



Scenario of Arthropods Fauna on Rose in Southern Rajasthan

Rajendra Singh¹, N.L. Dangi^{2*}, A.K. Meena³, Lekha⁴ and Gaurang Chhangani⁵

¹Maharan Pratap University of Agriculture & Technology, Udaipur 313 001, India

²Agriculture Research Station-Mandor, Agriculture University, Jodhpur 342 304, India

³College of Agriculture-Baytu, Agriculture University, Jodhpur 342 304, India

⁴Agriculture Research Sub-Station, Sumerpur, Agriculture University, Jodhpur 342 304, India

⁵College of Agriculture, Jodhpur, Agriculture University, Jodhpur 342 304, India

OPEN ACCESS

Received: November 7, 2023 Accepted: April 25, 2024

Editor-in-Chief
Praveen Kumar

Associate Editor
V.S. Rathore
P. Santra
R.K. Solanki

Managing Editor
N.R. Panwar

Editors
R.S. Tripathi
S. Soondarmurthy
U.R. Ahuja
R. Sharma
P.P. Rohilla
Raj Singh

Guest Editors
Mahesh Kumar
M.L. Dotaniya
Archana Verma

***Correspondence**
N.L. Dangi
nlento0249@gmail.com

Citation
Singh, R., Dangi, N.L., Meena, A.K., Lekha and Chhangani, G. 2024. Scenario of arthropods fauna on rose in southern Rajasthan. *Annals of Arid Zone* 63(3): 125-131
doi.org/10.56093/aaz.v63i3.144985
<https://epubs.icar.org.in/index.php/AAZ/article/view/144985>

<https://epubs.icar.org.in/index.php/AAZ>

Abstract: The arthropod fauna associated with rose at Udaipur comprised of 17 species of insects (6 pests and 11 pollinators). The pests included were thrips, aphids, the rose bud caterpillar, black flies and the scurfy rose scale while, pollinators included members of Hymenoptera and Diptera. During the crop season, the peak populations of thrips, aphids and larvae of rose bud caterpillar were recorded in the first week of April (9.80 thrips flower buds⁻¹), first week of March (17.04 aphids flower buds⁻¹) and first week of March (0.56 larvae flower⁻¹), respectively. The mean atmospheric temperature evinced a positive correlation with thrips ($r=0.832$), rose bud caterpillar ($r=0.607$) and insect pollinators. Thrips ($r=0.583$) and aphids ($r=0.622$) had a significant positive correlation with sunshine, whereas the relative humidity indicates significant negative correlation with thrips ($r=-0.720$), aphids ($r=0.581$) and rose bud caterpillar ($r=-0.817$), respectively. The population of pollinators showed a significant positive correlation ($r=0.573$) with the mean atmospheric temperature; while a significant negative correlation ($r=-0.769$) with relative humidity. The relative density of pollinators visiting rose comprised: honeybees, *A. florae* & *A. dorsata* with 68.24 per cent; solitary bees (12.08%) and dipteran flies (19.55%). Most pollinators preferred to visit rose flowers during 9 to 11 hours of the day.

Key words: Arthropod, diversity, insect-pests, pollinators and rose.

Rose as ornamental plant is found everywhere and is cultivated widely in most parts of the world. Furthermore, cut rose flower is regarded as one of the best cash crop among ornamental flowers. Plant is infested by several insects, mites, diseases, and nematodes posing a serious threat to rose cultivation. Commonly found and regular pests are thrips *Frankliniella* sp., aphids, *Macrosiphum rosae* L., scales,

Lindingaspis rossi (Maskell), *Aonidiella aurantii* (Maskell), *Aspidiotus* spp., whiteflies, *Bemisia tabaci* Genn., leafhoppers, *Edwardsiana rosae* L., chafers, *Oxycetonia versicolor* Fab., termites, *Odontotermes obesus* (Rambur), and mites, *Tetranychus cinnabarinus* (Boisduval). Several of these pests are found during the year damaging the rose and affecting the flower. All these sap sucking pests occur in large numbers in clusters under the surface of leaves, on shoots, flowers and buds in field. Mite and insect pests on rose can cause 28 to 95% damage individually both in field and in polyhouses (Hegde *et al.*, 2020). Among the beneficial insects, pollinators like solitary bees, honeybees and flies play a useful role. Study of the diversity of beneficial and pest arthropod fauna and their population activities are essential for developing a pest management strategy; hence, the present investigation was taken up.

