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Abundance of Rose Pests in Relation to Major Abiotic Factors

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***Abstract*:** Abundance of rose pests in relation to abiotic factors was carried out at farmers field of Malotha, Tapi, Gujarat, India during 2018-2020. Highest thrips were observed during 18 and 17th SMW, respectively. Aphid attained peak during 3rd SMW while scale insect attained peak at 23rd SMW. Castor semilooper peaked at 37th SMW. Tussock moth attained peak during 46-47th SMW. Bud borer attained peak at 8th SMW. Thrips population on rose leaves and flowers exhibited highly significant and positive correlation with T_{max} while it was highly significant but negative with RH and rainfall. Aphid population exhibited highly significant but negative correlation with $T_{min.}$, RH and rainfall. Scale insect indicated highly significant and positive correlation with T_{max} and T_{min}. Castor semilooper exhibited highly significant and positive correlation with T_{min}, RH and rainfall while, it was significant but negative with T_{max}. Tussock moth exhibited significant positive correlation with RH and significant negative with T_{max}. The bud borer population indicated highly significant but negative correlation with T_{min}, RH and rainfall.

***Keywords*:** Seasonal abundance, Thrips, Aphid, Castor semilooper, Tussock moth and bud borer

Rose belong to the family Rosaceae and is one of the most important ornamental flower species used in landscape and cut flowers. In the international flower market, rose is ranked first among the top three cut flowers *viz*; rose, chrysanthemum and carnation (Hegde 2010). The estimated area under rose cultivation and its cut flower production was 29.57('000) hectares and 172.294 ('00000) MT, respectively (Anonymous 2016-2017). Area and production of rose in Gujarat is 4161 ha with 39049 MT production, respectively (Director Agriculture and Horticulture 2019-2020). Among the various factors affecting production and quality of flowers, pests and diseases are of prime importance. The most commonly associated pests on rose are *viz*; thrips, *Frankliniella schultzei* (Pergande), *Scirtothrips dorsalis* Hood (Thysanoptera : Thripidae); aphid, *Macrosiphum rosae* (Linnaeus) (Hemiptera: Aphididae); whitefly, *Trialeurodes vaporariorum* (Westwood) (Hemiptera: Aleyrodidae); mealybug, *Planococcus citri* (Risso) (Hemiptera: Pseudococcidae); foliage feeders and bud borers, *Helicoverpa armigera* (Hubner)(Lepidoptera: Noctuidae); *Spodoptera litura* (Fabricius) (Lepidoptera: Noctuidae) and mite, *Tetranychus urticae* Koch (Acarina: Tetranychidae) (Dreistadt 2001, Rajkumar et al 2004). About sixteen species of insects and one species of mite were observed as pest and associated with various stages of the rose crop (Reddy 2018). As not much information is available on abundance of pests on rose in relation to weather factors, this experiment was carried out under open field condition from 2018 to 2020.

MATERIAL AND METHODS

The study based on seasonal abundance of rose pests was carried out under open field condition (plot size 400 m^2) at farmers field (latitude: 21.044694, longitude: 73.377468) of village Malotha, taluka Vyara, district Tapi in the Gujarat state of India during 2018-2020 on rose cv. Gladiator. Fertilizer application was done as per the recommendation. All the other cultural operations including irrigation was followed as and when required.

Method of recording observation: The regular plot under rose cultivation was selected and observations were recorded at standard week wise interval on 50 plants selected randomly. The observations on pest count were made during two years (2018-20) on each rose plant. The data of two years was summarized and pooled results are mentioned hereunder:

Thrips: Thrips were counted on randomly selected plants by tapping leaves and flowers on black paper. Thus, pest population per leaf and flower was assessed (Duraimurugan and Jagadish 2004).

Aphid: Nymph and adult aphids were counted on the plants by selecting three tender shoots of 10 cm length (Hole et al 1997). The pest population for one shoot per plant was computed.

Foliage feeders and bud borers: Number of larvae of castor semilooper, tussock moth and bud borer were counted on selected plants. The plants were examined thoroughly and absolute population of larvae was recorded at standard week wise interval (Patel and Koshiya 1997). The pest population per plant was computed.

