Population Dynamics of *Lipaphis erysini* (Kalt.) : arrival and migration pattern in Tarai, Pantnagar, India.

C.P.Singh [(1)] , R.P.Singh ([2)] and G.C.Sachan ([1)]

[1]Department of Entomology, College of Agriculture, G.B.P.U.A & T., Pantnagar, PIN-263145, U.S. Nagar (Uttaranchal) India

[2]Department of Agronomy, College of Agriculture, G.B.P.U.A & T., Pantnagar, PIN-263145, U.S. Nagar (Uttaranchal) India

Tele: 91-5944-233415, Fax: 91-5944-233473, Email: cp_singh523@yahoo.com

ABSTRACT

During the period of five consecutive years of investigation on population dynamics of Mustard aphid, *Lipaphis erysimi* (Kalt.), a very irregular pattern of occurrence and migration in/from experimental plots have been observed in different standard weeks at Crop Research Centre, Pantnagar which falls in the tarai region of Uttarahcal. During 1998-99 mustard aphid appeared on 2nd standard week on *B. campestris* cv. YST-151 remained on it till 11th standard week. Similarly during 1999-2000, 2000-01, 2001-02 and 2002-03 *Lipaphis erysimi* population's first incidence was observed in 3rd, 51st, 50th and 4th standard week on *B. campestris* cv. YST-151 and BSH-1; *B. campestris* cv. BSH-1 and YST-151; B. *campestris* cv. YST-151; B. *juncea,, B. campestris* cv YST-151and BSH-1, respectively. Where as it migrated from the field in 10th, 10th, 7th and 11th standard week from *B. napus;* and *B.carinata; B. nigra, B. napus, B. carinata*and *B. alba; B. carinata, B. napus* and *B. alba; B. alba and B. napus*, respectively. It was concluded that the aphid arrival and migration trend was not in a definite pattern because of variation in the environment.

Key words: *Lipaphis erysimi*, Mustard, population dynamics.

INTRODUCTION

Oilseed constitutes an important group of crops next only to cereals. Besides being a rich source of edible oils and cooking media, these serve as an important raw material for various industrial products. Oilseeds are sources of energy, essential fatty acids and fat-soluble vitamins. India is the third largest producer of oilseeds in the world.

Nearly 90 per cent of the total vegetable oil produced in India is derived from groundnut and rapeseed mustard. Rapeseed mustard alone occupies one fourth of the total area and account for an equivalent amount of total oilseeds. At the global level, this country producing one fifth of the world's rapeseed-mustard ranks second, next only to Canada (Deoghare and Agrawal, 1994).

Among these oilseeds, the cruciferous ones cultivated in India are *Brassica campestris* (L.) var. yellow sarson, *Brassica campestris* (L.) var. toria (lahi), *Brassica campestris* (L) var. brown sarson, *Brassica napus* (Gobhi sarson), *Brassica juncea* (L) (Rai/laha/bahta), *Brassica nigra* (koch) (Banarasi rai), *Brassica alba* (L.) (white mustard), *Brassica carinata* (L.) (Karan rai) and *Eruca sativa* (Mill) (Taramira). Out of these *Brassica* spp. *Brassica campestris* and *Brassica juncea* are the major ones and grown in large scale in the

country. *Brassica carinata* and *Brassica napus* are recently introduced and slowly being adopted by the farmers in part of the country.

A number of limiting factors are responsible for the low yield of rapeseed mustard and the insect pests are one of the major constraints for the poor yield followed by diseases. Forty two insect pests have been identified so far infesting rapeseed and mustard in the country. Out of these *Lipaphis erysimi* (Kaltanbach) is the key pest. Other insect pests such as *Athalia proxima* (Klug.), *Bagrada cruciferarum* (Kirkpatrik), *Spilosoma oblique* (Walker) are the major pests while*Plutella xylostella* (Linn.) *Pieris B.brassicae* (Linn.) *Phyllotreta cruciferae* (Goeze) are of minor importance.

