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Survey of Sapota fruit mite, *Tuckerella kumaonensis* Gupta (Tuckerellidae: Acari) and its predatory mite, *Octobdellodes* sp. in South Gujarat

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Abstract

Sapota, *Manilkara achras* (Mill.) Fosberg is an important tropical fruit crop of South Gujarat. Among the various factors affecting the yield and quality of fruit crops, the damage caused by insect pests is considered as a major constraint. The economic value of sapota fruits have been affected by *Tuckerella kumaonensis* Gupta (Tuckerellidae: Acari). This study was conducted to overcome the problem of fruit mite in a comprehensive manner. The results of the present investigation revealed that per cent infestation of sapota fruit mite was 63.53 ± 6.53 per cent in nine villages of three talukas in Navsari districts of South Gujarat area with randomly selected eighteen sapota orchards during the survey work. The population of sapota fruit mite was 2.85 ± 0.46 mites per 2 cm^2 area, while predatory mite, *Octobdellodes* sp. was 1.09 ± 0.28 mites per fruit surface. The highest per cent infestation of sapota fruit mite was observed in Gandevi taluka (Av. $68.91 \pm 5.40\%$) followed by Navsari (Av. $65.05 \pm 3.48\%$) and Jalalpore (Av. $56.64 \pm 3.38\%$). While, the highest population of sapota fruit mite was observed in Gandevi taluka (3.27 ± 0.52 mites/ 2 cm^2 area of fruit surface) while the maximum population of predatory mite was 1.32 ± 0.19 mites per fruit surface.

Keywords: *Tuckerella kumaonensis* Gupta, *Octobdellodes* sp., survey, per cent fruit infestation, etc.

Introduction

Sapota [*Manilkara achras* (Mill.) Fosberg] belongs to family Sapotaceae is an important tropical fruit crop having $2n=26$ chromosome number. It is a native of Mexico and Tropical America. It is commonly known as chiku. The sapota is a climacteric fruit. Fully ripen fruits of sapota are delicious and sweet in taste used as dessert fruits. It is a commercial orchard crop where the fruits are used for preparation of many value added products viz., sapota squash, sapota jam, sapota slices, sapota butter, sapota cheese, sapota candy, sapota milk shake, sapota powder, sapota biscuit, sapota ice cream, sapota shrikhand, sapota pulp, sapota juice, dehydrated sapota slices, sapota nectar, sapota lassie, sapota chocolate and sapota bar. The latex obtained from stems and immature fruits is used in the preparation of chewing gum. Besides food values, the sapota fruits are also used in some ayurvedic preparations. Sapota is supposed to be medicinal also seeds as diuretic, bark as tonic, antipyretic, febrifuge and in curing biliousness and febrile attacks. The fruit is a good source of digestible sugar (12 to 18%) and appreciable source of protein, fat, fibre and minerals like calcium, phosphorous and iron (Chadha, 2001) [4]. In India, sapota is cultivated in 80 thousand hectare area with an annual production of 979 thousand MT and productivity is 12.2 MT per ha (Anon., 2020a) [1]. The major sapota growing states in India are Gujarat, Maharashtra, Andhra Pradesh, Kerala, Uttara Pradesh, Karnataka, Haryana, Punjab, West Bengal and Tamil Nadu while sapota is largely grown in Gujarat, Karnataka and coastal Maharashtra. In Gujarat, it is grown in an area of 27.83 thousand hectare with an annual production of 310.01 thousand MT with the productivity of 11.14 MT per ha (Anon., 2020b) [9]. The area under major sapota producing district in Gujarat is 21.65 thousand hectare with 247.44 thousand MT annual production and productivity 11.43 MT per ha (Anon., 2020b) [9]. In Gujarat state, it is cultivated in districts viz., Valsad, Navsari, Surat, Mehsana, Junagadh, Bhavnagar, Gir Somnath and Kachchh. Among the various factors affecting the yield and quality of fruit crops, the damage caused by insect pests is considered as a major constraint. The yield and economic value of sapota fruits have been affected by number of insect pests as well as non- insect pests. More than 25 insect pests have been reported to attack on sapota tree at different crop stages during both on season and off seasons (Butani, 1979) [3].

