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Population dynamics of citrus psylla, *Diaphorina citri* Kuwayama in relation to abiotic factor

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Abstract
The experiment on population dynamics of Citrus psylla, *Diaphorina citri* Kuwayama in relation to abiotic factor was conducted round the year during 2017-18 at ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. Two peaks of citrus psylla in a year were observed. Highest psyllid population (10.23 nymphs and adults/twig/plant) were observed during 34th standard meteorological week (SMW) in a month of August while, it remained lowest (0.20 nymphs and adults/twig/plant) during 52nd SMW during winter season in a month of January. Second peak was observed during 16th SMW (8.75 nymphs and adults/twig/plant) in a month of May. Population of *D. citri* was highly significant and positively correlated with minimum ('r'= 0.728**) and average temperature ('r'= 0.675**), morning ('r'= 0.509**), evening ('r'= 0.620**) and average relative humidity ('r'= 0.639**), rainfall ('r'=0.362**) and wind velocity ('r'= 0.449**).

Keywords: Citrus psylla, polulation dynamics, abiotic factor, *Diaphorina citri* Kuwayama

Introduction
Citrus is one of the important fruit crops grown in India. Most of species of citrus are considered as native to South East Asia. Major citrus producing countries are Spain, USA, Israel, Morocco, South Africa, Japan, Brazil, Turkey and Cuba. In India, citrus fruits are mainly grown in Maharashtra, Andhra Pradesh, Punjab, Karnataka, Uttarakhand, Bihar, Odisha, Assam and Gujarat. Cultivation of acid lime or *Kagzi* lime is popular in Gujarat state and mostly cultivated in Anand, Kheda, Ahmedabad, Mehsana, Vadodara, Surendranagar and Bhavnagar districts.

Butani (1979) [4] reported more than 250 insect species damaging Citrus at different stages of crop growth from seedling till the plant exists. In Gujarat, citrus plant is affected by many insect-pests like Aphid, Blackfly, Mealy bug Fruit sucking moth, Thrips, Leaf miner, Lemon Butterfly, Citrus whitefly and Citrus psylla (*Diaphorina citri* Kuwayama). Out of these, Citrus psylla is a very serious pest in all the citrus growing regions in India. It is also a known vector of "Citrus greening" a bacterial disease (Helbert and Manjunath, 2004) [6]. Ahmad *et al*. (2004) [1] found two peaks of citrus psylla in a year. It has been observed that infestation of this pest is increasing day by day which adversely affects the economy of the farmer. Bassanezi *et al*. (2011) [3] recorded 19 per cent yield loss due to incidence of *D. citri.* There is very scanty information available on population dynamics of citrus psylla in South Gujarat so, the work has been undertaken on population dynamics of citrus psylla in relation to abiotic factor.

Material and Methods
Total population of nymph and adult of citrus psylla was observed at standard week interval from June 2017 to June 2018 at ACHF, N. A. U., Navsari. For this purpose, twenty plants of citrus (Kagzi lime) were selected randomly. Five twigs were selected in each of the four directions on each plant for counting nymph and adult population of citrus psylla. Fluctuation of citrus psylla was thus assessed at standard week interval during the period of investigation (June 2017- June 2018). Weather parameters *viz*; temperature (maximum and minimum), relative humidity (morning and evening), rainfall, bright sunshine, wind velocity and evaporation were collected from meterological observatory NMCA, N.A.U., Navsari one standard week prior to the first period of appearance of citrus psylla population till the last

week of pest appearance. Fluctuation of pest population (nymph and adult citrus psylla) was studied in relation to the weather parameters and correlation coefficient ('r') was worked out.

