

Research Application Summary

Assessment of the fruit fly, *Bactrocera invadens*, pest status and the establishment of the parasitoid, *Fopius arisanus* in Mozambique

Cugala, D.¹, Santos, L.¹ & Albano, G.¹

¹Faculty of Agronomy and Forest Engineering, Eduardo Mondlane University, Main University Campus, P.O. Box 257, Maputo, Mozambique

Corresponding author: dcugala@uem.mz

Abstract

Asian fruit flies in the genus *Bactrocera* (Diptera: Tephritidae) are regarded as some of the most destructive pests of fruits and vegetables worldwide and rank high on quarantine lists worldwide. Losses result from direct feeding damage, decay by opportunistic pathogens, and the loss of export market through quarantine restrictions imposed by importing countries to avoid entry and establishment of these pests. *Bactrocera invadens* is the most important pests of fruits and vegetables in Mozambique. The present project research will evaluate *B. invadens* population dynamics, fruit damage and yield loss due to fruit flies, conduct field releases and parasitoid establishment evaluation and will assess farmer's perception on the occurrence and socio economic impact of *B. invadens* on fruit and vegetable production and food security.

Key words: *Bactrocera invadens*, *Fopius arisanus*, fruit flies, groundnut, Mozambique, parasitoids

Résumé

Les mouches de fruit asiatiques de genre *Bactrocera* (Diptera: Tephritidae) sont considérés dans le monde entier comme parmi des parasites les plus destructifs des fruits et des légumes et se rangent à un haut niveau sur des listes de quarantaine dans le monde entier. Les pertes résultent des dommages directs d'alimentation, de l'affaiblissement par les microbes pathogènes opportunistes et de la perte du marché d'exportation par des restrictions de quarantaine imposées par des pays d'importation pour éviter l'entrée et l'établissement de ces parasites. *Bactrocera invadens* est le parasite le plus important des fruits et des légumes au Mozambique. La recherche actuelle de projet évaluera la dynamique de population de *B. invadens*, les dommages de fruit et la perte de rendement dus aux mouches de fruit, les dégagements de champ de conduite et l'évaluation d'établissement de parasitoïde et évaluera la perception du fermier sur l'occurrence et l'impact socio-économique du B.

invadens sur la production de fruits et de légumes et la sécurité alimentaire.

Mots clés: *Bactrocera invadens*, *Fopius arizanus*, mouches de fruit, arachides, Mozambique, parasitoïdes

Background

Fruit flies (Diptera : Tephritidae) are among the most important and widespread pests of fruits and vegetables worldwide. Many species are of African origin. However, Asian invasive species have also invaded African continent, among them *Bactrocera* species (Mwatawala et al., 2006). *Bactrocera invadens* is one of the *Bactrocera* species that invaded the African continent. It was recorded for the first time in 2003 from the Kenyan coast (Ekesi and Billah, 2006). In Mozambique, *B. invadens* was first recorded in 2007 in Cuamba, Niassa Province and in 2008 it was recorded in Cabo Delgado, Nampula and Manica provinces (Cugala et al., 2009). Recently it was detected in Zambezia, Tete and Sofala provinces. *B. invadens* is now well established and widespread in the Northern province of Mozambique.

In the absence of control methods, damage and crop losses due to *B. invadens* can be up to 100%. The presence of *B. invadens* in Mozambique will affect not only the commercial sector, but mainly small scale farmers that use fruits and vegetables for subsistence, cash income and food security. Fruit fly control methods are based on regular insecticide sprays. In Mozambique, insecticides have been used on large scale farms, but there is little or no use of insecticides by small scale farmers, because of the high cost. Until now, no single control method to reduce *B. invadens* population has been applied in Mozambique (Cugala et al., 2009).

Due to the fact that few surveillance activities have been conducted in Mozambique, the geographic distribution, and population dynamics of *B. invadens* and its impact on fruits and vegetables production are not well known. This study will evaluate *B. invadens* population dynamics, fruit damage and crop loss, initiate implementation of control strategies that are economically viable, sustainable and environmental friendly.

