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## THE INVASIVE HIBISCUS MEALYBUG *MACONELLOCUS HIRSUTUS* (HEMIPTERA: PSEUDOCOCCIDAE) AND ITS RECENT RANGE EXPANSION IN BRAZIL

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*Maconellicoccus hirsutus* (Green, 1908) (Hemiptera: Pseudococcidae) is an invasive mealybug species originally from Southern Asia or Australia (Williams 1996; Goolsby et al. 2002) that has expanded its range to other parts of the world including the Middle East, Africa, the Caribbean, North America, and South America (Guyana, French Guiana, Venezuela, Suriname, Colombia) (OEPP/EPPO 2005; Ben-Dov et al. 2012). This insect was first detected in Brazil in 2010 in the State of Roraima near Venezuela and Guyana (Marsaro Júnior et al. in press) and the purpose of this note is to document the recent discovery of *M. hirsutus* in a second Brazilian State, Espírito Santo (approximately 3.400 km southeast of Roraima in a major agricultural region). As an invasive, plant-feeding species with a wide variety of plant hosts, *M. hirsutus* is a potential pest and is likely to become more widely established in Brazil and South America. Therefore, information on the biology and management of *M. hirsutus* based on its past invasions of other regions is provided to reduce economic and ecological impacts of this and similar invasive pests in areas where they may be newly introduced or have become established.

Okra (*Abelmoschus esculentus* (L.) Moench; Malvales: Malvaceae) plants infested with insects were noticed in a commercial field (approximately 3 ha) intercropped with coffee (*Coffea canephora* Pierre ex A. Froehner; Gentianales: Rubiaceae) and papaya (*Carica papaya* (L.); Brassicales: Caricaceae) in the municipality of Cachoeiro de Itapemirim, Espírito Santo State, Brazil, in May 2012. A sample consisting of several okra fruits with stem and leaves, heavily infested with the insects was collected from the field on 28 May 2012, enclosed in a paper bag and transported to Vitória, Espírito Santo for identification of the insects. Following preliminary identification of the insects as *M. hirsutus* mealybugs, 10 adult females were preserved in alcohol for confirmation of the identity of the species. In Jun and Jul 2012

okra and other plants in the field and nearby areas were examined and additional samples of insect infested okra and weed plants were collected from the areas examined. In Nov 2012 samples were collected from the original municipality and 2 neighboring municipalities.

Preliminary identification of the insects as *M. hirsutus* was based on the plant host, and live appearance characteristic of the species: pinkish females covered with white, powdery wax, reddish egg masses and nymphs, with large numbers of eggs and nymphs. Identification of the mealybugs as *Maconellicoccus hirsutus* was confirmed by A.L.B.G. Peronti based on microscopic examination of slide mounted individuals and observation of key characteristics of the species (Rung et al. 2007); collection data: Brazil, Espírito Santo State, Cachoeiro de Itapemirim, 20° 41' 59.41" S, 41° 10' 16.76" W, 28-V-2012, col. J. S. Zanuncio Junior, host *Abelmoschus esculentus* (Malvaceae). Following confirmation of the identification, responsible State Agencies were notified and okra plants in the infested field were cut down in an effort to eliminate the infestation.

Additional *M. hirsutus* specimens were identified in samples collected from the field site in Jun (from 5 of 5 okra samples) and Jul (from 1 of 7 okra samples, 1 of 1 sample from *Solanum americanum*, and 1 of 1 sample from an unidentified weed (none were found on 1 sample of *Ageratum conyzoides*). *Phenacoccus solenopsis* Tinsley (Hemiptera: Pseudococcidae) was also found on 5 samples collected from okra, and on *S. americanum*; and a Coccidae was found on one okra sample. No *M. hirsutus* were observed on papaya and coffee plants in the field in which the species was found, and none was observed in neighboring areas in Jun and Jul. However, in Nov 2012 *M. hirsutus* was found in the municipality where it was initially collected and also in 2 neighboring municipalities (unpublished data).

Our observations indicate that *M. hirsutus* is established in Espírito Santo and this record

represents a major expansion in the known geographic distribution of this species. Because *M. hirsutus* is a potential plant pest in this and nearby regions, agricultural management methods may need to be modified because of its presence. Pheromone traps will likely be useful for detecting entry of *M. hirsutus* into new areas and for monitoring the insect where it has become established (Francis et al. 2007; Hall et al. 2008; González-Gaona et al. 2010).

