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**KM Patel**

Assistant Professor,  
Department of Entomology,  
N. M. College of Agriculture,  
Navsari Agricultural University,  
Navsari, Gujarat, India

**MR Siddhpara**

Assistant Research Scientist,  
Department of Entomology,  
N. M. College of Agriculture,  
Navsari Agricultural University,  
Navsari, Gujarat, India

**GG Radadia**

Professor and Head,  
Department of Entomology,  
N. M. College of Agriculture,  
Navsari Agricultural University,  
Navsari, Gujarat, India

**Correspondence****KM Patel**

Assistant Professor,  
Department of Entomology,  
N. M. College of Agriculture,  
Navsari Agricultural University,  
Navsari, Gujarat, India

## Survey of mango stone weevil, *Sternochetus mangiferae* (Fabricius) and pulp weevil, *Sternochetus frigidus* (Fabricius) (Curculionidae: Coleoptera) in South Gujarat

**KM Patel, MR Siddhpara and GG Radadia**

### Abstract

The aim of present study is to focus on pest free area of south Gujarat region from mango stone weevil, *Sternochetus mangiferae* (Fabricius) and mango pulp weevil, *S. frigidus*. For this purpose Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) India conducted roving survey. The field survey was conducted during April 2017 to June 2017 in different talukas of Navsari, Valsad, Surat, Dangs and Tapi districts of south Gujarat in different varieties of mango to know the status of mango stone weevil. For said survey programme, total 65 villages of 17 talukas in five districts of south Gujarat area were randomly selected and among them, 172 (6880 fruits) mango orchards were surveyed for the detection of mango stone weevil and pulp weevil. All random sampling fruits were longitudinal cut open and dissection of stones were made to know the presence of mango weevils. Incidence of stone weevil was observed only in two villages viz., Nargol, Umargam Taluka, Valsad district and Kesali, Chikhli Taluka, Navsari district. The observations from field report revealed that overall percent infestation of stone weevil was found 0.48 percent in south Gujarat. The maximum (1.29%) infestation was found in Valsad district while it was minimum (0.04%) in Navsari district. Moreover, the infestation of mango stone weevil was not observed in other surveyed parts of the south Gujarat. The maximum infestation was seen in Local cultivar (*Deshi*) (2.05%) while it was minimum in variety *Kesar* (0.14%). Variety viz., Alphanso, Amrapali, Dadam, Karanjio, Neelum, Rush, Sabja, Sardar and Totapuri exhibited zero percent infestation of mango stone weevil. The result further indicated that mango pulp weevil was not observed in south Gujarat during survey period.

**Keywords:** Mango, pulp weevil, stone weevil, survey, *S. mangiferae*, *S. frigidus*

### 1. Introduction

Mango (*Mangifera indica* L.) is one of the important fruit crops of tropical and sub-tropical regions of the world as it often referred as 'King of Fruits'. Mango is a widely exported fruit from India<sup>[1]</sup>. There are number of pests attacking to the mango tree such as hopper, mealy bug, fruit fly, stem borer, stone weevil, leaf gall midge, thrips, fruit borer, bark eating caterpillar, scale insect and shoot borer are more or less destructive pests of mango. Out of which, mango weevils, fruit flies, and fruit borers have the quarantine importance due to which Indian export value and consumer satisfaction are affected<sup>[2]</sup>.

Mango stone weevil, *S. mangiferae* is a monophagous pest of mango having quarantine importance. It is an insidious pest that spends most of its life cycle inside the mango stones. Adult female weevil laid eggs by making boat shaped cavity in the epicarp of the marble sized fruit. The eggs are elliptical and creamy white in colour which covers with a brown exudate by cutting a crescent shaped area 0.25-0.50 mm in the fruit near the posterior end of the egg. The newly emerged larva is an elongated, slender, white and legless grub which burrows through the pulp and entre into the stone where it feed on the seed coats; later feed on cotyledons of the fruit and remains there until it becomes an adult. There are at least five larval instars. The older instars are compact and C shaped, typical curculionoid form having black head. As the fruits mature, the tunnels are eliminated and it is not possible to distinguish between infested and non-infested fruits, unless they are cut open. Pupation takes place inside the stone. Newly form pupae are whitish in colour changing to pale red just prior to adult eclosion. The adult weevils are short and stout, 5-8 mm long and dark brown to black with grey markings. Adult emerge from stones and tunnel up through the fruit pulp, leaving a scar on the fruit from where

