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Population development of turnip aphid *Lipaphis erysimi* (Kaltenbach, 1843) (Hemiptera: Aphididae) and the associated predator *Coccinella septempunctata* Linnaeus, 1758 as affected by changes in sowing dates of oilseed Brassica.

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Abstract

Kular J, Brar A, Kumar S. 2012. Population development of turnip aphid *Lipaphis erysimi* (Kaltenbach, 1843) (Hemiptera: Aphididae) and the associated predator *Coccinella septempunctata* Linnaeus, 1758 as affected by changes in sowing dates of oilseed Brassica. Entomotropica 27(1): 19-25.

The effect of sowing date of Indian mustard crop, *Brassica juncea* (L.) Czern. on turnip aphid, *Lipaphis erysimi* (Kaltenbach, 1843) incidence and population build up of adults and larvae of its predator, the seven spotted lady bird beetle, *Coccinella septempunctata* Linnaeus, 1758 was studied by keeping five sowing dates viz. October 10, October 20, October 30, November 10 and November 20. The aphid incidence was found significantly lowest (12.5 aphids/plant) in plots sown on October 10 as compared to plots sown on November 10 (39.3) and November 20 (58.0) but it was on a par with plots sown on October 20 (14.4) and October 30 (14.1). Significantly highest larval population (1.4 and 1.2 larvae/plant) of *C. septempunctata* was recorded in crop sown on November 10 as compared to other sowing dates. However, significantly highest adult population of 2.0 beetles/plant was recorded on crop sown on November 20 as compared to all other sowing dates. The implications of changes in sowing time with respect to management of the pest are discussed.

Additional key words: Generalist predator, lady bird beetle, mustard

Resumen

Kular J, Brar A, Kumar S. 2012. Efecto de la fecha de siembra del cultivo de la mostaza sobre la incidencia del áfido *Lipaphis erysimi* (Kaltenbach, 1843) (Hemiptera: Aphididae) y su depredador *Coccinella septempunctata* Linnaeus, 1758. Entomotropica 27(1): 19-25.

El efecto de la fecha de siembra del cultivo de la mostaza, *Brassica juncea* (L.) Czern sobre la incidencia del áfido, *Lipaphis erysimi* (Kaltenbach, 1843) y el crecimiento de la población de adultos y larvas de su depredador, *Coccinella septempunctata* Linnaeus, 1758 fue estudiado en cinco fechas de siembra (10 de Octubre, 20 de Octubre, 30 de Octubre, 10 de Noviembre y 20 de Noviembre). La incidencia del áfido fue más baja (12,5 áfidos/planta) en parcelas sembradas el 10 de octubre en comparación con parcelas sembradas el 10 de noviembre (39,3 áfidos/planta) y 20 de noviembre (58,0 áfidos/planta), pero estuvo a la par con parcelas sembradas el 20 de octubre (14,4 áfidos/planta) y 30 de octubre (14,1 áfidos/planta). La población larval de *C. septempunctata* (1,4 y 1,2 larvas por planta) fue significativamente más alta en los cultivos sembrados el 10 de noviembre en comparación con otras fechas de siembra. Sin embargo, la de los adultos (2,0 escarabajos/planta) fue significativamente mayor en cultivos sembrados el 20 de noviembre en comparación con todas las demás fechas de siembra. Las consecuencias de los cambios de fecha de siembra con respecto al manejo de la plaga son discutidas.

Palabras clave adicionales: Depredador generalista, escarabajo, mostaza.

Introduction

Among the various pests that infest oilseed *Brassica* spp., the turnip mustard aphid, *Lipaphis erysimi* (Kaltenbach, 1843) (Hemiptera: Aphididae) is the major limiting factor in successful cultivation of rapeseed-mustard in India. This pest alone is responsible for causing mean yield loss of 54.2 per cent in rapeseed-mustard which under certain circumstances may go as high as 96.0 per cent (Bakhetia 1983; Kular and Kumar 2011). Though, an Integrated Pest Management (IPM) strategy is advocated to be followed for its management, the pest in reality is controlled mainly by the application of toxic insecticide. The adverse effects of the excessive use of insecticides are well known and hence, more emphasis should be given to the development of alternate pest management strategies including cultural and biological control.