*Maconellicoccus hirsutus* feeds on the sap of plants and has been recorded from a very large number and diverse variety of plant species (about 300) from approximately 75 families (Ben-Dov et al. 2012). However, many of these records may be of incidental hosts (Kairo et al. 2000; Michaud & Evans 2000) and although *M. hirsutus* may occur on many different species of plants, it is likely that relatively few species are suitable hosts for development of this insect and even fewer are favorable hosts (Sagarra and Peterkin 1999; Michaud 2003; Aristizábal et al. 2012). Natural enemies of *M. hirsutus* also commonly inhibit development of damaging populations of this pest in areas where they are present (Sagarra and Peterkin 1999; Michaud & Evans 2000; Michaud 2003; Roltsch et al. 2006; Reddy et al. 2009).

*Maconellicoccus hirsutus* is subject to biological control by a large complex of natural enemies (Krishnamoorthy & Mani 1989; Michaud & Evans 2000; Meyerdirk et al. 2001; Goolsby et al. 2002; Roltsch et al. 2006; Abd-Rabou 2008; Ben-Dov et al. 2012; Noyes 2012) and in most areas where this mealybug has become established, native or introduced natural enemies of the species have been effective in maintaining *M. hirsutus* populations below unacceptable levels (Sagarra & Peterkin 1999; Michaud & Evans 2000; Michaud 2003; Roltsch et al. 2006; Reddy et al. 2009). Therefore, it is apparent that management of *M. hirsutus* in invaded areas depends on preservation (conservation) of its natural enemies (and introduction of natural enemies if they are not present). Many of the natural enemies of *M. hirsutus* are widely distributed and 25 are known to occur in the Neotropical region with at least 8 species present in Brazil including *Anagyrus kamali* Moursi (Hymenoptera: Encyrtidae) and *Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae), considered to be the principal species responsible for control of *M. hirsutus* in invaded areas (Sagarra & Peterkin 1999; Michaud & Evans 2000; Sanches et al. 2002; Roltsch et al. 2006; Reddy et al. 2009; Culik et al. 2011). Two unidentified species of Coccinellidae and an unidentified dipteran predator were found associated with the *M. hirsutus* observed in the present study (unpublished data) confirming that natural enemies are likely to contribute to control of the pest in this region.

## SUMMARY

In South America the invasive hibiscus mealybug *Maconellicoccus hirsutus* (Green, 1908) (Hemiptera: Pseudococcidae) has been restricted to Caribbean South America until recently but in 2010 it was detected in Northern Brazil in Roraima, and this is the first report of this insect in a second Brazilian State, Espírito Santo, located approximately 3,400 km southeast of Roraima. Because *M. hirsutus* is a potential pest of many plant species and may become more widely established in South America, pheromone traps may be useful for detecting entry into new areas and monitoring this mealybug. Although *M. hirsutus* has been recorded on a diverse variety of plants, apparently few are favored hosts, and in most areas where it has become established natural enemies maintain populations of this mealybug below damaging levels, indicating that besides prevention of spread of this pest, efforts should be directed toward establishment, augmentation, and maintenance (conservation) of effective natural enemies of *M. hirsutus* in invaded areas for control of this invasive pest.

Key Words: biodiversity; biological control; geographic distribution; invasive species; Neotropical; natural enemies

## RESUMO

Até recentemente na América do Sul, a cochonilha *Maconellicoccus hirsutus* (Green, 1908) (Hemiptera: Pseudococcidae) estava restrita à região do Caribe, mas em 2010 foi detectada pela primeira vez no Brasil, em Roraima, e agora em 2012 foi encontrada no estado do Espírito Santo, localizado aproximadamente 3400 km a sudeste de Roraima. *Maconellicoccus hirsutus*, uma praga potencial de plantas economicamente importantes, pode tornar-se amplamente estabelecida na América do Sul e o uso de armadilhas de feromônio pode ser útil para detectar a entrada em novas áreas e para monitorar essa cochonilha. Embora *M. hirsutus* tenha sido registrada em um grande número de espécies de plantas, aparentemente poucas são hospedeiras preferidas e na maioria das áreas onde o inseto foi estabelecido, inimigos naturais mantêm as populações dessa cochonilha abaixo dos níveis prejudiciais. Isto indica que, além de prevenção da disseminação da cochonilha, esforços devem ser direcionados para evitar o estabelecimento dessa praga invasora e para o aumento a preservação de seus inimigos naturais em áreas invadidas.

Palavras-chave: biodiversidade, controle biológico, distribuição geográfica, espécies invasoras, Neotropical, inimigos naturais

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