The Pharma Innovation Journal 2022; SP-11(3): 612-616

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; SP-11(3): 612-616

www.thepharmajournal.com
Received: 21-01-2022
Accepted: 23-02-2022

O Shaila
Regional Agricultural Research Station (RARS), Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, Telangana, India

S Ramesh
Regional Agricultural Research Station (RARS), Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, Telangana, India

S Srinivas Redd
Regional Agricultural Research Station (RARS), Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, Telangana, India

K Vijaya Laxmi
Regional Agricultural Research Station (RARS), Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, Telangana, India

M Sujatha
Regional Agricultural Research Station (RARS), Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, Telangana, India

Ch. Damodar Raju
Regional Agricultural Research Station (RARS), Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, Telangana, India

Corresponding Author
O Shaila
Regional Agricultural Research Station (RARS), Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad, Telangana, India

Seasonal incidence of various insect pests in mustard crop and their relation with weather factors

O Shaila, S Ramesh, S Srinivas Reddy, K Vijaya Laxmi, M Sujatha and Ch. Damodar Raju

Abstract
Field experiment was conducted to study the seasonal incidence of various insect pests and diseases of mustard crop in variety, NRCHB:101 during rabi 2020-2021 at Regional Agricultural Research Station (RARS), Palem, Nagarkarnool district, Telangana State. Incidence of mustard aphids (*Lipaphis erysimi* Kalt.) started from 50th SMW (2.83 aphids/plt) and attained their peak during 51st (49.27 aphids/plt) to 4th (58.08 aphids/plt) SMW. The aphid appeared at its peak at flowering stage of crop, which was synchronized with the activities of predatory coccinellid beetles, *Coccinella septempunctata*. The first appearance of diamond back moth was during the vegetative stage of the crop and the peak incidence of DBM (12.31 larvae/plt) was observed at 49th SMW. The leaf webber (*Crocidolomia binotalis* Zeller) incidence was noticed during the entire crop stage. While, the incidence reached to its peak (3.76 webs/plt) at 52nd SMW. Among all the insects pests noticed during the crop period mustard saw fly incidence was comparatively less. The correlation studies between different weather parameters (Maximum temperature (T_{max}), Minimum temperature (T_{min}), Morning relative (RH I) and Evening Relative Humidity (RH II) and population of major insect pests revealed that aphids are positively correlated with T_{max} (r=0.460), T_{min} (r=0.147) and negatively correlated with RH I (r=-0.042) and a negative significant association with RH II (r= -0.752) at 0.05 level was noticed and coccinellids & are positively (r=0.364, r=0.193) correlated with temperature and negatively r=-0.221, r=-0.488 correlated with relative humidity. While the leaf webber (r=-0.090, r=-0.397 & r=-0.658, r=-0.282) and saw fly (r=-0.247 & r=-0.013, r=-0.408) incidence was negatively correlated with temperature and RH while, saw fly population had a negative significant (r=-0.707) association was observed with RH II. However, the incidence of diamond back moth negatively correlated with the temperature (r=-0.505, r=-0.090) and morning relative humidity (RH I) (r=-0.014) while, positive significant (r=0.769) association with evening relative humidity (RH II) was observed.

Keywords: Mustard, seasonal incidence, insect pests, diseases and natural enemies, weather parameters

Introduction
Mustard (*Brassica* spp.) is the major rabi oilseed crops, grown over an area of 6.34 million hectare with a production of 7.82 million tones and productivity of 1234 kg/ha in 2012-13 in India and production of edible oils was about 7.05 Mt (Jha, 2017) [6]. Mustard comes under major edible oilseeds in India. It is consumed in India as food oil and the meal cake left after the extraction of oil forms important cattle feed. It can also be used as manure for various grain crops.

In India, although mustard is cultivated in 13 states, production in Rajasthan, Uttar Pradesh, Haryana and West-Bengal with their respective share of 45,13,11 and 8 per cent accounts for 77 per cent of the total production of mustard in the country (Kaur, 2017) [7]. This crop accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop. This group of oilseed crops is gaining wide acceptance among the farmers because of adaptability for both irrigated as well as rain fed areas and suitability for sole as well as mixed cropping. Besides, it offers higher return with low cost of production and low water requirement.