Materials and Methods

The experimental field trials were conducted on rose plantations at farmer's field and at university farm, Department of Horticulture, RCA, Udaipur. The plantation comprised rose variety "Ganganager rose" in an area of 1000 m² at New Ashok Nagar, Udaipur and these rose plantations were monitored for the appearance of insect pests at weekly intervals during *Rabi* season November 2020 to April 2021.

Standard package of practices (Pramukh Udhyaniki Fasalen) was followed for cultivation of Rose. Observations on insects/mites pests were taken on a weekly basis during early morning hours (07.00 am to 08.00 am). Weather data *viz.* mean atmospheric temperature, relative humidity and sunshine hours during this period was collected from meteorology unit located close to the experimental plots.

- Thrips and aphids were recorded from the growing twigs and flower buds on 25 randomly selected plants. Aphids were recorded by visual count method, while thrips were counted by gentle shaking of selected twigs on a white paper sheet smeared with a thin layer of white grease.
- Leaf eating caterpillars were recorded visually from the same 25 flowers and expressed as numbers per plant.

Observations on insect pollinators visiting rose were taken for different groups of

pollinators during flowering at different time intervals: 09:00 to 11:00, 11:00 to 13:00 and 15:00 to 17:00 hrs of the day and their activity was observed for 1 minute on each flower. Such observations were recorded from 5 flowers during the bloom. The data were later averaged as per time interval and according to insect group to infer the pollinator faunal diversity as well as dominance of particular group during the time intervals being observed. Representative specimens of the pollinators' fauna, were processed and pinned on cards.

The following mathematical analyses were made to estimate the mean and relative density:

$$\text{Mean density} = \frac{\sum X_i}{N}$$

where,

X_i = No. of insects or natural enemies in i^{th} sample

N = Total no. of plants sampled

$$\text{Relative density (RD \%)} = \frac{\text{Number of individual of one species}}{\text{Total number of individual of all species}} \times 100$$

Results and Discussion

The arthropod fauna associated with roses has been tabulated (Table 1), comprising 17 species of insects, including 6 insect pests and 11 pollinators. The insect pest included aphid (Aphididae: Homoptera); thrips (Thripidae: Thysanoptera); Black fly (Aleyrodidae: Hemiptera); Rose bud caterpillar (Noctuidae: Lepidoptera) and Scurfy scale insect (Diaspididae: Homoptera). Whereas, pollinators recorded were Giant honey bee, Dwarf honey bee, Indian honey bee and Solitary bees from Aphidae and one solitary bee species from Halictidae; Leaf cutter bee (Megachilidae: Hymenoptera); Hover fly (Syrphidae: Diptera) and Rhiniidae fly (Rhiniidae: Diptera).

The pests included were thrips, aphids, the rose bud caterpillar, black flies and the scurfy rose scale; out of which only thrips, aphid and rose bud caterpillar population was recorded in significant number. Remaining two insect pest i.e. black flies and the scurfy rose scale population was very less in number and remained below ETL with scattered population throughout the year. So correlation only for

