

## SPECIES COMPOSITION OF MANGO FRUIT BORER IN HUMID REGIONS OF SOUTH GUJARAT

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**Abstract:** A study was undertaken in mango growing areas of South Gujarat to study the species composition of mango fruit borer during 2022. Results revealed that complex of two fruit borer species viz., *Citripestis eutrapphera* (Meyrick) (Lepidoptera: Pyralidae) and *Conogethes punctiferalis* (Guenée) (Lepidoptera: Crambidae) was observed in South Gujarat. Mango fruit borer, *C. eutrapphera*, originally confined to the Andaman Islands, is a recent invasion in mainland India. Based on the mean larval population of both the species from pea stage to mature stage, maximum composition of *C. eutrapphera* (95.66 % and 94.82 %) was observed than *C. punctiferalis* (4.34 % & 5.18 %) at Instructional Farm, Navsari Agricultural University (NAU), Navsari and Agriculture Experimental Station, NAU, Paria (Valsad), respectively.

**Keywords:** Mango Fruit borer, Species composition, *Citripestis eutrapphera*, *Conogethes punctiferalis*, South Gujarat.

### INTRODUCTION

The mango, *Mangifera indica* L. (Family: Anacardiaceae), is a tropical and subtropical fruit known as "National Fruit of India," "King of Fruits," "Fruit of the Gods," and "Apple of the Tropic," In India, area under mango cultivation is 2371 thousand ha with production of 20946 thousand MT (Anon., 2022a). The states of Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Gujarat and Maharashtra are major mango producers of the country. In Gujarat, mango cultivated area is 166325 ha with production of 917196 MT. In Gujarat, Valsad, Navsari, Gir Somnath, Katch and Surat are the major mango producing districts. In South Gujarat, mango cultivated area is 99489 ha with production of 505076 MT. Valsad and Navsari are major mango producing districts of South Gujarat. Valsad occupies highest area of 37344 ha under mango cultivation with production of 179251 MT which is followed by Navsari with area of 33855 ha and production of 146931 MT (Anon., 2022b).

In mango, about 492 species of insects, 17 species of mite and 26 species of nematodes have been reported from all over the world. Of these, 188 species have been reported from India

(Tandon and Verghese, 1985) and only handfuls are of major importance namely hopper, thrips, mealy bug, stem borer, fruit flies and stone weevil. Some of the minor pests were also found to become major pests as a result of the changes in the environment. Prior to recent time, minor or secondary pests such as scales, thrips, mites, leaf webbers, stem borers, fruit borers, *etc.*, were considered to be a threat (Jayanthi *et al.*, 2014). The mango fruit borer, *Citripestis eutraperha* (Meyrick), (Lepidoptera: Pyralidae) originally confined to the Andaman Islands, is a recent invasion in mainland India. *C. eutraperha*, a species of snout moth was described by Meyrick in 1933 and geographically distributed in Java, Indonesia, India and Northern Territory in Australia. However, in India the only official record of *C. eutraperha* is from Andaman Islands (Bhumannavar, 1991) and this is the first record from main land, indicating the geographical spread within the country. Mango fruit borer, *C. eutraperha* which was originally described from Java, is a significant borer of mango fruits in South and South-East Asia and some parts of Australia (Anderson and Tran-Nguyen, 2012). The most recent classical example of intra-national invasion of insect pests from the Andaman and Nicobar Islands to mainland India is the mango fruit borer, *C. eutraperha* and it was probably restricted to the Islands for almost two decades, till 2014, when it was reported by Jayanthi *et al.* (2014) from South India on *M. indica*, a cultivated mango. They first time reported the occurrence of *C. eutraperha* causing extensive damage to immature fruits of mango in Karnataka and Tamil Nadu (Soumya *et al.*, 2016). The infestation of *C. eutraperha* was recently reported for the first time in Gujarat, where it caused significant damage (Bana *et al.*, 2018). Besides mango, the incidence of *C. eutraperha* was also reported in cashew as apple and nut borer in South Gujarat (Chavan and Parmar, 2024). Mango-growing pockets in the South-Western parts of Gujarat, as well as parts of Kerala and Tamil Nadu will moderately to highly suitable for *C. eutraperha* distribution in 2050 and 2070 (Choudhary *et al.*, 2019). Knowledge on species composition could help in adopting pest management practices more effectively in the field. Based on these, an investigation was carried out to study the species composition of mango fruit borer in humid tropics of South Gujarat.