Mustard aphid, *L. erysimi* is the most serious pest and is found to damage the crop most at flowering and pod initiation stages and is alone responsible for yield losses under different agro climatic conditions (Bakhetia, 1986). Singh, (2000) reported from 91.3 to 100% loss due to the aphid.

To formulate a sustainable Integrated Crop Management (ICM) programme on rapeseed-mustard other than cultural practices, the Insect-Pests Management (IPM) criteria is equally important.

The knowledge of biology and bionomics of the pest plays a key role in formulating an eco-friendly and sustainable IPM and thereby ICM programme. With this view, an investigation was carried out on arrival and migration pattern of mustard aphid for five consecutive years, from 1998-99 to 2002-03.

MATERIALS AND METHODS

Experimental site and climate:

The experiment was conducted during rabi seasons of at the Crop Research Center, G.B.Pant University of Agriculture and Technology, Pantnagar. It is situated in the Tarai region of Uttaranchal, south of foothills of Himalayas (Shivalik range). Geographically, it is located at 29° N latitude and 79.3° E longitude and at an altitude of 243.84 meters above the mean sea level. The soil type of the experimental plot was sandy loam.

This region falls under subhumid and subtropical climatic zone, which is characterized by hot dry summer and cold winter. The summer temperature rises upto 43 °C, while it falls to 1.0 °C in winter. Variably monsoon occurs form the third week of June to the middle of September with average annual rainfall measuring 1400 mm. The relative humidity fluctuates around 90±5 percent (7.00am) during rainy season and remains high at above 90 percent to February after which it decreases up to 55 percent in April.

Experimental Detail :

The experiment was conducted during 1998-99 to 2002-03 and sowing was done on 26 October in every yearin rabi season, All the experimental details and site were same for all five years.

These experiments was sown in Randomized Block Design with three replications. Each plot measured 4m x 3 m with row-to-row and plant-to-plant distance of 30 cm and 10 cm,

respectively. There were eight *B. brassica* species, which comprise the treatments. The species included as *Brassica campestris*,cv. YST-151 and BSH-1, *B. juncea* cv. Varuna, *B. napus* (Gobhi sarsan) *B. carinata* (Karan Rai), *B.nigra, B. alba* (white mustard) and *E. sativa* (Taramira). All the recommended practices for raising healthy crop were adopted except pesticidal spray.

Observations were recorded on the population of the aphid at an interval of one week starting from the date of incidence till the migration of the aphid from the crops.

Aphids were counted visually from 10 cm TSL (Terminal shoot length) of 10 randomly selected plants in each plot. Meteorological data during the crop season were also recorded.

RESULTS AND DISCUSSION

The first appearance of mustard aphid was observed in the 2nd Standard week on *B.campestris*.cv. YST-151 whereas on *B.campestris* cv.BSH-1 *B. nigra* and *B.juncea*; *B. napus* and *B. alba; B. carinata* and *E. sativa*, the aphid was first appeared in 3rd,4th ,5th, and 7th , standard week , respectively during 1998-99 Later on the populations of the aphid increased slowly. The maximum population was recorded *B.campestris* cv. BSH-1 on and the least on *E. sativa*. (Table- 1).

Perusal of Table 2 revealed that aphid incidence was first observed in 3rd standard week on *B. campestris* c.v. YST-151and BSH-1 in 1999-2000. Subsequently it appeared on *B. juncea* (Rai) in 4th standard week on *E. sativa, B. nigra*and *B. alba* in 5th standard week and then it was observed on *B. napus* in 6th standard week during the current year.

After the arrival of the aphid there was an increasing trend in the population at slow rate on these species. The peak population of the aphid was observed in 5th, 7th, 8th and 9th standard week at YST-151 and BSH-1, *B. nigra, B. carinata,B. alba* and *B. napus*, respectively. There was good enough rain (95.2 mm) in 6th standard week, which became helpful in removing the aphid from *B. juncea*, *E. sativa* and *B. campestris*. However, the rain could not affect the aphid population on *B. carinata and B. nigra*. Contrary to this, the rain proved helpful in increasing the aphid population on *B. napus and B. alba.* The highest aphid population was recorded on *B. alba* followed by *B. napus*. (Table 2).

