

TSTAR FY2008 - Final Report 2010

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Project Title: *Investigating bio-ecological factors influencing infestation of the invasive passionvine mealybug, *Planococcus minor* (Maskell) (Hemiptera: Pseudococcidae). A potential threat to the US.*

The passionvine mealybug, *Planococcus minor* has recently been recorded in southern Florida. This grant allowed us to study the biology of *P. minor* as it travelled through the Caribbean to the United States. The project has allowed us to study the ecological factors that support the establishment of *P. minor* and develop management tactics to suppress populations in new areas.

1. Objective 1. Determine the life history of *P. minor* at constant temperatures

Life history data on *P. minor* will be useful for developing models of potential spread and improving predictions of its distribution. The effects of different temperatures (15, 20, 25, 29, and 35 °C) on the development, survival, and reproduction of *P. minor* on sprouted potatoes (*Solanum tuberosum* L.) were investigated in environmental chambers at CAB facilities in Curepe, Trinidad. The results indicated that colonies failed to establish at 15 and 35 °C. At temperatures ranging between 20 and 29 °C, the duration of development of all stages was shortened with increasing temperature. The total duration of development for females was ~49 days at 20 °C, 31 days at 25 °C, and 27 days at 29 °C. Overall developmental time of males was 2-3 days longer than females. Survival rates of individual instars averaged > 90%. From egg to adulthood, > 80% of individual mealybugs completed development. Females made up > 50% of the adult populations in all temperature treatments. Adult females at 25 °C recorded the highest fecundity, ~270 eggs.

Objective 2. Conduct surveys of *P. minor* and potential natural enemies in Puerto Rico

Several natural enemies were collected in Puerto Rico that is believed to play an important role in regulating *P. minor* populations. Experiments conducted in 2009 and 2010 with sprouted potatoes in cages excluding selected predators or allowing natural predation (with and without tangle-foot) found a few parasitoids in the family Encyrtidae (*Leptomastix dactylopii*). *Leptomastix dactylopii* is common in the West Indies and it is a known natural enemy of *Planococcus* spp. (Krishnamoorthy and Singh 1987). In addition to *L. dactylopii*, we found beetles in five families: Erotylidae (*Loberus* sp.), Coccinellidae (*Diomus* sp.), Curculionidae (*Hypothenemus* sp.), Laemophloeidae (*Cryptolestes ferrugineus*) and Monotomidae (*Europs* sp.) Of the beetles recorded only those in the family Coccinellidae appeared to be predaceous on mealy bugs. Other miscellaneous insects found were ants (Formicidae) in the genus *Wasmannia* and few predatory thrips in the families Aleoarthripidae and Phlaeothripidae.

Objective 3. Evaluate the impact of key natural enemies of *P. minor* under field conditions.

Three treatments using *P. minor* infested potatoes with adult females, 3rd instar nymphs, and 2nd instar nymphs, respectively, were used to evaluate the parasitoid (*Leptomastix dactylopii* and *Coccidoxenoides perminutus*) field dynamics at a cacao field site. Treatment 1 was mealybug + ant excluded, treatment 2 was mealybug + ant tended, and treatment 3 was mealybug, ant, and parasitoid excluded. The results indicated that no parasitoids were recovered from treatment 3, and percent parasitism did not exceed 17% from treatments 1 and 2 across sampling dates. Parasitism rates for adult females, 3rd instar nymphs, and 2nd instar nymphs were higher from treatment 1 than from treatment 2. *Leptomastix dactylopii* Howard was recovered from adult females and 3rd instar nymphs, with a female-biased sex ratio. *Coccidoxenoides perminutus* Girault was recovered from 2nd instar nymphs. This species is thelytokous; therefore no sex ratio determination was necessary. Parasitism data showed that rates for these two species were generally low. *Leptomastix dactylopii* was recovered more frequently and in higher numbers than *C. perminutus*.

Biological control agents that suppress *P. minor* populations are most useful for long-term control options. These agents have had some success with *Planococcus* sp. in India. The encyrtid parasitoid, *Leptomastix dactylopii* was introduced to control *Planococcus* sp. and achieved levels of field parasitization from 3.8-100% in coffee estates (Reddy et al. 1992, Reddy et al. 1997).

Coccidoxenoides perminutus Girault is another primary parasitoid that was reported to cause 10-30% parasitism in *P. citri* infested orchards (Krishnamoorthy and Mani 1989).

