Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2582-2845.7877

ISSN: 2582 – 2845

Ind. J. Pure App. Biosci. (2019) *7*(6), 13-18

Research Article

Indian Journal of Pure & Applied Biosciences

Susceptibility of Immature Mangoes to the Oriental Fruit Fly, *Bactrocera dorsalis* (Diptera, Tephritidae)

Ahamada Karihila BOINAHADJI[1, 2*], Emile Victor COLY[2], Ngagne Demba SARR[1], Elhadji Omar DIENG[2], Coumba Diaw NDIAYE[2], Pape Mbacké SEMBENE[1]

[1]Université Cheikh Anta DIOP de Dakar, Département de Biologie Animale, BP 5005, Dakar, Sénégal

[2]Direction de la Protection des Végétaux-Sénégal; Km 15, Route de Rufisque. BP: 20054 Thiaroye, Dakar

*Corresponding Author E-mail: karihila1989@hotmail.fr

Received: 1.11.2019 | Revised: 4.12.2019 | Accepted: 9.12.2019

ABSTRACT

The oriental fruit fly, Bactrocera dorsalis, is one of the most destructive pests of mango production in Senegal. The aim of this study was to evaluate the effect of four mango varieties on the oviposition preference of B. dorsalis at immature stage according to three physiological states of fruit. The oviposition preference was evaluated in choice and no-choice tests at laboratory conditions. This study showed that B. dorsalis is able to infest immature mangoes freshly harvest and those kept for 7 or 15 days after harvesting. Further, the variety and physiological state of the fruit influenced significantly the oviposition preference of this pest. In choice and no-choice tests, Kent proved to be the most preferred variety and Séwé the least preferred by B. dorsalis. Our results indicate also that B. dorsalis prefer to lay egg on fruits that kept for 15 and 7 days after harvest than those freshly harvest regardless of the variety in both experimental conditions.

Keywords: *Bactrocera dorsalis, Immature mangoes, Oviposition preference, Mango varieties.*

INTRODUCTION

Mango production is of great economic and food importance in several African countries. This production is, however, limited by the attack of fruit flies. Most tropical fruit flies only lay into mature fruit, but a small number can also oviposit into unripe fruit (Rattanapun et al., 2009). The larvae feed on the pulp of fruits forming tunnels inside them causing a great damage and make fruits unfavorable for marketing and exportation (Amin, 2017). Among fruit flies threatening the production of mangoes, the oriental fruit fly *Bactrocera dorsalis* is considered the most devastating fruit fly pest in Africa (Lux et al., 2003; Drew et al., 2005). *Bactrocera dorsalis* was first detected in Senegal in 2004 and causes mango production losses ranging from 30 to 50% in the Niayes zone and 60% in Casamance (Ndiaye et al., 2012). This pest is very abundant during the rainy season which coincides with the maturation period of mangoes in the areas where it was reported (Mwatawala et al., 2006; Ouédraogo et al., 2011; Vayssières et al., 2014).

Cite this article: Boinahadji, A.K., Coly, E.V., Sarr, N.D., Dieng, E.O., Ndiaye, C.D., & Sembene, P.M. (2019). Susceptibility of Immature Mangoes to the Oriental Fruit Fly, *Bactrocera dorsalis* (Diptera, Tephritidae), *Ind. J. Pure App. Biosci. 7*(6), 13-18. doi: http://dx.doi.org/10.18782/2582-2845.7877

However, immature abscission mangoes play an important role in maintaining the population of *B. dorsalis* in orchards before maturation of mangoes (Vayssières et al., 2008; Ndiaye et al., 2012). It has also been shown that the variety and physiological state of the fruit play an important role in the infestation of mangoes by *B. dorsalis* (Rattanapun et al., 2009 ; Diatta et al., 2013). However, the behavior of *B. dorsalis* with immature mangoes is not well known.

To obtain further information on the infestation of immature mangoes by *B. dorsalis*, the effect of four mango varieties with three physiological states was evaluated in laboratory conditions.

MATERIALS AND METHODS

The study was conducted in the agricultural zoology laboratory of the Direction de la Protection des Végétaux (DPV) in Dakar, Senegal. The temperature of this laboratory was 27 ° C ± 2 and the photoperiod (light / dark) 12 hours / 12 hours.