Results and Discussion

Studies based on combined population of nymphs and adults of *D. citri* and effect of weather parameters on it was carried out from 5th June 2017 (23rd std. week) to 4th June 2018 (22nd std. week) at ACHF, N. A. U., Navsari (Table-1). For this purpose, twenty citrus plants were selected. Population of *D. citri* fluctuated from 0.20 to 10.23 insects per twig. Psylla population increased from last week of June to September 2017 indicating highest population (10.23/ twig) in 3rd week of August (34th SMW). Population declined further in October. Lower population (< 2 nymphs/ twig) was recorded during 47th STW of 2017 - 5th SMW of 2018 indicating the lowest level (0.20 psyllid/twig) on 52nd SMW in 1st week of January.

Population build up started once again from 1st week of February and second peak was observed during 16th STW (8.75/ nymphs and adults/twig/plant) in 1st week of May. Atwal *et al*. (1970) [2] observed four peaks in the pest population curves in a year i.e. March, June-July, August-September and October-November. Viraktamath and Bhumannavar (2001) [7] also reported peak population of *D. citri* during March-April and July-August. Ahmed *et al*. (2004) [1] indicated two peaks of citrus psylla in a year, first in August and 2nd in April. Extremes of high and low temperature were observed to be injurious to the pest, the sub-zero temperatures occurring in some winters prevented severe outbreaks in the following spring.

Table 1: Numbers of nymphs and adults *D. citri* in relation to weather parameters (2017-18)

Standard week	Number of *D. citri* /twig (#)	Temp(◦C)			RH (%)			Bright sunshine (hrs)	Rainfall (mm)	Wind speed (km/hr)	Evaporation (mm)
		Max	Min	Av.	Mor.	Eve.	Av.				
	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
23(2017)	4.14	34.50	27.84	31.17	80.98	64.47	72.73	7.90	04.00	10.12	5.31
24	4.67	34.29	26.43	30.36	89.04	68.33	78.68	7.66	38.00	8.48	5.24
25	5.59	32.61	25.43	29.02	92.20	72.70	82.45	6.73	40.00	5.87	4.13
26	6.05	33.73	27.16	30.44	84.57	71.00	77.79	7.99	12.00	9.39	4.31
27	6.53	30.00	24.46	27.23	95.94	89.45	92.70	1.26	221.00	8.63	1.89
28	6.98	31.29	26.20	28.74	88.29	76.60	82.44	3.63	35.00	9.15	2.64
29	7.58	31.43	25.44	28.44	88.63	78.97	83.8	4.99	32.00	8.11	3.27
30	8.37	29.16	24.46	26.81	98.59	89.09	93.84	1.99	330.00	6.90	2.26
31	8.75	29.00	25.16	27.08	92.86	90.59	91.73	0.11	152.00	8.86	1.64
32	9.37	30.04	25.14	27.59	84.23	79.24	81.74	4.24	56.60	19.19	2.54
33	9.86	30.93	25.20	28.06	91.64	76.67	84.15	4.59	22.00	5.99	3.10
34	10.23	31.27	25.49	28.38	90.53	75.56	83.05	6.20	10.00	6.76	3.27
35	9.89	29.40	24.59	26.99	94.58	86.76	90.67	3.27	90.00	4.98	2.91
36	9.00	29.31	24.14	26.73	96.61	86.21	91.41	3.24	177.00	4.91	2.97
37	8.92	31.36	24.71	28.04	95.63	75.67	85.65	5.17	03.00	4.02	3.27
38	7.88	34.04	25.13	29.59	91.3	74.99	83.14	4.69	02.00	2.85	3.36
39	7.16	31.41	23.71	27.56	96.52	79.35	87.93	2.13	69.00	3.32	3.24
40	6.51	33.31	23.81	28.56	94.14	65.53	79.83	7.30	0.00	2.30	3.57
41	5.75	36.71	24.17	30.44	96.4	51.03	73.72	8.40	0.00	2.95	4.24
42	5.15	34.39	23.70	29.04	93.93	68.74	81.34	4.30	28.00	3.15	4.16
43	4.30	35.87	22.31	29.09	92.82	71.96	82.39	7.20	0.00	2.19	4.21
44	3.75	35.00	19.81	27.41	90.34	46.79	68.56	9.34	0.00	2.59	4.21
45	3.16	35.34	16.99	26.16	72.02	23.48	47.75	9.79	0.00	2.35	4.16
46	2.37	34.26	16.26	25.26	72.13	31.20	51.67	9.61	0.00	2.83	3.96
47	1.85	32.34	14.29	23.31	84.28	31.36	57.82	8.29	0.00	2.49	3.20
48	1.56	34.03	15.74	24.89	87.84	39.81	63.82	6.50	0.00	2.55	2.76
Note: # Average of 20 plants											

