (2012). Affected tomato plants were also found to exhibit clear symptoms of deformation and distortion of the terminal growth (arrows in Fig. 1D and E). Moreover, noticeable foliar yellowing, leaf wrinkling and puckering were observed in figure 1E (head arrow). Osborne (2005) and Silva (2012) recorded the same implications on tomato plants during their work. Growing populations of mealybugs caused severe damage to the plants, serving to help the growth of sooty moulds and causing plant death (Fig. 1F). These findings agreed with the symptoms recorded by Jagadish *et al.* (2009). Therefore, a noticeable decrease in the production of tomato plants was recorded. Also, the lack of previous records of this insect pest (*P. solenopsis*) combined with findings of well-established populations on tomato plants; indicate that the mealybug may soon become an important insect pest attacking tomato plants in Egypt. With this in mind, the present study highlights the need for additional surveys and further research on this species and its damage on such an economically important crop. Moreover, the challenge is to develop suitable management programs with less use of chemicals. A program with less use of chemicals would be necessary for important economic, health, and environmental impacts. Such a program for this insect pest then becomes warranted.

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