Bactrocera dorsalis rearing

The adults of *B. dorsalis* used in this study were reared in cages at the agricultural zoology laboratory of the Direction de la Protection des Végétaux (DPV). Flies were fed on a mixture of sugar, peptone and yeast hydrolysate. Water was also provided regularly with cotton whose base was immersed in a small plastic bottle. Egg-laying devices made with perforated plastic containers and coated with fruit jus were regularly introduced inside the cages for 24 hours. Eggs were collected and placed on an artificial diet for the immature stages development. The composition of the diet was wheat bran, yeast hydrolysate, sugar, distilled water, benzoate Sodium and HCL.

Mango varieties

Four mango varieties, *viz.* Kent, Keitt, Bouko Diékhal and Séwé, were chosen to determine the ability of *B. dorsalis* for infesting the immature mangoes at different physiological states. These mango varieties were harvested directly from trees at immature stage in an orchard located in the village of Niakourab (14° 47'47.19"N / 17° 13'47.71"W) in Niayes area.

Three physiological states of the fruit were considered: freshly harvested fruits, fruits that were kept for 7 days after harvest and fruits that were kept for 15 days after harvest.

Oviposition preference

❖ Choice test

The experiments were carried out in cages of size 1 x 0.6 x 0.6 m. In total, 50 couples of *B. dorsalis*, sexually mature (12 to 15 days old) and virgin, were introduced into each cage one day before the experiment. For each fruit, a nail attached to a wire was pointed at its base to facilitate its suspension in the cage. Indeed, three mangoes per variety depending on the three physiological states that mentioned above were suspended simultaneously in each cage as oviposition substrate to females and distant 25 cm. After 24 h, the fruits were removed from the cages and incubated individually in plastic containers with sand until the development of larvae into pupae. These pupae were extracted from the sand for each fruit and counted to determine the egg-laying preference of *B. dorsalis* for all the mango varieties depending their physiological state. Three replicated cages were maintained and the experiment was repeated twice.

❖ No-choice test

A mango from each variety depending on the three physiological states that mentioned above was placed individually in a 30 by 30 by 30 cm plexiglass cage that containing 10 couples of *B. dorsalis* at 12 to 15 days old. After 24 hours, mango were removed from cages and incubated individually in plastic containers containing sterilized sand until all larvae had pupated. The recovered pupae from each fruit were counted to determine the egg-laying preference of *B. dorsalis* for all the mango varieties depending their physiological state. Experiment was replicated six times.

Statistical anaylsis

The statistical analysis was done as one way ANOVA and means separated was conducted by using L.S.D. at the probability of 5%.

RESULTS

Oviposition preference of *B. dorsalis* on four mango varieties at immature stage in the choice test.

Table 1: Mean numbers of pupae recovery from four mango varieties at three physiological states in the choice test

	Physiological states of immature mangoes		
Mango varieties	Freshly harvested	Kept for 7 days after harvest	Kept for 15 days after harvest
Bouko Diékhal	28,00 [ab]	31,50 [ab]	46,50 [ab]
Keit	1,17 [b]	29,67 [ab]	38,33 [ab]
Kent	16,67 [b]	66,67[a]	70,17[a]
Séwé	10,00 [b]	31,00 [ab]	13,00 [b]

Statistical analysis showed that the oviposition preference of *B. dorsalis* varied significantly depending to the mango varieties (F = 2.207, p = 0.097) and physiological state of the fruit (F = 3.27, p = 0.045) in choice test. Overall, *B. dorsalis* prefers Kent and Bouko Diékhal varieties more than Keitt and Séwé at immature stage (Figure 1). In the Kent, Keitt and Bouko Diékhal varieties the average numbers of pupae obtained from the freshly harvested fruits were significantly lower than those recorded on the fruits that were kept for 15 and 7 days after harvest (Table 1). While, in the Séwé variety, the fruits that were kept for 7 days after harvest were recorded the highest number of pupae comparing to those that kept for 15 days after harvest (Table 1).

