J. Exp. Zool. India Vol. 25, No. 1, pp. 195-199, 2022	www.connectjournals.com/jez	*ISSN 0972-0030*
DocID: https://connectjournals.com/03895.2022.25.195		eISSN 0976-1780

FEEDING ASSAY FOR THE ATTRACTION OF FRUIT SUCKING MOTHS TOWARDS DIFFERENT FRUITS AND FRUIT ESSENCES

Muddasar*, Venkateshalu, Y. K. Kotikal, G. Bhuvaneshwari and G. Manjunath

Department of Entomology, College of Horticulture, University of Horticultural Sciences, Bagalkot - 587 104, India.
*e-mail: mudasirmsr@gmail.com

(Received 4 October 2021, Revised 20 November 2021, Accepted 19 December 2021)

ABSTRACT : Preference assay of primary fruit sucking moths towards ripe fruits and artificial fruit essences in the field condition revealed maximum preference towards ripened banana fruits followed by guava and pomegranate fruits. Similarly, a choice study on different fruit extracts and fruit essences in the field condition using bottle trap indicated the highest preference towards banana fruit extract followed by guava and pomegranate fruit extract. Since the major preference was banana fruit from the above assays, banana fruit and fruit extracts fermented at 12, 24 and 48 hours were evaluated and the results indicated that the highest number of moths were attracted towards ripe banana fruits followed by the banana fruits fermented for 12 hours.

Key words : Fruit sucking moth, attractant, fruits, fruit essences, feeding assay.

How to cite : Muddasar, Venkateshalu, Y. K. Kotikal, G. Bhuvaneshwari and G. Manjunath (2022) Feeding assay for the attraction of fruit sucking moths towards different fruits and fruit essences. *J. Exp. Zool. India* **25**, 195-199. DocID: https://connectjournals.com/03895.2022.25.195

INTRODUCTION

Fruit sucking moths are polyphagous pests where, an adult is a damaging stage (Leong and Kueh, 2011). It sucks the fruit juices out of mature and ripened fruits with its long and sclerotized proboscis armed with serrated ridges and erectile barbs (Zaspel *et al*, 2011), causing fruit rot. The moths are active from September to November and cause damage to a wide variety of commercially important fruits like pomegranate, citrus, guava, mango, papaya, carambola, grapes, litchi, *etc*. Fruit sucking moths attained importance as an economic pest in various countries with an increase in the cultivation of fruit crops. In India, the fruit sucking moths were first recorded as a serious pest by Lefroy and Hawlett (1909). A total of five species of fruit sucking moths were found feeding on pomegranate in Karnataka *viz*., *Eudocima materna* Linnaeus, *Eudocima phalonia* Linnaeus, *Eudocima homaena* Hubner, *Eudocima hypermnestra* Cramer & Stoll and *Eudocima salaminia* Cramer (Bhumannavar, 2000). Among them *E. materna* is the most predominant species followed by *E. phalonia* and *E. homaena*.

The fruit-piercing moth is an economically important group causing major damage. The use of insecticides for the control of larvae is undesirable since the larvae feed on a weed host that belongs to Menispermaceae and grows in remote areas and away from orchards. Further, utilization of biocontrol agents is also not feasible as the larvae are nocturnal and hide under the leaves during the daytime. Since the fruits are greatly susceptible near to maturation or near to harvest, is the stage that is not suitable for the application of chemical insecticides (Banziger, 1982) makes the pest difficult to control. Enormous efforts and enough money spent for the management of this pest often fail because of their nocturnal behaviour and selective feeding on internal juices where the chemicals on the surface of fruit will not be effective for control, hence it is difficult to manage. However, the nocturnal activity of moths makes them active only during dusk hours and inactiveness during sunshine hours make them difficult to control hence, the present study was aimed to evaluate fruits and fruit essences for the attraction and trapping of fruit sucking moths which further be utilized in the development of proper management tactics.

MATERIALS AND METHODS

Evaluation of fruits and fruit essences in pomegranate

The present study was carried out at pomegranate block, UHS, Bagalkot during 2017-18. The experiment

comprised of three fruits, essences of three different fruits diluted with ethanol in a 1:1 ratio and ethanol used as a control in bottle traps. The treatments including three fruits *viz*., banana, guava and pomegranate, artificial fruits essences of pineapple, orange and mango (purchased from the supermarket) along with control were evaluated for attracting fruit sucking moths during the peak activity period.