Table 1. Major insect pests and pollinators on rose during Rabi season

Common Name	Scientific Name
Insect pests	
Aphid	<i>Aphis craccivora</i> (Koch) <i>Macrosiphum rosae</i> (L.)
Thrips	<i>Frankliniella</i> sp.
Black fly	<i>Aleurocanthus rosae</i> (Quaintance)
Rose bud caterpillar	<i>Helicoverpa armigera</i> (Hub.)
Scurfy scale insect	<i>Aulascaspis</i> sp.
Insect pollinators	
Giant honey bee	<i>Apis dorsata</i> (Fabricius)
Dwarf honey bee	<i>Apis florea</i> (Fabricius)
Indian honey bee	<i>Apis cerana indica</i> (Fabricius)
Solitary bees	<i>Braunsapis</i> sp. (Michener) <i>Ceratina</i> sp. (Latreille) <i>Ceratina (Pithitis) binghami</i> Cockerell <i>Ceratina (Ceratinindia) sp. 1</i> <i>Lasioglossum</i> sp.(Curtis)
Leaf cutter bee	<i>Megchile albifrons</i> (Smith) Male
Hover fly	Unidentified
Rhiniidae fly	Unidentified

thrips, aphid and rose bud caterpillar were calculated.

Thrips: Frankliniella sp. (Thysanoptera: Thripidae)

During the investigation, the incidence of thrips commenced from end of December (52nd Standard Meteorological Week; SMW) during Rabi season and continued till the first week of April (13th SMW). The data recorded (Fig. 1) reveal that the population of thrips appeared in the end of December (5.08 flower⁻¹); There after population of thrips fluctuated many times and peaks were observed to in last week of January, first week of March and first week of April (7.50, 8.58 and 9.80 per flower, respectively) during the cropping season.

Table 2. Correlation coefficients between major arthropod fauna and abiotic factors during rabi

Arthropod fauna	Abiotic factors			
	Mean Atm. Temp. (°C)	Mean RH. (%)	Sun shine (hrs)	Wind velocity (Kmph)
Thrips	0.832*	-0.720*	0.583*	-
Aphid	0.519	-0.581*	0.622*	
Rose bud caterpillar	0.607*	-0.817*	0.536	
Insect pollinators	0.573*	-0.769*	0.480	0.490

* Value of 't' - statistically significant at 5%

The population of thrips indicates significant positive correlation with the mean atmospheric temperature ($r=0.832$) and sunshine ($r=0.583$), but with mean relative humidity it showed significant negative correlation ($r= -0.720$) (Table 2).

Aphid: Macrosiphum rosae L. and Aphis craccivora (Koch) (Hemiptera: Aphididae)

In the present investigation (Fig. 1), incidence of aphids initiated from first week of January that continued till the first week of April. The population increased gradually and reached to its peak in the first week of March with mean population of 17.04 aphids flower⁻¹. At the peak period of activity, mean atmospheric temperature, mean relative humidity and sunshine were 21.92°C, 45.29% and 9.57 hrs, respectively. The mean aphids population (Table 2) had a negative significant correlation with mean relative humidity ($r=-5.81$), but with sunshine the coefficient of correlation was significantly positive ($r=0.622$).

Rose bud caterpillar: Helicoverpa armigera Hub. (Lepidoptera: Noctuidae)

The incidence of the larvae of *H. armigera* first appeared in the fourth week of January and was noted up to the first week of April during the rabi season 2020-21. The maximum population of the larvae of rose bud caterpillar was recorded during first week of March (0.56 larvae per flower), when mean atmospheric temperature was 21.92°C, mean relative humidity 45.29% and sunshine 9.57 hrs. Correlation studies (Table 2) for the larval population with mean atmospheric temperature showed significant positive correlation ($r=0.607$) and mean relative humidity showed significant negative correlation ($r=-0.817$); where with sunshine it was found to be non-significant.

