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The new invasive fruit fly species, *Bactrocera invadens* Drew Tsuruta & White



Taxonomy



Photo 1: *Bactrocera invadens* male

Biological description and damage caused

- *B. invadens* is a new fly species for which few scientific data are available.
- The females pierce the fruit using their ovipositor to lay their eggs in the pulp (**Photo 2**). Each female can lay on average 700 eggs depending on the host.

- The species is multivoltine (i.e. several generations / year) with an average life span of about 3 months (Ekesi et al., 2006).

- Population monitoring is carried out using a trap with methyleugenol and a DDVP (dichlorvos) insecticide. This device targets *B. invadens* males.

- The new invasive species, *B. invadens*, causes considerable damage to mangos (**Photo 3**). Sampling of infested fruit at regular intervals during the mango season indicates that seasonal cultivars and late cultivars are attacked much more than early ones (Vayssières et al., 2005). Over 50% of adults emerging from seasonal and late cultivars are *B. invadens* in the Borgou and Atacora areas in Benin.

Name: *Bactrocera* (*Bactrocera*) *invadens* Drew et al

Family / tribe: Tephritidae – Dacini.

Description: This species is quite large (~ 1 cm). It has two yellow thoracic lines and an orange-coloured abdomen traced with a central T. Its wings are mostly transparent (**Photo 1**), with neither blotches nor macula, but the anal stripe is often quite distinctive. Several scutum colour patterns may be present.