The treatments were evaluated by placing the fruits and artificial essences in a 20-litre water bottle trap in which the fruits were hung at the top as well as at the bottom of the trap, fruits essence was kept in a plastic bowl inside the traps, the traps were hanged at the height of four feet above the ground. A total of seven treatments were evaluated along with control (water was placed in plastic bowls inside the trap). The treatments included T_1- Banana fruit, T_2- Guava fruit, T_3- Pomegranate fruit, T_4- Pineapple essence, T_5- Orange essence, T_6- Mango essence and T_7- Control (Ethanol). The experiment was replicated five times in RCBD design.

Observations : The number of primary fruit sucking moths (three dominant species *viz*., *E. maternal*, *E. phalonia* and *E. homaena*) attracted to different treatments and trapped inside the bottle trap was recorded during evening hours from 6:00 to 10:00 pm.

Evaluation of fruit extracts and fruit essences in pomegranate

Ripen banana, guava and pomegranate fruits were chopped and ground finely and soaked in absolute ethanol for 24 hours for fermentation. About 100 grams of fruit extract was soaked in 50 ml of ethanol.

The fruit extracts soaked in ethanol was placed in plastic bowls and kept inside the bottle trap and evaluated along with different artificial fruit essence. A total of seven treatments *viz*., banana extract, guava extract, pomegranate extract, pineapple essence, orange essence, mango essence and control (ethanol) were evaluated and replicated five times in RBD design.

Observations : The number of primary fruit sucking moths (three dominant species) attracted to different treatments was observed during evening hours from 6:00 to 10:00 pm and the number of moths trapped inside the trap was recorded.

Evaluation of banana fruit extracts for the attraction of fruit sucking moths at 12, 24 and 48 hrs of soaking

A highly preferred fruit from the previous experiment was selected (banana) and used for this field study. Ripen banana fruits were finely chopped, made as a thick paste and soaked in absolute ethanol for 12, 24 and 48 hours.

The Treatments included T_1- Banana fruit soaked for 12 hours, T_2- Banana fruit soaked for 24 hours, T_3- Banana fruit soaked for 48 hours, T_4- Banana fruit and T_5- Control (Ethanol). The banana fruit extracts were evaluated in bottle traps by keeping the fruit extracts in plastic bowls inside the traps, the experiment was replicated seven times.

Observations : The number of primary fruit sucking moths (three dominant species) attracted to different treatments was observed during evening hours from 6:00 to 10:00 pm and the number of moths trapped inside was recorded.

RESULTS

Evaluation of fruits and fruit essences in pomegranate

Fruit sucking moths pose a major problem in the production of pomegranate especially in the Mrig bahar season when the damage varied from 10 to 55 per cent. The proper management techniques were not explored yet in the field conditions for the management of fruit sucking moths including insecticide application. So attraction and trapping of moths could be one of the most efficient methods of management strategies. From the available literature and preliminary observations, it was known that the fruit sucking moths highly prefer to ripen banana and guava over pomegranate. So utilization of banana and guava-based attractant tactics play a key role in managing the fruit sucking moth population in pomegranate crops. However, the management of fruit sucking moths in field conditions is least studied. So, the present investigation on the attraction of fruits sucking moths in field conditions was taken up during 2019-20.

The observation on the number of moths attracted towards different fruits and commercially available fruit essences is presented in Fig. 1. The experiment comprised of three fruits, essences of three different fruits diluted with ethanol in a 1:1 ratio and ethanol used as a control in bottle traps in field conditions.

The results on the attraction of fruit sucking moths showed significant variation towards different fruits and fruit baits. Significantly, the maximum number of moths were attracted towards the treatment with bottle trap containing ripen banana fruits (1.60), followed by guava fruits (1.00) and the next best treatment was pomegranate fruits (0.60) when compared to control. However, not even a single fruit sucking moth showed attraction towards the treatments containing commercially available fruit essence (Fig. 1).

