Biolife
AN INTERNATIONAL QUARTERLY JOURNAL OF BIOLOGY & LIFE SCIENCES
3(4):783-787
ISSN (online): 2320-4257
www.biolifejournal.com
BIOLIFE RESEARCH ARTICLE

# Biology, ecology and control of weevils (Curculionidae: Coleoptera) on Mango *Mangnifera indica* Linn. from western Maharashtra

T. V. Sathe*[1], S. S. Patil[2], A. G. Khamkar[3] and Khairmode P. V[4]

[1,3,4]*Division of Entomology, Department of Zoology, Shivaji University, Kolhapur.*
[2]*Department of Zoology, Krishna Mahavidyalaya, Retre bk, Karad, Dist. – Satara*

*E-mail: profdrtvsathe@rediffmail.com

Mango *Mangifera indica* Linnaeus is king of the fruits and has nutritional and medicinal value and widely cultivated in Maharashtra. However, the crop is attached by about 11 species of Weevil (Coleoptera: Curculionidae). The important genera refer to *Sternochetus*, *Myllocerus*, *Apoderus*, *Rhynchaenus*, *Alcidodes*, *Amblyrrhinus* and *Camptorrhinus*. *Sternochetus* and *Rhynchaenus* were found damaging fruits and rest of genera has damaged the tender leaves, buds and shoots of mango. *S. mangiferae* have been studied with respect to biology, ecology, damage and control. *S. mangiferae* infested fruits of hybrid varieties of mango. The order of preference shown by the species refer to Neelum > Hapus > Ratnagiri > Deogadh > Totapuri > Indigenous. The pest feed on pulp, and cotyledons in seed and bore the fruit at ripen stage. Control measures suggested *S. mangiferae* ploughing and digging fields under mango tree will expose diapausing weevils to natural mortality factors. Dipping fruits into 53$^0$C hot water for 1 to 2 hours kill the pest stages in mango. Other weevils were control by spraying 0.02% phosphamidon and 0.03% monocrotophos.

**Key words**- Weevils, Mango, Biology, Ecology, Control

## INTRODUCTION

Mango *Mangifera indica* Linnaeus is king of the fruits and one of the ancient fruit of Indian origin. It has been cultivated since more than 6000 years. In India mango is cultivated in more than 750,000 hectares of land. Although it is widely cultivated from Uttar Pradesh, Andhra Pradesh, Bihar, West Bengal and Kerala, Maharashtra is leading state in India. India account about 80% of the world's mango production with great export potential. Fresh mango, tinned mango, slices juice, pickle etc. have tremendous demand from all over the world. Mango has great medicinal value; bark of the tree serves as an astringent and useful in control of dysentery and bleeding piles, its dried flowers also dysentery curative. Similarly, powder of tender leaves is antidiabetic and antidiarrhoeatic and the seeds are antihelminthic which helps in controlling roundworms. However, the crop is attacked by about 175 insect pests from all over the world. But, weevils are miracle due to their typical life cycle and nature of damage to mango. Review of literature indicates that weevils on mango have been studied by Subramanyan (1926), Mc Bride & Mason (1934), Voute (1935), Singh (1945), Gandhi (1955), Gangolly *et al.* (1957, 1962), Atwal (1963), David *et al.* (1964), Sundra Babu (1969), Wadhi (1972), Wadhi and Sharma (1972).