Table 1: Continue…

Standard week	No. of *D. citri* /twig (#)	Temp (◦C)			RH (%)			Bright sunshine (hrs)	Rainfall (mm)	Wind speed (km/hr)	Evaporation (mm)
		Max	Min	Av.	Mor.	Eve.	Av.				
	Y	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}
49	1.32	33.13	15.03	24.08	74.27	33.68	53.97	7.96	0.00	2.53	2.80
50	0.57	26.59	17.93	22.26	83.67	68.26	75.96	2.50	37.00	4.34	2.13
51	0.35	29.51	15.57	22.54	92.25	47.96	70.11	6.39	0.00	2.28	2.36
52(2017)	0.20	29.79	16.64	23.21	63.07	40.83	51.95	3.83	0.00	4.41	2.10
1(2018)	0.24	31.04	11.11	21.08	80.62	32.84	56.73	8.31	0.00	2.59	2.8
2	0.31	29.74	10.16	19.95	90.19	34.72	62.46	7.91	0.00	2.40	2.71
3	0.94	29.49	15.56	22.52	64.21	35.94	50.08	5.76	0.00	3.72	3.03
4	1.55	31.07	14.96	23.01	80.95	33.21	57.08	7.61	0.00	2.57	3.36
5	1.98	29.86	10.00	19.93	92.03	28.96	60.49	8.93	0.00	2.33	2.93
6	2.66	33.20	11.07	22.14	89.85	24.80	57.33	8.79	0.00	2.34	4.16
7	2.94	30.91	14.10	22.51	91.85	45.65	68.75	5.66	0.00	2.73	3.20
8	3.70	31.71	14.29	23.00	75.78	30.76	53.27	8.99	0.00	4.46	4.70
9	3.80	35.36	14.71	25.04	77.40	27.22	52.31	8.41	0.00	2.49	4.36
10	4.42	37.27	17.16	27.21	79.93	22.36	51.14	7.19	0.00	3.13	4.97

11	5.21	35.51	17.56	26.54	83.97	29.71	56.84	7.90	0.00	3.36	4.74
12	5.89	36.00	16.67	26.34	82.09	23.94	53.02	7.93	0.00	3.06	5.33
13	6.77	35.13	17.49	26.31	80.52	29.53	55.02	8.57	0.00	3.29	5.14
14	7.80	35.83	20.29	28.06	82.97	43.03	63.00	8.76	0.00	4.54	5.51
15	8.56	35.87	20.44	28.16	86.42	42.41	64.42	8.61	0.00	3.77	5.56
16	8.75	34.99	21.90	28.44	92.79	57.39	75.09	9.40	0.00	4.87	5.79
17	8.47	37.03	23.00	30.01	84.33	38.63	61.48	9.94	0.00	4.45	6.23
18	8.20	36.11	21.91	29.01	88.49	51.36	69.93	11.07	0.00	4.57	6.31
19	6.73	34.19	24.59	29.39	86.27	60.08	73.17	10.50	0.00	8.33	5.99
20	6.06	35.30	24.26	29.78	85.32	53.65	69.48	10.17	0.00	5.91	6.10
21	4.91	35.46	26.67	31.06	84.75	57.18	70.96	9.01	0.00	7.50	6.10
22(2018)	3.93	35.20	26.14	30.67	83.58	54.28	68.93	7.50	0.00	7.31	5.80
Correlation coeff.('r')	1.000	0.13	0.728**	0.675**	0.509**	0.620**	0.639**	-0.234	0.362**	0.449**	0.209
Note: # Average of 20 plants and ** Highly significant											