secondary fungal infection is started that renders the fruit unfit for human consumption [3]. The stones exhibited holes and the cotyledons turn black with merely a rotten mass. Damaged stones lost their viability. When disturbed, weevils drop to the ground and remain motionless. Adult weevils overwinter under loose bark around the base of mango trees or in the forks of branches during non-fruiting periods. The time from egg to adult takes five to eight weeks and only one generation is completed in a year. The longevity of adult weevil is about two years. The dispersal of mango weevil is only depending upon the transport of fruits and stones containing the larvae, pupae or adults [4].

Despite the above fact, real status of stone/pulp weevil in mango is lacking under south Gujarat condition. Hence survey on mango stone/pulp weevil was carried out by Department of Entomology, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) India under five districts of south Gujarat to know the current pest status for declaring pest free area for mango stone/pulp weevil as well as to promote the agriculture export in accelerated way by grading and sorting of good quality mango fruits for consumption and export.

## 2. Materials and Methods

### 2.1 Survey areas

The survey and monitoring protocols for mango stone weevil and pulp weevil was employed as per the National Standard established by the Directorate of Plant Protection, Quarantine and Storage, Faridabad with slight modification [5].

Survey on mango stone weevil and pulp weevil was done during April - 2017 to June - 2017 in mango cultivated areas of 5 districts (Navsari, Surat, Valsad, Dangs and Tapi) of south Gujarat region. In each district, 5 blocks (talukas) were selected as representatives of the district. In dangs and tapi districts, only one talukas was selected as per the availability of mango growers.

### 2.2 Detection survey

The survey was carried out on different mango varieties viz.

Alphanso, Amrapali, Badam, Dadam, Dasher, Deshi, Karanjio, Kesar, Langra, Neelum, Rajapuri, Rush, Sabja, Sardar, and Totapuri. Among them, Alphanso and Kesar are the main varieties for export purpose.

For this purpose, five villages were selected from each talukas of most of the districts of south Gujarat. In each village, minimum five mango orchards were selected (Fig 3). The selection of the villages and number of orchards per village were only based on practical availability of the orchard. In each mango orchard, five trees were randomly selected. The minimum of eight fruits (65 days old fruit set after flower induction) were randomly selected for pest detection with two fruits from each quadrant of the tree (Palte-1). Each fruit bearing mango tree (4 years and above for grafted trees, and 7 years and above for seeded trees) was considered as one sampling unit. The minimum 40 fruits per sampling were selected. Fruits were randomly collect by hand or with picking pouch on a short pole. For the purpose of inspection, sample fruits collected in mango orchards were longitudinally cut open and then dissected up to stone on the spot to know the presence of mango weevils in the field and collected specimens of stone weevil (Plate-2 and 3) sent for the identification and confirmation to the taxonomist, NBAIR, Bengaluru (Karnataka). Percent infestation of mango stone weevil was worked out by following formula;

$$\text{Percent infestation/orchard} = \frac{\text{No. of infested fruits}}{\text{Total No. of fruits}} \times 100$$

### 2.3 Practical issues

During the actual survey work, we observed that most of the orchards were auctioned and some of the farmers/concern parties were not ready to provide the fruits for sampling. Therefore, we had visited those orchards wherever harvesting of the fruits was ongoing. Most of the farmers and concerned parties were convinced for providing fruits sample. Such orchards were selected for survey work.

