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Effect of weather parameters on population fluctuation of guava fruit flies, *Bactrocera* Spp.

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Abstract
Studies related to population dynamics of fruit flies (*Bactrocera* spp.), infesting guava were conducted by using methyl eugenol trap and per cent infested fruits. The maximum population of *Bactrocera* spp. was observed during the month of June to November with peak activity during II week of September, which coinciding with fruiting period of guava. The fly population decreased during January to April. The trap catch study carried out for two years was correlated with abiotic factors and it was found that it showed positive correlation with temperature (maximum, minimum and average), relative humidity (maximum, minimum and average), rainfall and wind velocity.

Keywords: Guava, population dynamics, fruit fly, Gujarat

Introduction
Among the various tropical fruits, guava *(Psidium guajava* Linn.) the apple of tropics, is the fourth most important fruit crop in India, with an area of 264.85 thousand hectares and production of 4053.51 thousands MT. In Gujarat, guava is cultivated on 12.67 thousand hectares with production of 169.57 thousand MT [1]. Because of its versatility, widespread use, rich source of vitamin C, calcium and phosphorus the guava had been appropriately called " poor mans's apple". It had the highest level of the anti-oxidant property which had prompted several farmers to take up guava cultivation on a commercial scale. Guava fruit is seriously damaged by different environmental factors and pests which include diseases, birds, insects and mites. About 80 species of insects have been recorded on guava trees, affecting yield and quality of fruits. Fruit flies, bark-eating caterpillars, fruit borer, scale insects and mealy bugs are considered as major pest of guava, while aphids, white flies, thrips, cockchafers, stem borers and fruit borers, etc., are the minor pests.
Fruit fly, *Bactrocera* spp. is a serious pest of guava and causing qualitative losses. It has been reported that in India fruit flies causes loss up to Rs. 29,460 million per annum in mango, guava, sapota and citrus [2]. The extent of crop losses due to fruit flies have been recorded to vary between 10-80 per cent [3]; 20-46 per cent [4] and up to 100 per cent [5].
Three species of fruit flies namely *Bactrocera correcta* Bezzi, *B. dorsalis* (Hendel) and *B. zonata* Saunders occur in guava and mango fruits [6]. Damage occurs due to oviposition by females in developing fruits, which causes depreciation of the product for consumption. Females perforate the fruits causing cell death close to holes causing malformations in the developing fruits. Adults of the pests occur throughout the year however, monitoring and management of immature stages of fruit fly in field is difficult as the maggots remain inside the fruit and pupation and overwintering occur in soil.
Management of fruit flies remains a challenging task as they are polyphagous with overlapping generations and there is limited scope for the use of chemical insecticides because of the residual problems. Hence, development of an integrated management package with emphasis on non insecticidal approach becomes imperative. Looking to the apparent importance of the pest and as pre-requisites to this, studies on population dynamics of fruit fly populations and their relationship with weather parameters were made in guava orchard and the results are presented in this paper.

Materials and Methods
A study on population dynamics of fruit fly on guava was carried out at N.M. College of Agriculture, Navsari, Gujarat during 2004-2006, which was based on data of flies trapped in

methyl eugenol trap (DFID Trap) as well as per cent infested fruits. For the purpose fruits were collected randomly, at weekly intervals from the selected orchards during the peak fruiting period. The randomly collected fruits were dissected to check the incidence of fruit fly and per cent infestation was worked out by counting number of infested fruits, out of total number of observed fruits.

Similarly, three D.F.I.D (Department for International Development) water bottle traps based on plywood block technology (Plywood block of 5 x 5 x 1.2 cm was soaked in liquid mixture of ethanol: methyl eugenol: dichlorovos (6: 4: 1) v/v/v for 48 hours) were installed in each orchard. The data on trapped flies were collected at weekly interval. The data on trapped flies were correlated with weather parameters *viz*., temperature (minimum, maximum and average ^{o}C), relative humidity [(minimum, maximum and average) per cent %], rainfall (mm) rainy days, wind velocity (Km/hrs) and sunshine hours.

Results and Discussion

Population dynamics based on fly catches

Data collected are presented in table (1). It is revealed from the data the fly catches were observed throughout the year with its peak activity from I week of June (23 SMW) to III week of November (47SMW). The highest 562 flies were trapped in II week of September (36 SMW), exhibited the peak of fly population in the area. The fly population found decreasing during the January to April. The peak activity of fruit fly population in guava orchard also found coinciding with fruiting and harvesting period of fruits.

Table 1: Fruit fly population in different months in guava orchard

Month/Week	Standard week	Flies trapped / 3 traps (Avg. of 2 year)	Month/Week	Standard week	Flies trapped / 3 traps (Avg. of 2 year)
Nov I	45	123	May I	19	110
II	46	119	II	20	65
III	47	125	III	21	84
IV	48	88	IV	22	69
Dec I	49	72	June I	23	122
II	50	62	II	24	172
III	51	46	III	25	153
IV	52	48	IV	26	107
Jan I	1	82	July I	27	238
II	2	81	II	28	279
III	3	17	III	29	284
IV	4	10	IV	30	208
V	5	14	V	31	228
Feb I	6	14	Aug I	32	335
II	7	11	II	33	398
III	8	37	III	34	473
IV	9	48	IV	35	396
March I	10	11	Sept I	36	522
II	11	32	**II**	37	**562**
III	12	45	III	38	385
IV	13	56	IV	39	396
April I	14	69	Oct I	40	415
II	15	53	II	41	351
III	16	75	III	42	304
IV	17	79	IV	43	261
V	18	117	V	44	297

Observation on occurrence of fruit flies throughout the year and peak activity coinciding with fruiting and harvesting period of guava were also reported in Gujarat [7], Maharashtra [8] and Karnataka [9].