The aphid incidence was first observed in 51st standard week on *B.campestris* cv.BSH-1 and YST-151, and *B.juncea* during 2000-2001. Subsequently it appeared on *B. alba and B. juncea* var. Varuna, *Eruca sativa.* and *B. nigra, B. napus and, B. carinata* in 2nd ,4th ,5th and 7th standard week, respectively. The population of the aphid slowly increased and reached at its peak on 2nd, 4th, 5th, 6th, 8th and 9th standard week in *B. campestris* cv. YST-151, *B. juncea*var.Varuna; BSH-1,and *Eruca sativa; B. napus* and *B. alba; B. nigra* as well as *B. carinata*, respectively. The highest population was recorded on *B. alba* followed by *B. napus.*. Depending upon the experimental conditions, the migration of the aphid started after getting its peak and the aphid population recorded 0 during observations in 8th, 9th and 11th standard week on *B. campestris* and *E. sativa; B. juncea* and *B. campestris* (BHS-1); *B. napus, B. nigra, B. carinata* and*B. alba*. (Table 3)

Perusal of table 4 revealed that aphid incidence was first observed in 50th standard week on *B.campestris* cv. YST-151 during 2001-02. Subsequently it appeared on BSH-1, and *Eruca* sativa, *B.alba, B. nigra,* and *B. juncea, B. napus,* and in 51st, 1st, 2nd, 5th , and 6th standard week, respectively.

The population of mustard aphid increased slowly and reached at its peak on 2nd standard week in *B. campestris cv.*BSH-1 and *E .sativa* and because of rain fall (058.00mm) the aphid washed out or killed and could not develop further in these species. Similar pattern of development and multiplication of the aphid after the rain was observed in *B.nigra* and *B.juncea cv.*Varuna while the aphid, after the rain, multiplied at a little bit faster rate on *B.carinata, B.napus* and *B.alba*and reached to its peak on 7th standard week whereas, this peak infestation on *B. campestris* cv.(YST-151) was observed on 5th standard week. During the observation on 8th standard week, in all the species aphid was killed or migrated or disappeared from the field.

Perusal of table 5 indicated that aphid incidence was observed first in 4th standard week on *B.juncea cv* Varuna and *B. campestris cv* BSH-1 and YST-151. Later on it spread over on *E.sativa,B.alba* and *B.napus.* But during the whole season, *B.nigra,* remained free from the aphid incidence.

During the crop season especially at flowering stage, the Meteorological parameters Temperature (minimum and maximum) was very abnormal with regards to the pests multiplication. Therefore the multiplication of mustard aphid could not occured to the level of economic loss. (Table 5).

Such studies were also conducted in various parts of the country by the scientists and they reported an unstable pattern of incidence, multiplication, dispersal and migration of the mustard aphid in their respective agro-ecological zones (Devi 1995, Rohilla 1996, Manzar 1998, Biswas 2000 and Anonymous 2001). This variable pattern may be due to fluctuation in environmental parameters, which regulate the fecundity, multiplication and survival of the pest, mustard aphid.

CONCLUSION :

It was concluded that during all the years there was no common definite pattern of arrival and migration of mustard aphid in the experimental plot as well as nearby area based on regular periodic survey on the population dynamics. The lowest population was observed on *B. carinata* as compare to other species in all the years.

ACKNOWLEGEMENT :

The authors are grateful to the Director Experiment Station, Programme Coordinator and Head, Department of Entomology for providing research facilities.

REFERENCES :

Singh C.P. and Sachan GC. 2000. Annual Progress Report. All India coordinated Research Project on Rapeseed-Mustard. Sewar, Bharatpur. Pp. E1 – E58.