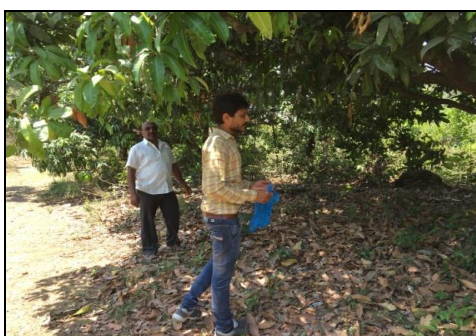
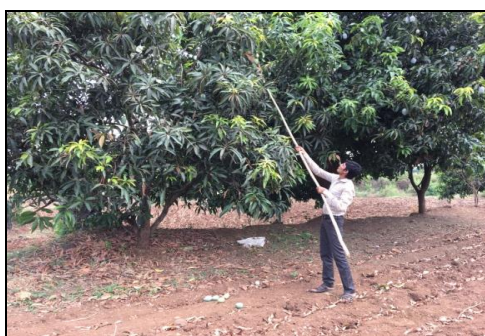
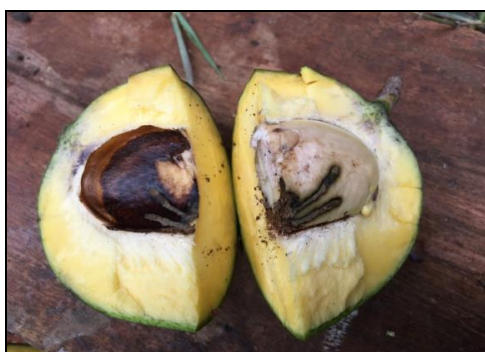


Plate 1: Collection of mangoes by hand or with picking pouch on a short pole







**Plate 2:** Sample fruits were cut opened and dissected stone for the presence of mango weevils



Larva

Adult

**Plate 3:** Larva and adult of mango stone weevil found inside stones

### 3. Results and Discussion

#### 3.1 Survey and monitoring of mango stone weevil in south Gujarat

The roving survey was conducted from April'17 to June'17 in different talukas of Navsari, Valsad, Surat, Dangs and Tapi districts of south Gujarat to know the presence of mango stone weevil. The specimens of mango Stone weevil were sent for the identification to NBAIR, Bengaluru and the same species was identified as *Sternochetus mangiferae* (Fabricius). The data so recorded for three months of survey are presented in Table-1, 2 and 3.

The roving survey work was conducted as per the protocols of National Standard established by the Directorate of Plant Protection, Quarantine and Storage, Faridabad. Total 6880 mango fruits from each of fifteen different varieties of mango viz. Alphanso, Amrapali, Badam, Dadam, Dasherri, Local cultivar (*Deshi*), Karanjio, Kesar, Langra, Neelum, Rajapuri, Rush, Sabja, Sardar and Totapuri were examined during the present investigation. The minimum of eight fruits from each five selected trees were collected for pest detection with two fruits from each quadrant of the tree was collected at random. The collected fruits were dissected with the help of mango stone cutter on the spot for the pest detection. The desired fruits (fruits set after 65 days after flower induction) were also brought to the PG Research Laboratory, Department of Entomology, N.M.C.A., N.A.U., Navsari for further investigation. The same stages were also brought to laboratory for rearing purpose. All these stages were not successfully completed life cycle and all were dead.

The results presented in Table-1 and Fig-1 revealed that the overall infestation of mango stone weevil was found 0.48 percent in 65 villages of 17 talukas in five districts of south Gujarat area with randomly selected 172 mango orchards during the present investigation. The data further showed that the maximum infestation of mango stone weevil was observed in Valsad district (1.29%) while the minimum infestation of mango stone weevil was observed in Navsari district (0.04%). Moreover, the infestation of mango stone weevil was not observed in other surveyed parts of the south Gujarat. The survey carried out at six regions of Thailand with three mango cultivars. The result from the survey indicated that *S. Mangiferae* was absent in Thailand [6]. In south Gujarat, incidence of stone weevil was observed 2.65 percent and 0.60 percent during 2006 and 2008 in Navsari district, respectively.

Whereas 2.50 percent and 0.64 percent was observed in Valsad district during 2006 and 2008, respectively [7].

As far as incidence of stone weevil is concerned, it was observed only in two villages out of 65 villages viz. Nargol, Ta. Umargam, Dist. Valsad (10.00%) (Latitude: 20:14:21.80, Longitude: 72:45:40.65, Altitude: 0.773345) and Kesali, Ta. Chikhli, Dist. Navsari (2.50%) (Latitude: 20:46:37.77, Longitude: 73:00:50.07, Altitude: 19.225097) (Table-2 and Fig-2).