## MATERIALS AND METHODS

A study was undertaken during 2022 in mango growing areas of South Gujarat to study the species composition of mango fruit borer. The climate of South Gujarat region is typically tropical, characterized by fairly hot summer, moderately cold winter and humid and warm monsoon with heavy rainfall. In general, monsoon commences from second week of June and

lasts up to third week of September. Post-monsoon rain during October-November is not uncommon. Most of the precipitation is received from South-West monsoon, concentrating in the months of July and August. Two locations viz., Instructional Farm, RHRS, Navsari Agricultural University (NAU), Dist. Navsari and Agriculture Experimental Station, NAU, Paria, Dist. Valsad.

Mango orchards irrespective of varieties were surveyed randomly at weekly interval starting from pea stage to the harvesting stage to record the presence or absence of mango fruit borer. The damaged fruits on standing tree which are clearly visible from the ground and also fruit borer infested dropped fruits along with larvae was collected and brought to the laboratory for dissection. The larvae of fruit borer were separated based on larval instars morphological characters and reared in laboratory till adult emergence. Different life stages of borers were recorded and documented. Using this information, the number of specimens collected for each species encountered at each site was tabulated. Based on these data the species composition was worked out.

## RESULTS AND DISCUSSION

The data on species composition of mango fruit borer (Table 1) revealed that complex of two fruit borer species viz., *Citripestis eutrapphera* (Meyrick) and *Conogethes punctiferalis* (Guenée) was observed during the study period in South Gujarat. Initially, based on the larval characters each species was separated and noted. In case of *C. eutrapphera* mature larva was dark brown to black in colour with metallic dark brownish head. Body was stout and long hairs on either side of each segment on dorso-lateral region (Fig. 3B). Larva was very active and have tendency to move backward on slight touch. Larvae of all the instars of *C. eutrapphera* were found at the time of dissection of each fruit during each observation. The adult was a medium-sized moth with a wingspan of 20 mm (Fig. 3H). The fore-wings were grey without any specific markings, whereas the hind wings were transparent. Both hind wings and forewings are metallic grey in colour. The colouring of a male's wings is a silvery grey. In comparison to female moths, males were smaller in size. Similarly, abdomen of male moth was also found smaller than female. Adult wings overlapped during the resting stage. In case of *C. punctiferalis* the mature larva was pinkish and speckled with minute black spots, measuring approximately 1.5 cm in length (Fig. 3J). The adult moth was medium sized and yellow with black spots on the body (Fig. 3L).

In case of both the species, on hatching, the caterpillars bore into mango fruit and feed within on pulp (Fig. 3 E) and seeds or soft tissues (Fig. 3 B). The fruit borer affects both mesocarp

and the seed preferably the seeds in mango; the pest renders fruits unfit for human consumption. The larva feeds on the rinds of fruits, later bores inside and feeds on internal contents. The granular faecal pellets are seen outside the fruits. Fruits damaged by this pest are exposed to secondary infection by pathogens leading to black corky appearance on the epicarp. Interestingly it was also noted that, generally single fruit was infested by *C. punctiferalis* (Fig. 3 I & J). However, single or couple or multiple fruits were damaged simultaneously by *C. eutraphera* (Fig. 3, E-G). In case of couple or multiple fruits usually attached fruits with each other were found infested. One larva of per fruit was observed in case of *C. punctiferalis* (Fig. 3 J). However many larvae feeding together per fruit was observed in case of *C. eutraphera* (Fig. 3 B).