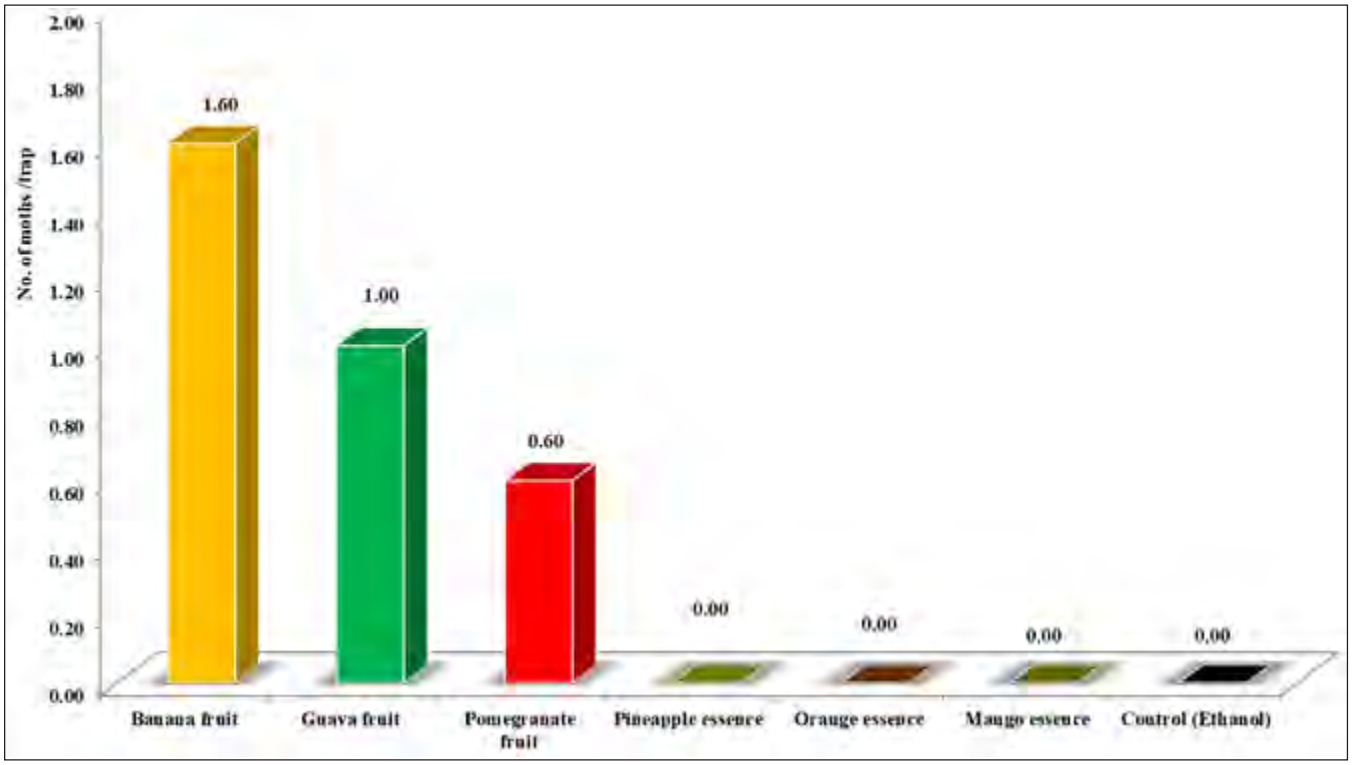

Fig. 1 : Attraction of fruit sucking moths towards fruits and fruit essences using bottle traps in field.

