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REVIEW ON FRUIT PIERCING MOTHS OF GENUS *OTHREIS (EUDOCIMA)*

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ABSTRACT

This review is on the occurrence and other details of fruit piercing moths of the genus *Othreis*, which are known as pest on the fruit crops inIndia.These moths occur on pomegranate, citrus and orange in Maharashtra. The details known on the diversity, seasonal abundance, and biology and management are reviewed. The review reveals about 12 species belonging to the genus *Othreis (Eudocima)*.

Key words: *Othreis*, *Eudocima*, fruit piercing moths, review, diversity, abundance, biology, management

The members of the genus *Othreis (Eudocima)* are fruit sucking moths occurring on pomegranate and various fruits crops in tropical parts of the world and Indo-Australian-Pacific region along with Africa (Waterhouse and Norris 1987).The adults are polyphagous, and their occurrence as serious pests was first reported by Lefroy and Howlett (1909). The moth feeds on ripened fruits with its proboscis during night. Internal injury consists of a bruised dry area beneath the skin. Secondary rots develop at the puncture site (Atachi et al., 1989). French botanist Thozet observed for the first time *Eudocima (Othreis) fullonia* (Clerck) moths sucking juice from ripe orange fruits at Rockhampton in Australia (Baptist, 1944). *Eudocimafullonia* was redescribed by Moore (1887) in his "Lepidoptera of Ceylon" and subsequently by Hamson (1892) in "Fauna of British India".Literature reveals that various species of fruit piercing moth (*Othreis* spp.) are serious pests ofpomegranate, guava, mango, citrus, papaya, litchi, carambola, grapes, eggplant and tomato etc. (Kamala Jayanthi, 2010; Ramkumar, 2010). The following details are as a result of a review on diversity and some other aspects of fruit piercing moths of genus *Othreis* in India.

Diversity

The occurrence of fruit piercing moths (*O. fullonia, O. maternal* and *O. ancilla)* had been noted on grapevine (David, 1973); *O. materna* moth was observed on *Quisqualis indica* flower at Rajasthan (Verma, 2003). The species viz., *O. materna, O. fullonia*and *O. ancilla* had been reported from Peechi Varhani wildlife sanctuary at Kerala by Mathew et al. (2005). Ramkumar et al. (2010) observed *O. materna, O. fullonia, O. homaena,* and *O. salaminia,* and their seasonal abundance on guava, citrus, and orchids in and around Agricultural College Research Institute, Madurai was documented; activity of *O. maternal* was observed in the second fortnight of July to January, and those of *O. fullonia* and *O. homaena* in the first week of September to first fortnight of January. *Othreis fullonia* was reported from Aravali Range, Rajasthan by Sharma (2011). Gurule and Nikam (2011) observed *Eudocimaphalonia, E. homaena*, and *E.materna* in the north Maharashtra from Nasik, Dhule, Jalgaon, and Nandurbar districts.

Occurrence of *Eudocimasalaminia, E. phalonia, E. homaena, E. hypermnestra* and *E. materna* was observed by Shubhalaxmi et al. (2011); and *O. homaena, E. hypermnestra, O. materna, E. phalonia* and *E. salmania* in the northern Maharashtra by Gurule and Nikam (2013). Sivasankaranand Ignacimuthu (2014) observed six species viz., *O. materna (L), E. salmania (C), O. phalonia (L), O. homaena (H), E. cajeta (C), E. aurantia (M)*from Tamil Nadu region of Western Ghats.The population density of *Othreis* on citrus with fruit damage during August to November with maximum fruit drop was observed and *O. materna, O. fullonia*, *and O. homaena* in September to October from Vidarbha, Maharashtra was observed (Mohite and Deshmukh, 2014). Sharma (2014) reported *O. fullonica* from foothills of Aravali range, Rajasthan; occurrence of *O. fullonica (L.)* and *E. maternal (L.)* along with distribution, and species richness from Amravati during August and January was analysed (Gadhikar et al., 2015). Bharamal (2015) observed *E. materna* from Amboli forest Sindhudurga, Maharashtra. Dey and Sanyal (2016) explored the diversity and potential role in conservation of two species of fruit piercing moths such as *O. homaena* and *O. phalonia.* Patel et al.(2016) observed the occurrence of *E. maternal* and *E. homaena*

