Estimation of avoidable yield losses of *Brassica* species due to insect pests in south -western region of Punjab

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Key words: *Brassica*, Indian mustard, *B. napus*, *B. carinata*, *B. campestris* and *Eruca vasicaria*, yield losses, aphid, *Lipaphis erysimi*, *Myzus persicae*, *Chromatomyia horticola*

Abstract: Indian Mustard (*Brassica juncea*) is a major *rabi* oilseed crop in the south western region of Punjab and sometimes the attack of mustard aphid (*Lipaphis erysimi*), green aphid (*Myzus persicae)* and leaf minor (*Chromatomyia horticola*) cause a grave loss in seed yield of *Brassicas*. To estimate avoidable yield loss by these insect-pests, a series of experiments were conducted on five species viz., *Brassica campestris* (var iety BSH-1), *B. juncea* (variety PBR 91 and RLM 619), *B. napus* (variety GSL-1and GSC-5) , *B. carinata* (variety PC-5) and *Eruca vasicaria* (variety ITSA-2 and TMLC-2) during 1993-94 to 1997-98, 1999-2000 and 2003-04 at PAU, Regional Station, Bathinda. The maximum loss of yield by the aphid attack was on PC-5 (65.6%) followed by ITSA-2 (61.4%), GSL-1 (58.8%), PBR 91 (35.0%) and BSH-1 (20.0%) in unsprayed plots during 1997-98, while the loss was minimum (0.0-8.1 %) during the year 1994-95. There was negligible incidence of leaf miner except during 1995-96 (3.1-11.5 maggots per 3 leaves). Green aphid dominated mustard aphid almost on all cultivars during the years under study. The coincidence of peak flowering of a variety with the peak population of insect-pests especially aphids proved to be the most important factor for reducing seed yield in all the Brassica species. Yield losses varied greatly with the season and nature of *Brassica* variety.

Introduction:
India is among the largest vegetable oil economies of the world after USA and China. Among the oilseed crops, *Brassicas* contribute nearly 22.2 and 24.2 percent towards the oilseeds acreage and production, respectively. Biotic stresses caused by insects, fungi, bacteria, viruses, nematodes, orobanche and weeds are collectively responsible for approximately 45 percent yield loss annually (Kumar, 2005). Among the insect-pests, mustrad aphid (*Lipaphis erysimi*), green aphid (*Myzus persicae*), painted bug (*Bagrada halaris*) and leaf minor (*Chromatomyia horticola*) are reported to cause yield losses up to 100, 30 and 15% respectively during the reproductive phase of *Brassica* crops (Singh, 2005). In the southwestern region of Punjab, Indian mustard (*B. juncea*) is a major *rabi* oilseed crop and grave loss of seed yield occurs every year mainly due to incidence of mustard aphid, green aphid and leaf minor. Singh *et al*., (1983) reported that in Punjab increase of 1 aphid beyond 25-aphids/ plant reduced yield by 1.5 kg/ha., Rahman *et al*. (1989) from Bangladesh confirmed these results. To estimate avoidable yield losses by these insect-pests on *Brassica* crops, a series of experiments were conducted on five *Brassica* species during 1993-94 to 1997-98, 1999-2000 and 2003-04 at Punjab Agricultural University, Regional Research Station, Bathinda.

Material and Methods
The varieties of five species viz., *Brassica campestris* (BSH-1), *B. juncea* (PBR 91 and RLM 619), *B. napus* (GSL-1and GSC-5) , *B. carinata* (PC-5) and *Eruca vasicaria* (ITSA-2 and TMLC-2) were grown in split plot design having three replications during the second fortnight of November in different year. The protected and unprotected blocks were kept as main treatments and the varieties of different *Brassica* species as sub treatments. The aphid population of was kept under Economic Threshold Level (ETL) i.e. 50-60 aphids/ 10 cm terminal portion of central shoot by applying 2-3 sprays of recommended insecticides at 15-20 days interval. The population counts were made at weekly interval in sprayed as well as unsprayed plots from 10 cm terminal portion of central shoot on each of 10 plants for aphids and on 3 leaves (one each from top, center and bottom) of 10 plants for mustard aphid and leaf minor. The yield data for all the treatments was recorded for each species/ variety during different years and yield losses were calculated.

Results and Discussion
The data recorded for 8 entries in 7 trials are presented in table 1. The peak populations of mustard aphid, green aphid and leaf minor varied during different years. It was minimum during 1994-95 and maximum during 1997-98 on overall basis. There was considerable incidence of leaf minor only during

1995-96 on different species. In general population of green aphid dominated that of mustard aphid on almost all cultivars during different years under study.

