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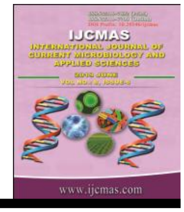

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Assessment of Avoidable Yield Losses Due to *Lipaphis erysimi* Kalt in Various *Brassica* spp.

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A B S T R A C T

Present field studies were conducted during the *Rabi* season of year 2015-16 at Regional Research Station, Rohtak (Haryana), India, to assess the yield losses due to mustard aphid in various *Brassica* spp. (*B. juncea*, *B.napus* and *B. rapa*) sown under early and late sown conditions. The avoidable losses in terms of seed yield varied from 9.26 to 17.48 per cent, found lowest (9.26%) in HNS 0901 whereas, highest (17.48%) in BSH 1 under timely sown conditions. These losses ranged from 20.11 to 32.62 per cent under late sown conditions, found lowest (20.11%) in HNS 0901 although highest (32.62%) in BSH 1. The avoidable oil content losses in all three *Brassica* spp. were ranged from 3.38 to 6.34 per cent, found lowest (3.38%) in RH 0749 however, highest (6.34%) in BSH 1 under timely sown conditions. These losses in oil content varied from 4.92 to 8.14 per cent, found lowest (4.92%) in RH 0749 however, highest (8.14%) in BSH 1 under late sown conditions. Germination percentage was not significantly affected by the mustard aphid in all three *Brassica* species.

Introduction

The oilseed *Brassica* species are, Indian mustard (*B. juncea* (L.) Czern. & Coss.), toria (*B. rapa* L. var. *toria*), yellow sarson (*B. rapa* L. var. *yellow sarson*), brown sarson (*B. rapa* L. var. *brown sarson*), gobhisarson (*B. napus L.*), karanrai (*B. carinata* Braun.) and taramira (*Eruca sativa* Mill.). These species belongs to the genus *Brassica* and family *Brassicaceae* and are called rapeseed-mustard in vernacularly language and are traditionally grown as the major groups of winter oilseed crops under irrigated and natural rainfall areas of India. India is one of the largest rapeseed mustard growing country in the world, occupying the first position in area and second position in production after China (Khavse *et al.*, 2014). India accounts for 19.29 per cent and 11.13 per cent of the total acreage and production of rapeseed-mustard in the world, respectively (Anonymous, 2013). Among the seven edible oilseeds cultivated in India, rapeseed-mustard contributes 28.6% in the total oilseeds production and ranks second after groundnut sharing 27.8% in the India's oilseed economy (Shekhawat *et al.,* 2012). In India, during 2015-16, rapeseed and mustard were grown over an area of 5.75 million ha area with production and productivity of 6.80 m tonnes and 1183 kg/ha respectively (Anonymous, 2017). Haryana is the third most important rapeseed–mustard producing state in the country with an area of 0.53 million ha, production of 0.90 million tonnes and productivity of 1721 Kg/ha (2015-2016) which is the highest in the country (Anonymous, 2017).

Insect pests are important biotic constraints that posed severe threat to mustard from germination to harvest and about 50 insect species have been found infesting the rapeseed-mustard in India (Sharma and Singh, 2010), out of which about a dozen of species are considered as major pest (Singh, 2009). Among them, the aphid species that damage rapeseed-mustard in India include *L. erysimi*, *Brevicornae brassicae* L. and *Myzus persicae* Sulzer (Sarangdevot *et al.*, 2006).

Among these, *L. erysimi* referred as both the turnip and mustard aphid is one of the major limiting factors causing up to 96 per cent yield losses and 5-6 per cent reduction in oil content (Shylesha *et al.,* 2006). Aphid sucks the cell sap from the stems, twigs, buds, flowers and developing pods causing a significant loss in yield. Heavy yield losses to the rapeseed-mustard by *L. erysimi* have been reported in India. Various researchers reported reductions up to 91% in yield due to the attack of this pest (Prasad and Phadke, 1983; Bakhetia, 1984; Singh and Sachan, 1994; Sekhon *et al.*, 1996; Prasad, 1997; Verma, 2000; Malik *et al.,* 2003; Chauhan and Chauhan, 2005; Bunker *et al.*, 2006 and Kular and Kumar, 2011). Such losses may go upto 100% in certain mustard growing regions (Singh and Sachan, 1999). The losses were also varied in different *Brassica* species. Higher losses were reported in *B. campestris* and *B. napus* while lower were reported in *B. carinata*. However, the losses were highly variable in *B. juncea* (Kumar, 2010). Keeping the above facts in mind, the present investigation was undertaken to assess the avoidable yield losses due to *L. erysimi* Kalt. in various *Brassica* spp.