Meteorological parameters: For developing insect pest management programme for specific agro-ecosystems, information on abundance and distribution of pest in relation to weather parameters *viz*; temperature (maximum, minimum), relative humidity, rainfall, rainy days and sunshine were procured daily during the experimental period and later computed at standard week wise interval.

Statistical analysis: Relationship between pest population and weather parameters were studied using correlation and regression using SPSS software.

RESULTS AND DISCUSSION

The pooled results of both the years (2018-2020) are presented and discussed in Table 1-3.

Thrips: Highest population of thrips was during 17th and 18th and SMWs, respectively (Table 1). The correlation studies of both the years indicated highly significant and positive correlation of thrips population on rose leaves with maximum temperature (T_{max}) while, it was highly significant but negative with RH and rainfall. Likewise, thrips population on rose flowers were highly significant and positively correlated with T_{max} while, it remained highly significant but negative with RH and rainfall (Table 2). Total contribution of all the weather factors on abundance of thrips on rose leaves was 83.3 per cent indicating significant multiple correlation. Likewise, total contribution of all the weather factors on abundance of thrips on rose flowers was 75.1 per cent indicating highly significant multiple correlation (Table 3). Relationship of thrips population with maximum temperature was significant and positive implying that with increase in temperature, there was bound to rise in the thrips on rose leaves and flower and vice-versa. Patel (2006) indicated appearance of thrips on rose flowers throughout the year except in rainy season at 23rd SMW (1st week of June) wherein thrips population was reported to have positive correlation with maximum temperatures, while it exhibited negative correlation with relative humidity which confirms the present findings wherein same trend of thrips population on leaves and flowers was also reported. Hegde (2010) reported thrips abundance throughout the flowering period which attained peak during May. Bukero et al (2015) found maximum thrips population at 14th SMW (2nd April) wherein the pest population was negatively correlated with temperature and relative humidity. Similarly, Norboo et al (2017a) observed in 14th SMW which reached its peak at 48th SMW. In the present findings, the thrips population remained highest during warmer days (17-18 SMW) indicating significant positive correlation with maximum temperature. So, the present findings are more or less same as reported earlier and some variation reported earlier might be due to variation in ecological conditions of present investigation and earlier reports. This implies that with unit increase in temperature and unit decrease in RH and rainfall there was corresponding increase in thrips population on rose plant under open field conditions and vice-versa.

Aphid: Aphid population was observed on rose from 50th SMW and reached to its peak at 3rd SMW. Thereafter, the pest population was found declining. No variable could exhibit positive relationship with aphid population however, it indicated highly significant but negative correlation with minimum temperature) $T_{min.}$, RH and rainfall . Negative impact of weather parameters on aphid population implied that unit decrease in these variables led to increase in aphid numbers and vice-versa. Total impact of all-weather factors considered in this investigation on aphid abundance was 67.4 per cent with highly significant multiple correlation coefficient (Table 3). Kmiec (2007) studied different groups of rose in relation to first occurrence of *Macrosiphum rosae* aphids in April and colonies in December. Mehrparvar *et al.* (2008) reported two peaks of rose aphid in a year (May and December). Hegde (2010) found peak aphid density during August indicating positive correlation with maximum relative humidity and negative correlation with maximum temperature. Quratulain et al (2015) observed development of aphid population in November and another rise at the end of February. The present findings are similar to this report wherein the aphid population peaked in colder months; however, the findings tend to vary from other the reports which could be due to difference in location and ago-ecological conditions. This implies that with unit decrease in temperature, relative humidity and rainfall there was corresponding increase in aphid population on rose buds and vice-versa.

Scale insect: The buildup of scale insect on rose started from 17th SMW which later attained peak status at 23rd SMW. Highly significant and positive correlation was found to exist between scale insect and T_{max} and T_{min}. The multiple correlation coefficient explained variation to the tune of 70.6 per cent due to all the weather factors taken into consideration. Hegde (2010) found infestation of red scale and soft scale on rose from January to June wherein pest attained peak during April- May. In the current investigation also peak population of scale insect was observed on rose during 23rd SMW. This indicate that with unit increase in these variables there was corresponding increase in larval population of the semilooper and vice-versa.