The peak flowering in trials was observed during the first fortnight of January in *Brassica campestris*, first fortnight of February in *B. juncea* and *Eruca vasicaria*, last week of February to first week of March in *B. napus* and first fortnight of February in *B. carinata* .The vulnerable stage for infestation from flowers and young siliquae to the mature siliquae formation in different varieties lasted for 20-35 days with decreasing susceptibility with maturity . Aphid inflicts maximum damage to young buds, flowers and young siliquae by sucking sap from them. However, there was no direct relationship of peak population recorded on a species and yield loss over different years (Table 1). The yield losses in all most in all the species were positively correlated with co-incidence of peak flowering and peak insects population of a variety. The yield losses were observed to be maximum in *B. carinata* (65.6 %) following *Eruca vasicaria* (61.4%), *B. juncea* (35.2%) and *B. campestris* (15.8%) in the year 1997-98 having 111.1, 92.1, 51.1, 92.7,and 66.2 aphids respectively per 10 cm top portion of central shoot. Though the incidence on *B. napus* and *B. juncea* was almost same but yield losses in *B. napus* were significantly higher, indicating that the most vulnerable stage of *Brassica* to aphids is the peak flowering as this stage in these years coincided with the peak aphid population in *B. napus*. Similarly, in *Eruca vasicaria,* though density of aphids was very low, but losses were very high. Though *B. campestris* is very vulnerable to aphid attack as reported by Sekhon *et al.,* (1996) yet losses were low as this species escaped from the attack of aphids due to its early maturing habit. The demage escaped in other species in decreasing order were observed in *B. carinata*, *Eruca vasicaria*, *B napus* and *B. juncea* ,which is in conformity with the findings of Sekhon *et al*., (1996). Though leaf miner appeared every year yet its infestation resulting into yield loss was negligible. This pest showed moderate (11.5 maggots on three leaves) incidence on *B. juncea* only during the year 1995-96.

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Table 1. Peak population density of mustard aphid, green aphid and leaf miner and yield loss (%) in different *Brassica* species.

Year	Variety	Mustard aphid (*Lipaphis erysimi*)		Green Aphid (*Myzus persicae*)		Leaf minor (*Chromatomyia horticola*)		Yield losses (%)
		Date	Peak population density	Date	Peak population density	Date	Peak population density	
Brassica campestris								
1993-94	BSH-1	28-02-94	39.0	05-03-94	3.0	15-02-94	1.0	19.4
1994-95	,,	20-03-95	0.1	16-03-95	0.0	20-03-95	2.1	1.38
1995-96	,,	28-02-96	2.7	11-03-96	20.8	28-02-96	3.6	31.1
1996-97	,,	18-02-97	68.0	18-02-67	10.8	2-02-97	0.0	16.5
1997-98	,,	15-03-98	56.0	15-03-98	10.2	15-03-98	0.2	15.8
1999-00	,,	28-02-00	30.2	28-02-00	1.7	28-02-00	0.7	20.0
2003-04	,,	17-02-04	0.0	28-02-02	2.2	12-03-04	0.0	1.1
Brassica juncea								
1993-94	PBR 91	24-02-94	6.0	05-03-94	2.3	20-02-94	2.1	19.0
1994-95	PBR 91	22-03-95	2.3	10-03-95	48.0	05-03-97	3.3	5.9
1995-96	PBR 91	11-03-96	24.7	11-03-96	24.8	11-03-96	11.5	11.0
1996-97	PBR 91	04-03-97	24.2	18-02-97	13.0	15-03-97	0.1	7.60
1997-98	PBR 91	28-03-98	37.0	28-03-98	55.7	28-03-98	0.0	35.2
1999-00	PBR 91	28-02-00	63.8	28-02-00	27.0	21-02-00	0.6	20.3
2003-04	PBR91	04-03-04	0.0	12-03.04	15.26	12-03-04	2.23	15.04
	PBR210	04-03-04	0.0	12-03-04	18.43	12-03-04	1.35	24.05

Brassica napus								
1993-94	GSL-1	05-03-94	24.0	25-03-94	77.0	10-03-94	2.0	5.3
1994-95	GSL-1	20-03-95	0.8	20-03-95	0.1	15-03-95	2.2	8.11
1995-96	GSL-1	11-03-96	13.4	11-03-96	12.3	11-03-96	9.2	41.6
1996-97	GSL-1	10-03-97	29.4	25-02-97	3.8	25-02-97	0.3	14.40
1997-98	GSL-1	28-03-98	35.6	28-03-98	56.5	28-03-98	3.4	59.4
1999-00	GSL-1	21-02-00	0.7	28-02-00	1.4	28-02-00	0.4	13.41
2003-04	GSL-1	12-03-04	0.0	12-03-04	63.7	12-03-04	2.82	15.20
	GLC-5	12-03-04	0.0	12-0304	61.6	12-03-04	4.39	25.27
Brassica carinata								
1993-94	PC-5	05-03-94	38.0	05-03-94	68.0	05-03-94	1.0	13.9
1994-95	PC-5	25-03-95	2.2	25-03-95	0.0	25-03-95	1.7	-
1995-96	PC-5	11-03-96	7.4	11-03-96	7.9	11-03-96	6.0	58.8
1996-97	PC-5	28-02-97	13.7	28-02-97	1.9	28-02-97	0.4	30.1
1997-98	PC-5	28-03-98	40.1	28-02-97	71.0	28-02-97	3.0	65.6
1999-00	PC-5	21-02-00	0.6	21-02-00	2.3	28-02-00	0.2	19.8
2003-04	CCN 8	12-03-04	0.0	12-03-04	24.3	12-03-04	1.62	28.34
Eruca . vasicaria								
1993-94	ITSA-2	25-02-94	3.0	25-02-94	9.0	25-02-94	2.1	36.1
1994-95	ITSA-2	25-03-95	0.6	25-03-95	0.0	25-03-95	0.4	-
1995-96	ITSA-2	05-02-96	1.7	05-02-96	42.8	11-03-96	3.1	32.8
1996-97	ITSA-2	10-03-97	11.4	10-03-97	22.2	10-03-97	0.2	18.70
1997-98	ITSA-2	15-03-98	10.9	15-03-98	40.2	15-03-98	0.1	61.4
1999-00	ITSA-2	28-02-00	8.9	28-02-00	6.0	28-02-00	0.1	28.1
2003-04	TMLC-2	24-03-04	0.0	24-03-04	0.6	24-03-04	0.0	15.8