***How to Site This Article:***
T. V. Sathe, S. S. Patil, A. G. Khamkar and Khairmode P. V. (2015). Biology, ecology and control of weevils (Curculionidae: Coleoptera) on Mango Mangnifera indica Linn. from western Maharashtra. *Biolife*, 3(4), pp 783-787. doi:10.17812/blj.2015.344

Published online: 6 October 2015

## MATERIALS AND METHODS

### Study area:

From western Maharashtra, India, three districts namely Kolhapur, Satara and Sangli were selected for present study on the basis of geographic and climatic variations. Kolhapur is situated between 15-17$^0$ North latitude and 73-74$^0$ East longitude with an average rain fall 1200 mm and is admixture of plain parts and forestry including Western Ghats. Similarly, Satara is situated between 17.5$^0$ to 18.11$^0$ latitude and 73.33$^0$ to 74.54$^0$ East longitudes and average rainfall of the district is 1426 mm while, Sangli is relatively with low rainfall 425 mm and situated between 16.4$^0$ to 17.0$^0$ North latitude and 73.43$^0$ to 75.00$^0$ East longitudes. Three spots of mango orchards were selected from each district for survey and surveillance studies of the weevils. Observation on the occurrence, diversity, sex- ratio, biotic and abiotic factor leading to the population dynamics of weevil were taken at one week interval by spot observations in the field. Life cycle of weevil was studied by noting ovi-position by female on mango fruits and the development of weevil from egg to adult. Nature of damage both by female weevil and the grubs were noted by spot observations and sometimes by dissecting grubs/pupae/adults from ripening mango pulp and stones. Preventive control measures were adopted as per the situation of crop and appearance of the weevils, especially diapausing stages, inactive period and active period of the weevils on the crop. For curative control non chemical methods were given priority specially, destructive infected stages and recidal places of the pest or treatment of pesticide to tree trunk and soil. Hot water treatment was also advised for killing weevils.

## RESULTS AND DISCUSSION

Results recorded in table 1 to 2 and figs 1 to 4 indicated that a total of 11 species were associated with mango crop in western Maharashtra. However, the most destructive species to fruits was *S. mangiferae* from western Maharashtra. In all 6 varieties of mango, namely Hapus, Neelum, Ratnagiri, Totapuri, Deogadh and Indigenous have been studied with respect to infestation by *S. mangiferae*. The results recorded in table-2 indicated that Neelum, Hapus, Ratnagiri and Deogadh varieties of mango were more susceptible to the pest attack. Maximum 48.00% and minimum 2% infestation was noted on the orchards of Satara and least on the orchards Sangli district (table-2)

**Table-2. Infestation by *S. mangiferae* to mango fruits from Western Maharashtra**

| S.No. | Variety | Kolhapur | Satara | Sangli |
|---|---|---|---|---|
| 1. | Hapus | 37.00 | 29.00 | 17.00 |
| 2. | Neelum | 48.00 | 42.00 | 23.00 |
| 3. | Ratnagiri | 31.00 | 22.00 | 14.00 |
| 4. | Devgadh | 23.00 | 17.00 | 5.00 |
| 5. | Totapuri | 4.00 | 3.00 | 2.00 |
| 6. | Indigenus | 2.00 | 2.00 | 0.00 |

### Life cycle of *S. mangiferae*

The weevil showed four distinct stages of its life cycle viz. egg, larva, pupa and adult on Hapus variety of mango in western Maharashtra. There were five instars in the larval form.

### Egg:

Eggs were minute and whitish and laid singly in the skin of ripening fruits. Incubation period was 4 - 6 days. With the help of snout or ovipositor female prepared a wound for filling the eggs in it. A typical deepening was noted on the fruit. A secretion from fruit was released from wound but, later was dried soon and no prominent sign of oviposition was left on the fruit.

**Table -1 Diversity of weevils on mango from Western Maharashtra**

| Sr.No. | Name | Family | Crop pest damage |
|---|---|---|---|
| 1. | *Sternochetus mangiferae* (Fabricius ) | Curculionidae | Fruit/ Stone |
| 2. | *Deporatus manginatus* (Pascal) | Curculionidae | Young leaves |
| 3. | *Apoderus trasquebaricus* (Fab.) | Curculionidae | Leaf-twisting |
| 4. | *Alcides frenatus* (Faust) | Curculionidae | Bore into top shoot |
| 5. | *Myllocerus spp.* | Curculionidae | Root lets |
| 6. | *Myllocerus discolor* Boheman | Curculionidae | Tender leaves |
| 7. | *Myllocerus laetivirens* Marshall | Curculionidae | Tender leaves |
| 8. | *Amblyrrhinus poricollis* Boheman | Curculionidae | Tender leaves |
| 9. | *Camptorrhinus mangiferae* (Marshall) | Curculionidae | Tender leaves |
| 10. | *Deltotrachelus pubes* Faust | Curculionidae | Tender leaves |
| 11. | *Rhynchaenus mangiferae* Marshal | Curculionidae | Tender leaves |