Materials and Methods

The present investigation was carried out during *Rabi* season of the year 2015-16 at research farm of Regional Research Station, Rohtak (Haryana), India. Assessment of yield losses was done on three Rapeseed-mustard varieties i.e. RH 0749, HNS 0901 and BSH 1 belonging to three *Brassica* spp. i.e. *B. juncea*, *B.napus* and *B. rapa* grown under recommended Package of Practices (Anon. 2006).The experiment was laid out in paired plot design as suggested by Leclerg (1971). The paired plot, i.e., Protected (sprayed with insecticides) and unprotected (unsprayed) were replicated 13 times. The size of each plot was 2.7 m ×1.8 m and was separated by a strip of one meter all around. Spraying was done at economic threshold level (ETL) with Dimethoate 30EC by using a knapsack sprayer. The population of the mustard aphid was recorded from 10 cm top twig of 10 randomly selected and tagged plants in each plot. Finally crop yield, reduction in oil content and germination percentage from both the sets (protected and unprotected) for each genotype per replicate was recorded. The per cent avoidable yield loss in each genotype was calculated according to Khosla (1977):

Genotype = X
Mean yield under protected set = A
Mean yield under unprotected set = B
Avoidable yield losses = A-B
Per cent avoidable loss = (A-B)/A x 100

Table 1: Assessment of yield losses due to mustard aphid, *L. erysimi* in *B. juncea* cv. RH 0749 in Rohtak, 2015-16

	Timely sown				Late sown			
	Aphid Population	Germination (%)	Oil (%)	Yield (kg/ha)	Aphid population	Germination (%)	Oil (%)	Yield (kg/ha)
Unprotected	22.03	90.07(71.65)	39.44	1773	61.37	89.30(70.93)	38.60	1361
Protected	1.97	90.69(72.26)	40.82	2010	6.29	89.61(71.21)	40.60	1792
Percent reduction in Aphid population	91.04	---	---	---	89.76	---	---	---
Avoidable losses (%)	---	0.31	3.38	11.79	---	0.21	4.92	24.05
T "calculated"	29.53**	(1.78)	53.56**	25.09**	124.13**	(0.94)	75.29**	61.62**

Figures in parentheses are angular transformations
** Significant at "t" = 0.01

Table 2: Assessment of yield losses due to mustard aphid, *L. erysimi* in *B. napus*cv. HNS 0901 in Rohtak, 2015-16

	Timely sown				Late sown			
	Aphids population	Germination (%)	Oil (%)	Yield (kg/ha)	Aphid population	Germination (%)	Oil (%)	Yield (kg/ha)
Unprotected	19.62	91.92(73.52)	39.29	1616	55.92	90.69(72.25)	38.48	1335
Protected	1.85	92.23(73.84)	40.93	1781	6.58	91.15(72.72)	40.59	1671
Percent reduction in Aphid Population	90.48	---	---	---	88.21	---	---	---
Avoidable losses (%)	---	0.10	4	9.26	---	0.31	5.19	20.11
T "calculated"	41.05**	(0.72)	42.60**	21.64**	69.80**	(1.60)	118.64**	37.20**

Figures in parentheses are angular transformations
** Significant at "t" = 0.01

Table 3: Assessment of yield losses due to mustard aphid, *L. erysimi* in *B. rapa* cv. BSH 1 inRohtak, 2015-16

	Timely sown				Late sown			
	Aphids population	Germination (%)	Oil (%)	Yield (kg/ha)	Aphid population	Germination (%)	Oil (%)	Yield (kg/ha)
Unprotected	30.41	94.92(77.04)	39.43	977	85.39	94.23(76.16)	38.1	665
Protected	3.48	95.69(78.12)	42.1	1184	10.28	94.61(76.67)	41.48	987
Percent reduction in Aphid population	88.54	---	---	---	87.97	---	---	---
Avoidable losses (%)	---	0.40	6.34	17.48	---	0.20	8.14	32.62
T "calculated"	40.84**	(2.09)	128.13**	24.73**	101.85**	(1.1)	100.50**	27.53**