Our observations are comparable with similar studies as reported by Deshmukh *et al.* (2017), who reported that thrips were found in large

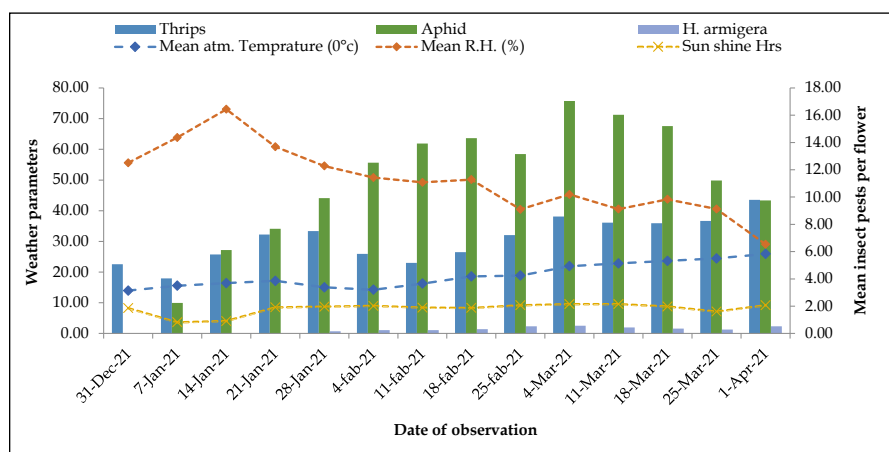


Fig.1: Seasonal incidence of major insect pests infesting rose during Rabi season, 2020-21.

numbers during summer and first fortnight of March. Similar reports were also made by Bukero *et al.* (2015), Hegde *et al.* (2016), and Norboo *et al.* (2017). Most workers reported that the relative humidity showed negative impact on thrips population. Deshmukh *et al.* (2017) observed that maximum temperature showed positive and significant effect on thrips.

Appearance of aphids commenced from first week of January. It increased steadily and attained peak during first week of March and was recorded on rose up to first week of April. Aphid population showed a significant negative correlation with mean relative humidity, while with sunshine it had a significant positive correlation. The present findings more or less agree with the results of Hole and Salunkhe (1997). They also reported that the *Macrosiphum rosae* build-up started in third week of January and peaked during the fourth week of February. Similarly, Quratulain *et al.* (2015) observed initiation population of aphid in November

and a different phase of increase at the end of February. Miles (1985) who observed Aphids' population were generally found on buds during periods in early autumn and spring and climatic factors was daily maximum temperatures were above 17°C and below 30°C.

First appearance of the rose bud borer (*Helicoverpa armigera* Hub.) was recorded in the last week of January. The pest was noted on the crop up to the first week of April. The mean atmospheric temperature showed a significant positive correlation with the rose bud caterpillar, while, the mean relative humidity showed a negative correlation. Earlier, Rajkumar *et al.* (2004) and Vashisth *et al.* (2013) reported *H. armigera* as the one of the major pest associated with rose crop. Gahukar (2003) reported that humidity had a significant negative relation with affected flowers and larval counts of *Helicoverpa armigera* (Hub.) on rose. Available literature on foliage or flower feeding insect pests of rose is scanty; hence, impact of abiotic

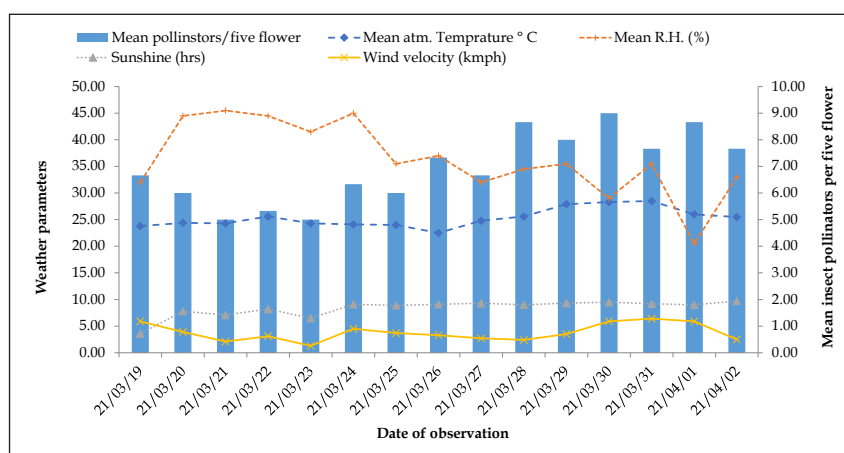


Fig. 2. Seasonal activity of insect pollinators on rose during 2020-21.