**Figure-1. *S. mangiferae* damaged fruit**

***Figure-2. S. mangiferae* damaged fruits**

## Larvae

First instar- first instar was whitish opaque with well-developed mandibles. First instar lasted for 2 days, during which the larva feed on pulpy content of the fruit.

Second instar- This instar was also whitish and with well-developed mandibles for feeding pulp of the fruit and boring through pulp towards stone. This stage staged for 2 days.

Third instar – Third instar showed relatively well developed and large sized mandibles for feeding /boring in to hard stone. Third instar reached into the stone by boring and fed on embryo inside the stone. This stage was also whitish in color and lasted for 3 days.

Fourth instar – Fourth instar was whitish with dark mandibles and fed on seeds in stone and lasted for 3 days.

Fifth instar – Fifth instar was also whitish and with enlarged size. Full grown larva prepared a cell inside the stone and pupated in the stone. This stage lasted for 4 days and finally transformed into pupa inside the stone only.

**Fiure-3. Mango stone weevil**

**Figure-4. *Myllocerus sp*. Mango defoliator**

### Pupa

Pupa was whitish initially but became brownish and with three distinct body divisions and in advanced stage with developed appendages like antennae, legs and wings or wing pads. The pupa was exarate type since the appendages were not tightly appressed to the body. Pupal stage lasted for 7 -10 days and fully developed adult was formed into the pupal cell of stone. Later, the adult take the cut to stone wall and come out of stone through pulp of ripen fruits.

### Adults

Adults were dark brown to black color with a prominent snout and small antennal pair. Legs were well developed and with 4 tarsal segments. The adults measured for 6 – 8 mm in body length. Males were smaller than females. The life cycle was completed within 25 days to 32 days. Field sex ratio (♂ :♀**)** was 1:1.150.

### Diapause

The adults were found sitting in cracks and crevices of tree trunk as hibernating form from a period of July-August to March-April. Similarly, adults were also found in soil during their hibernating period. Only one generation was completed on all varieties of mango studied.

### Nature of damage by Weevil

Soft varieties of mango noted in table -2 were more attacked by the weevils. The female damages full grown fruits for oviposition. A typical deepening was noted as a sign of oviposition on the fruits. The wound was sealed by fruit secretion. The main damage to fruit was made by the grubs by feeding on the pulp before ripening and then boring into the stone, and feeding on cotyledons (seeds) and again while adult coming out of the stone by boring into stone and ripen fruits (Fig.1 and 2)

Weevil diversity on mango has been reported in Table 1. Sprouting of leaf buds and tender leaves occurred twice in a year during Aug-Sept and March-April most of the weevils were associated with this stage of crop and caused defoliation and affected the growth of crop and fruit setting. Defoliating weevils can be controlled by spraying the crop with 0.03% monocrotophos or phosphamidon 0.02%.

## DISCUSSION

According to Gandhi (1955) *S. mangiferae* is widely distributed in the tropics as a specific pest of mango much preferred sweet varieties of mango such as Alfanso, Bangalora, Neelum, etc. Sundra Babu (1969) reported that mango varieties Alfanso, Bangalora and Neelum were affected with 73%, 93% and 100% respectively. According to him the pest was more common in South India. As like the findings of Sundra Babu (1969) Neelam variety was most susceptible for pest attack. While, other varieties like Hapus, Ratnagiri, Deogadh, Totapuri and Indigenous varieties have been tested for first time from Western Maharashtra region and order of preference given by the pest to varieties refer to Neelum> Hapus> Ratnagiri> Deogdh> Totapuri> Indigenous in most of the study spots of Kolhapur, Satara and Sangli districts.