Time of sowing has a significant effect on the infestation of mustard crop by aphid. Sowing the crop early in the season is reported to be affected less by aphid attack because of phenological asynchrony between the most susceptible crop growth stage and pest population (Patel et al. 2004). Since, sowing time has a great influence on the population development of aphids on rapeseed-mustard, this, in turn affects the population dynamics of the natural enemies of this pest. Among the various natural enemies of mustard aphid, the aphidophagous ladybird beetle, *Coccinella septempunctata* Linnaeus, 1758 (Coleoptera: Coccinellidae) is the most efficient predator and occupies a remarkable place among the different biocontrol agents of aphids (Mathur 1983). One of the approaches in biological control programmes is aimed at increasing the effectiveness of already present natural enemies by allowing them to grow and multiply in an agro-ecosystem. Thus, the study was carried out to generate information on the optimum sowing time of mustard so that this information can be used for development of an efficient pest management programme that incorporates the components of cultural and biological control.

Materials and methods

The experiment was carried out at oilseeds research farm, Department of Plant Breeding, Genetics and Biotechnology, Punjab Agricultural University, Ludhiana (30° 9' N, 75° 85' E, 244 m above msl). The *Brassica juncea* cv. PBR-91 was sown on 5 different dates viz. October 10, October 20, October 30, November 10 and November 20 in 10 x 10 m plots. The experiment was laid out in randomized complete block design with three replications. Recommended package of practices for raising a good crop were followed except for spray of insecticides. The crop was kept unprotected throughout the crop season.

The data on the population of mustard aphid and adults and larvae of *C. septempunctata* were recorded at weekly intervals on five randomly selected plants from each plot. The population of aphid was recorded from top 10 cm portion of the central twig whereas that of *C. septempunctata* larvae and adults was recorded on per plant basis.

The data so obtained were analyzed statistically to find out the difference in mean population on different sowing dates using LSD at 5 per cent level of significance.

Results and discussion

Effect of sowing dates on the incidence of mustard aphid

The population of mustard aphid varied significantly on different dates of sowing (Figure 1). Significantly lowest population was recorded on the crop sown in October 10, 20 and 30 as compared to the crop sown in November 10 and 20. In October sown crop, the first appearance of mustard aphid was observed

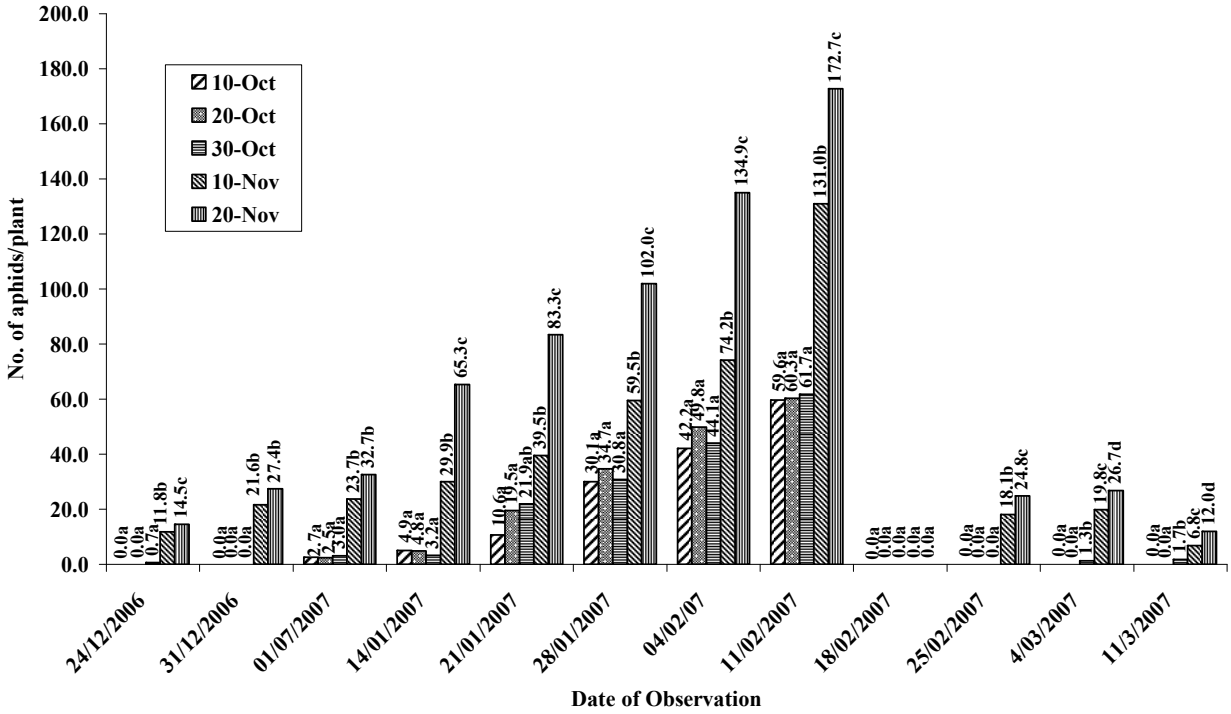

Figure 1. Effect of different sowing dates of *Brassica juncea* on the population of *Lipaphis erysimi*. Significant difference are shown by different letters according to LSD at 5 % level of significance.