Mustard yields were lower in India compared to other mustard producing countries such as Germany (3811 kg/ha), France (3240 kg/ha), China (1834 kg/ha) and Canada (1769 kg/ha) as well as the world average (1849 kg/ha) (Kaur, 2020) [8]. Mustard yields, which were low (about 647 kg/ha on the average) during the early 1980s, witnessed a steady increase during the last three decades and reached a level of 1121 kg/ha in the recent decade in India. Among the major oilseed producing states, Haryana has the highest yield (1533 kg/ha) followed by Rajasthan (1170 kg/ha) and Uttar Pradesh (1121 kg/ha) while West Bengal (911 kg/ha) has the

lowest yield. It is interesting to note that all states witnessed a positive growth in mustard yield during the last three decades but rate of growth was the highest during the decade of 1980's, which decelerated during 1990's but again picked up during the last decade (Sharma, 2014) [21, 24].

More than 43 species of insect pests have been reported to infest rapeseed-mustard crop in India, of which sawfly (*Athalia lugens proxima*), aphid (*Lipaphis erysimi*), painted bug (*Bagrada hilaris*) and leaf miner (*Phytomyza horticola*) are the important ones (Singh *et al.* 2000) [22]. Among these, mustard aphid, *L. erysimi* (Hemiptera: Aphididae) is the major limiting factor causing up to 96 per cent yield losses and 5-6 per cent reduction in oil content (Shylesha *et al*., 2006) [17]. Both nymph and adult stages of this pest cause economic damage by sucking the cell sap from leaves, petioles, tender, stems, inflorescence and pods. Biological control provides an alternative to pesticide use in pest management. Biological control is not only effective in regulating pest populations, but is also considered as a sustainable, ecofriendly pest management tool which can improve ecological system by minimizing pesticide use. Parasitoids are fascinating insects that by eggs in or on the body of the hosts where parasitic immature grow and develop by exploiting the fixed resources available in a host. The Lady Birds (*Coccinella septempunctata*) is the important entomophagous predators against many species of aphids and observed as an efficient and mightiest predator of *L. erysimi* in field conditions (Singh and Singh, 2013) [23].

Hence, in the present investigation, seasonal incidence of major insect pests and their natural enemies and the effect of different meteorological parameters like maximum and minimum temperature, morning and evening relative humidity on development and survival of the insect pests and natural enemies were studied.

Materials and Methods

Field experiment was conducted during Rabi, 2020-2021 at RARS, Palem to ascertain the insect pests incidence in mustard variety 'NRCHB:101'. The experiment was laid out in a randomized block design. The plot size was 5 x 5 m^2 with row to row and plant to plant distances were 45 and 10 cm, respectively. The crop was sown on 25th October, 2000-2001. The experimental plots were kept free from weeds by weeding and hoeing. All the agronomical practices were followed to raise a crop except the plant protection measures. Application of manure and fertilizer at recommended dose as per package of practices and intercultural operations such as thinning, weeding etc. were done at proper time.

Observations on insect population were recorded soon after the appearance of the insect pests during the crop stage. Initially the population of aphid was recorded on whole plant as a one single unit but later on three leaves, *i.e.* top, middle and bottom per plant. From flowering stage, Observations on incidence of mustard aphid and its natural enemies were recorded on 10 cm apical twig at weekly interval by selecting 10 plants randomly. To assess the population of mustard sawfly, DBM & leaf webber, 10 plants were selected at random and from each plot the population of the insects counted visually in situ at weekly interval. Meteorological factors such as maximum and minimum temperature, morning and evening relative humidity that prevailed during the field experiment were collected from RARS, Palem. To study the influence of meteorological factors on the population build up and correlation studies were carried out with major insect pests and natural enemies of mustard.

Results and Discussion

The insect pest population was found to be fluctuating during the crop period. Population buildup of insect pests and the influence of several weather parameters on their population were presented in the Table 1. Simple correlations of major insect pests and their natural enemies with maximum & minimum temperatures (^{0}C) and morning & evening relative humidity (%) were presented in the Table. 2.