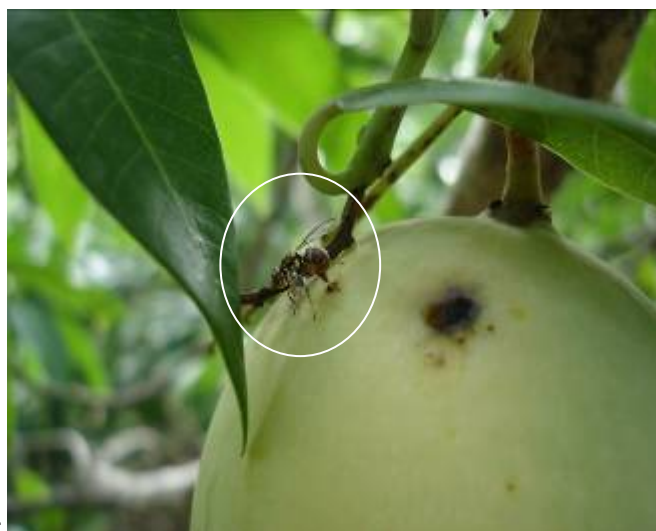


Photo 2: Female *B. invadens* laying eggs

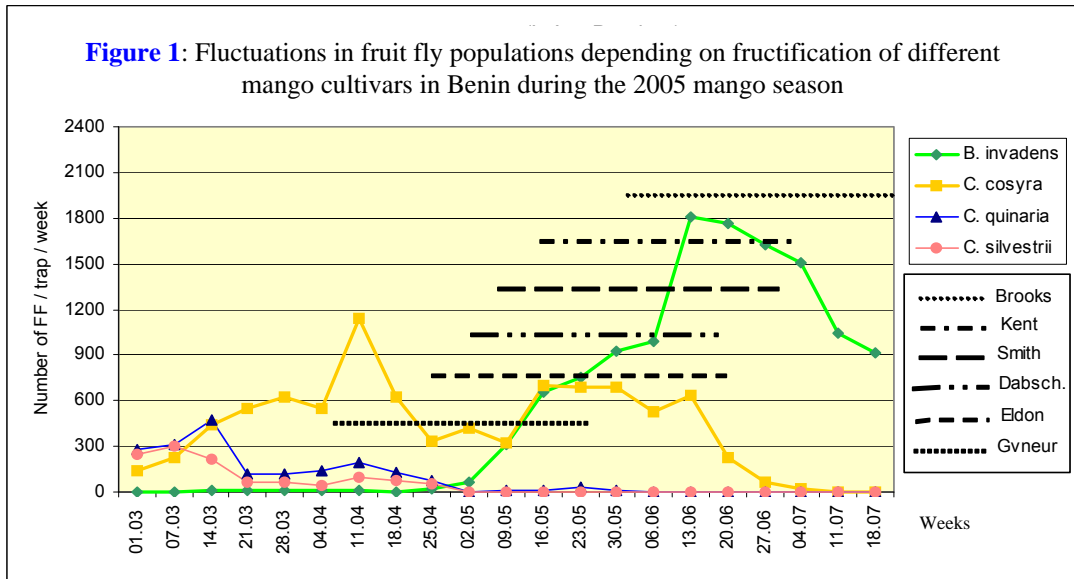


Photo 3: Damage caused to mangos by fruit flies



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Figure 1: Fluctuations in fruit fly populations depending on fructification of different mango cultivars in Benin during the 2005 mango season



Ecology and behaviour

- This species is scarce during the dry season (Fig. 1) in the Soudanian zone. Populations increase when the rainy season starts in earnest (Fig. 2) and persist until the end of the rainy season (Vayssières et al., 2006).

- *B. invadens* has a highly-developed flying ability which allows it to spread easily and also to re-infest the orchards quickly after treatment.

- A whole series of different plant hosts, both cultivated and wild, allow it to maintain active populations in Benin throughout most of the year.

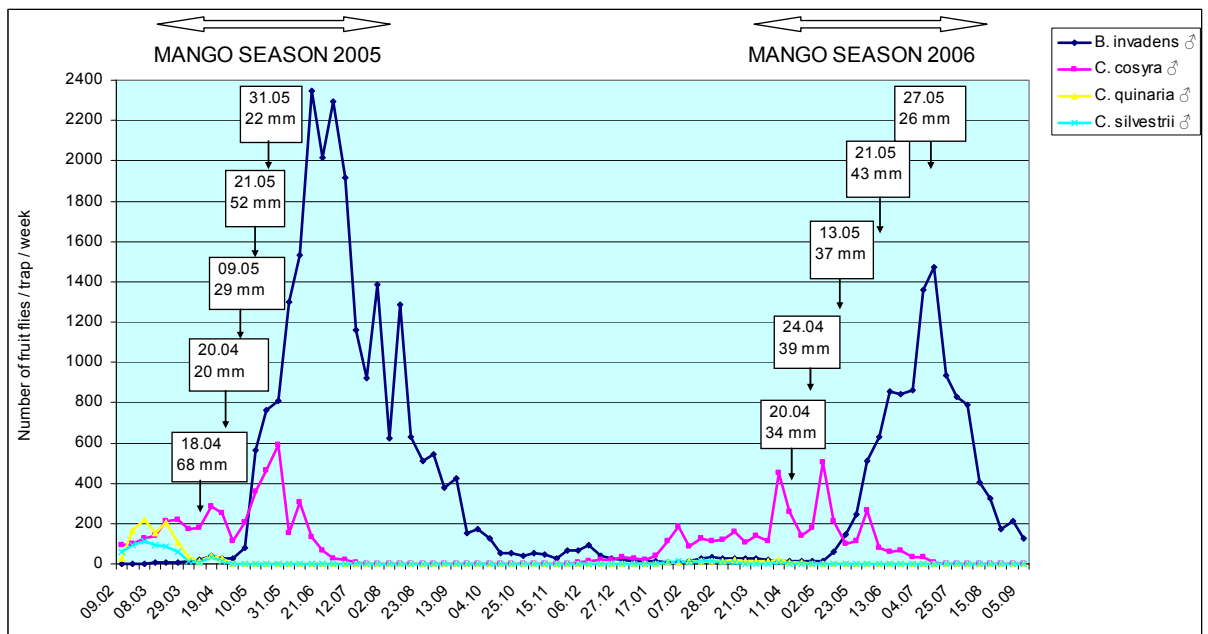


Figure 2: Fluctuations in fruit fly populations infesting the mango trees in Komi (Benin) correlated with first major rainfalls during 2005 and 2006 mango seasons.