It can be seen from the results presented in Table-3 and Fig-3 that the maximum infestation was seen in Local cultivar (*Deshi*) with 2.05 percent while it was minimum in variety Kesar with 0.14 percent. The varieties viz., Dasherri (1.67%), Langra (0.89%), Badam (0.83%) and Rajapuri (0.21%) showed intermediate reaction. Moreover, the remaining screened varieties viz., Alphanso, Amrapali, Dadam, Karanjio, Neelum, Rush, Sabja, Sardar and Totapuri exhibited zero percent infestation of mango stone weevil.

The grub population was higher in Bangalora during the month of May recording 1.84 numbers per fruit [8]. At the same time, as the season progresses during the month of June, the grub population was higher in Neelum variety recording 2.53 and 2.67 number per fruit in collected and fallen fruits, respectively. The varieties viz. Kesar, Payari, Dadmiyo and Karanjio were free from stone weevil infestation. On the other hand, the maximum percent infestation (7.50%) was recorded with the variety Sardar followed by Badami Model (5.85%), Totapuri (4.97%), Neelum (2.56%), Alphanso (2.13%) and Dashehari (1.67%) [7]. The present findings are not tally with past workers. The discrepancy might be due to difference in selected varieties, prevailing weather conditions and adopted methodology for the present investigation.

#### 3.2 Survey and monitoring of mango pulp weevil in south Gujarat

The roving survey was conducted from April'17 to June'17 in different talukas of Navsari, Valsad, Surat, Dangs and Tapi districts of south Gujarat to know the presence of mango pulp weevil. The result indicated that pulp weevil was not seen during the entire period of investigation at above mentioned locations. Therefore, all the above locations were free from the pulp weevil infestation. Similar result was found during the year 2006 and 2008 [7].

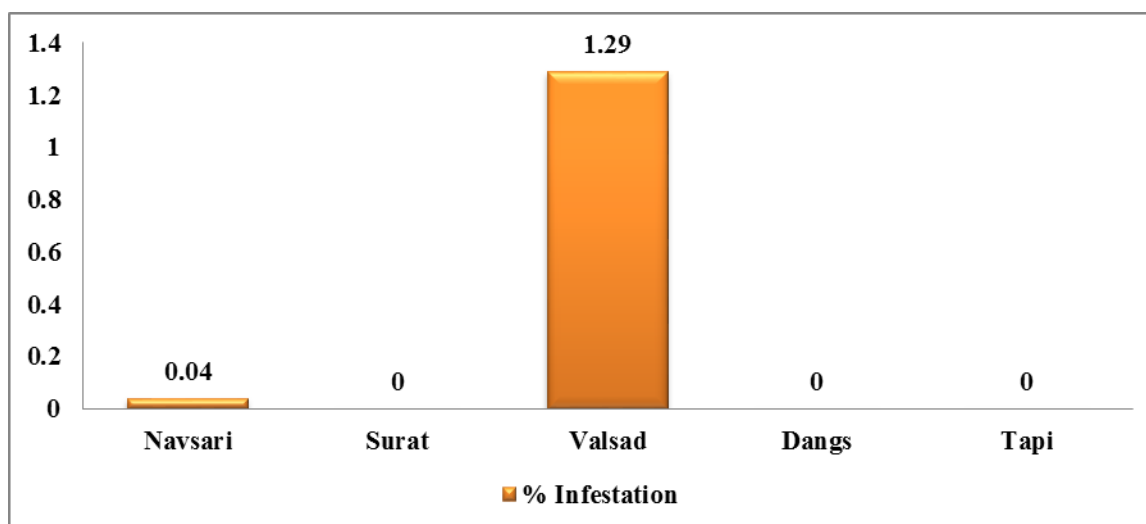


Fig 1: Percent infestation of mango stone weevil (*S. mangiferae*) in different districts of south Gujarat. (April'17 to June'17).

**Table 1:** Percent infestation of mango stone weevil (*S. mangiferae*) and pulp weevil, *S. frigidus* in different talukas of Navsari, Valsad, Surat, Dangs and Tapi districts of south Gujarat. (April'17 to June'17).

