14.3 Old and New Host-parasitoid Associations: Parasitism of the Native African and Invasive Fruit flies Species

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In Africa, horticulture is an important agricultural subsector for ensuring food security and providing job opportunities for millions of growers and other stakeholders along the commodities value chain. However, the subsector is hindered by several constraints, ranked high among them is the tephritid fruit flies, causing both direct (> 80% fruit yield losses) and indirect losses through quarantine restriction imposed by importing countries, resulting in annual losses of approximately two billion dollars (Ekesi *et al.*, 2016). Although Africa is home of key notorious fruit fly species, some of which, e.g., *Ceratitis capitata* Wiedemann and *Bactrocera oleae* Rossi (Diptera: Tephritidae), invaded and established as a major pests in other part of the world (De Meyer and Ekesi, 2016), the continent continues to be invaded by alien fruit flies (Lux *et al.*, 2003; Mwatawala *et al.*, 2007; De Meyer and Ekesi, 2016) further compounding the threat to horticultural industry in Africa. Proper management of these pests requires a holistic IPM approach of which biological control is viewed as an essential component (Wharton, 1989; Mohamed *et al.*, 2016). This paper highlights the results of performance of three African native parasitoid species; *Psyttalia concolor* (Szépligeti), *P. cosyrae* (Wilkinson) (Hymenoptera: Braconidae) and *Tetrastichus giffardii* Silvestri (Hymenoptera: Eulophidae) and two exotic introduced parasitoids, *Fopius arisanus* (Sonan) and *Diachasmimorpha longicaudata* (Ashmead) (Hymenoptera: Braconidae) against six native tephritid fruit fly species, *Ceratitis capitata* (Wiedmann), *C. cosyra* (Walker), *C. rosa* (Karsch), *C. fasciventris* (Bezzi), *C. anonae* Graham and *Dacus ciliatus* Loew, in addition to two alien invasive species *Bactrocera dorsalis* (Hendel) and *Zeugodacus cucurbitae* (Coquillett) (Diptera: Tephritidae). *Fopius arisanus* and *D. longicaudata* were introduced from Hawaii for classical biological control of *B. dorsalis* following its invasion and wide spread into Africa (Mohamed *et al.*, 2008; 2010).

Methodology: The acceptability of the different species of fruit flies by each parasitoid species was evaluated in no choice test. After 3 hours of exposure of 10 individuals of the suitable host stage (eggs for *F. arisanus*; or larvae for *P. concolor*, *P. cosyrae*, *T. giffardii* and *D. longicaudata*) to the parasitoids, the hosts were dissected in a saline solution under microscope. Then, the numbers of parasitized egg/larvae were recorded.

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To further investigate the performance of these parasitoid species on the target fruit fly species, the suitable host stages were exposed to the parasitoid in the same way described above. However, after the exposure the hosts, they were maintained till fruit flies and parasitoid emergence. Number of enclosed parasitoid wasps were counted and computed as percentage out the total number of retrieved puparia of each host and each parasitoid species.

Results: Acceptability in terms of the number of parasitized eggs or larvae varied with the host species, generally being highest on the parasitoid natural host. However, the invasive fruit fly *B. dorsalis* was moderately accepted by the indigenous parasitoid *T. giffardii* while the native fruit fly, *C. cosyra* was highly accepted by the introduced parasitoid *D. longicaudata* (Table 14.3.1).

Table 14.3.1. Acceptability of the five parasitoid species for key African native and invasive fruit flies species.

Host species	Host species				
	Psyttlia concolor	***Psyllia cosyrae***	***Tetrastichus giffardii***	***Fopius arisanus***	***Diachasmimorpha longicaudata***
Ceratitis capitata	++	+	+	+	+
Ceratitis cosyra	+	++	+	+	++
Ceratitis rosa	-	-	-	-	-
Ceratitis fasciventris	-	-	-	-	-
Ceratitis anonae	-	-	-	-	-
Dacus ciliatus	N/T	N/T	++	N/T	N/T
Bactrocera dorsalis	-	-	+	++	++
Zeugodacus	-	-	-	N/T	N/T

Poorly accepted (-); Moderately accepted (+); Highly accepted (++); Not Tested (N/T).