Literature Summary

Fruits and vegetables production is seriously constrained by the presences of fruit flies worldwide. Fruit flies belonging to the family Tephritidae are considered a very destructive group of insects that cause enormous economic losses in fruits and

vegetables (Vayssières *et al.*, 2009). Reduction in fruit and vegetable production in quantity and quality due to fruit fly infestations will affect nutritional status and food security of the majority of population living in rural areas.

Fruit fly control needs a combination of strategies. Integrated fruit fly control methods include: male annihilation technique (MAT), bait stations, biological control (entomopathogens, parasitoids), use of GF-120 and orchard sanitation (Ekesi and Billah, 2006). Classical biological control has traditionally emphasized the control of introduced pests through the introduction of old association natural enemies from the pest's native home. Old association natural enemies are best adapted to locating and successfully attacking the target pest species. Following this approach, *Fopius arisanus*, an egg-pupal parasitoid of Asian origin was introduced in Kenya, Tanzania and Uganda where it became established and it was found to have promising potential in reducing *B. invadens* population (Ekesi and Billah, 2006). This parasitoid will be released in Mozambique to increase the natural suppression of *B. invadens*.

Study Description

Field and laboratory work will be conducted in six selected locations in the Northern province of Cabo Delgado, where *B. invadens* is well established and widespread. Field work will consist of, 1) surveillance in farmers' fields for population dynamics; 2) fruit sampling for fruit damage, loss and parasitoid establishment; and 3) releasing of the parasitoid *Fopius arisanus*. Monitoring the fluctuations in the populations of *B. invadens* throughout the year will be done by trapping in the study sites. Para-pheromone lures such as Methyl Eugenol (for *B. invadens*), and Cuelure (for species of genus *Dacus*, *Bactrocera cucurbitae*) will be used in dry traps of type tephri trap and/or chempac Bucket trap. An insecticide strip (DDVP: 2,2 Dichlorovinyl dimethyl phosphate) will be placed in the traps to kill any attracted fruit fly.

An average density of 1 to 2 para-pheromone dry traps per hectare will be used. The exact position of each trap will be determined by using Geographic Positioning Systems (GPS). All traps will be inspected for captured fruit flies at weekly interval in each of the sampling sites. The lures will be replaced every 4 weeks to obtain the best results. All flies from each trap and type of lure will be removed from the traps and placed on plastic vials containing 70% or absolute alcohol and then taken to laboratory. In the laboratory, the fruit fly specimens

will counted and identified. The number of fly per trap per day will be estimated for *B. invadens* population density.

Damage and yield loss assessment will be conducted on mango and guava at each study site, 10 host trees will be selected and 10 to 20 fruits will be collected at monthly interval. The fruits will be inspected for fruit fly infestation (punctures), counted, weighted and placed in containers covered with fine net and a bottom layer of sand and then taken to the laboratory for rearing of fruit flies and parasitoids. Fruit samples will be incubated for at least six weeks. The sand will be sieved every four days for pupae collection. All pupae will be placed into small hatchery boxes for adult emergence. All fruit fly adults and other insects which will emerge will be collected, counted and identified to species level. Level of parasitism, fruit damage, yield loss and infestation rate will be estimated.

Fopius arisanus (Hymenoptera: Braconidae) will be obtained from mass rearing at Quarantine Unit at The International Centre of Insect Physiology and Ecology (ICIPE), Nairobi. The exotic parasitoid will then be released into Northern region of Mozambique when the host fruit fly, *B. invadens*, is abundant. About 1000 adult parasitoids will be released at each study site according to the method described by Ekesi and Billah (2006). Field monitoring of *F. arisanus* will be conducted at least three months after releases to evaluate parasitoid's field colonization and one year after releases for parasitoid establishment by sampling infested fruits.

Research Application

This research is expected to have *B. invadens* population dynamics determined, damage and fruit yield loss due to *B. invadens* infestation quantified, parasitoid, *Fopius arisanus*, released and establishment and preliminary impact evaluated. Also farmer's perception and socio-economic implications of the occurrence of *B. invadens* in small scale farmers fruit and vegetable production system determined.

Acknowledgement

The present study is funded by the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM).

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