Table 1. Occurrence of species of *Othreis (Eudocima)* in India

S. No.	Species	Collected by	Location	State
1	O. ancilla O .fullonica Linn. O. materna	Vasantharaj David (1973)	Puliampatti Coimbatore	Tamil Nadu
2	*O. cajeta* (Cramer,1779) *O. fullonia* (Clerk,1764)	H.S. Rose (2001)	Jatinga	Assam
3	O. materna O. fullonia O. ancilla Cram.	George Mathew et al (2005)	Peechi-Vazhani wildlife sanctuary	Kerala
4	O. materna O. fullonia O. homaena O. salaminia	J. Ramkumar et al (2010)	Madurai campus	Tamil Nadu
5	E. salaminia E. phalonia E. homaena E. hypermnestra E. materna	V. Shubhalaxmi et al (2011)	Northern Western Ghats	Maharashtra
6	O. materna	S.K. Verma (2011)	Arid zone	Rajasthan
7	O. fullonica (Linnaeus)	Gaurav Sharma (2011)	Aravali Range	Rajasthan
8	*E. maternal* (Linnaeus,1767) *E. homaena* (Hubner,1816) *E. phalonia* (Linnaeus,1763) *E. hypermnestra* (Cramer, 1780) *E. salaminia* (Cramer, 1777)	Sachin A. Gurule et al (2013)	Nashik, Dhule, Nandurbar, Jalgaon	Maharashtra
9	E. materna E. phalonia	Y.A. Gadhikar et al (2013)	Amravati	Maharashtra
10	O. materna O. fullonia O. homaena	A.S. Mohite and C.K. Deshmukh (2014)	Vidarbha	Maharashtra
11	E. materna E. homaena	T.M. Bharpoda et al (2015)	Sabarkantha and Kheda	Gujarat
12	E.materna	D.L. Bharamal (2015)	Amboli Reserved Forest	Maharashtra
13	E. materna	Jadhav.P et al (2016)	Washim	Maharashtra
14	E. materna E. homaena	H.C. Patel et al (2016)	Panchamahal	Gujarat
15	E. materna	Shashi Bhushan Mishra et al (2016)	Kodagu	Karnataka
16	E. phalonia E. homaena	Prithadey and Abeshkumarsanyal (2016)	Protected areas Uttarakhand	Uttarakhand
17	E. materna E. phalonia *Educoiamsikhimensis* *E. homaena* *E. salaminia* *E. aurantia* (Moore,1877) *E. cajeta* *E. hypermnestra* *E. cocalus* (Cramer,1777)	Kuppusamy Sivasankaran et al (2016)	Nilgiri Hills	Tamil Nadu

18	E. phalonia	Soumya Channi et al (2017)	Dharwad (Chota Mahabaleshwar Hill)	Karnataka
19	E. homaena E. materna E. phalonia E. salaminia	Subhasish Arandhara et l (2017)	Tinsukia	Assam
20	E. phalonia	Navneet Singh et al (2017)	Topchanchi wildlife sanctuary	Jharkhand
21	E. salaminia E. membliaria	A Rahman et al (2017)	Jorhat	Assam
22	O. fullonica	J.S. Tara and Anu Bala (2018)	Jammu	Jammu
23	*E. homaena* *E. hypermnestra* *E. materna* *E. phalonia* *E. salaminia E. sikhimensis* (Butler,1895)	Yash Sondhi et al (2018)	Agastyamalai Biosphere Reserve	Kerala
24	E. homaena E. hypermnestra	Pratheesh Mathew et al (2018)	Vagamon hill (Western Ghats)	Kerala