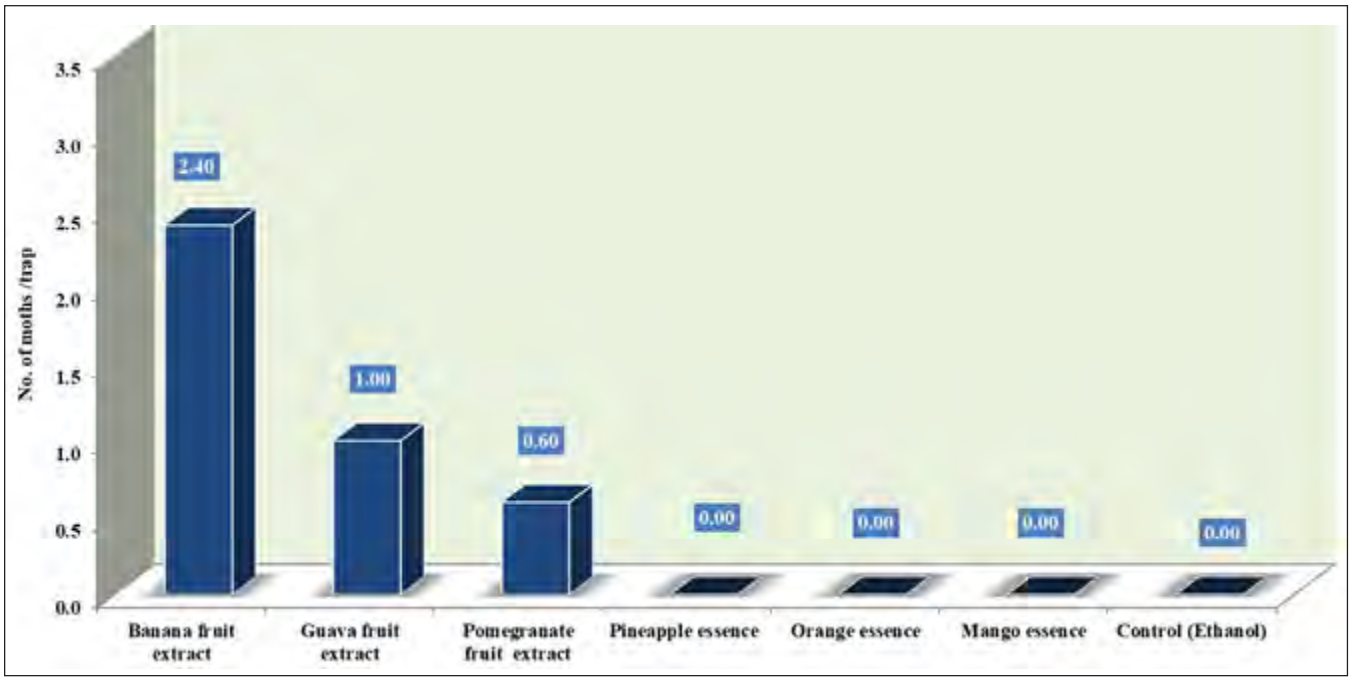

Fig. 2 : Attraction of fruit sucking moths towards fruit extracts and fruit essences using bottle traps in field.

The attraction of fruit sucking moths towards fruit extracts and fruit essences in the field

The results on the number of fruit sucking moths attracted towards different fruit extracts and fruit essence in the bottle traps showed significant variation among the different treatments when compared to control. Amongst the different treatments evaluated, the treatment containing banana fruit extract was found significantly superior in attracting more moths (2.40 moths) followed by the guava fruit extract (1.00 moths). The next best treatment was pomegranate fruit extract (0.60 moths). Whereas, the other treatments containing fruit essences failed to attract the fruit sucking moths (Fig. 2).