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Geographical spread

- This Asian species probably originated from India and Sri Lanka.
- Countries invaded on the African continent (March 2008): East Africa (Kenya, Uganda, Tanzania...); West Africa (Benin, Burkina, Côte d'Ivoire, Gambia, Ghana, Guinea-Conakry, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo) (**Fig. 3**); Central Africa (Angola, Cameroon, Congo, Chad, Equatorial Guinea, Gabon...).

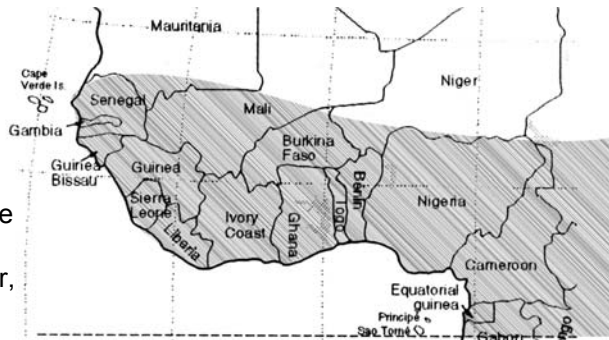


Figure 3: Areas invaded by *B. invadens* in West Africa and Central Africa (2008).

Host plants

- This species is particularly polyphagous. It attacks over 30 different species of fleshy fruits in Benin. In those African countries where it has recently appeared, it is commonly found on cultivated fruits such as mango (*Mangifera indica*), guava (*Psidium guajava*), citrus fruits (*Citrus* spp.) (**Photo 4**), papaya (*Carica papaya*), bush mango (*Irvingia gabonensis*), avocado (*Persea Americana*), star apple (*Chrysophyllum albidum*), badamier (*Terminalia catappa*) and other wild species such as *Sclerocarya birrea*, *Vitellaria paradoxa* (Vayssières et al., 2005).
- Further research will be required to identify the entire range of host plants. These different hosts play an important role in infestation and re-infestation of orchards in West Africa. All these hosts (cultivated and wild) should be incorporated in an overall pest control strategy to fight against this invasive fly species (area-wide management).



Photo 4:
B. invadens on a citrus fruit.



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Pest control methods

As for all species of fruit fly, pest control in relation to *B. invadens* needs to call upon a number of complementary methods. Efficiency will be improved if control is both widespread (area-wide management) and continued over a long time period. These methods include:

1 – Biological pest control

- An ovo-pupal parasite of Asian origin, *Fopius arisanus* (Hymenoptera Braconidae), has been shown to be highly efficient in laboratory tests for controlling *B. invadens* (results obtained by *CIPE*), and was successfully used in the Pacific area (Vargas et al., 2007). This species is a favoured candidate for biological pest control, and could be introduced into countries invaded by *B. invadens*.

- Recent research in Benin has shown that abundant *Oecophylla longinoda* or weaver ants (Hymenoptera Formicidae) considerably reduce the damage done by fruit flies in mango orchards (results obtained by IITA-WARDA-CIRAD-Benin; Van Mele et al., 2007). Information campaigns and integrated fruit production methods aim to encourage the introduction and protection of these useful weaver ants in West African orchards (**Photos 5 and 6**).



Photo 5: Larval predation

Photo 6: Adult predation

2 – Prophylactic pest control

This consists of gathering up the fallen or infested fruit and destroying it. Use of a black plastic bag is advised because it is practical and cheap. The gathered fruit is hermetically enclosed in the plastic bag which is then left in the sun. After 48h, all the larvae are destroyed and the bag, once emptied, can be re-used.

3 – Integrated pest control

Main integrated pest control methods include : MAT (Male Annihilation Technique), bait stations, the use of entomopathogens and localised treatments using Success Appat.

While the Success Appat treatment has been tested and yielded positive results in Benin, the MAT, bait station, and entomopathogen methods require testing and further development before they can be validated and integrated into the pest control methods (IPM package) used in West Africa.

Another potential control method could be to optimise ecological mechanisms of management of fruit fly populations (push-pull with mimetic molecules...) linked and enhanced with supra-specific plant diversity (SSPD cf ATP Omega 3).

The control strategy for this fly species should imperatively focus on control of the whole production basin and not just on orchard protection.

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