Chapter - III

COMPARATIVE STUDY ON APHID (*Lipaphis erysimis* Kalt) INCIDENCE ON THE SAME CULTIVARS OF *Brassica campestris* AND *B. juncea* GROWN IN DIFFERENT ECOLOGICAL CONDITION OF NORTHERN PART AND SOUTHERN OF WEST BENGAL TO SELECT SUITABLE STRAIN OF *Brassica* FOR DARJEELING CONDITION.

INTRODUCTION

Aphid *Lipaphis erysimi* Kalt is the most destructive pest of Brassica crops In India. According to Bakhetia (1983) the major reason for realising low yield in India vis a vis West Bengal is due to attack of the key pest *L. erysimi* Kalt.

Some reports are available on the effect of different cultural practices such as fertilizer trial in connection with the cultural practices such as fertilizer trial in connection with the control of mustard aphids (Bhattacharjee 1961), Sidhu and Kaur 1977, Kalra et al 1983; Bhaketia and Sharma 1977; Kalra et al 1983; Bhakeia and Sharma 1978; Sachan et al 1983).

The chemical control measures recommended so far have not been sucessful in as much as besides killing the pest. These highly toxic insecticides also kill all the parasites and predators thereby upsetting the balance of ecosystem in nature. This has in recent years led to a greater emphasis on the evaluation of aphid resistant varieties. During the last few decades increasing importance has consequently been felt towards closer analysis of the plant aphid relationship concerning various factors in the plant itself which may govern susceptibility or resistance to aphid attack.

Now it is realised that the use of resistant varieties of Brassica serves as an effective, safe economical method to save crop from such type of pests.

From survey and priliminary experiment it appears that some of the cultivars of *Brassica campestris* and *B. juneca* which are declared resistant in southern part of West Bengal are very much affected in North Bengal. On the other hand, some of the cultivars which are very much infested by the aphid in southern part of West Bengal have the capacity to thrive well against the aphid in the ecological condition of Northern region of West Bengal.

This part of work deals with an investigation in collaboration with Pulses and Oil Seed Research Station, Berhampore in southern part of West Begnal to study fluctuations in population density of *Lypaphis erisim* Kalt. On the same type of cultivars of *B. campestris* and *B. juneca* grown in the ecological condition of Northern and Sourthern part of West Bengal with a view to selecting resistant cultivar suitable for commercial utilisation in Darjeeling District, West Bengal.

MATERIALS AND METHODS

MATERIALS

1. Plants : The following cultivars of Brassica are during investigation.

Species	Cultivars
Brassica campestris	YSB-9
	NC-1
	B-54
	C-3
Brassica juncea	B-85
	with glossy
	T-6342
	RW-85-89
	RW-85
	B-85 glossy
	RC-781
	Sharma 85-89

II. Animals : Mustard aphid, *Lipaphis erysimi* Kalt (Order-Hemeptera, suborder-Aphidae) is a tiny, soft bodied insect about 2mm long and whitish green in colour. The species collected from Darjeeling and Murshidabad district was compared and observed to be similar in all chacteristic.

METHODS

Raising of different cultivars

Four cultivars of *Brassica campestris* (YSB-9, NC-1, B-54 and C-3) and eight cultivars of *Brassica juneca* (B-85 white glossy, T-6342, RW-85-89, RW-85,-B-85 glossy, RC-781, and Sharma 85-89) were sown in a randomised block design with three replications in the experimental plot for research in North Bengal University, Darjeeling, District West Begnal, as well as in Pulses and Oils Seed Research Station, Berhampore, West Bengal. Each strain was sown in 30cm. row to row and 15cm. plant to plant distance in 5mx4m plot sowing was done on 10th, October in each year during the period 1994-1996.

Aphid population counts per plant

Aphid population counts were made following the procedure adopted by Singh et al (1984). Aphid population counts were made on the basis of whole plant at the flowering stage. Population was recorded on 10 cm long central twigs of 10 randomly selected plants per plot. The aphids were removed with the help of hair brush and counted directly.

Percentage of plant affected with aphid

Total number of plants per plot showing aphid infestation were counted and percentage of plant affected with the aphid was calculated.

Meteriological data

Meteriological data was collected from meteriological section, Alipore, Calcutta for both the regions of Northern and Southern part of West Bengal.