Figures in parentheses are angular transformations
** Significant at "t" = 0.01

Results and Discussion

The results depicted in the Tables 1, 2 and 3 revealed that under timely sown conditions, *B. napus* cv. HNS 0901 harboured a minimum population of 19.62 aphids/10 cm apical shoot while the maximum population was observed on *B. rapa* cv. BSH 1 (30.41 aphids/10 cm apical shoot) in the unprotected set followed by *B. juncea* cv. RH 0749 (22.03 aphids/ 10 cm apical shoot).

In the protected set, a very low population of 1.85, 1.97 and 3.48 aphids/10 cm apical shoot was observed on *B. napus* cv. HNS 0901, *B. juncea* cv. RH 0749 and *B. rapa* cv. BSH 1, respectively. Under late sown conditions, *B. napus* cv. HNS 0901 harboured a minimum population of 55.92 aphids/10 cm apical shoot while the maximum population was observed on *B. rapa* cv. BSH 1 (85.39 aphids/10 cm apical shoot)in the unprotected set followed by *B. juncea* cv. RH 0749 (61.37 aphids/ 10 cm apical shoot). In the protected set, a low population of 6.29, 6.58 and 10.28 aphids/10 cm apical shoot was observed on *B. juncea* cv. RH 0749, *B. napus* cv. HNS 0901 and *B. rapa* cv. BSH 1, respectively.

The yield was found to be adversely affected by aphid infestation. The mean yield obtained was significantly lower in unprotected plots (1773, 1616 and 977 kg/ha) in comparison to the protected plots (2010, 1781 and 1184 kg/ha) under timely sown conditions, in *B. juncea* cv. RH 0749, *B. napus* cv. HNS 0901 and *B. rapa* cv. BSH 1, respectively. Similarly, under late sown conditions, the mean yield obtained was significantly lower in unprotected plots (1361, 1335 and 665 kg/ha) in comparison to the protected plots (1792, 1671 and 987 kg/ha) in *B. juncea* cv. RH 0749, *B. napus* cv. HNS 0901 and *B. rapa* cv. BSH 1, respectively. The average avoidable yield losses were more in genotypes belonging to *B. rapa* cv. BSH 1 (32.62 %) followed by *B. juncea* cv. RH0749 (24.05 %) and *B. napus* cv. HNS 0901 (20.11 %) under late sown conditions. Under timely sown conditions average avoidable yield losses (17.48 %) were recorded in *B. rapa* cv. BSH1 followed by *B. juncea* cv. RH 0749 (11.79 %) and *B. napus* cv. HNS 0901 (9.26 %). The present studies are in close conformity with Bakhetia (1982 and 1984) who observed 11.6 to 39.0 per cent yield losses in *B. juncea*. Verma (2000) reported that mustard aphid is the most important aphid causing up to 96 per cent yield loss in *Brassica* spp.

Similarly, Chauhan and Chauhan (2005) also reported yield losses in Brassica cultivars ranged from14.0 to 27.9 per cent due to aphid infestation. In agreement with the present studies, Kular and Kumar (2011) also reported the losses in seed yield due to mustard aphid infestation ranged from 6.5 to 26.4 % in different Brassica species (*B. juncea*, *B. napus* and *B. rapa*).

In present investigations, the mean oil content was significantly lower in unprotected plots (ranged from 39.29 to 39.44 and 38.1 to 38.60 %) as compared to protected plots (ranged from 40.82 to 42.1 and 40.59 to 41.48 %) in all the *Brassica* spp. both under timely and late sown conditions, respectively.

The avoidable oil content losses in all three *Brassica* spp. ranged from 3.38 to 6.34 per cent under timely sown conditions and 4.92 to 8.14 percent under late sown conditions. The present findings are in line with Mehta (1984) who reported 1.51 to 13.34 per cent reduction in oil content in *B. juncea* due to mustard aphid infestation. Verma and Singh (1987) also reported 15 per cent oil content reduction by mustard aphid infestation. In present studies, germination percentage was not significantly affected by the mustard aphid in all three *Brassica* species.

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