Summary. We completed all of the objectives outlined in the proposal. *Planococcus minor* has officially arrived in the United States. This pest has recently been recorded in southern Florida. This project is providing baseline information for management of this new invasive species. Over the next few years we will be publishing some of our findings from the project.

2. Outputs

Recent Publications.

Francis, A. W., K. T. Moses, A. L. Rod and O. E. Liburd. The passionvine mealybug, *Planococcus minor* (Maskell) (Hemiptera: Pseudococcidae), in Trinidad: A new invasion or a case of fortuitous biological control? *Submitted to Biological Control*

Francis, A. W. 2011. Investigation of bio-ecological factors influencing infestations by the passionvine mealybug, *Planococcus minor* (Maskell) (Hemiptera: Pseudococcidae) in Trinidad. Application towards its management. A Ph.D. dissertation submitted to the graduate school in partial fulfillment of the requirements for the degree of Doctor of Philosophy; August 2011.

Francis, A., M., T. K. Kairo, A.L. Roda, and P. Polar. Pheromone trapping and phenology of *Planococcus minor* (Hemiptera: Pseudococcidae) in Trinidad. Submitted to Florida Entomologist.

Conference presentations

Francis, A., M. Kairo, A. Roda, and O. Liburd. 2011. The passionvine mealybug, *Planococcus minor* (Maskell): What we know and the way forward to deal with this new incursion. Southeastern Branch of the Entomological Society of America and American Phytopathological Society - Caribbean Division Joint Meeting, San Juan, PR, 19-22 March, 2011.

Francis, A., and M. Kairo. 2010. Field assessment of two encyrtid parasitoids of *Planococcus minor* (Maskell) in Trinidad. 58th Annual Meeting of the Entomological Society of America, San Diego, CA, 12-15 December, 2010.

Francis, A., and M. Kairo. 2010. Offshore research on two candidate natural enemies for the biological control of the passionvine mealybug, a serious pest threat to the US. Poster presentation at the Global Food Security and Plant Biosecurity Symposium, Baton Rouge, LA, 9-10 November, 2010.

Francis, A., and M. Kairo. 2010. Survey for the passionvine mealybug, a potential pest threat to US agriculture, and its natural enemies in Trinidad. 25th Annual Career Fair and Training Conference, Minorities in Agriculture, Natural Resources and Related Sciences, Orlando, FL, 24-27 March, 2010.

Francis, A., M. Kairo, and A. Roda. 2010. Host size selection in *Leptomastix dactylopii* and *Coccidoxenoides perminutus*, parasitoids of *Planococcus minor*. 84th Annual Meeting of the Southeastern Branch of the Entomological Society of America, Atlanta, GA, 8-10 March, 2010.

Francis, A., and M. Kairo. 2009. The influence of different temperatures on the life history of the passionvine mealybug, *Planococcus minor* (Maskell). 57th Annual Meeting of the Entomological Society of America, Indianapolis, IN, 13-16 December, 2009.

Francis, A., M. Kairo, and A. Roda. 2009. *Planococcus minor*, a potential mealybug threat to the Caribbean and U.S. mainland. 92th Annual Meeting of the Florida Entomological Society, Ft. Myers, FL, 26-29 July, 2009.

Francis, A., M. Kairo, and A. Roda. 2009. Taking the war against invasive species offshore: The case of the passionvine mealybug, *Planococcus minor* (Maskell) in Trinidad and Tobago. Poster presentation at the Caribbean Food Crops Society Meeting, Frigate Bay, St. Kitts, 12-19 July, 2009.

References:

Krishnamoorthy A. and S. P. Singh. 1987 Biological control of citrus mealybug, *Planococcus citri* with an introduced parasite, *Leptomastix dactylopii* in India. *Biocontrol*. 32: 143-148

Krishnamoorthy, A., and M. Mani. 1989. *Coccidoxenoides peregrina*: a new parasitoid of *Planococcus citri* in India. *Current Science*. 58: 466.

Reddy, K. B., C. B. Prakasar, P. K. Bhat, and A. C. Kumar. 1992. Establishment of *L. dactylopii* How. (Hym: Encyrtidae) in Karnataka for control of *Planococcus citri* (Risso) (Hom: Pseudococcidae) of coffee. *J. Coffee Research*. 22 (1): 37-44.

Reddy, K. B., and H. G. Seetharama. 1997. Integrated management of mealybugs in coffee. *Indian Coffee*. 61 (3): 26-28.