Among them, about 16 insect pests and mites were identified in last two decades from sapota orchards in Gujarat (Patel, 2002) [7] and there numbers reached to 33 insect pests and non-insect pests in sapota orchard with increase in the acreage (Bisane *et al.*, 2018) [2]. Sapota fruit mite or peacock mite, *T. kumaonensis* is responsible for qualitative losses to sapota. The immature and adults of red coloured mite suck the cell sap from the fruit surface starting from marble size fruit stage thereby fruit surface become corky rough and black or dark colour with encrustation on fruits, which leads to qualitative loss of harvested products. This mite remains active throughout the year on sapota cv. Kalipatti under south Gujarat agro-climatic conditions. It is well known fact that in South Gujarat, the sapota crop has played a significant role in socio-economic upliftment of both marginal and big farmers. Due to the change in agronomic practices as well as increasing the area of double cropping, creating microclimates favourable for pest population build up, heavy dosage of nitrogenous fertilizers, the problem of fruit mite increasing day by day in recent past, thereby causing qualitative loss in sapota fruits. Thus, the survey of sapota fruit mite was initiated to overcome the problem of fruit mite in a comprehensive manner

Material and Methods

The roving survey was undertaken to know the infestation of *T. kumaonensis* infesting sapota fruits. For this purpose extensive sapota growing talukas of Navsari district of South Gujarat *viz.*, Navsari, Jalalpore and Gandevi were surveyed during the peak activity of the fruit mite in the months of March, April, May and June during the year 2020 and 2021. For the survey of sapota mite, nine sapota growing villages from three talukas *viz.*, Navsari, Jalalpore and Gandevi having two orchards in each village were randomly selected. Five trees were randomly selected from each orchard. From each tree, 2 fruits were randomly selected from east, west, north and south directions; thereby total 8 fruits were observed from each tree. The mobile stages (immature and adult stages) of mites were recorded with the help of 40X eye glass from surface of 2 square cm area of fruit at fortnightly interval. The mobile stages of predatory mite, *Octobdellodes sp.* were recorded with the help of 40X eye glass from the entire surface of sapota fruit at fortnightly interval. Mean population of fruit mites per 2 square cm area of fruit and natural enemies per fruit was calculated. Percentage infested fruits were also calculated on the basis of total number of infested and uninfested fruits.

Results and Discussion

The pooled results for the year 2020 and 2021 are presented in Table 1 and 2 revealed that the overall per cent infestation of sapota fruit mite was ranging between from 53.05 to 73.52 per cent with an average 63.53 ± 6.53 per cent in nine villages of three talukas in Navsari district of South Gujarat with randomly selected eighteen sapota orchards during the survey. Similarly, the population of sapota fruit mite and predatory mite, *Octobdellodes sp.* were varied from 2.38 to 3.76 mites per 2 cm² area of fruit surface with an average 2.85 ± 0.46 mites per 2 cm² area of fruit surface and 0.65 to 1.51 mites per fruit surface with an average 1.09 ± 0.28 mites per fruit surface, respectively.

The data showed that the maximum per cent infestation of sapota fruit mite was observed in Gandevi taluka *i.e.* 62.97 to

73.52 per cent (Av. $68.91 \pm 5.40\%$) followed by Navsari and Jalalpore taluka with 61.57 to 68.52 per cent (Av. $65.05 \pm 3.48\%$) and 53.05 to 59.77 per cent (Av. $56.64 \pm 3.38\%$), respectively (Table 1, 2 and Figure 1). While, the highest population of sapota fruit mite and predatory mite were observed in Gandevi taluka ranging between 2.72 to 3.76 mites per 2 cm² area of fruit surface with an average 3.27 ± 0.52 mites per 2 cm² area of fruit surface and 1.13 to 1.51 mites per fruit surface with an average 1.32 ± 0.19 mites per fruit surface, respectively. The Navsari taluka noted 61.57 to 68.52 per cent mite infestation with an average 65.05 ± 3.48 per cent, however, the population of sapota fruit mite and predatory mite were ranging between 2.64 to 3.06 mites per 2 cm² area of fruit surface (Av. 2.85 ± 0.21 mites/2 cm² area of fruit surface) and 1.05 to 1.26 mites per fruit surface (Av. 1.18 ± 0.11 mites/fruit surface), respectively. Further, minimum population of sapota fruit mite was recorded in Jalalpore taluka with sapota fruit mite infestation ranging between 53.05 to 59.77 per cent with an average 56.64 ± 3.38 per cent. The population of sapota fruit mite and predatory mite varied from 2.38 to 2.48 mites per 2 cm² area of fruit surface with an average 2.43 ± 0.05 mites per 2 cm² area of fruit surface and 0.65 to 0.88 mite per fruit surface with an average 0.77 ± 0.12 mite per fruit surface, respectively.