Mustard aphid (*Lipaphis erysimi* Kalt)

The aphid infestation was started during 49th SMW i.e 1st week of December and active until 4th SMW (58.10 & 58.08/10 cm twig) when maximum temperature were 32.46 ^{0}C, 29.9 ^{0}C & 20.34 ^{0}C, 15.36 ^{0}C with 87.2%, 41.14% & 90.57%, 36.71% morning and evening relative humidity, respectively. Malik and Sachan, 2013 reported that the incidence of mustard aphid started during 51st SMW and reached its peak level in 5th SMW & 8th SMW. While, Sahoo, 2012 reported that mustard aphid observed from 52nd SMW, with the peek population on 6th SMW, and Sarkar *et al*., 2008 [16] reported that aphid population was most abundant during 3rd and 4th week of January when the temperature ranged from 7.9 to 25.5 ^{o}C respectively. The findings of Singh and Lal, 2012 [19] were slightly different, which revealed that the appearance of mustard aphid population started from 2nd week of January and reached its peak in 8th standard week.

Correlation studies revealed that the aphids are positively correlated with T_{max} (r=0.460), T_{min} (r=0.147) and negatively correlated with RH I (r=-0.042) and a negative significant association with RH II (r= -0.752) at 0.05 level was noticed (Fig. 1). Gour and Pareek (2003) [3] and Nayak (2010) [13] were also reported that the mustard aphid population was negative correlation with maximum and minimum temperature and positive with morning and evening relative humidity with aphid population infesting mustard. Kashyap *et al*. 2018 [10] revealed that the aphid population exhibited positive but non-significant interaction with maximum temperature (r = 0.146), minimum temperature (r = 0.279). However, Patel *et al.* 2014 reported morning and evening relative humidity exhibited negative influence (r= -0.022, -0.327) on activity of aphid population. In addition to this, Ishwarbhai, 2015 also found positive correlation in between aphid population and maximum and minimum temperature while a negative correlation with morning and evening relative humidity was recorded with aphid population. However, the present findings were in accordance with the results of Kumar *et al*. 2000 [9], Hasan *et al*. 2009 [4], Singh and Lal, 2012 [19] and Abbas *et al*. 2014 also reported that the aphid population was found to be positively governed by temperature whereas, relative humidity had shown negative effect.

Diamond Back Moth (*Plutella xylostella*)

The first appearance of diamond back moth was during the vegetative stage of the crop and the peak incidence of DBM (12.31 larvae/plt) was observed at 49th SMW *i.e* during first week of December, later the population declined gradually. The incidence of diamond back moth negatively correlated with the temperature (r=-0.505, r=-0.090) and morning relative humidity (RH I) (r=-0.014) while, positive significant (r=0.769) association with evening relative humidity (RH II) was observed (Table. 2). The infestation of *Plutella xylostella*,

diamondback moth started from the 5th SMW (0.88 larvae plant) and reached peak (18.68 larvae plant) in 14. The maximum and minimum temperature showed significant positive correlation with larval population of diamondback moth whereas, non-significant correlation with relative humidity (Sharma *et al*., 2017) [18]. Shukla and Kumar, 2004 reported that the diamondback moth appeared in the beginning of September and the population reached its peak by the end of November followed by a declined phase from the last week of December to the last week of January, but this difference may probably be due to the difference in transplanting time and the prevailing climatic conditions of the region.

Mustard saw fly (*A. lugens proxima* Klug)

Among all the insects pests noticed during the crop period mustard saw fly incidence was comparatively less ranged from 0.04 to 0.38 (larvae/plant) and the saw fly (r=-0.247 & r=-0.013, r=-0.408) incidence was negatively correlated with temperature and RH while, a negative significant (r=-0.707) association was observed with RH II (Fig. 1). Bhatt and Bhapodra, 2004 observed that the infestation of mustard sawfly commenced in December and kept fluctuating throughout the crop season. Patel *et al*. 2005 revealed that morning relative humidity and evening relative humidity had negative and non-significant correlation (r= -0.354, -0.327) with sawfly population. However, the temperature had a negative correlation with *A. lugens proxima* as reported by Manzar *et al*. 1999 [12]. Similarly, Bhatt and Bapodra, 2004 also reported that mustard sawfly population had negative correlation with minimum temperature.