Castor semilooper, *A. janata*: Larval population of castor semilooper started appearing from 25th SMW. The pest

Table 1. Abundance of major pests of rose at farmers field (Malotha, Vyara, Tapi, Gujarat, India) during (2018-19 to 2019-20)

SMW	Thrips/ leaf	Thrips/ flower	Aphids /bud	Scales /shoot	Semilooper larva/plant	Tussock moth larva/plant	Bud borer larva/plant
15	2.23	6.97	0.00	0.00	0.00	0.00	0.09
16	2.14	6.91	0.00	0.00	0.00	0.00	0.04
17	2.48	7.30	0.00	3.66	0.00	0.00	0.00
18	2.56	6.84	0.00	3.86	0.00	0.00	0.00
19	2.23	6.29	0.00	9.54	0.00	0.00	0.00
20	1.90	5.47	0.00	9.80	0.00	0.00	0.00
21	1.78	5.28	0.00	11.54	0.00	0.00	0.00
22	1.59	4.16	0.00	13.32	0.00	0.00	0.00
23	1.42	3.76	0.00	16.71	0.00	0.00	0.00
24	1.41	3.96	0.00	13.24	0.00	0.00	0.04
25	1.37	3.61	0.00	15.84	0.09	0.00	0.05
26	0.95	2.57	0.00	15.40	0.08	0.00	0.00
27	0.71	2.26	0.00	13.39	0.12	0.00	0.00
28	0.78	2.24	0.00	5.88	0.14	0.00	0.00
29	0.75	2.12	0.00	3.84	0.16	0.00	0.00
30	0.78	1.90	0.00	1.07	0.19	0.00	0.00
31	0.58	1.15	0.00	0.00	0.26	0.00	0.00
32	0.57	1.83	0.00	0.00	0.45	0.06	0.00
33	0.59	1.88	0.00	0.00	0.26	0.09	0.00
34	0.60	2.02	0.00	0.00	0.25	0.12	0.00
35	0.61	2.26	0.00	0.00	0.23	0.16	0.00
36	0.61	2.41	0.00	0.00	0.27	0.19	0.00
37	0.85	2.47	0.00	0.00	0.49	0.19	0.12
38	0.92	3.11	0.00	0.00	0.37	0.15	0.09
39	1.02	3.30	0.00	0.00	0.29	0.16	0.06
40	1.14	3.42	0.00	0.00	0.33	0.12	0.00
41	1.18	3.82	0.00	0.00	0.22	0.20	0.08
42	1.23	4.30	0.00	0.00	0.14	0.19	0.26
43	1.36	5.12	0.00	0.00	0.14	0.18	0.40
44	1.50	6.15	0.00	0.00	0.18	0.22	0.36
45	0.78	2.10	0.00	0.00	0.31	0.19	0.00
46	1.00	2.52	0.00	0.00	0.23	0.26	0.00
47	1.03	2.26	0.00	0.00	0.16	0.26	0.07
48	0.97	1.94	0.00	0.00	0.00	0.22	0.15
49	0.42	0.18	0.00	0.00	0.00	0.05	0.10
50	0.41	0.41	1.74	0.00	0.00	0.05	0.07
51	0.63	0.84	3.86	0.00	0.00	0.00	0.10
52	0.72	1.32	5.76	0.00	0.00	0.00	0.07
1	0.71	2.10	6.10	0.00	0.00	0.00	0.00
2	0.98	2.05	8.76	0.00	0.00	0.00	0.17
3	1.16	2.60	10.55	0.00	0.00	0.00	0.24
4	1.20	3.13	8.68	0.00	0.00	0.00	0.34
5	0.97	3.54	9.16	0.00	0.00	0.00	0.36
6	1.36	4.78	7.50	0.00	0.00	0.00	0.37
7	1.63	4.61	5.47	0.00	0.00	0.00	0.40
8	1.62	4.67	3.31	0.00	0.00	0.00	0.50
9	1.84	5.12	1.51	0.00	0.00	0.00	0.39
10	1.92	4.93	1.09	0.00	0.00	0.00	0.38
11	1.94	4.85	0.00	0.00	0.00	0.00	0.35
12	1.73	4.11	0.00	0.00	0.00	0.00	0.44
Mean	1.22	3.46	1.47	2.74	0.11	0.06	0.12

Table 2. Correlation coefficients of rose pests in relation to weather parameters (2018-19 to 2019-20)