The data presented in Table 1, 2 and graphically depicted in Figure 2 revealed that the maximum infestation of sapota fruit mite was recorded in Gadat village of Gandevi taluka (73.52%) while, the minimum infestation was observed in orchards of Mandir village of Jalalpore taluka (53.05%). The maximum population of sapota fruit mite and predatory mite were recorded in Gadat village of Gandevi taluka (3.76 mites/2 cm² area of fruit surface and 1.51 mites/fruit surface, respectively). The lowest population of sapota fruit mite and predatory mite were recorded in Mandir village of Jalalpore taluka (2.38 mites/2 cm² area of fruit surface and 0.65 mite/fruit surface, respectively).

In past, Patel (1997) [6] revealed that the fruit infestation due to sapota fruit mite, *T. kumaonensis* was noticed during March to April 1994 in sapota growing villages *viz.*, Amalsad, Gadat, Gandevi, Ajarai, Kharel, Abrama, Vedachha of Navsari district. Among the surveyed villages, the maximum mean number of mites were recorded in village Vedachha (2.81 mites/cm² area of fruit), which contributed 78.00 per cent fruit infestation during March to April 1994. The overall infestation of sapota fruit mite in Navsari district was 75.13 per cent during March to April 1994. Further, the maximum tetranychid mite was observed on brinjal *i.e.* 10.39, 11.50, 4.97 and 0.70 per 4 cm² leaf area in Narendra (Dharwad Taluka), Thamburu (Kalaghatagi Taluka), Biranagaddi (Gokak Taluka) and Koppa (Mundagod Taluka) villages of Karnataka, respectively (Prasanna and Kumar, 2008) [8]. Suvash *et al.* (2018) [10] reported six species of predatory mites belonging to the family Phytoseiidae and order Mesostigmata *viz.*, *Euseius alstoniae* Gupta, *Euseius sp.*, *Typhlodromus (Anthoseius) sp.*, *Typhlodromips syzygii* Gupta, *Amblyseius largoensis* Muma and *Scapulaseius asiaticus* Evans in Jharkhand. Wankhede *et al.* (2019) [11] reported maximum eriophyid mite infestation in Ratnagiri district (37.15%) with a mean grade index (MGI) of 0.70. Similarly, Manal *et al.* (2017) [5] found that the mean abundance of *Tetranychus urticae* Koch adult stages on *S. melongena* was highest in Sarabium during April (11.04 ± 1.54 adults/2.5 cm² leaf area) in most of the months as compared to Wasfia during

March (10.04±1.5 adults/2.5 cm² leaf area). The findings of the past workers more or less similar with the present findings. The difference in the infestation level observed on sapota during the present study (March to June of the year 2020 and 2021) with the Patel (1997) [6] who reported that

75.13 per cent infestation of sapota fruit mite, *T. kumaonensis* during March to April 1994 in Navsari district which might be due to difference in sampling site/location, prevailing weather conditions, and surveyed varieties during the investigation.

Table 1: Incidence of *T. kumaonensis* and predatory mite, *Octobdellodes sp.* in sapota growing talukas of Navsari district during the year 2020 and 2021 (Pooled)

Sr. No.	Villages	No. of fruits observed	Percentage of infested fruits	Mean number of mites per 2 square cm area of fruit	Mean number of predatory mite per fruit
Taluka: Navsari					
1.	Navagam	80	68.52	3.06	1.26
2.	Nagdhara	80	65.08	2.87	1.23
3.	Sattem	80	61.57	2.64	1.05
	Min.		61.57	2.64	1.05
	Max.		68.52	3.06	1.26
	Av.		65.05	2.85	1.18
	± SD		3.48	0.21	0.11
Taluka: Jalalpore					
1.	Abrama	80	57.11	2.44	0.80
2.	Vedchha	80	59.77	2.48	0.88
3.	Mandir	80	53.05	2.38	0.65
	Min.		53.05	2.38	0.65
	Max.		59.77	2.48	0.88
	Av.		56.64	2.43	0.77
	± SD		3.38	0.05	0.12
Taluka: Gandevi					
1.	Gadat	80	73.52	3.76	1.51
2.	Amalsad	80	70.24	3.33	1.32
3.	Khaparwada	80	62.97	2.72	1.13
	Min.		62.97	2.72	1.13
	Max.		73.52	3.76	1.51
	Av.		68.91	3.27	1.32
	± SD		5.40	0.52	0.19
Overall mean					
	Min.		53.05	2.38	0.65
	Max.		73.52	3.76	1.51
	Av.		63.53	2.85	1.09
	± SD		6.53	0.46	0.28

Note: Number of observations - 8, No. of orchards/village - 2, No. of trees/orchard - 5, No. of fruits/tree - 8