Anonymous, 2001. Annual Progress Report. All India coordinated Research Project on Rapeseed-Mustard. Sewar, Bharatpur. Pp. E1 – E55.

Bakhetia, D.R.C. 1986 . Control of insect pest of toria, sarson and rai. Indian Farming. 36: 43-44.

Biswas, G.C. and Das, C.P. 2000. population dynamics of the mustard aphid, *Lipaphis erysimi* (Kalt.) . (Homoptera: Aphididae) in relation to weather parameters. Bangladesh J. Ent. 10:15-22.

Deoghare, P.R. and Agrawal, M.P. 1994. An analysis of production, demand and constraint to growth of edible oils in India, Agric. Situation in India XLIX (1) : 25-28.

Devi, N.; Raj , D. and Chandel, Y.P. 1995. Population dynamics of *Lipaphis erysimi* (Kalt.) on rapeseed in mid hill zone of Himachal Pradesh (India). J. Ent. Res. 19:367-371.

Manzar, A.; Lal, M.N. and Singh, S.S. 1998. Population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt.) on Brassica crop in relation to abiotic and biotic factors. 5:21-24.

Rohilla, H.R.; Harvir Singh; Yadava, T.P. and Singh, H. 1996. Seasonal abundance of aphid pests on rapeseed mustard crops in Haryana . Ann. Agric. Biol. Res.1:75-78.

Table No.1. Population dynamics of mustard aphid on *Brassica species* during 1998-1999

Rain–Fall (mm)	R. H. %		Sun – Shine (Hrs)	*B .jumcea*	*B. campestris* YST-151	*B. campestris* BSH - 1	*E. sativa.*	*B. napus*	*B carinata*	*B. nigra*	*B. alba*
	Max.	Min.									
13.6	96	73	2.8	0	1	0	0	0	0	0	0
0.0	97	84	0.3	0	2	2	0	0	0	0	0
0.0	93	58	6.8	1	13	9	0	0	0	4	0
36.4	95	57	5.9	6	27	15	0	4	0	7	3
0.0	93	55	6.0	10	45	25	0	13	0	14	13

1	0.0	95	53	6.2	13	54	36	2	33	2	18	25
	0.0	92	60	5.9	3	29	52	2	42	5	7	48
	0.0	94	50	7.7	1	13	73	1	16	4	2	24
1	0.0	89	36	9.2	0	4	37	0	3	1	0	7
	0.0	88	37	10.3	0	9	0	0	0	0	0	0

Table No.2. Population dynamics of mustard aphid on *Brassica species* during 1999-2000

Standred Week no.	Temperature Max.	Min.	Rain–Fall (mm)	R. H. % Max.	Min.	Sun – Shine (Hrs)	*B .jumcea*	*B. campestris* (YST-151)	*B. campestris* (BSH - 1)	*E. sativa*	*B. napus*
3	19.5	4.5	0.0	96	54	6.9	0	2	1	0	0
4	22.0	7.7	4.6	90	52	7.1	2	4	2	0	0
5	20.9	9.0	0.0	89	53	6.3	7	15	17	1	0
6	19.3	9.9	95.2	95	67	5.7	2	4	4	1	13
7	20.4	6.6	0.0	93	49	7.6	0	0	0	0	14
8	22.5	4.5	0.0	82	38	10.2	0	0	0	0	32
9	23.8	7.9	0.0	86	42	9.5	0	0	0	0	45
10	26.4	9.3	9.6	89	38	9.2	0	0	0	0	2

Table No.3: Population dynamics of mustards aphid on Brassica species (2000-01)

Standard Week no.	Temperature Max.	Min.	Rain–Fall (mm)	R. H. % Max.	Mini	Sun – Shine (Hrs)	B.*jumcea*	*B.* Campestris (YST-151)	*B. napus*	*B. nigra*	*B. carinata*
51	23.0	7.5	0.0	93	43	6.4	0.0	2.8	0.0	0.0	0.0