RESULT AND DISCUSSION

Table -11 shows that infestation of Aphid (*L.erysimi* Kalt) on *B.campestris* YSB-9 *B.juneca* B-85 and RC-781 is observed to become high in Darjeeling District when average number of aphid per twig of a single plant has been taken into consideration. The high infestation of aphid on all the three cultivars mentioned, grown in Musshidabad District has also been observed (Table-14). It is very interesting to note that the highest number (190) as observed in *B. juncea* Sharma-85-89 grown in South Bengal (Table-12) is remarkably lowered to 60 (Table-11). In Darjeeling condition similar observation has also been recorded in *B.campestris* B-54 which shows the average number of 55 in North Bengal as compared to 184 observed in South Bengal. Though lower values have also been observed in *B.campestris* C-3 and cultivars of White glossy, T-6342, B-85 glossy of *B.juncea* grown in Darjeeling condition (Table-11) but their growth performances in Darjeeling condition (Table-7,8) is not good enough to be utilised commercially in the region as worked out in Chapter-II. Rest of the cultivars such as *B.campestris.*NC-1, *B. juncea* RW-85 are more or less having the same trend of infestation at both the situation of Northern and Southern part of West Bengal (Table-11,12) but their growth performances in Darjeeling

are not good enough to be considered as commercially viable cultivars suitable for the region.

When infestation of aphid (*L. erysimi* Kalt) on *Brassica* cultivars grown in both the regions of West Bengal taking the consideration of different plots, much lowered percentage of affected plants has been observed in *B.juncea,* White glossy, T-6342 and B-85 glossy in Darjeeling condition (Table-13) though their growth performances are not well enough in the same ecological condition as revealed in Tables 7 and 8. In this respect. *B. campestris* B-54 may be considered resistant cultivars to show 46.43 percent of plants affected in Darjeeling District (Table-13) as compared to the value of 86.26 percent in Southern part of West Bengal (Table-14). This cultivar has also shown the best result of growth performance out of all the cultivars so far considered in the ecological condition of Darjeeling District (Tables-7,8).

In this connection *B. juncea* Sharma 85-89 may be placed in the category next to *B.campestris* B-54 when both the criteria of growth performance and infestation rate of aphid in Darjeeling condition are taken into consideration (Tables, 7,8,11,13).

The fluctuation of aphid manifestation to different cultivars may involve due to different environmental condition at two places of Northern and Southern part of West Bengal, the meteriological data of which has been repesented in the tables-15 and 16.

Table -11

Infestation of aphid (*L.erysimi* Kalt) on single plant of different *Brassica* cultivars grown in Darjeeling District in Northern part of West Bengal.

Serial No.	Brassica sps.	Cultivars	Average number of aphid per twig of a single plant
1.	*Brassica Campestris*	YSB-9	107.00
2.		NC-1	92.00
3.		B-54	55.00
4.		C-3	61.00
5.	*Brassica juncea*	B-85	112.10
6.		White glossy	41.23
7.		T-6342	41.58
8.		RW-85-89	67.66
9.		RW-85	60.43
10.		B-85 glossy	55.66
11.		RC-781	102.10
12.		Sharma 85-89	60.68
		Mean :	71.38
		S.E. :	7.26
		C.D at 57% level :	15.98
		C.D. at 1% level :	22.54

Table -12

Infestation of aphid (*L.erysimi* Kalt) on single plant of different *Brassica* cultivars grown in Murshidabad District in Southern part of West Bengal.

Serial No.	Brassica sps.	Cultivars	Average number of aphid per twig of a single plant
1.	*Brassica Campestris*	YSB-9	176.33
2.		NC-1	107.00
3.		B-54	184.00
4.		C-3	86.30
5.	*Brassica juncea*	B-85	176.36
6.		White glossy	50.61
7.		T-6342	79.55
8.		RW-85-89	111.33
9.		RW-85	90.66
10.		B-85 glossy	67.22
11.		RC-781	154.10
12.		Sharma 85-89	190.60
		Mean :	122.83
		S.E. :	14.56
		C.D at 5% level :	32.07
		C.D. at 1% level :	45.25

Table -13

Infestation of aphid (*L.erysimi* Kalt) on population of different *Brassica* cultivars grown in Darjeeling District in Northern part of West Bengal.

Serial No.	Brassica sps.	Cultivars	Percentage of plant affected
1.	*Brassica Campestris*	YSB-9	68.10
2.		NC-1	42.20
3.		B-54	46.43
4.		C-3	55.38
5.	*Brassica juncea*	B-85	62.00
6.		White glossy	18.20
7.		T-6342	28.46
8.		RW-85-89	60.61
9.		RW-85	50.50
10.		B-85 glossy	20.15
11.		RC-781	89.30
12.		Sharma 85-89	54.66
		Mean :	49.66
		S.E. :	5.92
		C.D at 5% level :	13.04
		C.D. at 1% level :	18.40

Table -14

Infestation of aphid (*L.erysimi* Kalt) on population of different *Brassica* cultivars grown in Murshidabad District in Southern part of West Bengal.