Table 2: GPS Coordinates of different villages of Navsari district of South Gujarat during the year 2020 and 2021

Sr. No.	Villages	GPS Coordinates	
		2020	2021
Taluka: Navsari			
1.	Navagam	20° 53' 32.70'' N, 72° 59' 18.44'' E	20° 54' 52.95'' N, 73° 03' 58.82'' E
2.	Nagdhara	20° 54' 56.03'' N, 73° 06' 29.59'' E	20° 55' 37.67'' N, 73° 05' 39.14'' E
3.	Sattem	20° 55' 06.80'' N, 73° 04' 38.05'' E	20° 55' 05.99'' N, 73° 04' 30.08'' E
Taluka: Jalalpore			
1.	Abrama	20° 51' 40.32'' N, 72° 54' 37.81'' E	20° 51' 30.93'' N, 72° 55' 13.45'' E
2.	Vedchha	20° 52' 20.49'' N, 72° 55' 57.32'' E	20° 52' 28.79'' N, 72° 56' 22.90'' E
3.	Mandir	20° 53' 08.78'' N, 72° 55' 15.68'' E	20° 52' 59.77'' N, 72° 55' 34.23'' E
Taluka: Gandevi			
1.	Gadat	20° 51' 04.85'' N, 72° 59' 13.95'' E	20° 51' 03.68'' N, 72° 59' 15.28'' E
2.	Amalsad	20° 49' 15.77'' N, 72° 57' 56.89'' E	20° 49' 15.63'' N, 72° 57' 49.93'' E
3.	Khaparwada	20° 44' 28.10'' N, 72° 57' 45.07'' E	20° 44' 14.09'' N, 72° 57' 35.80'' E

