

A Study of the Invasive Fruit Fly, *Bactrocera invadens* (Drew, Tsuruta & White)

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Abstract

The invasive fruit fly, *Bactrocera invadens* (Drew, Tsuruta and White), belongs to the order Diptera and family Tephritidae, were introduced to East Africa from Sri Lanka and subsequently invaded practically the whole of sub-Saharan Africa and other regions, hence the name “invadens”. It is highly polyphagous and high risk quarantine organism infesting both wild as well as cultivated fruits. It completes its life cycle within 25 to 30 days. It possesses K trait and displaces other species of fruit flies in an area. The population of *B. invadens* coincides with the fruiting and harvesting period of fruits. The infestation of *B. invadens* can be reduced by timely harvesting the fruits, raking and ploughing the soil, male annihilation technique and spraying of Malathion *etc.*

Introduction

The invasive fruit fly, *B. invadens* is one of the most vicious agricultural pests with traits such as high mobility, large dispersive power, rapid reproductive rates and extreme polyphagy (Ekesi *et al.* 2006). Ever since it first arrived from the Indian subcontinent, *B. invadens* numbers have steadily risen, displacing indigenous fruit fly species and causing a 40 percent loss in crop yield in some parts of Tanzania (Ekesi *et al.* 2006). The economic impacts of *B. invadens* invasion are felt through the destruction of produce from infestation and the imposition of international quarantine by importing countries (Ekesi *et al.* 2006). Damage to the fruit and vegetable product occurs through the feeding of *B. invadens* larvae, often just before the product ripens for harvest. *B. invadens* is known to infest over 40 cultivated and wild fruits and vegetables including mango, lemon, orange, tomato, banana, guava, avocado, custard apple and Indian almond (Ekesi *et al.* 2006; Mohamed *et al.* 2008). This polyphagous trait supplies *B. invadens* with sufficient reproductive bases throughout every growing season. However, mango is the preferred host of *B. invadens* and

population levels are known to peak during the harvesting period of various mango cultivars (Mwatawala *et al.* 2006).

Taxonomic position**Kingdom:** Animalia**Phylum:** Arthropoda**Sub-phylum:** Uniramia**Class:** Insecta**Order:** Diptera**Family:** Tephritidae**Genus:** *Bactrocera***Species:** *invadens***Distribution**

Sri Lanka (De Meyer *et al.* 2010), southeast India (Sithanantham *et al.* 2006), Bhutan (Drew *et al.* 2007), eastern Africa (Ekesi *et al.* 2006; Mwatawala *et al.* 2006a), northern parts of Namibia, Botswana and Mozambique (Correia *et al.* 2008) and India *etc.*

Host Range

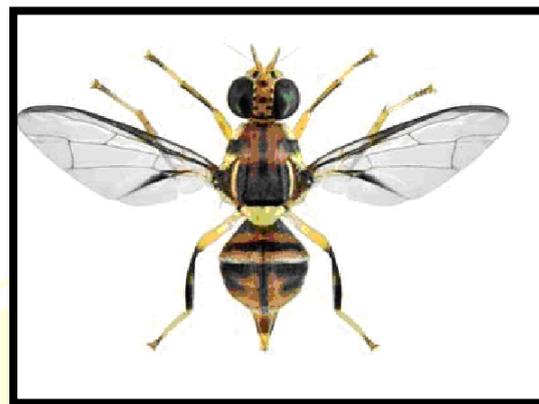
Although, *B. invadens* infest a wide number of fruit hosts, mango and guava are economic hosts. Other hosts are tropical almond, avocado, banana, carambola (starfruit) and citrus *etc.* (Mwatawala *et al.* 2006b, 2009; Vayssieres *et al.* 2009).

Biology

The *B. invadens* adult female lays eggs singly below the rind of the physiologically mature fruit. The eggs are reticulate, white to white-yellow and 0.8 mm long with micropyle slightly protruding. The length and width of full grown maggot varied from 7.50 to 10.00 mm and 1.50 to 2.00 mm, respectively. The egg incubation, maggot and pupa to adult period on yeast-carrot-based artificial diet at 28°C was 1.20, 11.10 and 12.40 days, respectively. The immature development on yeast-carrot-based artificial diet at 28°C took 25 days with 55 per cent survival and the mean generation time is 31 days (Ekesi *et al.* 2006).

Life expectancy at pupal eclosion is lower for females (75.10 days) than for males (86.40 days). Adult females were observed to have a net fertility of 608 eggs (Ekesi *et al.* 2006). The adults are identified by having tergite-III with extensive black markings extending on most of the tergite; Costal band confluent with R₂₊₃ and remaining narrow around costal

margin to end just beyond extremity of R_{4+5} . A further study by Rwomushana *et al.* (2008) showed that developmental times for all stages is affected by temperature, with the shortest at 30°C (17.76 days) gradually becoming longer under colder temperatures (75.74 days at 15°C). Lower developmental thresholds were between 8.70 and 9.40°C for the different immature life stages, while 35°C proved to be the higher threshold for adult emergence.

Photo 1. *B. invadens* malePhoto 2. *B. invadens* female

Temporal and spatial abundance

The peak period of *B. invadens* coincides with the fruiting season of both mango and guava. However, the relative abundance strongly declines along an altitudinal transect and there are indications that presence at higher elevations is the result of dispersal from lower regions during high abundance (Mwatawala *et al.* 2006; Vayssières *et al.* 2005, 2009).

Interspecific competition

Many invasive *Bactrocera* spp., including *B. invadens* demonstrate K traits, such as large adult size, that seem to favour both exploitation and interference competition. The competitive displacement of other fruit flies by *Bactrocera* species has been demonstrated in a number of cases (Duyck *et al.* 2004, 2007). In Kenya, evidence for such displacement of the indigenous mango fruit fly *Ceratitis cosyra* by *B. invadens* has been shown by Ekesi *et al.* (2009) and Rwomushana *et al.* (2009). This plays an important role in evaluating the potential impact of *B. invadens* in new areas.

Nature of Damage

The maggots of *B. invadens* feed internally within the fruit. Black or brown lesions develop at the feeding site later on. The exit holes are easily observed on the infested fruit.



Photo 3. Initial damage



Photo 4. Damage at a later stage

Management

- Timely harvest
- Raking and ploughing of the soil
- Phytosanitary cold treatments
- Use of parapheromone lure trap such as Methyl Eugenol trap
- Use of protein baits and other food baits
- Male Anihilation Technique (MAT), in combination with protein bait spraying etc.

Conclusion

The invasive fruit fly, *B. invadens* population coincides with the harvesting and maturity of fruits. When *B. invadens* invade in an area, it gets dominated and displaces other species of fruit flies inhabiting that area. They are polyphagous and quarantine pests possessing K trait. There is vast scope to carry out different characteristics of this pest.

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