In the current investigation, highest population of *D. citri* (10.23/twig) was observed on 34th SMW wherein the periods of 25-42 STW of 2017 and 11-20 SMW of 2018 had higher population (>5 psyllids/twig) while, it was low (< 2 psyllids/twig) during 47th STW of 2017 - 5th SMW of 2018 which was also observed by Atwal *et al*. (1970) [2] (March, June-July, August-September and October-November), Viraktamath and Bhumannavar (2001) [7] (March-April and July-August) and Ahmed *et al*. (2004) [1] (first week in August and 2nd in April). So, looking to similarity of ongoing results with those of earlier reports, the ongoing results are said to be confirmed.

Correlation between weather parameters and citrus psylla

Correlation studies were conducted to study the impact of weather factors (maximum, minimum and average temperature), (morning, evening and average relative humidity), wind velocity and bright sunshine has effect on combined population of nymph and adult citrus psylla.

Nymph and adult population of citrus psylla was positively and significant correlated with minimum temperature ('r' = 0.728**), average temperature ('r' = 0.675**), morning relative humidity ('r' = 0.509**), evening relative humidity ('r' = 0.620**), average relative humidity ('r' = 0.639**), rainfall (r= 0.362**) and wind speed ('r' = 0.449**) which implies that with linear increase in these variables led to increase in population of *D. citri*. Earlier, Halbert and Manjunath (2004) [6] reported that maximum and minimum temperature, sunshine and rainfall were positively correlated with nymphal, adult and mixed population but the effect of rainfall on adult population was non-significant, while relative humidity was negatively correlated. In the current investigation, temperature, relative humidity, rainfall had significant and positive impact on fluctuation of *D. citri* population. This pattern of pest population fluctuation was found synchronous with this weather parameter which is also reported by Halbert and Manjunath (2004) [6] thus, confirm the current findings.

In short nymphal and adult population was positively correlated with Minimum temperature and average temperature, while it is negatively correlated with maximum temperature (Fig.1). Psyllid population was positively correlated with Morning, evening and average relative humidity (Fig.2) indicated that when morning and evening humidity increase, population of citrus psylla also increase. Population of *D. Citri* positively correlated with Rainfall and wind speed. When rainfall and wind speed increase population of psylla increase (Fig.3).