Leaf webber (*Crocidolomia binotalis* Zeller)

The leaf webber (*Crocidolomia binotalis* Zeller) incidence was noticed during the most of the crop stage from 48th to 4th SMW. While, the incidence reached to its peak (3.76 webs/plt) at 52nd SMW. While the leaf webber (r=-0.090, r=-0.397 & r=-0.658, r=-0.282) incidence was negatively correlated with temperature and RH (Table. 1). The pest was active from 3rd week of November to 4th week of December. The findings by the Pawar *et al*., 2010 revealed that the pest population ranged between 1.10 to 9.20 larvae per plant throughout the season. A study on correlation of leaf webber with weather parameters indicated that sunshine hours (-0.4360) was negatively non significant. While the other weather parameters showed positive non significant correlation with larval population of the pest.

Coccinellids (*Coccinella septempunctata*)

The aphid appeared at its peak at flowering stage of crop, which was synchronized with the activities of predatory coccinellid beetles. The observation were more or less identical to those of Varmora *et al*., 2010, who reported that the activity of coccinellids initiated from 1st week of January (0.22 beetle/plant) and reached to its peak (1.20 beetle/plant) in 2nd SMW. The correlation studies revealed that the coccinellids are positively correlated with temperature (r=0.364, 0.193) and negatively correlated with relative humidity (r=-0.221, r=-0.488) (Fig. 1).

Table 1: Seasonal incidence of major insect pests of mustard and their natural enemies during 2020-21

Standard Meteorological week (SMW)	Temperature (ºC)		Relative humidity (%)		Mean aphids population (top 10 cm apical shoot)/ 10 plants	Diamond back moth (larvae/plant)	Saw fly (larvae/ plant)	Leaf webber (larvae/ web/ panlt)	Mean Coccinellids populations/ 10 plants
	T_{max}	T_{min}	RH I (Morning)	RH II (Evening)					
48	28.29	17.29	91.57	66.57	0.000	8.367	0.040	0.623	0.000
49	29.93	16.36	88.71	56.29	0.480	12.317	0.123	3.417	0.000
50	30.57	15.21	88.57	46.57	2.830	3.533	0.140	2.350	0.000
51	29.36	14.07	89.57	40.29	49.270	1.850	0.350	1.350	4.600
52	30.21	15.43	89.86	37.14	51.200	0.583	0.383	3.767	5.173
1	29.93	15.36	87.29	41.14	58.180	1.150	0.067	3.317	15.400
2	30.44	17.50	88.71	50.71	57.420	0.017	0.043	2.177	13.027
3	30.54	16.81	91.57	43.14	55.020	0.000	0.133	1.733	11.383
4	32.46	20.34	90.57	36.71	58.080	0.000	0.000	1.250	8.750
Fp					<0.001	<0.001	0.198	<0.001	<0.001
Mean					36.94	3.09	0.14	2.22	6.48
SE±					0.27	0.10	0.11	0.13	0.10
LSD (P 0.05)					0.80	0.30	0.32	0.38	0.31

Table 2: Correlation co-efficient (r) of mustard aphid with different weather factors during 2020- 21

	Diamond back moth	Leaf webber	Saw fly	Aphids	Coccinellds
T_{max} (ºC)	-0.505	-0.090	-0.247	0.460	0.364
T_{min} (ºC)	-0.090	-0.397	-0.707*	0.147	0.193
RH I (%)	-0.014	-0.658	-0.013	-0.042	-0.221
RH II (%)	0.769*	-0.282	-0.408	-0.752*	-0.488