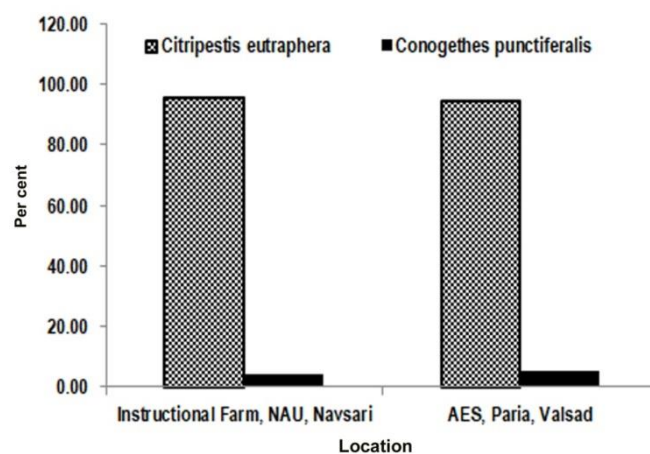
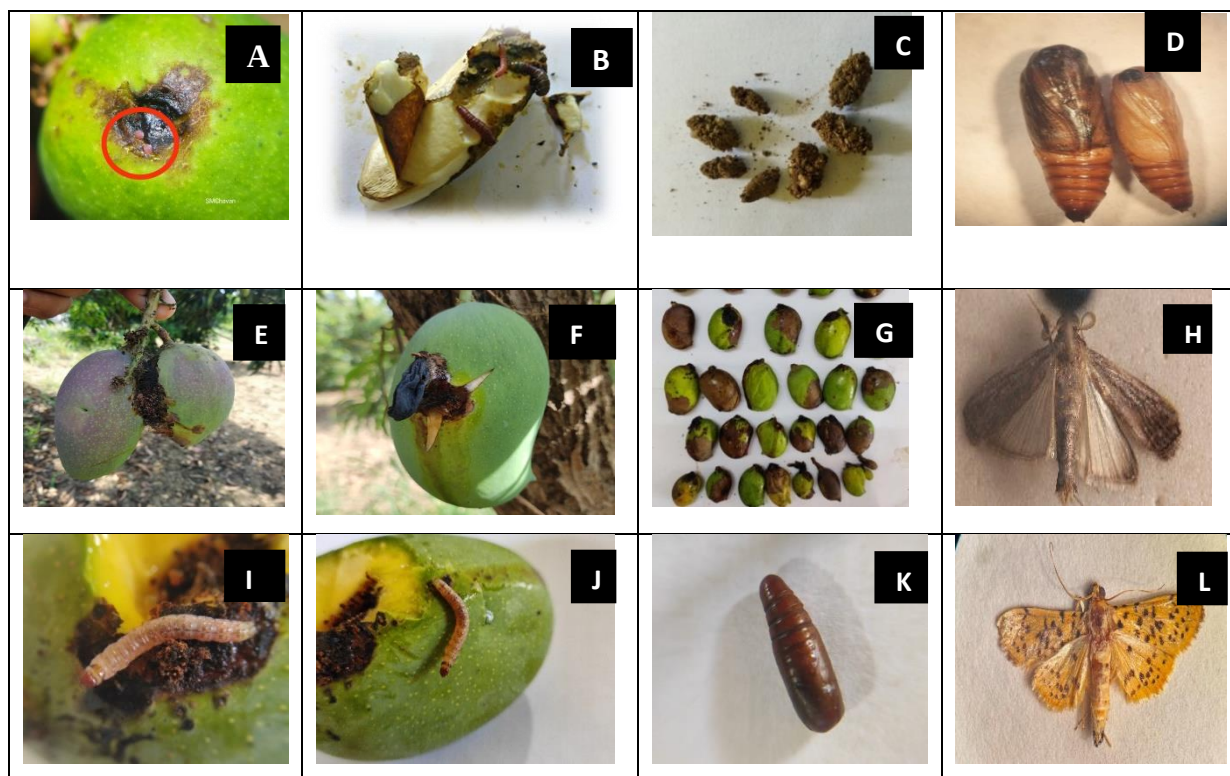


