

## Male fruit flies, a new threat to black pepper cultivation in Kerala, India

T. Jiji<sup>1,\*</sup>, C.R Manu<sup>2</sup>, M.U. Akhila<sup>1</sup> and Aswathy Asokan<sup>1</sup>

<sup>1</sup>Department of Agricultural Entomology, College of Agriculture, Vellayani,  
Thiruvananthapuram 695 522, Kerala, India

<sup>2</sup>Farming System Research Station, Kerala Agricultural University, Sadanandapuram,  
Kottarakkara 691 531, Kerala, India

\*E-mail: jijirajmohan2004@yahoo.co.in

Fruit flies of the genus *Bactrocera* are global in distribution and most are frugivores, hence limits orchard and vegetable production. Generally, the females are indicted as pests, as, post mating, it is the females which pierce into fruit rinds and oviposit eggs which on hatching as maggots devour the fruits. The fruit fly, *Bactrocera dorsalis* is known to cause > 40% loss in fruit crops, and is widely distributed in India. The fruit fly *B. caryeae* with same habits also equally harmful, but is restricted to the west coast of India (Verghese *et al.*, 2006). In both these species, males are attracted to the parapheromone methyl eugenol (ME), which is a component of essential oils from leaves, roots, stems, flowers and the plant as whole from over 450 plant species from 80 orders. Hence, it is natural for the males to frequent ME emitting plants (Tan and Nishida, 2012). Methyl eugenol is required for the development of the reproductive system in males. However, plants are not known to be damaged by the males. It is in this context, the present report assumes importance that the males were found damaging the spice crop, black pepper (*Piper nigrum*) or the 'black gold of India'. India is the second largest producer of black pepper, the most traded spice of the world. Kerala and Karnataka in south India are the major producers of black pepper, for the country and beyond.

In Kollam, a southern district of Kerala, a black pepper farmer complained about spike (inflorescence) drying in May 2015, in a local variety which was grown along with coconut and vegetables, in a mixed cropping system. The pepper vines were trailed on jatropha plants and were in the early flowering stage. When examined, male fruit flies were seen hovering and settling on the spikes for feeding. Flies were collected at random, from different spikes. These were identified as two species, *Bactrocera dorsalis* and *B. caryeae* using keys for males (Madhura and Verghese, 2004) which were present in equal ratios. On an average, there were four fruit flies (Table 1) of each species/spike (n=10 spikes). In a random count of 10 spikes/vine from a random seven vines, 47.5% of the spikes were recorded as damaged. The fruit flies, belonging to the two species were found lapping the sap from soft tissues of spikes by their sponging type of mouth parts. The feeding spots turned black (Figure 1). These feeding spots later coalesced, turning the entire spike into a black colour. Subsequently, the spikes dried up. The prevailing climatic parameters on the day of visit included a maximum temperature of 32.1 °C and a minimum temperature of 24.9 °C. The average precipitation during the month of May was 12 cm.



**Figure 1.** Male fruit flies feeding on black pepper spikes, turning them black.

**Table 1. Population of male fruit flies on pepper spikes**

Plant part infested	No. of <i>B. dorsalis</i>	No. of <i>B. caryeae</i>	Total no. of flies
Mean/ spike	4	4.3	8.3

The Oriental fruit fly, *B. dorsalis*, originally described from Taiwan, is one of the most destructive fruit fly pests of East Asia and the Pacific. Economic significance of these fruit flies in India was reported by Verghese *et al.* (2004). *Bactrocera caryeae* forms a group within the *dorsalis* complex (Clark *et al.*, 2005), also is trying to make its identity by infesting new crops. The females of both flies are notorious for causing damage to fruit crops. Primary damage to crops caused by oriental fruit flies results from oviposition in fruit and soft tissues of vegetative parts of certain plants, feeding by the larvae, and decomposition of plant tissue by invading secondary microorganisms. There are no reports of fruit flies infesting black pepper. Contrary to the expectations,

here the males were found causing serious infestation by feeding. This is a new concern, especially of black pepper growers. The methyl eugenol present in black pepper may be one reason for attracting these fruit flies to the pepper spikes.

The farmer was advised to set up methyl eugenol traps, and spray jaggery 10% containing malathion 0.1%, at the base of the plant (50 ml/splash) in order to prevent further crop loss. Bait application technique and Male annihilation technique were reported to be effective for fruit fly management (Stonehouse *et al.*, 2002 and Jiji *et al.*, 2005). This led to remarkable progress, saving the remaining spikes.

It was interesting to reason why the spikes turned black due to the males' feeding. Generally, flies with spongy mouthparts are innocuous to plants. However, a tender spike may be morphologically soft and hence vulnerable to a "sponge pressure" from the flies while it laps the methyl eugenol or any surface chemical exudates. It was observed that when flies were diverted to traps containing ME, spikes were spared, and yielded normally. Evidence suggests that spongy mouth parts of the flies can inflict damage to the soft emerging spikes, and warrants protection. The blackening of the soft spike parts might have been due to the pressing action of the spongy mouth parts of the insects during feeding, causing dehydration of soft tissues. Other physiological reactions in the host tissue may also be responsible for their blackening. The histopathological and biochemical changes due to male feeding may be interesting to investigate further, as well as studying the labella of male *Bactrocera*. Though feeding by males is considered non-abrasive, evidence in other fruit flies like *Blepharoneura* sp shows that internal surface of the flagellum has blade like and brush like pseudotracheal ring tips which can scarify plant tissues (Driscoll and Condon, 1994). There are reports that attraction of males of *B. carambolae*, *B. papayae* and *B. umbrosa* to floral synomone of wild orchid, *Bulbophyllum cheiri*, help in the pollination of orchid (Tan *et al.*, 2000). In certain cases, the plants may not be affected like attraction of *B. dorsalis* males to *Cassia fistula* flowers (Shelly, 2000).

## CONCLUSION

Fruit flies were found damaging black pepper (*Piper nigrum*) in a mixed cropping system, in Southern Kerala. The affected plants were in the early flowering

stage and the fruit fly species damaging the spikes were *Bactrocera dorsalis* and *B. caryeae*, which were present in equal ratios. Male fruit flies were hovering and settling on the spikes for feeding. On an average, there were four fruit flies of each species / spike (n=10 spikes). In a random count, 47.5% of the spikes were observed to be damaged. This is a new concern to black pepper growers, which needs attention.

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