

# First record of the Madeira mealybug, *Phenacoccus madeirensis* Green (Hemiptera: Pseudococcidae), in Jordan

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The Madeira mealybug, *Phenacoccus madeirensis* (Hemiptera: Pseudococcidae), is recorded from Jordan for the first time. Specimens were collected from heavily infested ornamental geranium plants, *Pelargonium* sp. (Geraniaceae), *Chrysanthemum* sp. (Asteroideae), *Hibiscus rosa-sinensis* L. (Malvaceae), *Kalanchoe blossfeldiana* Poellnitz (Crassulaceae) and basil, *Ocimum basilicum* L. (Lamiaceae). In addition, this mealybug was taken from infested leaves of cherry tomato, *Solanum lycopersicum* L., and sweet pepper, *Capsicum annuum* L. (Solanaceae). *Kalanchoe blossfeldiana* is recorded as a new host for *P. madeirensis*. Slide mounts were prepared, and voucher specimens were preserved at the University of Jordan Insect Museum. An urgent survey should be initiated to determine the current distribution of the pest in Jordan. Inspection of ornamental nurseries should be given priority and plant protection officials should pay particular attention to this serious pest.

## Introduction

The Madeira mealybug, *Phenacoccus madeirensis* Green (Hemiptera: Pseudococcidae), is an important pest which is invading new areas worldwide. It is a polyphagous insect which has been recorded from 135 genera in 51 families. It is a pest of many fruit trees, fibre plants, food crops, vegetables, cacao and ornamentals (Wang *et al.*, 2019; García Morales *et al.*, 2016). It can feed on any aboveground plant part (Papadopoulou & Chryssohoides, 2012). *Phenacoccus madeirensis* is a serious pest on greenhouse ornamentals in the USA (Chong & Oetting, 2006). It has a Neotropical origin, although it was first described on the island of Madeira in 1923 (Green, 1923). It has spread to 88 countries and regions across five continents (Wang *et al.*, 2019). In Europe, it has been recorded in mainland Italy (Tranfaglia, 1981), then in Sicily (Longo *et al.*, 1995), France (Matile-Ferrero & Germain, 2004), Greece (Crete) (Jansen *et al.*, 2010), Spain (Beltrà & Soto, 2011), Portugal, (Franco *et al.*, 2011), northern Greece (Papadopoulou & Chryssohoides, 2012), Turkey (Kaydan *et al.*, 2012) and Croatia (Milek *et al.*, 2015). Halima-Kamel *et al.* (2014) recorded this species from Tunisia. In Asia, it has been recorded from Japan, Pakistan, the Philippines, Vietnam, China, Thailand, India, Laos and Cambodia (Wang *et al.*, 2019). Marotta *et al.* (2001) reported this species from Yemen. This worldwide global distribution is considered most likely to be due to introduction by travellers or transport of agricultural or forest products across regions or countries (Williams, 1987; Williams & Granara de Willink, 1992; Vijay and Suresh, 2013 cited in Wang *et al.*, 2019).

The objective of this paper is to officially record *P. madeirensis* in Jordan and to alert plant protection officials to the potential threat of this pest in Jordan.

## Materials and methods

During April 2018 mealybug infestations were detected on indoor ornamental plants (Fig. 1) on a house balcony in Amman, Jordan. The infested ornamentals and the respective numbers of infested specimens were: geranium, *Pelargonium* sp. (Geraniaceae) (20 plants), *Chrysanthemum* sp. flowering plants (Asteroideae) (4 plants), *Hibiscus rosa-sinensis* (Malvaceae) (2 plants), *Kalanchoe blossfeldiana* (Crassulaceae) (4 plants) and basil, *Ocimum basilicum* (Lamiaceae) (15 plants). In addition, samples were taken from infested leaves of cherry tomato, *Solanum lycopersicum* L. (15 plants), and sweet pepper, *Capsicum annuum* (Solanaceae) (10 plants), on the same balcony. Five avocado trees were also observed to be infested in the garden outside the same house. The symptoms included yellow and/or wilted leaves, the presence of honeydew or sooty mould, retarded growth and wilting of flowers.

Samples from infested parts were taken to the laboratory and mealybugs were removed with a fine brush. The specimens were slide mounted according to the method used by Kosztarab and Kozar (1988) and identified by using the keys of Williams (2004) and Kaydan *et al.* (2012). Voucher specimens of the collected samples were preserved in the University of Jordan Insect Museum. The entire mealybug was photographed under a dissecting microscope (Leica M165 C)



**Fig. 1** *Phenacoccus madeirensis* females on geranium (left), basil (middle) and cherry tomato (right). [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

using a dome illumination unit, while enlargements were taken under a light microscope with a digital camera (CMEX 5.0 megapixel digital USB2 camera, Euromex) attached to the eye tube.

## Results and discussion

All examined specimens were found to be of the Madeira mealybug, *P. madeirensis* (Fig. 2). All developmental stages were found on the plants. The species was reproducing sexually and male cocoons, pre-pupae and adult males were seen (Fig. 3). This mealybug appears to be recently introduced to the country, most probably associated with ornamental plants imported from Italy, as ornamentals have been imported from there for many years. This pest was recorded in Italy several decades ago (Tranfaglia, 1981). In addition, *P. madeirensis* has been recorded on basil from southern Italy (Mazzeo *et al.*, 1994) and heavily infested basil was observed to be among the plants examined in this study.