Fig. 2 Species composition of mango fruit borer

During summer 2022, at both the locations viz., Instructional Farm, NAU, Navsari and AES, NAU, Paria, the infestation by mango fruit borer was commenced at early fruit development stage viz., pea stage during third week of March coinciding with 11<sup>th</sup> Standard Meteorological Week (SMW) and continued up to the full mature stage or harvesting stage i.e. fourth week of May coinciding with 21<sup>st</sup> SMW (Table 1). Moreover, it also noted that, at Instructional farm, NAU, Navsari during early stage of fruit development (pea and marble stage), mango fruits were infested by only one dominant species, *C. eutraphera*, whereas, at AES, NAU, Paria both the species were observed. However during later stage of fruit development (egg and mature stage) complex of two fruit borer species viz. *C. eutraphera* and *C. punctiferalis* were observed at both the locations. Maximum larval collection was observed during 16 to 20<sup>th</sup> SMW coinciding with egg to full mature stage at both the locations (72 to 82 and 66 to 105 larvae at Instructional Farm, NAU, Navsari and AES, NAU, Paria, respectively). Based on the mean larval population of both the species from pea stage to mature stage, maximum

composition of *C. eutraperha* (95.66 % and 94.8 2%) was observed than *C. punctiferalis* (4.34 % & 5.18 %) at both the locations, respectively.



**Fig.3: Different life stages and damage by *C. eutraperha* A.Eggs, B. Larva, C. Earthen cocoon, D. Pupa, E. Damaged fruits F. Cracking of fruits, G. Damaged fruits at different stages, H. Adult; Different life stages and damage by *C. punctiferalis* I. Larva, J. Damaged fruits with larva, K. Pupa, L. Adult**

In past, Bana *et al.* (2018) from South Gujarat reported three species of mango fruit borer viz., *Deanolis* spp., *C. punctiferalis* and *C. eutraperha*. Moreover, *C. eutraperha* is a new indigenous restricted mango fruit borer species and found causing extensive damage to immature fruits though made bored holes filled with frass and adjacent fruits of mango were often found blackened around the bored area. In the present investigation only two fruit borer species viz., *C. punctiferalis* and *C. eutraperha* was observed. *Deanolis* spp. was not observed during present investigation. This may be due to change in climatic condition. The present findings are more or less in line with earlier workers and thus confirm the present investigation. However, Sunitha *et al.* (2020) from Andhra Pradesh recorded 3 fruit borer species infesting mango viz., *D. sublimbalis*, *C. eutraperhas* and *C. punctiferalis*. Moreover, *D. sublimbalis* found to be dominant species causing 3.70 to 36.50 per cent damage followed by *C. eutraperha* (4-5 % damage). Recorded infestation levels on mango fruits ranged from 2.46 to 64.00 per cent in India during fruiting period in the surveyed region of Karnataka and

Tamil Nadu (Soumya *et al.*, 2016; Jayanthi *et al.*, 2014). Singh and Kaur (2016) recorded *C. punctiferalis* larvae feeding tunnel on mango inflorescence and fruit in Hoshiarpur, Punjab. But, during present study we have not observed the shoot or inflorescence feeding by *C. punctiferalis*. Black frass was also seen near the entrance, and attacked fruits were found to rot and drop off. One larva per fruit was observed causing about 10% damage to the trees (Singh and Kaur, 2014). The present findings are more or less in line with earlier workers.

**Table 1: Species composition of mango fruit borer at different locations in South Gujarat**

| SMW | Instructional Farm, NAU, Navsari |                  |              |                     |              | AES, NAU, Paria               |                  |              |                         |              |
|-----|----------------------------------|------------------|--------------|---------------------|--------------|-------------------------------|------------------|--------------|-------------------------|--------------|
|     | Total no. of larvae recovered    | No. of larvae of |              | Species composition |              | Total no. of larvae recovered | No. of larvae of |              | Species composition (%) |              |
|     |                                  | <i>C.e.</i>      | <i>C. p.</i> | <i>C.e.</i>         | <i>C. p.</i> |                               | <i>C.e.</i>      | <i>C. p.</i> | <i>C.e.</i>             | <i>C. p.</i> |
| 12  | 42                               | 42               | 0            | 100.0               | 0.00         | 62                            | 60               | 2            | 96.77                   | 3.23         |
| 13  | 48                               | 48               | 0            | 100.0               | 0.00         | 54                            | 52               | 2            | 96.30                   | 3.70         |
| 14  | 42                               | 42               | 0            | 100.0               | 0.00         | 43                            | 43               | 0            | 100.00                  | 0.00         |
| 15  | 40                               | 37               | 3            | 92.50               | 7.50         | 51                            | 48               | 3            | 94.12                   | 5.88         |
| 16  | 72                               | 68               | 4            | 94.44               | 5.56         | 79                            | 75               | 4            | 94.94                   | 5.06         |
| 17  | 92                               | 85               | 7            | 92.39               | 7.61         | 105                           | 98               | 7            | 93.33                   | 6.67         |
| 18  | 94                               | 88               | 6            | 93.62               | 6.38         | 78                            | 72               | 6            | 92.31                   | 7.69         |
| 19  | 78                               | 73               | 5            | 93.59               | 6.41         | 85                            | 80               | 5            | 94.12                   | 5.88         |
| 20  | 82                               | 77               | 5            | 93.90               | 6.10         | 66                            | 60               | 6            | 90.91                   | 9.09         |
| 21  | 52                               | 50               | 2            | 96.15               | 3.85         | 44                            | 42               | 2            | 95.45                   | 4.55         |
|     |                                  | <b>Avg.</b>      |              | <b>95.66</b>        | <b>4.34</b>  |                               | <b>Avg.</b>      |              | <b>94.82</b>            | <b>5.18</b>  |