During present studies, the activity of fruit fly found higher during June to November in south Gujarat. However, this period recorded during July to November [8] in Maharashtra, May to June and September to October in Bangalore [10], three peak *viz*; IVth week of July, IVth Oct. and Ist Nov. in Dharwad [11], July to August in Tamil Nadu [12], August to September in north Gujarat [7] and October-November (44and 45 SMW) in Himachal Pradesh [13]. Moreover, study of [14] revealed that, the fly population was lowest during January to February. The variation in peak activity of fruit fly in present finding and in reports of different workers might be due to differences in experimental location, flowering period, environmental factors and duration of experiment

Correlation, multiple regression studies

The data on fly catches during experimentation were correlated with weather parameter and presented in table (2). It is revealed from the data that, there was significant positive correlation with minimum temperature (X_2), average temperature (X_3), maximum relative humidity(X_4), minimum relative humidity (X_5), average relative humidity (X_6), rainy days (X_7), however, it showed significant negative correlation with maximum temperature (X_1) and sunshine hours(X_{10}).

Table 2: Effect of weather parameters on fruit fly population in guava

Meteorological Factors		Correlation Coefficient	Regression Coefficient
Max. temp.	(X_1)	-0.216*	441.320
Min. temp.	(X_2)	0.521*	449.510
Av. temp.	(X_3)	0.350*	-877.840

Max. R.H.	(X_4)	0.318*	-4046.654
Min. R.H.	(X_5)	0.582*	-4044.791
Av. R.H.	(X_6)	0.543*	8089.498
Rainy days	(X_7)	0.471*	6.256
Rainfall	(X_8)	0.134	--
Wind velocity	(X_9)	0.190	--
Sunshine hours	(X_{10})	-0.587*	-26.300
R2		--	0.463
Variation explained (%)		--	46.31
R value		--	0.680
Constant (A value)			205.956

N=104, * significant at 5% level (r value ± 0.193)

The coefficient values of multiple regression analysis are presented in table (2). The significant parameter utilized for prediction of fruit fly population gives 46.31 per cent co-efficient of determination due to temperature, relative humidity, rainy days and sunshine hours. Therefore, it can be stated that the variation (R^2= 0.463) in fruit fly population was due to above factors. Suitable regression equation for prediction of fruit fly is developed as:

$Y^{\wedge} = 205.956 + 441.320 (X_1) + 449.510 (X_2) - 877.840 (X_3) - 4046.654 (X_4) - 4044.791 (X_5) + 8089.498 (X_6) + 6.256 (X_7) - 26.300 (X_{10})$

So looking to the relationship of abiotic factors on overall population, it may be concluded that, fly population was directly influenced by temperature (minimum and average), relative humidity (maximum, minimum and average), rainy days, whereas maximum temperature and sunshine hours showed negative bearing on its abundance. This implies that, the increase in temperature (minimum and average), relative humidity (maximum, minimum and average) and rainy days increases the fruit fly population and vice-versa. Whereas, decrease in maximum temperature and sunshine hours increases population and vice-versa.

This interpretation is sustained by the fact that fruit fly population was higher during June to November during experimentation, which coinciding with fruiting and harvesting period of guava fruit, when the weather parameter *viz*; temperature (minimum and average), relative humidity (maximum, minimum and average), rainy days were in the range of 16.80 to 32.45 ºC., 22.00 to 97.00 per cent and 0 to 7.0 days, whereas the maximum temperature and sunshine hours were in the range of 27.0 to 36.36 ºC and 0.53 to 10.31hrs, respectively. Positive correlation with minimum temperature, relative humidity (maximum, minimum and average), and rainy days whereas, negative with maximum temperature, sunshine hours and rainfall had been recorded from north Gujarat [7]. Similarly, positive correlation with relative humidity and rainfall and significantly negative correlation with maximum temperature in Andhra Pradesh was also reported [15]. Further, [11] also found positive correlation with minimum temperature and relative humidity and negative with maximum temperature in Karnataka.

Population dynamics based on per cent infested fruits:

The observations on per cent infested fruit were made at weekly interval (Table 3). It can be seen from the mean data, that the infestation of fruit fly was observed from I week of August to I week of January and it was ranged between 9.17 to 30.95 per cent. The maximum fruit infestation (15.42 to 30.95 per cent) was observed from II week of August to V week of October, which coinciding with harvesting period of guava fruit. The highest per cent (30.95) fruit infestation was observed in II week of September.