*. Correlation is significant at the 0.05 level

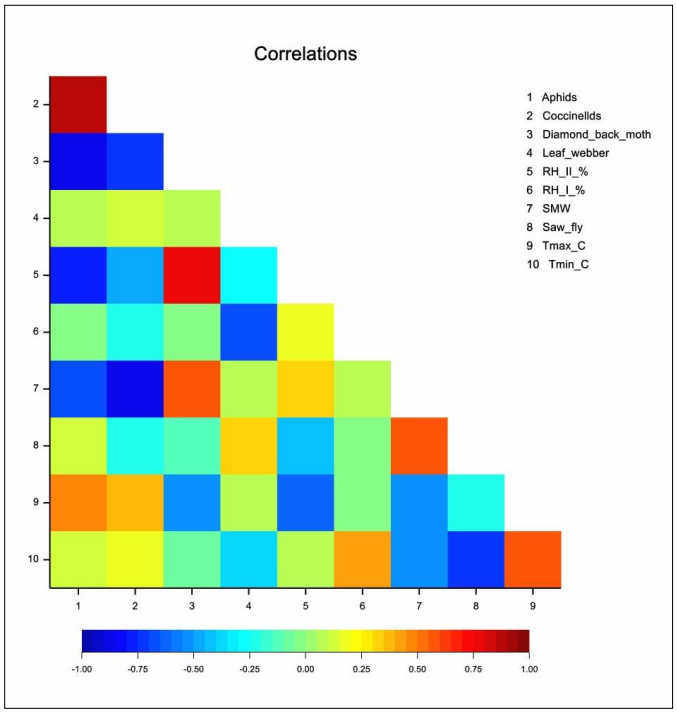

Fig 1: Correlation co-efficient (r) of mustard aphid with different weather factors

Conclusion

The present investigations revealed that the activity of mustard aphids observed from 50th SMW and attained their peak during 51st to 4th SMW. The aphid appeared at its peak at flowering stage of crop, which was synchronized with the activities of predatory coccinellid beetles, *Coccinella septempunctata*. The diamond back moth was observed during the vegetative stage of the crop and the peak incidence was at 49th SMW. The leaf webber incidence was noticed during the entire crop stage from 48th to 4th SMW. While, the incidence reached to its peak at 52nd SMW. Among all the insects pests noticed during the crop period mustard saw fly incidence was comparatively less. The correlation studies between different weather parameters (and population of major insect pests revealed that aphids are positively correlated with $T_{max,}$ T_{min} and negatively correlated with RH I and a negative significant association with RH II at 0.05 level was noticed and coccinellids are positively correlated with temperature and negatively the with relative humidity. While the leaf webber and saw fly incidence was negatively correlated with temperature and RH while, saw fly population had a negative significant association with RH II was noticed. However, the incidence of diamond back moth negatively correlated with the temperature and morning relative humidity (RH I) while, positive significant association with evening relative humidity (RH II) was observed.

Acknowledgements

Authors are greatly thankful to the University, Professor Jayashankar Telangana State University (PJTSAU) for their support, which helped to complete the research work smoothly