The shoot and fruit borer, *C. punctiferalis*, mainly occurs in tropical and subtropical countries (Pena *et al.*, 2002) and is distributed in Asia and Australia. Among the fruit crops, infestation of *C. punctiferalis* reported on banana, citrus, sapota, pomegranate, mango, guava, grape, apple and peach (Konno *et al.*, 1980; Kodoi and Kaneda, 1990; Gour and Sriramulu, 1992; Butani, 1978; Ram *et al.*, 1997; Singh *et al.*, 2002). In the 1980s and 1990s, *C. punctiferalis* was found infesting mango fruits occasionally and was considered a minor pest. But in the twenty-first century, this pest has attained the status of a major pest, especially in Uttar Pradesh and North India.

Singh *et al.* (2002) observed reddish-brown larvae of *C. punctiferalis* feeding on unripe mango fruits in the Sambhalhera village of Muzaffarnagar, Uttar Pradesh. The highest incidence (20%) of *C. punctiferalis* was noticed during the 32<sup>nd</sup> Standard Meteorological

Week (SMW) at Udheywala, while the other peak incidence (9%) was recorded during the 33<sup>rd</sup> SMW at Raya. *C. punctiferalis* is a polyphagous species, well distributed in the tropics and subtropics. In Punjab and Himachal Pradesh, *C. punctiferalis* has become a serious pest of plum, peach, pear, litchi and pomegranate. On guava, it was a major pest from the beginning of the twenty-first century infesting up to 20 per cent fruits in Jammu and Kashmir and Allahabad Safeda is the most susceptible cultivar to infestation.

Kannan and Rao (2007) reported that *C. punctiferalis* infested matured leaves of mango during September to October and ripened fruits during April to June. Gundappa *et al.* (2015) reported that, the caterpillars bore into mango fruit, bud or shoot and feed within on pulp and seeds or soft tissues. The fruit borer affects both mesocarp and the seed, preferably the seeds in mango; the pest renders fruits unfit for human consumption. The larva feeds on the rinds of fruits, later bores inside and feeds on internal contents. The granular faecal pellets are seen outside the fruits. When fruits are in close proximity, it forms favorable niche for the larva to bore into fruits. Fruits damaged by this pest are exposed to secondary infection by pathogens leading to black corky appearance on the epicarp. Singh and Kaur (2016) recorded *C. punctiferalis* larvae feeding on mango inflorescence in Hoshiarpur, Punjab. Larvae were observed to tunnel inside the fruit by joining two fruits together. Black frass was also seen near the entrance and attacked fruits were found to rot and drop off. One larva per fruit was observed causing serious damage to the trees (Singh and Kaur, 2014).

### CONCLUSION

Species composition of mango fruit borer from South Gujarat mango ecosystem revealed that complex of two fruit borer species viz., *Citripestis eutrapphera* (Meyrick) (Lepidoptera: Pyralidae) and *Conogethes punctiferalis* (Guenee) (Lepidoptera: Crambidae) were observed. This comprehensive documentation not only updates the fruit borer infesting mango in the region but also provides a baseline for future taxonomic, ecological and population-based studies by students and scientists and for effective management practices by mango growers.

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