Table 2. Studies on the genus *Othreis* from India

S. No.	Species	Aspects covered	References
1	*O. materna*	Immature stages, bionomics	Srivastava and Jatan Kumari Bogawat (1968)
2	*O. materna*	Feeding mechanism	Srivastava and Jatan Kumari Bogawat (1969)
3	*O. materna*	Nervous system	Srivastava and Jatan Kumari Bogawat (1969)
4	*O. materna*	Seasonal incidence, parasitization	Bhumannavar and Viraktamath (2001)
5	E. salaminia O. fullonia O. homaena *O. materna*	Proboscis morphology and nature of fruit damage	Bhumannavar and Viraktamath (2001)
6	O. materna	Biologyon sweet orange	Patel and Patel(2006)
7	*E. materna*	Managing using feeding repellents	Kamala Jayanthi et al (2010)
8	E. salaminia	RAPD – PCR technique	K. Shivasankaran et al.(2013)
9	E. materna, E. srivijiyana	DNA extraction and molecular identification	Shere-Kharwar et al. (2013)
10	E. materna E. homaena E. fullonia	Aromatic fruits baits	Kamala Jayanthi et al. (2015)
11	*O. materna*	Cytological changes during oogenesis	Mohite and Dorlikar (2015)
12	*E. materna*	Host specificity and biorational management	Kulkarni et al. (2017)
13	*E. materna*	Parasitoids	Magar et al. (2017)
14	E. cocalus	DNA Barcoding	Priya Bhaskaran and Sebastian (2018)
15	*E. materna*	Chemosterilant- HEMPA on spermatogenesis	Mohite and Dorlikar (2019)
16	*E. materna*	Role of fruit volatiles and sex Pheromone components in mate recognition	Mallikarjun et al (2019)

on tomato crop at Panchmahal district of middle Gujarat during 2013-14.

The nine species of *Eudocima*viz., *E. materna, E. phalonia, E. sikhimensis, E. homaena, E. salaminia, E. aurantia, E. cajeta, E. hypermnestra, E. cocalus* were observed from Tamil Nadu Western Ghats region by Sivasankaran et al.(2016); and *E. materna* was observed at Kodagu district of Karnataka (Mishra et al., 2016), and *E. materna* from Washim region Maharashtra (Jadhav et al., 2016); *O. materna* on mango and *E. membliaria* on pumpkin were observed at Jorhat district, Assam by Rahman et al. (2017). Arandhara et al. (2017) has observed *E. homaena, E. materna, E. phalonia*and *E. salaminia* from Tinsukia district, Assam; and *E.phalonia* by Singh et al (2017) from Topchanchi wildlife sanctuary, Jharkhand, and from Karnataka University, Dharwad (Channi et al., 2017); and *E. homaena* and *E.hypermnestra* from Vagamon hills, Kerala (Mathew et al., 2018). *Othreisfullonica* was studied from Jammu district during May 2012 to April 2013 (Tara and Bala, 2018); and *E. homaena*, *E. hypermnestra, E. materna, E. Phalonia, E. salaminia* and *E. sikhimensis* were observed from Shendurney and Ponmudi in Agastyamalai Biosphere Reserve, Kerala (Sondhi et al., 2018).

Biology andmanagement

The nervous system of *O. maternal* was studied by Srivastava and Bogawat (1968), and its immature stages described by Srivastava and Bogawat (1969); and mouth parts were examined in *E. salaminia, O. fullonia, O. homaena* and *O. materna* (Bhumannavar and Viraktamath, 1999).The life cycle of *O. materna* was studied by Patel and Patel (2006). Feeding mechanism and the structures such as head, mouth parts, and proboscis in *O. maternal* were explained by Srivastava and Bogawat (2007). The management practices were studied by Jayanthi et al. (2010), which provided details of using feeding repellents/ attractants against *E. materna* on guava and pomegranate. Kharwar et al. (2013) described molecular diagnostics of *E. materna*, *E. srivijiyana;* and *E. phalonia and E. salaminia*were subjected to RAPD-PCR (Sivasankaran et al., 2013).

Application of aromatic fruit baits in pomegranate was evaluated by Jayanthi et al.(2015). Mohite and Dorlikar (2015) did a cytological study of vitellogenic stages of ovary development in*O.maternal*, and parasitoidswere studied by Magar et al.(2017) with larval parasitoids like tachinid fly, *Goniophthamushali*, *Eulophid wasps, Euplectrusmaternus* and *Tetrastichus*. Kulkarni et al (2017) carried out host biorational practice/ host specificity studies on *Othreis* larvae to various host plants under laboratory conditions. The molecular taxonomy of *E. cocalus* was attempted by Bhaskaran and Sebastian (2018). The effect of chemosterilanthexamethyl phosphoramide on spermatogenesis was evaluated in *E. materna*by Mohite and Dorlikar (2019). The role of fruit volatiles in mating and sex recognition in *E. materna* was studied by Mallikarjun et al. (2019). Thus, the study reveals that the fruit piercing mothsbelonging to the *O. (Eudocima)* are widely distributed in Indiawith 12 species known. Lot of work has been done on their biology, management practices and various aspects.

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