Serial No.	Brassica sps.	Cultivars	Percentage of plant affected
1.	*Brassica Campestris*	YSB-9	82.30
2.		NC-1	50.80
3.		B-54	86.26
4.		C-3	64.61
5.	*Brassica juncea*	B-85	81.65
6.		White glossy	37.39
7.		T-6342	48.66
8.		RW-85-89	70.00
9.		RW-85	62.23
10.		B-85 glossy	40.10
11.		RC-781	82.66
12.		Sharma 85-89	85.66
		Mean :	66.02
		S.E. :	5.02
		C.D at 5 % level :	11.08
		C.D. at 1% level :	16.61

Table -15

Average Meteriological data of South Bengal at Pulses and Oil seeds Research Station, Berhampore during 1994-1996.

Month	Temp °C (mean)	Rainfall (mm)	Relative humidity %	Sunrise (A.M)	Sunset (P.M)	Total Sun hours (hrs)
January	20.25	30.00	63.00	6.25	5.07	10.82
February	22.75	10.00	57.00	6.14	5.27	11.13
March	30.05	32.00	54.00	5.51	5.41	11.90
April	30.03	28.00	63.00	5.21	5.53	12.32
May	31.50	53.00	61.00	5.00	6.06	13.06
June	28.81	228.00	83.00	4.54	6.10	13.65
July	28.81	285.00	83.00	4.54	6.10	13.65
August	28.51	350.00	82.00	5.15	6.07	12.92
September	29.75	202.00	75.00	5.25	5.39	12.14
October	27.25	92.00	69.00	5.36	5.09	11.73
November	23.75	26.00	66.00	5.53	4.49	10.96
December	20.21	2.00	62.00	6.13	4.52	10.39

Table -16

Average Meteriological data of North Bengal University Campus (Experimental garden) during 1994-1996.

Month	Temp °C (mean)	Rainfall (mm)	Relative humidity %	Sunrise (A.M)	Sunset (P.M)	Total Sun hours (hrs)
January	15.10	4.00	34	6.45	5.00	10.15
February	18.40	10.00	38	6.30	5.30	11.00
March	21.10	45.90	43	6.10	5.45	11.35
April	22.90	189.70	47	6.00	5.50	11.50
May	25.50	399.40	58	6.00	6.10	12.10
June	26.60	480.20	62	5.50	6.20	12.30
July	27.00	531.00	80	6.00	6.25	12.25
August	28.50	692.50	86	6.15	6.15	12.00
September	28.90	620.00	82	6.20	6.10	11.50
October	26.70	271.50	55	6.25	6.00	11.35
November	19.00	55.50	50	6.30	5.45	11.15
December	13.90	1.80	47	6.45	5.15	10.30

Fluctuations in populatin density of *L.erysimi* on different cultivars of *Brassica* was observed earlier by different investigator at different places other than North Bengal. Rana et al, (1993) observed influence of abiotic environment on the population dynamics of mustard aphid *L. crysimi* Kalt. They observed their appearance towards the end of December of first week of January. The cultivar RH (*B. juncea* Zern and Cross) harboured comparatively less population of aphids as against *B. campestris* cv. BSH-I. Kabir et al (1989) also observed that in *B. campestris* cv M-4 showed significantly the highest infestatin on aphid being 28% at 59 days of sowing and this might be highly susceptible. Most of the germplasm under *B. juncea* became less susceptible to aphid which attack 9 to 24% mustard plants. Strains M-128-17 and B.I.N.A-M-46 showed significantly least infestation. Relative resistance 4 strains of *B. campestris* (cv. Tora; cv. Trope, cv. Span and cv. BSH-1) was observed by Gill and Bhaketia (1985) against the mustard aphid *L.erysimi.* They studied in the field at Ludhiana condition during 1982-1983. They observed that *B.campestris* strains supported very high population and were considered highly susceptible to the aphid. Preference tested by Sachan and Singh (1983) indicated that the varieties of *B.juncea* namely Porbriya and Varina were highly preferred, RLM 198, RH 7361 and T. 6342 were intermediate in response, while RW 2-2, RW 15-6 and B-85 were less preferred hosts for feeding and development of the aphid *L.erysimi.* The amount of honey dew excreted by the aphid was less when fed in less preferred entries as compared to moderately and highly prefered entries.

Three levels each of data of sowing irrigation, nitrogen application and row spacing were tried by Kalra et al (1983) to formulate an integrated control of mustard aphid *L. erysimi* on Indian mustard. On the basis of field studies during 1985-86, 1986-87 and 1987-88 the economic injury level of mustard aphid *L.erysimi* Kalt in toria (V-M-27) was found to be 30-40 aphids / 10cm of terminal shoot during the first and second week of January, when 17 to 28.67% of the twigs were infested.