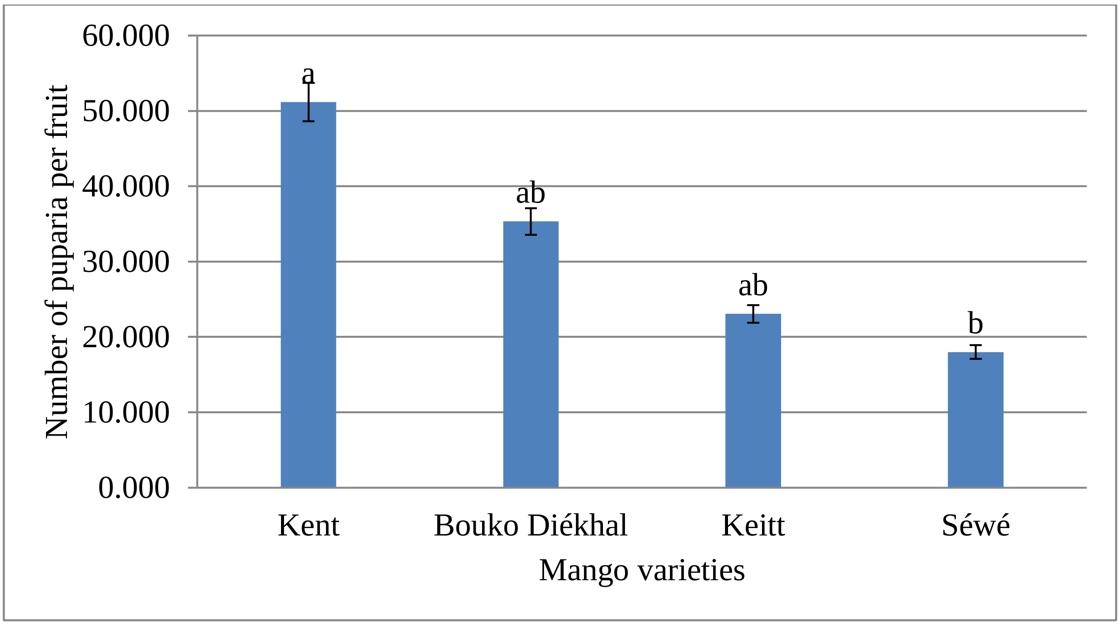

Fig. 1: Oviposition preference of *B. dorsalis* on mango varieties at immature stage in choice test (F=2,207 ; p= 0,097)

Oviposition preference of *B. dorsalis* on four mango varieties at immature stage in the no-choice test.

Table 2: Mean numbers of pupae recovery from four mango varieties at three physiological states in the no-choice test

	Physiological states of immature mangoes		
Mango varieties	Freshly harvested	Kept for 7 days after harvest	Kept for 15 days after harvest
Kent	69,16 [abc]	113,50 [ab]	123,83 [a]
Keit	73,83 [abc]	110,17 [ab]	71,33 [abc]
Bouko Diékhal	14,50 [c]	115,167 [ab]	68,00 [abc]
Séwé	14,17 [c]	35,50 [c]	63,17 [bc]

In the no-choice test, there were also significant differences in the number of pupae recovered from the four varieties (F=5.067 ; p= 0.003) and at the three physiological states of fruits (F = 6.17, p = 0.004). The highest number of puparia was recovered from Kent, followed by Keitt, Bouko Diékhal and Séwé (Figure 2). In the Kent and Séwé varieties, the highest mean numbers of pupae were obtained on fruits that were kept for 15 and 7 days after harvest. While the freshly harvested fruits recorded the lowest numbers of pupae. In the Keitt and Bouko Diékhal varieties, the highest numbers of puparia were recovered from the fruits that were kept for 7 days after harvest, followed by those that were kept for 15 days after harvest. While, the lowest numbers of pupae were obtained from the freshly harvested fruits (Table 2).