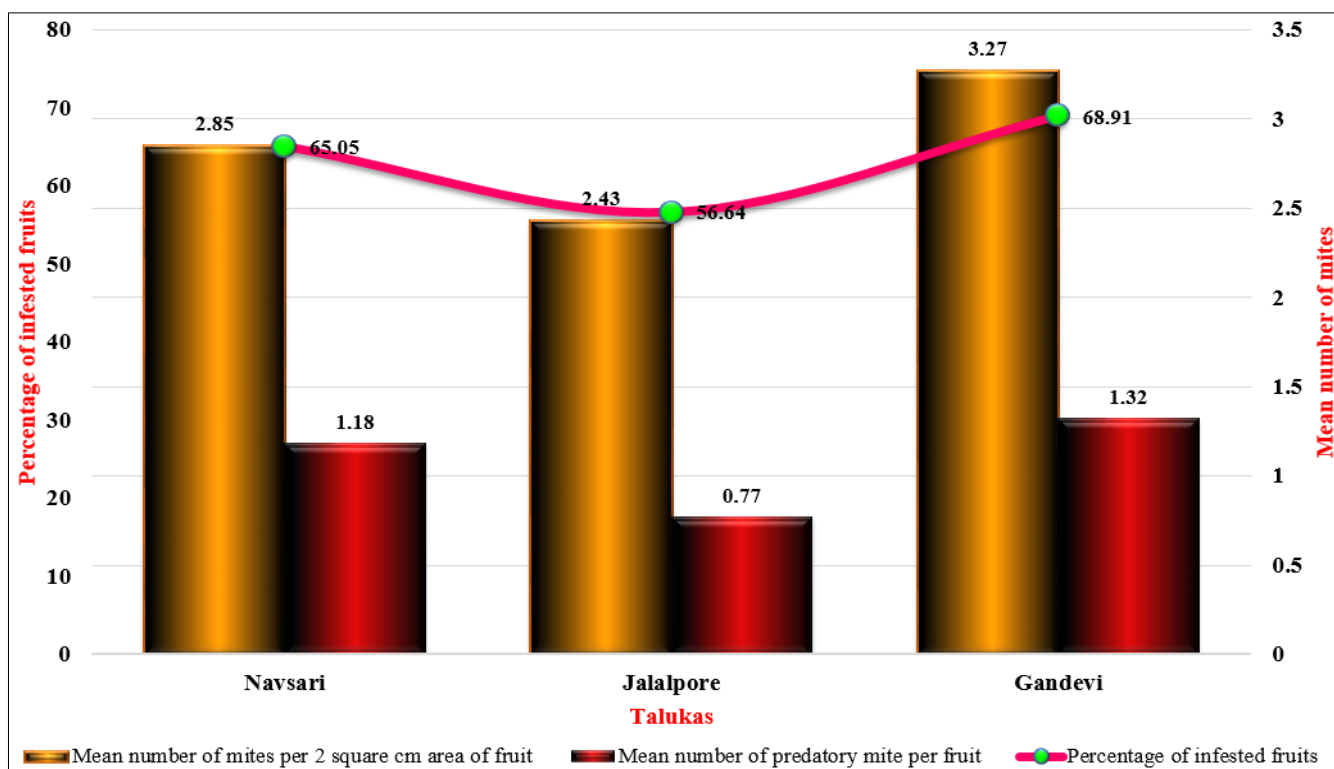


Fig 1: Population of *T. kumaonensis* and predatory mite, *Octobdellodes sp.* in sapota growing talukas of Navsari district (Pooled)

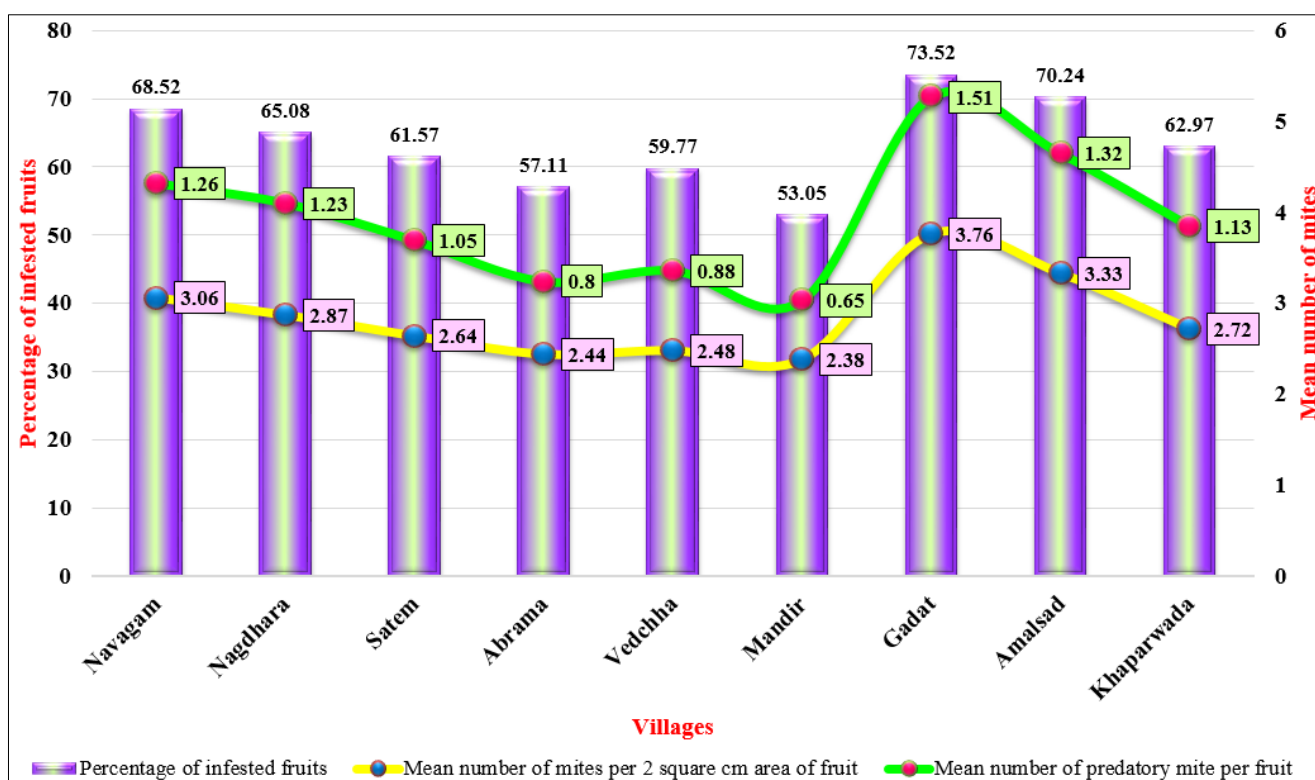


Fig 2: Population of *T. kumaonensis* and predatory mite, *Octobdellodes sp.* in sapota growing villages of Navsari district (Pooled)

Conclusion

The present investigation indicated that the highest infestation of sapota fruit mite was observed in Gandevi taluka followed by Navsari and Jalalpore taluka of Navsari district of South Gujarat. Therefore, selection of proper site should be very important for new sapota plantation to avoid the infestation of fruit mite, *T. kumaonensis*. So, integration of these cultural management tactic should be considered with utmost care

during the implementation of integrated pest management programme.

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