Ben-Dov (1994) listed only one host from Crassulaceae, therefore *K. blossfeldiana* is recorded as a new host for *P. madeirensis*. However, *Adromischus cristatus* and *Chrysanthemum* were recorded by Ben-Dov (1994) as a host for this mealybug. In Tunisia, Halima-Kamel *et al.* (2014) collected *P. madeirensis* from the leaves, shoots and the collar of a single *Cestrum nocturnum* (Solanaceae)



**Fig. 2** Mounted *Phenacoccus madeirensis* adult. [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

plant, which was the first record of this species in North Africa.

*Phenacoccus madeirensis* has often been misidentified as *Phenacoccus gossypii*. Both species were redescribed, illustrated and their range of variation discussed in Williams (1987). *Phenacoccus madeirensis* Green was also redescribed from Turkish material (Kaydan *et al.*, 2012). Abd-Rabou *et al.* (2012) combined molecular analysis of three DNA markers with morphological examination for the identification of 17 mealybug species (including *P. madeirensis*) infesting various crops and ornamental plants in Egypt and France.

Mealybugs have been discovered attacking cassava crops (*Manihot esculenta*) in Colombia and their natural enemies surveyed and briefly described. *Acerophagus coccois* (Encyrtidae: Hymenoptera) was found to parasitize females of *P. madeirensis*, while *Cleothera* [*Hyperaspis*] sp. and *Cleothera notata* [*H. notata*] (Coccinellidae: Coleoptera) were the main predators. Larvae of *Ocyptamus* (Syrphidae: Diptera) attacked the eggs. *Anagyrus amnestos*, Noyes and Poorani, 2013 (Hymenoptera: Encyrtidae) was recorded as a koinobiont endoparasitoid of *P. madeirensis* in Turkey. An undetermined coleopterous larva (Fig. 4) was observed in one of the ovisacs. The local predators and parasitoids of this mealybug are unknown at this stage.

*Phenacoccus madeirensis* could potentially become a serious pest on many ornamentals as well as cultivated plants. Infestations have already been detected on five avocado trees planted as ornamentals in an outdoor garden of the same house. The Jordan Valley is a very suitable environment for the development of this species. Chong *et al.* (2003, 2004) and Yeh (2006) found that *P. madeirensis* can reproduce at temperatures between 15°C and 35°C and females may produce about 500 eggs. The movement of ornamentals from and to the Jordan Valley may contribute to the spread of this pest in Jordan. Many nurseries are located in the Jordan Valley and their plants are sold in the highlands (Amman and other major cities). Further investigations are needed to determine the current distribution and hosts of this pest in Jordan in order to prevent it from

**Fig. 3** *Phenacoccus madeirensis* male cocoon (left), pre-pupa (middle), and adult (right). [Colour figure can be viewed at wileyonlinelibrary.com]



**Fig. 4** Coleopterous predator of *Phenacoccus madeirensis* eggs. [Colour figure can be viewed at wileyonlinelibrary.com]

spreading to new areas or hosts. This should include inspection of ornamental nurseries and other cultivated plants and a search for local natural enemies of *P. madeirensis*.

### Premier signalement de la cochenille *Phenacoccus madeirensis* Green (Hemiptera : Pseudococcidae) en Jordanie

La cochenille *Phenacoccus madeirensis* (Hemiptera : Pseudococcidae) est signalée pour la première fois en Jordanie. Des spécimens ont été prélevés sur des géraniums d'ornement fortement infestés, *Pelargonium* sp. (Geraniaceae), ainsi que sur chrysanthème, *Chrysanthemum* sp. (Asteroideae), rose de Chine, *Hibiscus rosa-sinensis* L. (Malvaceae), kalanchoé, *Kalanchoe blossfeldiana* Poellnitz (Crassulaceae), et sur basilic, *Ocimum basilicum* L. (Lamiaceae). Cette cochenille a également été prélevée sur des feuilles infestées de tomate cerise, *Solanum lycopersicum* L., et de poivron, *Capsicum annum* L. (Solanaceae). *Kalanchoe blossfeldiana* est signalée comme étant une nouvelle espèce hôte de *P. madeirensis*. Des lames d'observation ont été préparées et des spécimens de référence ont été conservés au musée des insectes de l'Université de Jordanie. Une prospection devrait être entreprise d'urgence afin de déterminer la répartition géographique actuelle de l'insecte en Jordanie. L'inspection des pépinières ornementales devrait être réalisée en priorité et les responsables de la protection des végétaux devraient prêter attention à cet organisme nuisible important.

### Первые сведения об инвазивном мучнистом червце *Phenacoccus madeirensis* Green (Hemiptera: Pseudococcidae) в Иордании

Мадейрский мучнистый червец *Phenacoccus madeirensis* (Hemiptera: Pseudococcidae) был впервые зарегистрирован в Иордании. Образцы были собраны с сильно заражённых декоративных растений герани, *Pelargonium* sp. (Geraniaceae), *Chrysanthemum* sp. (Asteroideae), *Hibiscus rosa-sinensis* L. (Malvaceae), *Kalanchoe blossfeldiana* Poellnitz (Crassulaceae), базилика, *Ocimum basilicum* L. (Lamiaceae). Кроме того, этот мучнистый червец был снят с заражённых листьев помидоров черри, *Solanum lycopersicum* L. и сладкого перца *Capsicum annum* L. (Solanaceae). *Kalanchoe blossfeldiana* был зарегистрирован как новый хозяин для *P. madeirensis*. Были подготовлены микропрепараты, контрольные образцы были сохранены в Музее насекомых Иорданского университета. В срочном порядке необходимо провести обследование с целью определения нынешнего распределения вредителя в Иордании. Досмотр декоративных питомников должен быть первоочередным и должностные лица по карантину и защите растений должны уделить внимание этому опасному вредному организму.

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