Table 3. Diversity of insect pollinators (Mean insect pollinators / five flowers) on rose during 2020-21

Observation dates	Recoding intervals (hrs.)											
	9:00 to 11:00				11:00 to 13:00				15:00 to 17:00			
	A	B	C	D	A	B	C	D	A	B	C	D
19/03/21	1.00	0.40	0.60	0.40	0.00	0.40	0.20	0.20	0.60	0.00	0.00	0.20
20/03/21	0.60	0.60	0.40	0.20	1.00	0.00	0.00	0.20	0.40	0.00	0.00	0.20
21/03/21	0.80	0.40	0.40	0.20	0.40	0.20	0.00	0.00	0.00	0.40	0.00	0.20
22/03/21	0.60	0.20	0.00	0.60	0.00	1.00	0.00	0.00	0.40	0.40	0.00	0.00
23/03/21	0.80	0.40	0.20	0.20	0.40	0.40	0.40	0.00	0.00	0.00	0.00	0.20
24/03/21	1.40	0.60	0.20	0.40	0.00	0.40	0.00	0.20	0.00	0.20	0.20	0.20
25/03/21	0.60	0.80	0.00	0.20	0.60	0.00	0.20	0.20	0.40	0.20	0.20	0.20
26/03/21	1.00	0.60	0.40	0.60	0.40	0.40	0.00	0.20	0.20	0.20	0.00	0.40
27/03/21	0.80	0.40	0.20	0.40	0.20	0.40	0.20	0.20	0.40	0.60	0.20	0.00
28/03/21	1.20	0.80	0.40	0.40	0.40	0.80	0.20	0.20	0.20	0.40	0.00	0.20
29/03/21	1.20	0.60	0.00	0.20	0.40	0.60	0.20	0.40	0.40	0.20	0.20	0.40
30/03/21	1.20	0.80	0.40	0.20	0.40	0.40	0.20	0.40	0.80	0.40	0.00	0.20
31/03/21	1.00	0.60	0.40	0.60	0.20	0.40	0.00	0.00	0.20	0.40	0.20	0.60
01/04/21	0.80	0.40	0.40	0.20	0.20	0.60	0.20	0.20	0.60	0.40	0.40	0.80
02/04/21	1.20	0.60	0.20	0.60	0.40	0.40	0.20	0.40	0.00	0.40	0.00	0.20
Total	14.20	8.20	4.20	5.40	5.00	6.40	2.00	2.80	4.60	4.20	1.40	4.00
Relative Density (%)	44.38	25.63	13.13	16.88	30.86	39.51	12.35	17.28	32.39	29.58	9.86	28.17
Pollinator status (%)	51.28				25.96				22.76			

A- *Apis florea* (Fabricius) (38.14%); B- *Apis dorsata* (Fabricius) (30.13%); C- Solitary bees (12.08%); D- Diptera flies (19.55%)

factors on *H. armigera* infesting vegetable crops has been consulted. In a field study on tomato during rabi season, the larval population of *H. armigera* showed significant positive correlation with maximum atmospheric temperature and significant negative correlation with mean relative humidity (Khokhar *et al.*, 2019), which is similar to our findings on rose.

Seasonal activity of insect pollinators

The activity of insect pollinators during 19/03/2021 to 02/04/2021 on rose flowers was manifested by honeybees, solitary bees and dipteran flies. As can be observed from (Fig 2), honeybees were the primary and dominant pollinators (68.27%). The numbers of bees visiting/flower per minute was recorded at different hours of the day from 09:00 to 17:00 hours. The maximum population of pollinators (9.00 pollinators/five flowers) was observed on 30th March, 2021, as compared to other dates of observation. The total pollinators population indicates (Table 3) a positive significant correlation with the mean atmospheric temperature ($r=0.573$); while a

significant negative correlation with relative humidity ($r=-0.769$).