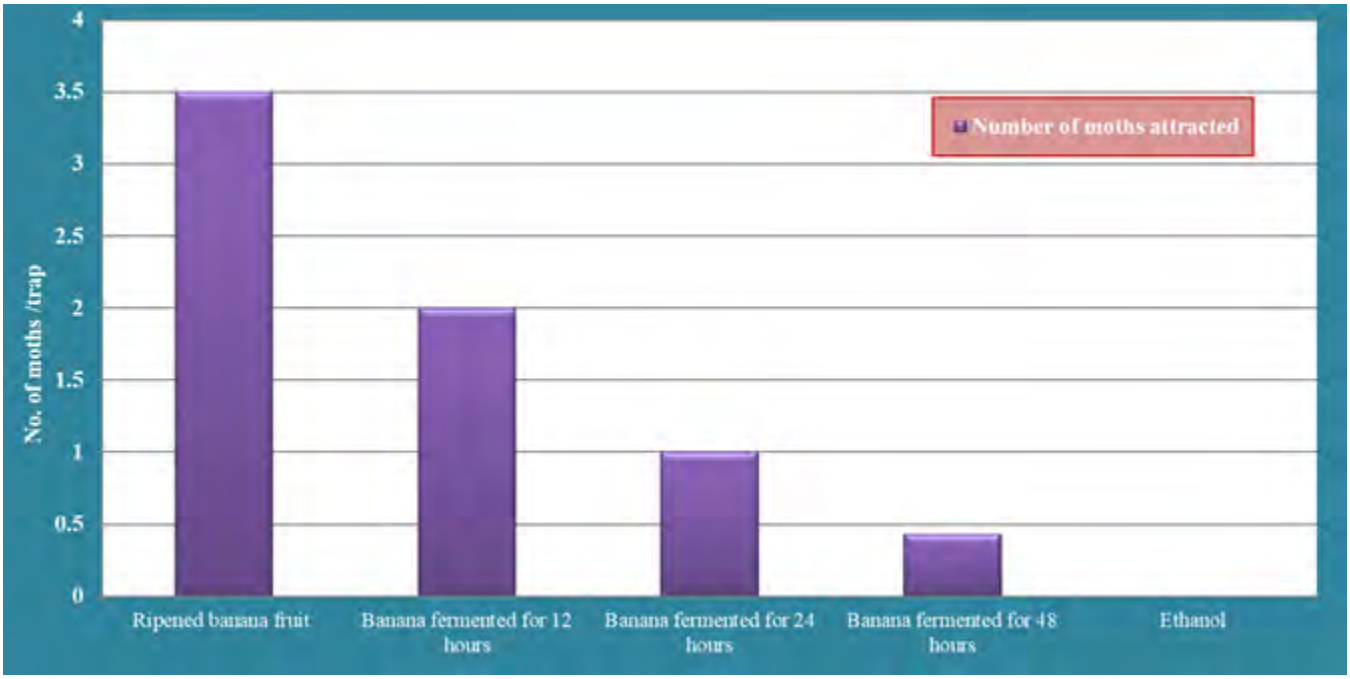

Fig. 3 : Attraction of fruit sucking moths towards banana fruit at different hours of fermentation.

The attraction of fruit sucking moths towards banana fruit extracts at different hours of fermentation

Superior treatment (banana fruit) from the above feeler trial was selected and the fruit extracts were fermented at 12, 24 and 48 hours and evaluated for the attraction of fruit sucking moths in the field. The fruit extracts showed significant variation among the treatments in the attraction of fruit sucking moths. The results on the attraction of fruit sucking moths indicated that significantly the highest number of moths were attracted towards ripened banana fruit (3.50 moths) followed by the banana fruits fermented for 12 hours (2.00 moths). The next best treatments were banana fruits fermented for 24 hours (1.00 moths) and 48 hours (0.43 moths). However, the treatment with ethanol failed in the attraction of fruit sucking moths (Fig. 3).

DISCUSSION

An attempt was made to evaluate the attraction of primary fruit sucking moths towards ripe fruits and artificial fruit essences in the field condition using a bottle trap. The results of the present study revealed that ripen banana fruits (1.60 moths/trap) attracted a higher number of moths followed by guava fruits (1.00 moths/trap) and the next best treatment was pomegranate fruits (0.60 moths/trap). However, the treatments containing commercially available fruit essences were failed to attract the fruit sucking moths. Most of the insects rely on olfaction for the location of food/host, the specialized structures located on antenna enables them to detect the food from longer distances especially in nocturnal insects. Correspondingly, during the present study fruit sucking moths showed more preference towards banana and guava. Similar results were obtained by Jayanthi *et al* (2015). However, Goddard (2016) studied the attraction of fruit sucking moths in citrus orchards, where fresh and frozen bananas were compared along with nine different synthetic attractants, among them fresh banana was found to be the most attractive bait. Similarly, Holloway *et al* (2013) trapped *E. phalonia* and *E. homaena* with banana fruit as bait. The observations of Pujari (2008) suggested that the fruit sucking moths showed attraction towards the orange flavour and vanilla flavour but the moths settled not more than two minutes and showed more attraction and feeding towards the ripe banana fruit. Thus, results suggested that banana-based bait trapping provides an effective means of controlling fruit sucking moths in pomegranate.

