Preparedness in biological control of priority biosecurity threats

Peach fruit fly, *Bactrocera zonata* (Saunders)

Introduction

Bactrocera zonata Saunders (Diptera: Tephritidae), commonly known as peach fruit fly, is a serious and polyphagous fruit pest native to tropical Asia and was first recorded in India. It is currently present in Southern and South-East Asia but has also spread and established in Egypt and other north African countries where it causes tremendous damage (EPPO 2010). Crop damage is caused through punctuation by oviposition under the fruit skin and the subsequent larval development. The main host species for *B. zonata* are guava, mango and peach. However, a total of over 50 cultivated and wild plants are recorded as host species (EPPO 2010). International tourism and trade of infested fruit are the main reason of introduction of *B. zonata* into new areas, where it has a high dispersal ability based on its polyphagy, high reproduction rates and good mobility.

Current distribution patterns suggest that it has the ability to establish in tropical and subtropical conditions, possibly including the Mediterranean area. Its dispersal is mainly restricted by temperature and humidity. Under climate change conditions, the potential distribution area is assumed to increase poleward resulting in an expansion in Asia, North America, South America, Europe and New Zealand and a decrease in Africa and Australia (EPPO, 2010)

History of classical biological control against *Bactrocera zonata*

Even though *B. zonata* is a serious pest, few documented attempts have been conducted by releasing natural enemies because of a lack of knowledge about potential biological control agents.

Mohamed et al. (2016) summarised the effort that has been done releasing different parasitoids against *B. zonata* in Africa. Namely, *Aganaspis daci* (Weld) (Hymenoptera: Figitidae), *Fopius arisanus* (Sonan), *Diachasmimorpha longicaudata,* (Ashmead) and *Psyttalia incisi* (Silvestri) (Hymenoptera: Braconidae) have all been released and, with the exception of *P. incisi,* all have at least partially established.

Detailed monitoring results are still lacking. In Pakistan, parasitism rates of *B. zonata* by *A. daci* (native to South-East Asia) are reported to have reached 45% whereas preliminary results from Egypt indicate less than 10% parasitism by *A. daci* (El-Heneidy et al. 2014).

Most promising natural enemies

Rousse et al. (2005) suggested that *F. arisanus* could be used as a biological control agent in African countries were *B. zonata* is invasive. In the laboratory, *F. arisanus* is able to parasitize *B. zonata* with survival rates on *B. zonata* eggs of more than 70% (Rousse et al. 2006). However, climatic conditions might not be suitable for *F. arisanus* in North African countries were *B. zonata* (Ndlela et al. 2016).

Similarly, although *A. daci* is known to parasitize *B. zonata,* climatic conditions in North Africa may not be suitable for the establishment of this parasitoid due to its thermal requirements (being lower

than for *B. zonata*); it is therefore not recommended for use against *B. zonata* in Egypt by Adly (2016).

Other natural enemies

In a Sudanese monitoring study, Mahmoud et al. (2020) found *Tetrastichus giffardianus* (Silvestri) (Hymenoptera: Eulophidae), *Agonaspis* sp. and *Psyttalia* sp. (Walker) (Hymenoptera: Braconidae) to be associated with *B. zonata*. However, because of the low parasitism rates, their use as biological control agents is not recommended.

Furthermore, the following natural enemies (all Hymenoptera: Braconidae) have been reported to parasitize *B. zonata* (Stibick 2004): *Fopius vandenboschi* (Fullaway), *Austroopius* sp., *Opius* sp., *Psyttalia makii (*Sonan), *Psyttalia* sp. nr. *fletcheri* (Silvestri) and probably *Fopius persulcatus* (Silvetsri). Their potential as biological control agents still needs to be investigated.

References

1. Adly, D. (2016) Thermal requirements of the peach fruit fly, *Bactrocera zonata* (Saunders) (Diptera: Tephritidae), and its exotic parasitoid species *Aganaspis daci* (Weld) (Hymenoptera: Eucoilidae). Egyptian Academic Journal of Biological Sciences 9: 89-96.
2. El-Heneidy, A., Hosni, M., Ramadan, M. (2014) Potential of the parasitoid species, *Aganaspis daci* (Weld) (Hymenoptera: Eucoilidae) against the peach fruit fly, *Bactrocera zonata* (Saund.) (Diptera: Tephritidae). In Proceedings of the Ninth International Symposium on Fruit Flies of Economic Importance (ISFFEI), Bangkok, Thailand, May 2014, pp 395–400.
3. EPPO (2010) PM 9/11 (1): *Bactrocera zonata*: procedure for official control. EPPO Bulletin 40(3):39 - 395.
4. Mahmoud, M.E.E., Mohamed, S.A., Ndlela, S., Azrag, A.G.A., Khamis, F.M., Bashir, M.A.E., Ekesi, S. (2020) Distribution, relative abundance, and level of infestation of the invasive peach fruit fly *Bactrocera zonata* (Saunders) (Diptera: Tephritidae) and its associated natural enemies in Sudan. Phytoparasitica 48(4):589 - 605.
5. Mohamed, S.A., Ramadan, M.M., Ekesi, S. (2016) In and Out of Africa: Parasitoids Used for Biological Control of Fruit Flies. In: Ekesi, Mohamed et al. (Eds.) Fruit Fly Research and Development, 235 - 368.
6. Ndlela, S., Mohamed, S., Ndegwa, P., Ongamoo, G., Ekesi, S. (2016) Release, establishment and dispersal of *Diachasmimorpha longicaudata* (Ashmead) and *Fopius arisanus* (Sonan): Hymenoptera: Braconidae, for the management of *Bactrocera dorsalis* in Kenya.
7. Rousse P, Gourdon F, Quilici S (2006) Host specificity of the egg pupal parasitoid *Fopius arisanus* (Hymenoptera: Braconidae) in La Reunion. Biol. Control 37(3):284 - 290.
8. Rousse, P., Harris, E.J., Quilici, S. (2005) *Fopius arisanus*, an egg–pupal parasitoid of Tephritidae. Overview. Biocontrol News and Information 26(2):59N - 69N.
9. Stibick, J.N.L (2004) Natural enemies of true fruit flies (Tephritidae). United States Department of Agriculture (USDA). Animal and Plant Health Inspection Service (APHIS).