Parameters	Correlation coefficients						
	Thrips/ leaf	Thrips/ flower	Aphids /bud	Scales /shoot	Semilooper larva/plant	Tussock moth larva/plant	Bud borer larva/plant
$T_{max.}$ (°C)	0.880**	0.802**	-0.269	0.397**	-0.500**	-0.280*	0.005
$T_{min.}$ (°C)	0.171	0.237	-0.795**	0.598**	0.352*	0.046	-0.569**
RH (%)	-0.576**	-0.446**	-0.512**	0.150	0.775**	0.347*	-0.543**
Rainfall (mm/day)	-0.449**	-0.378**	-0.292*	0.243	0.423**	-0.072	-0.384**

*Significant (p = 0.05) **Significant (p = 0.01)

Table 3. Regression coefficients of rose pests in relation to weather parameters (2018-19 to 2019-20)

Parameters	Correlation coefficients						
	Thrips/ leaf	Thrips/ flower	Aphids /bud	Scales /shoot	Semilooper larva/plant	Tussock moth larva/plant	Bud borer larva/plant
Constant	-2.656	-7.467	26.180	31.925	-0.392	-0.786	1.984
$T_{max.}$ (°C)	-0.140	-1.144	0.077	3.665	-0.098	-0.001	-0.154
$T_{min.}$ (°C)	-0.361	-1.865	0.703	9.258	-0.150	-0.071	-0.084
RH (%)	0.003	0.019	-0.141	-0.570	0.011	0.011	-0.013
Rainfall (mm/day)	0.006	-0.006	0.056	0.129	-0.007	-0.008	-0.003
Multiple correlation (R)	0.913	0.867	0.821	0.840	0.889	0.706	0.691
Total variation explained (%)	83.3	75.1	67.4	70.6	88.9	49.8	69.1

multiplied further indicating peak at 37th SMW. Highly significant and positive correlation of semilooper population was reported with T_{min}, RH and rainfall while, it indicated significant but negative correlation with $T_{max.}$ The multiple correlation coefficient explained 88.9 per cent variation due to all the weather factors. Positive correlation between larval population of semilooper with minimum temperature, RH and rainfall indicate that with increase in every unit of these parameters there was corresponding increase in pest population and vice-versa while, maximum temperature had negative relationship with the pest build up implying increase in pest led to decrease its population. The unit increase in RH and unit decrease in maximum temperature will increase larval population of tussock moth and vice-versa.

Tussock moth, *Orgyia* sp.: Larval population of tussock moth started appearing from 32nd SMW attaining peak during 46-47th SMWs thereafter, the population declined gradually. Population of the tussock moth exhibited significant positive correlation with RH while, it indicated significant negative correlation with T_{max} (Table 2). Multiple correlation coefficient explained 49.8 per cent variation due to all the weather factors (Table 3). Thus, it is evident from the above results that larval population of tussock moth increased with unit increase in relative humidity and decrease in maximum temperature.

Bud borer, *H. armigera*: The bud borer *H. armigera* population started appearing from 15th SMW indicating highest larval population at 8th SMW. Bud borer population failed to establish positive relationship with any variable considered in this investigation. However, it indicated significant but negative correlation with $T_{min.}$ RH and rainfall. Multiple correlation coefficient explained 69.1 per cent due to all the weather factors taken into consideration. Hegde (2010) reported occurrence of *H. armigera* larvae throughout the year indicating higher density from August to October wherein varied from 0.5 to 2.2 per plant. In the present findings, larval population of *H. armigera* varied inconsistently throughout the year wherein the active period of the pest was reported during 42nd-44th SMWs which is also reported in the above report. Thus, the current results are more or less in accordance with the earlier reports. The with unit decrease in the above abiotic factors there was corresponding increase in larval population of bud borer under open field condition.

CONCLUSION

Peak activity of thrips was observed during 17th-19th SMW while, scale insects remained very active during 23rd SMW. Aphid and bud borer *H. armigera* indicated higher activity during 3rd-8th SMW. Castor semilooper and Tussock moth remained very active during 46-47th SMW. Thrips population was influenced positively by temperature and negatively by

RH and rainfall. Aphid was influenced negatively by temperature, RH and rainfall. Scale insect and castor semilooper were directly influenced by temperature while tussock moth was directly associated with RH and indirectly with maximum temperature. Bud borer, *H. armigera* was negatively influenced by temperature, RH and rainfall.

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