The activities of insect pollinators were influenced by the abiotic factors of the environment. Insect pollinator population showed significant positive correlation with mean atmospheric temperature, but with mean relative humidity it showed significant negative correlation. Similar to our observations, the population of *A. florea* and *A. dorsata* was significantly and positively correlated with maximum atmospheric temperature and negatively with relative humidity in the evening but was non-significant with wind speed (Bajiya and Abrol, 2017). In another report, the bee activity increased with temperature, but was not affected by vapour pressure (Nunez, 1977).

Diversity of insect pollinators on rose

Lists of pollinators (Table 1), includes honeybees and general pollinators on rose during Rabi season 2020-21. The pollinators' diversity comprised two species of honey bees (68.24%), five species of solitary bees (12.08%)

and two species of dipteran flies (19.55%); besides few others insects groups were also observed Megachilidae and butterflies but then numerical abundance was very low.

The relative density (Table 3) revealed that *A. florea* (44.38%) was dominant between 09:00 to 11:00 AM, followed by *A. dorsata* (25.63%), dipteran flies (Syrphidae, Rhiniidae) (16.88 %) and solitary bees (Apidae; Halictidae) (13.13%). At mid-day between 11:00 AM to 13:00 PM *A. dorsata* (39.51%) dominated among the pollinators, followed by *A. florea* (30.86 %), dipteran flies (17.28%), and solitary bees (12.35 %). Diversity during 15:00 and 17:00 PM indicated *Apis florea* (32.39%) to be the maximum followed by *Apis dorsata* (29.58%), dipteran flies (28.17 %) and solitary bees (9.86%). Maximum pollination occurred between 09:00 to 11:00 AM (51.28%) as compared to between 11:00 AM to 13:00 PM (25.96%) and 15:00 PM to 17:00 PM (22.76%) on rose flowers under natural conditions (Table 3). The peak activity of honeybees as well as solitary bees was recorded between 09:00 and 11:00 AM.

These observations are in line with Kevan *et al.* (1990) who found that most insect pollinator activity on *Rosa setigera* started around 08:00 hrs, peaked around 11:30 h for bees, and then decreased. The peak of honeybee activity on *Rosa* spp. was between 08:00 and 09:00 AM, with their pollen being available from around 06:30, 07:00, or 07:30 AM until 11:00 AM or 12:00 Noon, depending on the species in temperate zones during summer season (Parker, 1926). A great diversity of insects were observed collecting pollen from rose flowers, particularly in the mid-to late mornings. Bees have been reported as the most common visitor, and are probably the best pollinators of *Rosa*, particularly. Besides, honeybees are the most common managed pollinators, and have been shown to have positive effects on many crop species (Free, 1970). Bajiya and Abrol (2017) also recorded Hymenoptera to be the most dominant visitors constituting (87.48, 88.18%) of the insect pollinators, followed by other insect pollinators (12.52, 11.82%). Bisht (1975) studied that the rose flowers were mostly visited by pollinating insects such as *A. florea*.

Conclusion

The rose plantation was found to be infested by thrips, aphids, the rose bud caterpillar, black

flies and the scurfy rose scale and pollinators associated were members of Hymenoptera and Diptera. The pollinators' diversity comprised of two species of honey bees, five species of solitary bees and two species of dipteran flies. Most pollinators preferred to visit rose flowers between 9 and 11 AM.

Acknowledgements

The authors sincerely thank to the Director Research, Dean RCA and Head, Department of Entomology for making available the facilities to conduct the research. Authors are thankful to Dr .V.V. Belavadi, Department of Entomology, GKVK, Bangalore for identification.