Kabir et al (1989) suggested that cultivars with less chlorophyll content, soft and hairy leaves appeared to be more infested by *L. erysimi* comparision with higher chlorophyll, coars and high plants. In connection with the study on population dynamics of the aphid by Gill and Bakhetia (1985) observed on different cultivars of *B. juncea* and *B. campestris* that the was a positive correlation between the aphid population and the total ash, nitrogen and

phosphorus, where as total sugars flavonoids and glucosinolates had inverse relationship with the aphid population.

While studying cultivars of *B. juncea,* and *B. campestris* in connection with host susceptibility to the mustard aphid. *L. erysimi pseudobrassicae* Weigel et al. (1990) analysed free aminoacid in phloen sap by means of HPLC. They observed that aspartic acid and glutamic together with glutamine were the dominating aminoacids. All plants had very little glycine, Y-amino-butyric acid (GABA), metheonine, and tryptophane in their sap. However, they observed that *B. campestris* cv. YSB-9 on which the aphids were shown to grow more slowly had less amino acid content than other *B.campestris* varieties. According to Weigel et al (1990) slow population growth of aphids on *B. juncea* compared to that of *B. campestris* was probably due to other nutritional factors.

Resistance of plants to an insect as defined by Painter (1951) is the relative amount of heritable qualities possessed by the plant which influences the ultimate degree of damage done by that insect. The inherent qualities, specific to the mechanism in different varieties may have different degrees of resistance varying from high resistance to tolerance and finally to susceptibility and high susceptibility depending upon the development of the resistance mechanism to the specific insect.

Life history, populatin dynamics and dispersal in the mustard aphid *L.erysimi* Kalt have been worked out by Landin (1982). Detailed study on the biology of the aphid were made by Sidhu and Singh (1964) in Punjab and Rout and Senapati (1968) in Orissa. These were subsequently suplemented by many other workers (Kuri and Misra 1979; Roy, 1975; Phadke 1982). In connectin with the growth of aphid population and aphid incidence the effect of different factors such as rainfall (Bakhetia and Sindhu, 1983), temperature (Bakhetia and Sindhu 1983) hailstorm (Sekhon and Bakhetia 1987) soil nitrogen (Sidhu and Kaur, 1977) water strees (Bakhetia and Brar 1986; Sidhu and Kaur 1976) have been worked out.

It is very interesting to note that germplasm lines, elite progenies from breeding materials and other strains of *Brassica* species have been tested for resistance to the aphid (Bakhetia and Sekhon 1984), some have been reported as resistant (Singh et al, 1985) but there is no range of cultivars to suit all environmental conditions prevailing in India to resist *L. erisimi* Kalt.

No population increases indefinitely. Sooner later growth has to slow down and even stop. When slows the growth of population and what kind of stability or equilibrium a population achieves with its resource and environment may be the result of some intrinsic factors those found with the population or extrinsic influence or of an interaction of both. According to Smith (1977) there ar several option for a population once it has arrived at some level of density or equilibrium point population may tend to remain fluctuating between some upper and lower limits. In this manner the population achieves some stability. The population may fluctuate widely without any reference to equilibrium size. Such populations are at the linfluence of some poowerful outside or extrinsic force such as weather that may alter the population level. A population can oscillate between high and low points with some regularity of amplitude. Most likely the levels of most populations results from an interaction of the first two options together with interspecific relationship.

SUMMARY

Aphid, *Lipaphis erysimi* Kalt is the most destructive pest of *Brassica* crops in India. The major reason for realising low yield in India visa vis West Bengal is due to attack to the key pest.

Investigation in collaboration with Pulses and Oil Seeds Research Station, Berhampore in southern part of West Bengal has been carried out to study fluctuation in population density of *L. erysimi* Kalt on twelve types of cultivars of *Brassica* grown in the ecoogical condition of Northern and Sourthern part of West Bengal, to select a cultivar having less incidence of the pest in Darjeeling condition.

In this connection aphid populations counts per plant and percentage of plant affected with the aphid in both the ecological condition of Northern and Southern part of West Bengal have been made.

Comparatively less incidence of aphid infestation to all the cultivars has been observed in Darjeeling condition as compared to that in Southern part of West Bengal.

Out of all the cultivars, marked variation in aphid incidence has been observed in *B. campestris* B-54, *B. juncea* RW-85-89 and Sharma 85-89.

B. campestris B-54, an early flowering types associated with less incidence of aphid infestation in Darjeeling condition has been selected to be the best as a commercially valuable cultivar in the region.