Subramanyam (1926) studied the life cycle of *S. mangiferae*. He reported that the pest completed its life cycle from egg to adult within 40 to 50 days during June to July. In the present study the pest has completed its life cycle within 25 to 32 days on Hapus variety of mango from Western Maharashtra. While *Sternochaetus gravis* (Fabricious) completed its life cycle from egg to adult within 40 to 48 days on mango fruits from Indonesia and China (Voute, 1935).

As regards to oviposition, there are controversies and different opinions. According to Butani (1979) *S. mangiferae* laid its eggs on the epicarp of partially developed fruits. In the present study, eggs were laid singly in the skin of matured and ripening fruits and created a deepening a typical sign of oviposition on the fruit. The oviposition on the crop was occurred quite late because of the late blossoming and the frequent rains of pre monsoon. According to Butani (1979) and Atwal (1993) only one generation was possible in a single year. Our results are in agreement with the previous workers.

Mc Bride and Mason (1934) studied the effect of sub-freezing temperature on mango seeds containing grubs and pupae of *S. mangiferae* and noted that exposure of the stones for 48 hours at $12^0$ C killed all grubs and pupae and 77.7% adults while 100% mortality was achieved in adults by exposing the infected mangoes to above conditions for five days. David and Sundra Babu (1962) suggested the spray of 0.01% fenthion on the crop as an effective measure for pest control, while, Wadhi (1972) advised dipping of hard fruits in ethylene dibromide emulsion at $50^0$c for two hours. According to him the treatment will not affect the taste, flavor and quality of the fruits of varieties, Alfanso and Dashahri but, Langra variety of mango cannot tolerate the treatment and fruits cannot maintain the quality.

As regards to the control of weevils in the stone of fruit, Wadhi and Sharma (1972) worked on dose dependence of ethylene dibromide on mango fruits. They estimated total level of bromide in the pulp of fruits below 5 ppm and 2 ppm in 24 and 72 hours exposure respectively, which was far below the tolerance level of 10 ppm. Their suggestions are acceptable for weevil control in mango fruits. Gangoly *et al*., (1957) reported *Sternochetus frigidus* (Fabricious) (*gravis* Fabricius) damaging fruits from West Bengal and Assam. This species was not reported from Western Maharashtra. *S. gravis* was also reported from Indonesia and China where the

red ants *Oecephylla smaragdina* (Fab) were found predating *S. gravis*.

Butani (1979) reported 13 species of weevils feeding on fruits, tender leaves and shoots of mango crop from different parts of India. Out of 12 species, 11species were prevalent from Western Maharashtra as it is diversity rich area of India since some parts of Western Ghats is also located in Western Maharashtra. The control measures suggested in the present text for *S. mangiferae* will add area relevance for solving the damage problem of weevil to mango fruits since pest control on edible and horticultural crops with pesticides is more difficult and need ecofriendly approaches (Sathe, 2003; 2014; Sathe and Chougule, 2014; Khairmode *et al*.2015; Sathe *et al*., 2014a, b; 2015).

## ACKNOWLEGEMENT

Authors are thankful to Shivaji University, Kolhapur for providing facilities to this work.

## Conflict of Interests:

The authors declare that there is no conflict of interests regarding the publication of this paper.