The present result revealed that, the maximum fruit fly infestation was coinciding with harvesting period i.e. August to October in guava. More or less similar observations were also made in south Gujarat [16] and in Pakistan [14] and [17].

Table 3: Periodical infestation of fruit flies in guava

Month/Week	Per cent fruit infestation (Avg.of 2 year)	Month/Week	Per cent fruit infestation (Avg.of 2 year)
Aug I	11.25	Oct IV	22.5
II	18.34	V	27.72
III	22.99	Nov I	9.17
IV	29.07	II	15.08
Sept I	25.4	III	9.55
II	30.95	IV	12.38
III	25.00	Dec I	12.92
IV	26.00	II	14.17
Oct I	22.92	III	15.00
II	15.77	IV	14.36
III	15.42	Jan I	10.80

Conclusion

Studies on population dynamics of fruit fly indicated that, the fruit fly population prevailed throughout the year in guava orchard. However, its maximum activity was found during June to November months. The population dynamics of fruit fly, based on per infestation also indicated that, the maximum fruit fly infestation was found coincided with harvesting period of guava fruit. Further, it was observed that, fruit fly population was directly influenced by temperature (maximum, minimum and average), relative humidity (maximum, minimum and average), rainfall and wind velocity, whereas maximum temperature and sunshine hours showed negative bearing on its abundance.

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References

1. Anonymous. Area, production and yield of horticultural crops. Horticultural Statistics at a Glance. Horticulture Statistics Division. Department of Agriculture, Cooperation and Farmers Welfare, Government of India, 2018, 179, 224.
2. Mumford JD. Project memorandum on integrated management of fruit flies in India. Department for International Development (DFID), 2001, 6.
3. Verghese A, Madhura HS, Jayanthi PDK, Stonehouse JM. Fruit flies of economic significance in India, with special reference to *Bactrocera dorsalis* (Hendel). In: Proceedings of sixth international symposium of fruit flies of economic importance, Stellenbosch, South Africa, 2002, 317-324.
4. Haseeb M. Current status of insect pest problem in guava. Acta Horticulture. 2007; 735:453-468.
5. Mondal C, Garain PK, Maitra NJ, Atit M. Biofriendly management of guava fruit fly (*Bactrocera correcta* Bezzi) through wrapping technique. J Applied and Natural Sciences. 2015; 7:358-363.
6. Rajitha AR, Viraktamath S. Monitoring fruit flies (Diptera: Tephritidae) in guava orchard in Dharwad, Karnataka. Karnataka Journal of Agricultural Sciences. 2006; 19:35-39.
7. Dale NS. Studies on biology of *Bactrocera zonata* (Saunders) and management of fruit flies in mango orchards. M.Sc. (Agri.) Thesis (Unpublished), submitted to Gujarat Agricultural University, S. K. Nagar. Gujarat, India, 2002.
8. Kadam, UK. Studies on species diversity, population dynamics and management of fruit flies in guava (*Psidium guajava* L.). Ph. D Thesis (Unpublished), submitted to Mahatma Phule Krishi Vidyapeeth, Rahuri, Dist. Ahmednagar, Maharashtra, India, 2002.
9. Ravikumar. Studies on fruit flies in guava and mango orchards with special reference to their management through mass trapping. M.Sc. (Agri.) Thesis (Unpublished), submitted to University of Agricultural Sciences, Dharwad, Karnataka, India, 2005.
10. Shukla RP, Prasad VG. Population fluctuation of oriental fruit fly, *D. dorsalis* in relation to host and abiotic factors. Trop. Pest Management. 1985; 31(4):273-275.
11. Ranjitha AR, Viraktamath S. Investigation on the population dynamics of fruit flies in mango orchard at Dharwad, Kanataka. Karnataka J Agric. Sci. 2006; 19(1):134-137.
12. Jalaluddin SM, Natarajan K, Sadakathulla S. Population fluctuation of guava fruit fly *B. correcta* in relation to host and abiotic factors. J Exp. Zool. 2001; 4(2):323-327.
13. Umesh, Rajesh Kumar, Gaurav Kant. To study seasonal incidence of guava fruit fly, *Bactrocera* spp. and its impact on yield. Inter. Jr. Chemical Studies. 2018; 6(6):1018-1020.
14. Qureshi ZA, Ashraf M, Bughio AR, Siddiqui QH. Population fluctuation and dispersal studies of the fruit fly, *D. zonatus* Saunders. Proceeding of Symposium on the Sterility Principle for Insect Control., Jointly organized by the IAEA and the FAO of the United Nations and held in Innsbruck, 1974, 201-206.
15. Sarada G, Maheswari TU, Purushotham K. Seasonal incidence and population fluctuation of fruit flies in mango and guava. Indian. J. Ent. 2001; 63(3):272-276.
16. Anonymous. Survey on infestation of fruit fly in different month of year in south Gujarat. Annual Report. 18th Plant Protection Sub Committee Meeting, Department of Entomlology N.M. College of Agriculture, Gujarat Agricultural University, Navsari, Gujarat, India, 1984.
17. Khan MA, Muhammad A, Waseem A, Lee LL. Management of fruit flies of the most perishable fruit. Entomological Research. 2007; 35(2):79-84.