Generally, parasitoid performance, as measured by percent viable eclosed parasitoid wasps, was higher when reared on their respective co-evolved host species (Fig. 14.3.1 and 14.3.2). Although, the native parasitoid also perfomed differentially on the native fruit flies species (Fig. 14.3.1) with species in the FAR group (*C. rosa*, *C. fasciventris, C. anonae*) being non or very poor hosts. The introduced parasitoids were able to establish new association with some of the native fruit fly species, but the reverse was not true; whereby, the native parasitoid were unable to parasitize the alien fruit fly species as their egg were encapsulated in these host species (Fig. 14.3.1 and 14.3.2).

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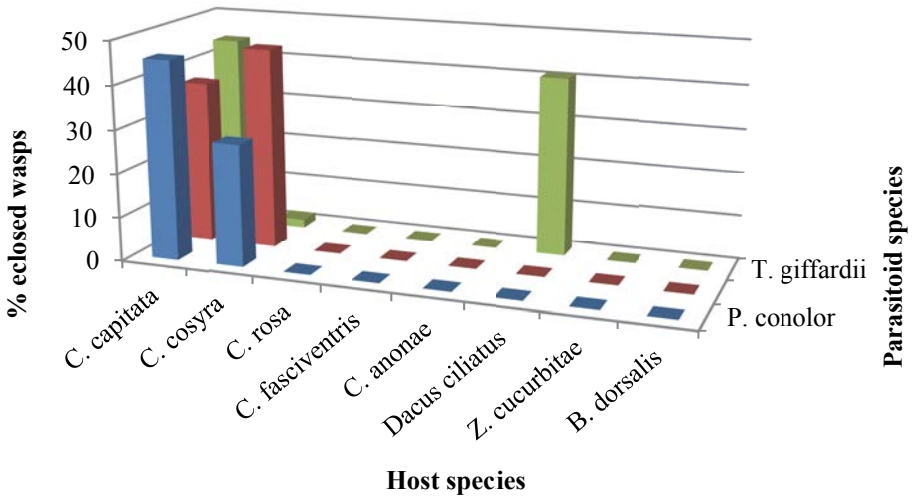

Fig. 14.3.1. Performance of the native parasitoid species, *Tetrastichus giffardii* and *Psyttalia concolor*, on native and invasive fruit flies species.

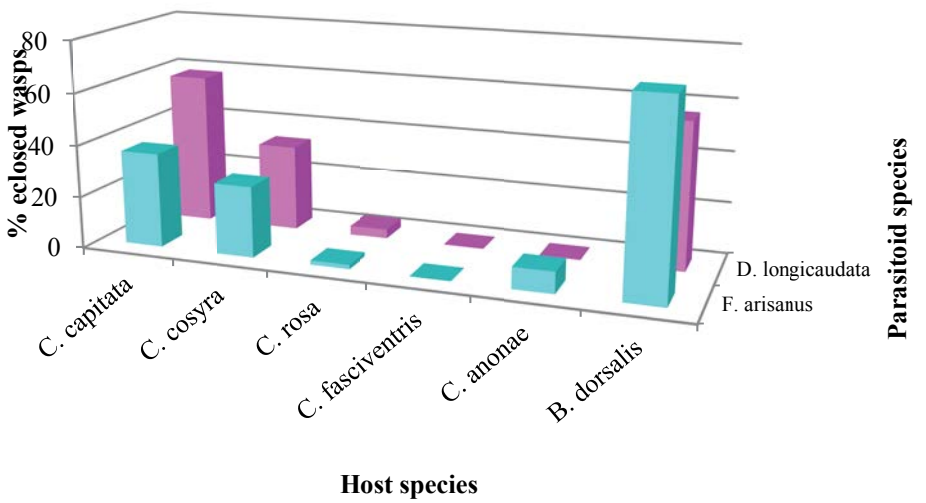

Fig.14.3.2. Performance of the introduced parasitoid species, *Diachasmimorpha longicaudata* and *Fopius arisanus*, on native and invasive fruit flies species.

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