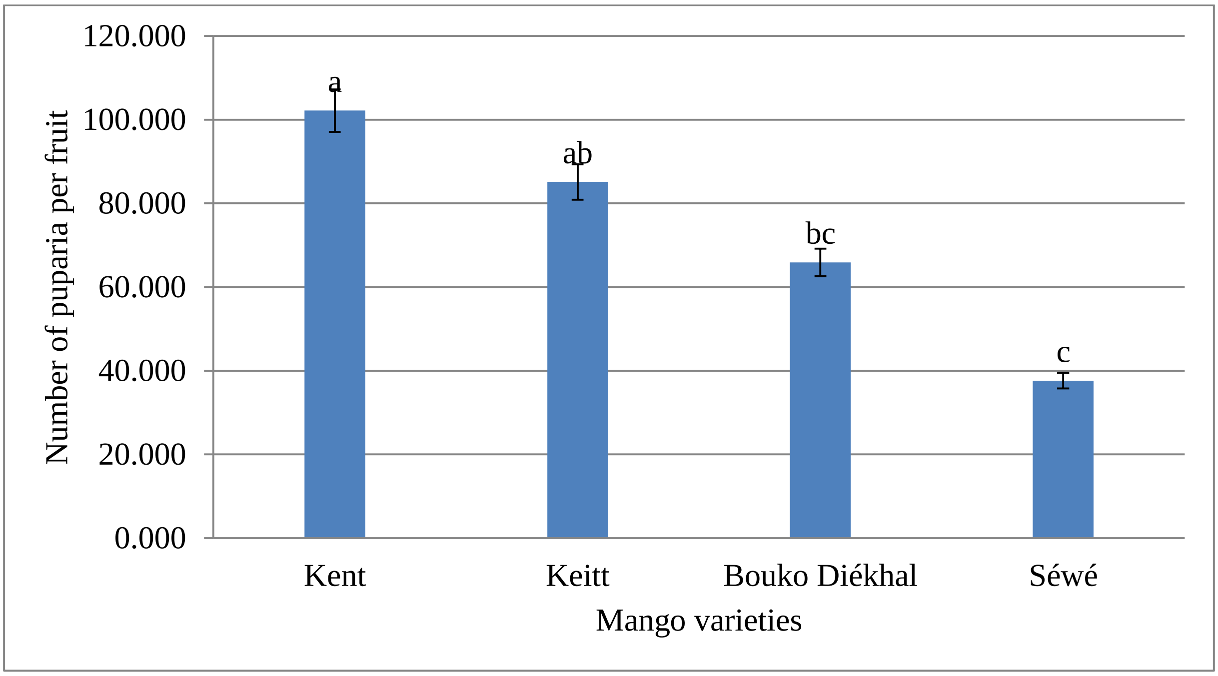

Fig. 2: Oviposition preference of *B. dorsalis* on mango varieties at immature stage in no-choice condition (F=5,067 ; p= 0,003)

DISCUSSION

Results of present study revealed that the oviposition preference of *B. dorsalis* varied significantly depending to the mango varieties and physiological state of the fruit in choice and no-choice conditions. In both experimental conditions, Kent proved to be the most preferred variety and Séwé the least preferred by *B. dorsalis*. In another laboratory study in Ghana with four mango cultivars (Kent, Haden, Keith and Palmer), (Ambele et al., 2012) have also found that Kent was the most susceptible variety to *B. dorsalis* comparing to the other varieties tested. The higher numbers of pupae that recorded on Kent variety, may be partially explained by the physicochemical characteristics of this variety which would be more attractive to *B. dorsalis* comparing to those of the other varieties. The physical traits of the fruit such as the color and thickness of the pericarp or the shape of the fruit could be factors determining the oviposition of fruit flies (Balagawi et al., 2005; Ambele et al., 2012; Rattanapun et al., 2009). However, the lowest numbers of pupae that were recorded on Séwé variety can be explained by its smaller size comparing to other varieties. (Sohail et al., 2015) showed that fruit flies prefer larger fruits than smaller ones.

Our results indicate strongly that *B. dorsalis* prefer to lay egg on fruits that kept for 15 and 7 days after harvest than those freshly harvest regardless of the variety in both experimental conditions. These results corroborate to those obtained by (Amin, 2017) who showed that *B. zonata* prefers immature mangoes that kept 15, 10 and 5 days after harvesting than those freshly harvest. The higher numbers of pupae were obtained on the fruits that kept 15 and 7 days after harvest, may be explained by their softer pericarp comparing to those fruits freshly harvest. Indeed, female tephritids have been shown on several occasions to have an oviposition preference for fruit with softer pericarp, over fruit with harder pericarp (Balagawi et al., 2005; Rattanapun et al., 2009; Diatta et al., 2013; Amin, 2017; Gómez et al., 2019). Moreover,(Rattanapun et al, 2009) showed that resin ducts in the pericarp of unripe fruit may also be an obstacle for ovipositing female flies. These authors added that when flies made an oviposition wound in the pericarp of unripe mango, the resin flowed out immediately and pushed the eggs outside the fruit. This also justifies the low number of pupae obtained on freshly harvested mangoes in all varieties.

CONCLUSION

This study showed that *B. dorsalis* is able to infest immature mangoes freshly harvest and those kept for 7 or 15 days after harvesting. The variety and physiological state of the fruit play an important role on the oviposition of this pest. The capacity of *B. dorsalis* to lay on immature mangoes freshly harvest under laboratory conditions, suggests that this pest could also attack small mangoes on the tree in orchards. Thus, for better control this pest, an integrated pest management system should be implemented in orchards from the immature stage of mangoes.

Acknowledgements

The authors are thankful to the Direction de la Protection des Végétaux (DPV) of Senegal for providing necessary material for conducting this study.

REFERENCES

Ambele, F.C, Billah, M.K, Afreh-Nuamah, K., & Obeng-Ofori D. (2012). Susceptibility of four mango varieties to the Africa Invader fly , *Bactrocera invadens* Drew, Tsuruta and White (Diptera : Tephritidae) in Ghana, *49*, 3425–3434.