## REFERENCES


1. **Atwal A. S.** Some ecological problems relating to insect pests of mango. Gardening, 3(10), 75-76 (1961).
2. **Atwal A. S.** Insect pests of mango and their control. *Punjab Hort. J.*; 3(2-4), 235-258 (1961).
3. **Ayyar Ramakrishna T. V.** Weevil fauna of South India with special reference to economic species. *Imperial Agriculture Research Institute Pusa Bull.12*, 121 (1922).
4. **Butani D. K.** Save your mango crops from insect pests. *Indian Horti*.,6 (2), 6-7 & 19, New Delhi (29) (1962).
5. **Butani D.K.** Insect and Fruits. Khosia & Pragati printers. New Delhi pp. 9 -39 (1979).
6. **David B. Vasantharaj and P.C. SundraBahu.** Preliminary investigation on the varietal incidence and control of mango nut weevil *Crytoeehynchus mangiferae (*Fab.). *Madras agric. J*., 48(2): 54-67 (1964).
7. **Gandhi S. R.** The mango in India. Farm Bull.6, ICAR, New Delhi (21) 1955.
8. **Gangolly S. R., Ranjit Singh, S. L. Katyal and Daljit Singh.** The mango, 530 pp. ICAR, New Delhi (11,23) (1957).
9. **Khairmode P.V., T.V. Sathe and A.S. Desai.** Biology, Ecology and control weevil (Coleoptera : Curculionidae) on banana from Kolhapur region, India.Biolife, 3 (1), 16 – 20 (2015).
10. **Mc Bride O. C. and A.C. Mason**. The effect of the subfreezing temperatures on the mango weevil J.econ. Ent.,27, 902. **(**1934)
11. **Sathe T.V.** Agrochemical and pest management. Daya publication House, New Delhi pp- 1-217 (2003).
12. **Sathe T.V.** Recent trends in biological pest control. Daya publication House. Astral Int. pvt. Ltd. New Delhi pp 1-204 (2014).
13. **Sathe T. V. and Chougale T. M.** Hymenopterous biopesticides and their preliminary biocontrol potential from western Maharashtra including Ghats. *Biolife*, 2 (4), 1254-1261 (2014).
14. **Sathe T. V., P. M. Bhoje, A. S. Desai and Divya Jadhav.** Pests of mango *Mangifera indica* L. at storage and their control. *Indian J. Appl. Res*.,4(7), 1-4 (2014a).
15. **Sathe T.V., B.V. Jadhav, A.S.Desai, Nilam Shendage, Chandani Kamble and A.D. Jadhav.** Ecology, ethology and control of green sting bug *Plautia affinis* Dallas (Hemiptera: Pentatomidae) on mulberry *Morus alba* L. varieties V-1 M-5 from Kolhapur. Biolife, 2 (4), 1332-1338 (2014b).
16. **Sathe T.V., Anna Gophane and Nilam Shendage.** Colour attractively and occurrence of some cell sap sucking pests on crop plants. *Biolife*, 3(2), 540- 546. **(2015).**
17. **Singh S.M.** *Rhynchaenus mangiferae* a serious mango pest in Uttar Pradesh. *Curr.Sci*. 23(8), 270-271 (1945).
18. **Subramanyam, C.K.** A note on the life history of *Cryptorrhynehus mangiferae* Fab. *Madras Agric.* Dept Yibk, 1925, 29 – 36.Govt. of Madras, Madras (22) (1926).
19. **Sundra Bahu P.C.** Studied on the varietal incidence of the mangonut weevil, *Sternochetus mangiferae* Fab. *South India Hort*., 177 (1 & 2), 34 – 40 (1969).
20. **Voute A. D.** *Crytorrhynchus gravis* F. and die Ursachen seiner massenvermehrung in Java. *Arch Neeri. Zool*.,2,112 (1935).
21. **Wadhi S. R.** Investigation to develop quarantine disinfestations procedure for mangostone weevil, *Sternochetus mangiferae* (Fab.) and the oriental fruit fly, *Dacus dorsalis* Hendel. *Entmologist Newsletter*, 3(11), 67 (1972).
22. **Wadhi S. R. and Sharma D. N.** Bromide residues in pulp of mango fruits subjected to hot aqueous ethylene dibromide dips. *Acta. Horticulture*, 24, 239 (1972)


*****