References

- Bajiya, M.R. and Abrol, D.P. 2017. Flower-visiting insect pollinators of mustard (*Brassica napus*) in Jammu Region. *Journal of Pharmacognosy and Phytochemistry* 6(5): 2380-2386.
- Bisht, D.S. 1975. Pollen gathering activity of honeybees and *Halictus*Sp. in roses. *Indian Bee Journal* 37: 1-3.
- Bukero, A., Talpur, M.A., Rais, M.N., Lanjar, A.G., Arain, I. and Nahiyoan, S.A. 2015. Activity of thrips and their natural enemies on rose. *Science International* 27(4): 3293-3296.
- Deshmukh, A.P., Kharbade, S.B., Shaikh, A.A. and Kulkarni, K.V. 2017. Incidence of thrips on rose and their correlation with weather parameters under polyhouse condition. *Contemporary Research India* 7(2): 235-237.
- Free, J.B. 1970. Insect pollination of Crops. *Academic Press London*, 544p.
- Gahukar, R.T. 2003. Factors influencing thrips abundance and distribution on rose flowers in central India. *Journal of Entomological Research* 27: 271-279.
- Hegde, J.N., Chakravarthy, A.K., Kumar, N.G., Kumar, C.T., Thyagaraj, N.E., Jayanthi, R. and Surendra, H.S. 2016. Bio-ecology and seasonal incidence of thrips, *Scirtothrips dorsalis* Hood in rose. *Entomon* 41(3): 215-226.
- Hegde, J.N., Ashrith, K.N., Suma, G.S., Chakravarthy, A.K. and Gopalkrishna, H. R. 2020. Insect pests of roses and their management. *Advances in Pest Management in Commercial Flowers* 86-101
- Hole, U.B. and Salunkhe, G.N. 1997. Effect of meteorological parameters on the population dynamics of aphid on rose. *Central for Agriculture and Bioscience International*.
- Kevan, P.G., Eisikowitch, D., Ambrose, J.D., Kemp, J.R. 1990. Cryptic dioecy and insect pollination in *Rosa setigera* Michx. (Rosaceae), a rare plant

- of Carolinian Canada. *Biological Journal of the Linnean Society* 40: 229-243.
- Khokhar, S., Rolania, K., Singh, G. and Kumar, A. 2019. Influence of prevailing weather parameters on population dynamics of fruit borer, *Helicoverpa armigera* (Hübner) on tomato in Haryana. *Journal of Agrometeorology* 21(2): 193-196.
- Miles, P.W. 1985. Dynamic aspects of the chemical relation between the rose aphid and rose buds. *Entomologia Experimentalis et Applicata* 37:129-135.
- Norboo, T., Ahmad, H., Shankar, U., Ganai, S.A., Khaliq, N. and Mondal, A. 2017. Seasonal Incidence and Management of Red Spider Mite, *Tetranychus urticae* Koch. Infesting Rose. *International Journal of Current Microbiology and Applied Sciences* 6(9): 2723-2729.
- Nunez, J.A. 1977. Nectar flow by melliferous flora and gathering flow by *Apis mellifera ligustica*. *Journal of Insect Physiology* 23(2): 265-276.
- Parker, R.L. 1926. The Collection and Utilization of Pollen by the Honeybee. *Cornell University Agriculture Experiment Station, Memoir No. 98*: 55.
- Quratulain, M.A., Muhammad, K.R., Mian, A.A. and Rashid, M. 2015. Population dynamics of rose aphid, *Macrosiphum rosae* L. on different cultivars of *Rosa indica* L. in Pakistan. *Pakistan Journal of Agricultural Research* 28(3): 281-286.
- Rajkumar, M., Reddy, K.L. and Gour, T.B. 2004. Thrips and mites infesting roses. *Insect Environment* 10(1): 27-28.
- Vashisth, S., Chandel, Y.S. and Kumar, S. 2013. Observations on insect pests problems of polyhouse crops in Himachal Pradesh. *Journal of Entomological Research* 37: 253-258.