Amin, A. A. (2017). field and laboratory studies on infestation of immature mango fruits by the peach fruit fly, *Bactrocera zonara* (saunders). *Egyptian Journal of Agricultural Research*, *95*(1), 89–106.

Balagawi, S., Vijaysegaran, S., Drew, R. A. I., & Raghu, S. (2005). Influence of fruit traits on oviposition preference and offspring performance of *Bactrocera tryoni* (Froggatt) (Diptera : Tephritidae) on three tomato (*Lycopersicon lycopersicum*) cultivars, *Australian Journal of Entomology*. *44*(2), 97-103.

Diatta, P., Rey, J.-Y., Vayssieres, J.-F., Diarra, K., Coly, E. V., Lechaudel, M., & Ndiaye, O. (2013). Fruit phenology of citruses, mangoes and papayas influences egg-laying preferences of *Bactrocera invadens* (Diptera: Tephritidae) . *Fruits*, *68*(6), 507–516. https://doi.org/10.1051 /fruits/2013093

Drew, R. A. I., Tsuruta, K., & White, I. M. (2005). A new species of pest fruit fly (Diptera : Tephritidae : Dacinae) from Sri Lanka and Africa. *African Entomology*, *13*(1), 149–154.

Gómez M., Paranhos B.A.J., Silva J.G., De Lima M.A.C., Silva M.A., Macedo A.T., V. J. F. & W. J. M. M. (2019). Oviposition preference of *Ceratitis capitata* (Diptera: Tephritidae) at different times after pruning 'Italia' table grapes grown in Brazil. *Journal of Insect Science*, *19*(1), 1–7.

Lux, S. A., Copeland, R. S., White, I. M., Manrakhan, A., & Billah, M. K. (2003). A New Invasive Fruit Fly Species from the *Bactrocera dorsalis* (Hendel) Group Detected in East Africa. *International Journal of Tropical Insect Science*, *23*(04), 355–361. https://doi.org/10.1017 /s1742758 40001242x

Mwatawalaa, M. W. M., Eyerb, M. D. M., Akundic, R. H. M., & Aererea, A. P.

M. (2006). Original article Biodiversity of fruit flies (Diptera , Tephritidae) in orchards in different agro-ecological zones of the Morogoro region , Tanzania, *61*(5), 321–332. https://doi.org/10.1051 /fruits

Ndiaye, O., Vayssieres, J.-F., Yves Rey, J., Ndiaye, S., Diedhiou, P. M., Ba, C. T., & Diatta, P. (2012). Seasonality and range of fruit fly (Diptera: Tephritidae) host plants in orchards in Niayes and the Thiès Plateau (Senegal). *Fruits*, *67*(5), 311–331. https://doi.org/10.1051/fruits/2012024

Ouédraogo, S. N. O., Ayssières, J. V, Abiré, A. R. D., & Efèvre, C. R. O. (2011). Article original Biodiversité des mouches des fruits (Diptera : Tephritidae) en vergers de manguiers de l ' ouest du Burkina Faso : structure et comparaison des communautés de différents sites, *66*(6), 393–404. https://doi.org/10.1051/ fruits/2011054

Rattanapun, W., Amornsak, W., & Clarke, A. R. (2009). *Bactrocera dorsalis* preference for and performance on two mango varieties at three stages of ripeness. *Entomologia Experimentalis et Applicata*, *131*(3), 243–253. https://doi.org/10.1111/j.1570-7458.2009.00850.x

Sohail M., Aqueel M. A., Assi M. S., Javed M., Khalil M. S., K. K., & A. M. H. (2015). Food and ovipositional preference of oriental fruit fly *Bactrocera dorsalis* Hendel (Diptera: Terphritidae) on different fruit and vegetable hosts. *European Academic Research*, *III*(1), 45–60.

Vayssières, J.-F., Sinzogan, A., Adandonon, A., Rey, J.-Y., Dieng, E. O., Camara, K., & Tamo, M. (2014). Annual population dynamics of mango fruit flies (Diptera: Tephritidae) in West Africa: socio-economic aspects, host phenology and implications for management. *Fruits*, *69*(3), 207–222. https://doi.org/10.1051/ fruits/2014011

Vayssières, J.F., Korie, S., & Coulibaly, L. (2008). The mango tree in central and northern Benin: cultivar inventory, yield assessment, infested stages and loss due to fruit flies (Diptera Tephritidae). *Fruits*, *63*(6), 335–348.