52	23.2	7.5	0.0	93	46	7.5	0.0	8.0	0.0	0.0	0.0
1	16.5	8.5	23.0	94	68	2.3	0.0	11.0	0.0	0.0	0.0
2	14.4	4.0	0.0	96	79	3.7	3.8	18.4	0.0	0.0	0.0
3	19.5	2.8	0.0	95	42	7.2	4.2	14.0	0.0	0.0	0.0
4	20.6	5.0	0.0	94	47	8.5	11.6	15.8	0.0	0.8	0.0
5	22.5	6.7	0.0	95	46	8.1	15.2	15.2	10.4	2.8	0.0
6	22.7	4.5	0.0	93	41	9.3	13.0	14.0	20.8	6.8	0.0
7	24.2	8.9	16.2	90	47	7.4	3.8	1.2	32.4	8.8	10.0
8	25.3	10.0	4.4	94	50	8.3	0.6	0.0	55.8	17.2	25.2
9	25.2	7.0	0.0	94	43	8.7	0.0	0.0	28.0	32.6	35.4
10	26.1	9.4	0.0	88	36	8.8	0.0	0.0	22.7	9.2	16.2

Table No.4. Population dynamics of mustard aphid on *Brassica species* during (2001-2002)

Rain–Fall (mm)	R. H. % Max.	Min.	Sun – Shine (Hrs)	B. ***jumcea***	*B. carinata*	*B. napus*	*B. alba*	*B. nigra*	*B. Campestris* (YST-151)	*B. campestris* (BSH-1)	*E. sativa*
0.0	95	65	6.1	0	0	0	0	0	0.4	0.0	0.0
0.4	96	63	4.6	0	0	0	0	0	1.2	2.4	0.4
0.0	94	53	7.0	0	0	0	0	0	3.0	7.0	0.0
0.0	96	46	7.8	0	0	0	3.4	0	3.0	18.0	0.0
0.0	92	47	6.7	21.0	0	0	3.6	19	0.0	18.8	7.0
58.0	91	71	4.2	*	*	*	*	*	*	*	*
2.6	90	48	6.7	0	0	0	10.8	0	0.0	0.0	0.0
0.0	93	45	9.4	0	0	8.2	153.8	0	12.0	0.0	0.0

17.6	87	61	6.0	0	12.0	41.2	329.0	0	3.8	0.0	0.0
42.0	92	57	5.9	0	56.4	89.8	644.0	0	0.0	0.0	0.0

- Rain fall: Because of rain observation could not be taken**.**

Table No.5. Population dynamics of mustard aphid on *Brassica species* during (2002 – 03)

	Rain–Fall (mm)	R. H. % Max.	Min.	Sun – Shine (Hrs)	B**.** ***jumcea***	*B. campestris* (BSH-1)	*B. Campestris* (YST-151)	*B. carinata*	*B. nigra*	*E. sativa*	*B. alba*	*B. napus*
5	000.2	96	74	03.3	1.6	7.0	1.7	0.0	0.0	0.0	0.0	
0	032.2	95	69	04.3	1.8	12.0	2.0	0.0	0.0	0.0	0.0	
4	000.0	91	46	07.7	6.9	15.3	3.7	0.0	0.0	0.0	0.0	0.0
3	001.0	90	56	06.9	18.4	17.2	4.6	1.2	0.0	0.4	3.1	4.3
9	057.4	94	61	07.0	*	_*	*	*	*	*	*	*
4	009.8	91	58	07.0	4.2	0.0	0.0	1.1	0.0	0.1	6.6	15.4
7	000.0	92	49	09.5	1.2	0.0	0.0	0.2	0.0	0.0	10.4	8.2
5	000.0	87	48	07.2	0.3	0.0	0.0	0.0	0.0	0.0	4.9	3.4

*Rain fall: Because of rain observation could not be taken**.**