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Managing Alien Invasive Species through Classical Biological Control: Case Study of the Papaya Mealybug in West and Central Africa

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Abstract

West and Central Africa have been repeatedly exposed to exotic pests and diseases - accidentally introduced - rapidly spreading and causing serious crop losses (e.g. 40 % typical yield losses for the introduced cassava mealybug, 35 % for cassava green mite, 90 % for mango mealybug, and 66 % for the water hyacinth). In all aforementioned cases, biological control through introduced natural enemies (e.g. parasitoids or predators) has redressed the situation maintaining the pests below economic damage levels. The latest exotic pest invading West Africa, the papaya mealybug, *Paracoccus marginatus* Williams & Granara de Willink (Hemiptera: Pseudococcidae), a native to Mexico, was first detected on the African continent at the end of 2009 when outbreaks were causing severe damage in papaya orchards near Accra, Ghana. Currently, this highly polyphagous pest has already spread to at least 15 countries on the African continent attacking more than 80 host plants in 33 botanical families including important tropical crops, fruits, ornamentals and wild plants. To contain this invasive pest, a classical biological control project involving national partners from Ghana, Togo, Benin, Nigeria, Cameroon and Gabon was initiated by IITA in 2012. For its implementation, the specific exotic encyrtid parasitic wasp *Acerophagus papayae* Noyes & Schauff (Hymenoptera: Encyrtidae) originating from USDA Puerto Rico was imported following a pilot project in Ghana, mass reared at IITA Cotonou, Benin, and field released in papaya mealybug hot spot locations in West and Central Africa between 2013 and 2015. Field evidence shows that by 2015 the exotic parasitoid had been able to spread and establish in all papaya mealybug infested areas of Ghana, Togo, Benin, Nigeria and Cameroon covering a distance of more than 1500 km. Field monitoring conducted at regular intervals over 2 years in Benin shows that already shortly following its introduction, the natural enemy was able to decrease papaya mealybug populations by more than 90 % of their initial densities and to maintain it at such levels. This drastic reduction in the mealybug pest population underpins, along similar actions conducted in the Caribbean, Pacific islands and elsewhere, a good ability of the parasitoid to adapt to a wide range of climatic conditions which is crucial for a successful and permanent control of the papaya mealybug in Africa. In addition to the above cases with reported estimated savings of

e.g. 7.9 to 20.2 US\$ billions for the cassava mealybug alone, depending on the modelling scenario, the recent case of the papaya mealybug further shows that classical biological control remains the most efficient and practical control option against alien invasive species. All these successes have only been possible because of sustained effort by dedicated research and extension staff, effective partnerships within and beyond the African continent, and the continuous support of development investors who have been factually convinced by this type of approach.

Keywords: *Acerophagus papayae*, alien invasive species, exotic pests, parasitic wasp, yield losses