The attraction of fruit sucking moths towards fruit extracts and artificial fruit essence revealed that significantly highest number of fruit sucking moths attracted towards the treatment containing banana fruit extract (2.40 moths/trap) followed by guava fruit extract (1.00 moths/trap). The next best treatment was pomegranate fruit extract (0.60 moths/trap). While the artificial fruit essences failed to attract the fruit sucking moths. The highest preference and attraction towards banana was due to the quick fermentation, highest aroma and carbohydrate contents of ripened fruit which drives more number of fruit sucking moths towards it. A study

by Robinson *et al* (2012) points out that the crushed banana serves as the most effective fruit bait in attraction and capturing of fruit sucking moths in citrus orchards compare to any other baits. However, few studies also claimed that the odour of fermented or rotten fruits attracts the fruit feeding moths from distances, a similar mechanism would have worked concerning the attraction of fruit sucking moths towards the banana fruit extracts.

Since, the fruit sucking moths showed the highest preference towards the ripe banana fruits and fruit extracts from previous trials, an attempt was made to check the attraction of moths towards fresh ripe fruit and banana extracts fermented in absolute ethanol for 12, 24 and 48 hours. The results of this trial indicated that significantly the highest number of moths were attracted towards ripened banana fruits followed by the banana fruits fermented for 12 hours. The next best treatment in the attraction of fruit sucking moths was banana fruits fermented for 24 hours and 48 hours. There were no studies on the attraction of fruit sucking moths towards the fruits at different hours of fermentation using ethanol, the results of our study also reveal the least preference of moths towards banana at different hours after fermentation of overripe banana fruits. During the study, ethanol was used for the fermentation of banana fruits and very few moths were attracted to 24 hours fermented extract. However, the synthetic and commercially available ethanol was least attractive to the fruit feeding moths and do not produce any volatiles hence, the least number of fruit sucking moths were attracted towards the banana fruit fermented in synthetic ethanol at different hours. While, the ethanol produced during natural fermentation was most effective in attracting fruit feeding moths from distances and can produce more volatiles. Thus, the fruit feeding moths were attracted to the fruits which ferment naturally.

REFERENCES

Banziger H (1982) Fruit-piercing moths (Lepidoptera: Noctuidae) in Thailand. A general survey and some new perspectives. *Mitt. Schweiz. Entomol. Ges.* **55**, 213-240.

Bhumannavar B S (2000) Studies on fruit piercing moths (Lepidoptera: Noctuidae)-species composition, biology and natural enemies. *Ph.D. Thesis*, University of Agricultural Sciences, GKVK, Bengaluru, Karnataka, India.

Goddard K M (2016) Developing an attractant for monitoring fruit-feeding moths in citrus orchards. *M. Sc. Thesis*, Rhodes University, Makhanda, 6139, South Africa.

Holloway J D, Barlow H S, Loong H K and Khen C V (2013) Sweet or savoury? Adult feeding preferences of Lepidoptera attracted to banana and prawn baits in the oriental tropics. *Raffles Bull. Zool.* **29**, 71-90.

Jayanthi P D K, Aurade R M, Kempraj V and Verghese A (2015) Aromatic fruits as baits for the management of fruit-piercing moths in pomegranate: exploiting olfaction. *Curr. Sci.* **109**(8), 1476-1479.

Lefroy H M and Howlett F M (1909) *Indian Insect Life.* Calcutta and C. Thacer, Spink 786 p.

Leong S C T and Kueh R J H 2011 Seasonal abundance and suppression of fruit-piercing moth *Eudocima phalonia* (L.) in a citrus orchard in Sarawak. *Sci. World J.* **11**, 2330-2338.

Pujari M K (2008) Studies on fruit sucking moths with special reference to test light and food attractants for moths of *Othreis materna* Linn. *M. Sc. (Agri.) Thesis*, Mahatma Phule Krishi Vidyapeeth, Rahuri, Maharashtra, India.

Robinson C G, Pretorius T, Moore S D and Hill M P (2012) Monitoring attraction of fruit-feeding moths in citrus orchards to different fruit baits in the Eastern Cape province. *South Africa Fruit J.* **10**, 87-92.

Zaspel J M, Weller S J and Branham M A (2011) A comparative survey of proboscis morphology and associated structures in fruit-piercing, tear feeding and blood-feeding moths in Calpinae (Lepidoptera: Erebidae). *Zoomorphology* **130**, 203-225.