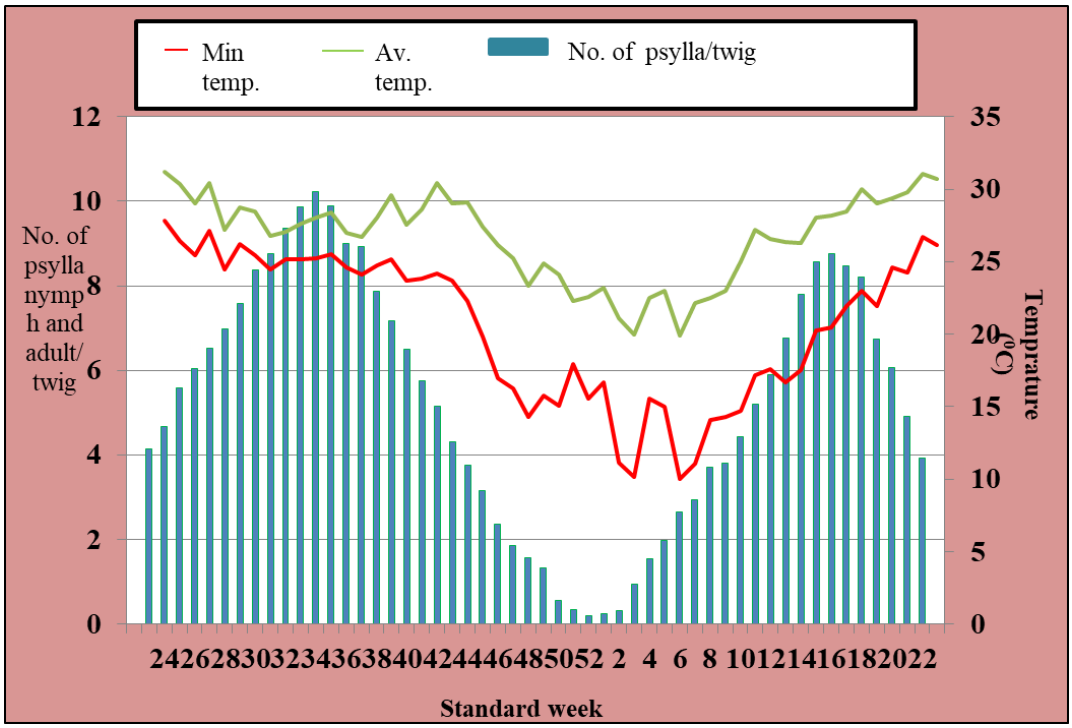

Fig 1: Impact of temperature on population fluctuation of citrus psylla

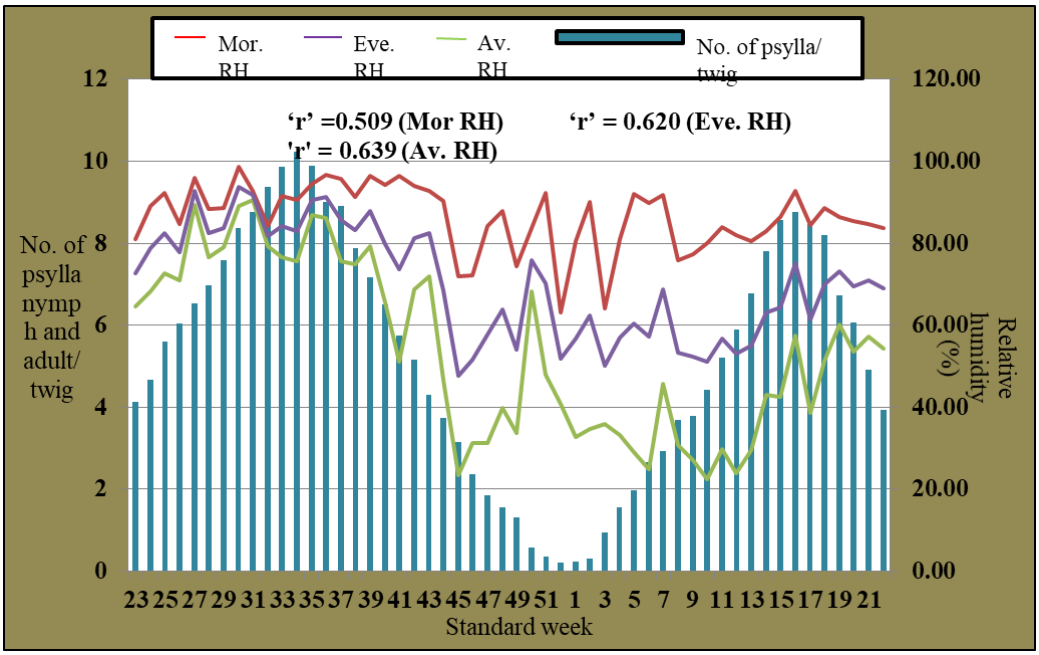

Fig 2: Impact of relative humidity on population fluctuation of citrus psylla

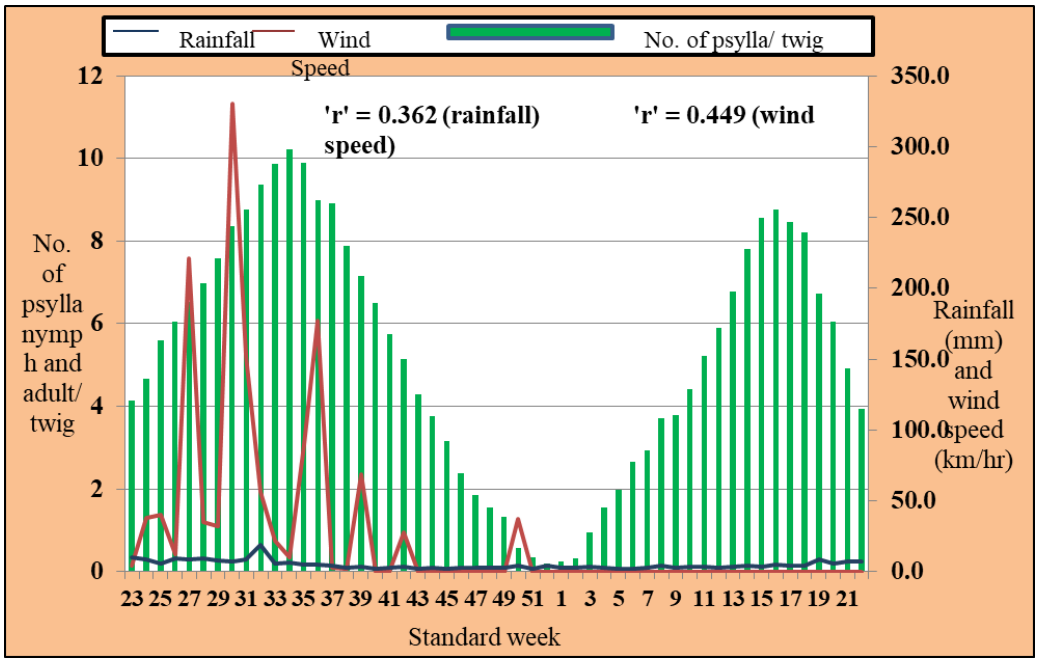

Fig 3: Impact of rainfall and wind speed on population fluctuation of citrus psylla

Conclusion

Active period of the pest was found during 34th SMW in a month of August and 16th SMW in month of May while, it was lowest on 52nd SMW in month of January. Citrus psylla was positively and significant correlated with minimum temperature, average temperature, morning relative humidity, evening relative humidity, average relative humidity, rainfall and wind speed which implies that with linear increase in these variables led to increase in population of psylla.

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References

1. Ahmed S, Ahmed N, Khan RR. Studies on Population dynamics and chemical control of citrus psylla, *Diaphorina Citri*. Int. J Agric. and Biol 2004;6(6):970-973.
2. Atwal AS, Chaudhary JP, Ramzan M. Studies on the development and field population of citrus psylla, *Diaphorina citri* Kuwayana (Psyllidae: Hemiptera). J Punjab. Agri. University 1970;7:333-338.
3. Bassanezi RB, Montesino LH, Gasparoto MCG, Filho AB, Amorim L. Yield loss caused by huanglongbing in different sweet orange cultivars in Sao Paulo, Brazil. Eur. J. Plant. Pathol 2011;130:577-586.
4. Butani DK. Insect pests of fruit crops and their control: jackfruit. Pesticides 1979, 55-57.
5. Devi HS, Sharma DR. Impact of abiotic factors on build-up of citrus psylla, *Diphorina citri* Kuwayama population. J of App. and Nat. Sci 2014;6(2):371-376.

6. Halbert, Manjunath Asian citrus psyllids (sternorrhyncha: psyllidae) and greening disease of citrus. Florida entomologist. 2004;87(3):330-353.
7. Viraktamath CA, Bhumannavar BS. Biology, ecology and management of *Diaphorina citri* Kuwayama (Hemiptera: Psyllidae). Pest management in Horticultural Ecosystems 2001;7(1):1-27.