References

1. Abbas Q, Ahmad I, Shahid MA, Akhtar MF, Hussain M, Akram M *et al*. Role of Climatic Factors on Population Fluctuation of Aphids (*Brevicoryne brassicae*, *Myzus persicae* and *Lipaphis erysimi*) on Canola (*Brassica napus*) in Punjab, Pakistan. Pakistan Journal of Nutrition. 2014;13:705.
2. Bhatt PD, Bhapodra JG. Population dynamics of mustard sawfly, *Athalia lugens proxima* (Klug) on mustard in relation to weather parameters. Indian Journal of Entomology. 2004;66:284-285.
3. Gour IS, Pareek, BL. Seasonal incidence of major insect-pests of mustard crop and their correlation with abiotic factors under semiarid region of Rajasthan. Journal of insect science. 2003;16:37-40.
4. Hasan MR, Ahmad M, Rahman MH, Haque MA. Aphid incidence and its correlation with different environmental factors. Journal of the Bangladesh Agricultural University. 2009;7:15-18.
5. Ishwarbhai CR. Insect pest succession and management of aphid, *L. erysimi* (kalt.) infesting mustard, *Brassica juncea*) Czerm and Coss. M.Sc. (Agri.) thesis submitted to Anand Agricultural University, Anand, Gujarat, 2015.
6. Jha DK. India's edible oil output to hit all-time high of 7.7 mn tonnes in, 2017-18. Business standard, Mumbai. Retrieved from https://www.business-standard.com/article/markets/india-s-edible-oil-output-to-hit-all-time-high- of-7-7-mn-tonnes-in-2017-18-117092001074_1. Html. 2017.
7. Kaur K. An analytical study of production and marketing of rapeseed and mustard in Bathinda district (Punjab). MS.c thesis, Punjab Agricultural University, Ludhiana), 2017.
8. Kaur A, Grover DK. Trends in area, yield and production of major oilseeds in Punjab: District wise analysis. Agricultural Situation in India. LXXVI. 2020;(10):26-36
9. Kumar J, Singh SV, Malik YP. Population dynamics and economic status of *Lipaphis erysimi* on mustard, *Brassica juncea*. Indian Journal of Entomology. 2000;62:253-259.
10. Kashyap N, Painkra GP, Painkra KL, Bhagat PK. Insect-pests succession, natural enemies and their correlation with weather parameters in mustard crop. Journal of Plant Development Sciences. 2018;10(10):563-568.
11. Malik R, Sachan SK. Population buildup of mustard, *Lipaphis erysimi* (Kalt.), on Indian mustard in relation to some abiotic factors. Progressive Agriculture. 2013;13(1):153-157.
12. Manzar A, Lal MN, Singh SS. Population dynamics of mustard sawfly, *Athalia proxima* Klug; leaf miner, *Chromatyia horticola* and painted bug, *Bagrada cruciferarum* on different varieties of Brassica oilseed crop. Journal of Entomological Research. 1999;29(4):354-364.
13. Nayak MK. Population dynamics of major insect species of mustard (*Brassica compstris* Sariah) towards weather parameters. Journal of Rural and Agricultural Research. 2010;10(1):19-21.
14. Pawar VR, Bapodra JG, Joshi MD, Ghadge SM, Dalve SK. Incidence of leaf webber, *Crocidolomia binotalis* (zeller) on mustard. International Journal of Plant Protection. 2010;3(1):130-131.
15. Sahoo SK. Incidence and management of mustard aphid (*Lipaphis erysimi* Kaltenbach) in West Bengal. The Journal of Plant Protection Sciences. 2012;4(1):20-26.
16. Sarkar A, Konar A, Hazra S, Choudhuri S. Incidence and chemical control of mustard aphid, *Lipaphis erysimi* (Kalt.) on mustard in new alluvial zone of West Bengal. Journal of Entomological Research. 2008;32(1):41-43

17. Shylesha AN, Thakur Azad NS, Pathak KA, Rao KR, Saikia K, Surose S *et al*. Integrated management of insect pest of crops in north eastern hill region. Technical Bulletin No. 19. ICAR for NEH Region, Umiam, 2006, 50.
18. Sharma S, Ahmad H, Norboo T. Studies on seasonal incidence and field efficacy of insect growth regulators against diamondback moth, *Plutella xylostella* (L.) infesting cabbage, *Brassica oleracea var. capitata* (L.). Journal of entomology and zoology studies, 2017, 5(5).
19. Singh AK, Lal MN. Population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt.) on mustard in relation to weather parameters. Asian Journal of Bio Science. 2012;7(2): 216-218.
20. Shukla A, Kumar A. Seasonal incidence of diamondback moth *Plutella xylostella* (Linn.) In relation to abiotic factors in cabbage. Plant Protection Bulletin. 2004;56(3/4):37-38.
21. Sharma VP. Problems and prospects of oilseeds production in India. Centre for Management in Agriculture (CMA), Indian Institute of Management (IIM), Ahmedabad, 2014, 236.
22. Singh NN, Rai S, Rai S. Relative abundance of different coccinellids in mustard ecosystems. Indian Journal of Entomology. 2000;62:422-426.
23. Singh K, Singh NN. Preying capacity of different Established Predators of the aphid *L. erysimi* (Kalt.) infesting Rapeseed-mustard crop in laboratory condition. Plant Protection Science. 2013;49(2):84-88.
24. Thomas L, Sharma AK, Singh D. Strategies for enhancing rapeseed mustard production in Rajasthan. Directorate of rapeseed-mustard research, Sewar, Bharatpur 3213003, Rajasthan, India, 2014, 44.
25. Varmora JM, Raghvani KL, Joshi MD, Makadia RR, Dalwadi NG, Boricha HV. Population dynamics of aphid, *Lipaphis erysimi* (Kalt.) and predators on cabbage. Asian Sciences. 2009;4:56-58.