Sr. No.	Talukas	No. of Villages	No. of orchards	No. of fruits examined	No. of fruits infested by stone weevil	No. of mango stone weevils				% Infestation	Mango pulp weevils (% Infestation)
						Grub	Pupa	Adult	Total		
A. NAVSARI											
1.	Gandevi	5	16	640	0	0	0	0	0	0.00	0.00
2.	Chikhli	8	32	1280	1	0	0	1	1	0.08	0.00
3.	Navsari	4	9	360	0	0	0	0	0	0.00	0.00
4.	Vansda	3	8	320	0	0	0	0	0	0.00	0.00
5.	Jalalpore	2	3	120	0	0	0	0	0	0.00	0.00
Total (a)		22	68	2720	1	0	0	1	1	0.04	0.00
B. SURAT											
1.	Bardoli	7	11	440	0	0	0	0	0	0.00	0.00
2.	Mandavi	7	11	440	0	0	0	0	0	0.00	0.00
3.	Palsana	3	8	320	0	0	0	0	0	0.00	0.00
4.	Umarpada	2	3	120	0	0	0	0	0	0.00	0.00
5.	Mahuva	1	2	80	0	0	0	0	0	0.00	0.00
Total (b)		20	35	1400	0	0	0	0	0	0.00	0.00
C. VALSAD											
1.	Dharampur	4	10	400	0	0	0	0	0	0.00	0.00
2.	Pardi	5	13	520	0	0	0	0	0	0.00	0.00
3.	Kaparada	2	8	320	0	0	0	0	0	0.00	0.00
4.	Valsad	5	8	320	0	0	0	0	0	0.00	0.00
5.	Umargam	5	23	920	32	12	0	20	32	3.48	0.00
Total (c)		21	62	2480	32	12	0	20	32	1.29	0.00
D. DANGS											
1.	Waghai	1	4	160	0	0	0	0	0	0.00	0.00
Total (d)		1	4	160	0	0	0	0	0	0.00	0.00
E. TAPI											
1.	Songadh	1	3	120	0	0	0	0	0	0.00	0.00
Total (e)		1	3	120	0	0	0	0	0	0.00	0.00
Overall Total (a+b+c+d+e)		65	172	6880	33	12	0	21	33	0.48	0.00

**Table 2:** Percent infestation of mango stone weevil (April'17 to June'17)

Sr. No	Village	No. of orchard	Date of survey	Variety	No. of fruits examined	Mango stone weevil				Percent infestation
						No. of infested fruits				
						G	P	A	T	
1.	Nargol (Ta. Umargam, Dist. Valsad)	1	11.05.17	Badam	40	4	0	0	4	10.00
		2	11.05.17	Langra	40	3	0	2	5	12.50
		3	11.05.17	Rajapuri	40	2	0	0	2	5.00
		4	11.05.17	Rush	40	0	0	0	0	0.00
		5	11.05.17	Dasheri	40	2	0	4	6	15.00
		6	03.06.17	Deshi	40	0	0	9	9	22.50
		7	03.06.17	Dasheri	40	1	0	3	4	10.00
		8	03.06.17	Kesar	40	0	0	2	2	5.00
Total (A)					320	12	0	20	32	10.00
2.	Kesali (Ta. Chikhli, Dist. Navsari)	1	01.06.17	Kesar	40	0	0	1	1	2.50
Total (B)					40	0	0	1	1	2.50
Overall Total (A+B)					360	12	0	21	33	9.17

G= Grub, P= Pupa, A= Adult, T= Total

**Table 3:** Screening of different varieties/cultivars against mango stone weevil (*S. mangiferae*) and pulp weevil, *S. frigidus* in south Gujarat. (April'17 to June'17).

Sr. No.	Varieties	No. of fruit examined	No. of fruit infested by stone weevil	No. of mango stone weevil				% Infestation	Mango pulp weevils (% Infestation)
				Grub	Pupa	Adult	Total		
1.	Alphanso	320	0	0	0	0	0	0.00	0.00
2.	Amrapali	280	0	0	0	0	0	0.00	0.00
3.	Badam	480	4	4	0	0	4	0.83	0.00
4.	Dadam	280	0	0	0	0	0	0.00	0.00
5.	Dasheri	600	10	3	0	7	10	1.67	0.00
6.	Deshi	440	9	0	0	9	9	2.05	0.00
7.	Karanjio	40	0	0	0	0	0	0.00	0.00
8.	Kesar	2120	3	0	0	3	3	0.14	0.00





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