in the first week of January which reached to its peak of 59.6, 60.3 and 61.7 aphids/plant in the second week of February on crop sown on October 10, 20 and 30, respectively. On the other hand, in November sown crop, the first appearance was reported in the last week of December which reached to peak population of 131.0 and 172.7 aphids/plant in the second week of February on crop sown on November 10 and 20, respectively. Significantly highest population of 172.7 aphids/plant was recorded on crop sown on November 20 as compared to that sown on November 10 (131.0), October 30 (61.7), October 20 (60.3) and October10 (59.6). It is clearly evident that the late sown crop i.e. in November had significantly higher population of mustard aphid than early normal sown crop i.e. in October. These data also revealed that maximum aphid population/plant was recorded on all sowing dates in middle of February and then started to decline in the month of March. These results are in conformity with the work done by Kular et al. (2001), Singh et al. (1998) who reported that early sown crop escaped the attack of mustard aphid.

Effect of sowing dates on population build-up of *Coccinella septempunctata*

The adults of *C. septempunctata* started appearing on all the sowing dates in the second week of January and reached to peak in the second week of February except November 10 sown crop where it reached to peak in first week of February (Figure 2).

Significantly highest population of 2.07 beetles/plant were recorded on crop sown on November 20 as compared to all other sowing dates i.e. November 10 (1.7), October 30 (1.3), October 20 (1.2) and October 10 (1.1) (Figure 4).

The larvae of *C. septempunctata* started appearing in the second week of February in all sowing dates. It is important to note here that while the adult population was first recorded

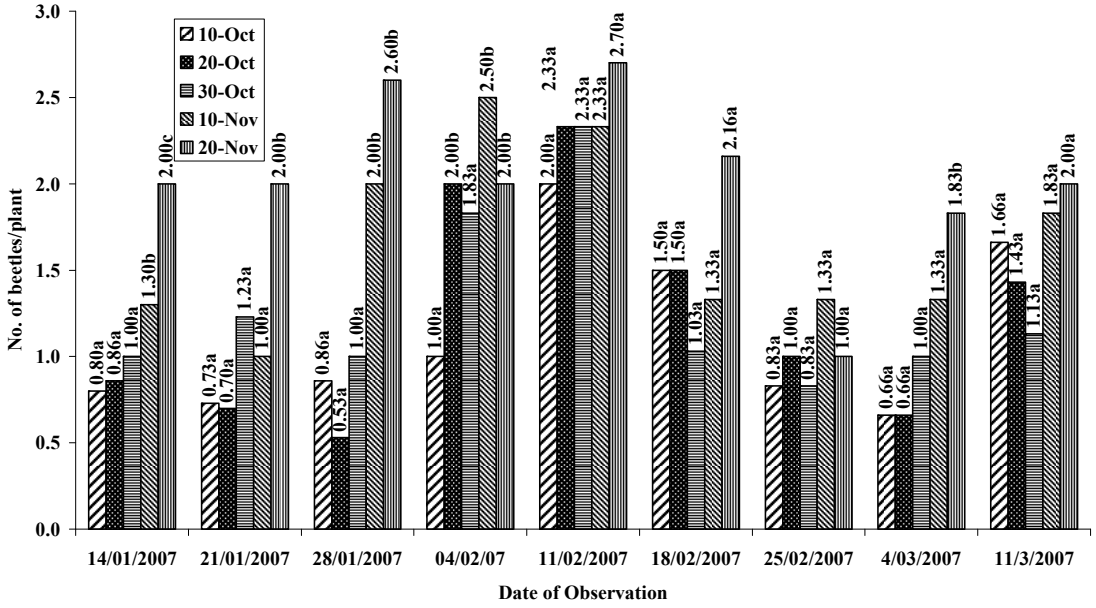

Figure 2. Effect of different sowing dates of *Brassica juncea* on the population build up of *Coccinella septempunctata* adults. Significant difference are shown by different letters according to LSD at 5 % level of significance.

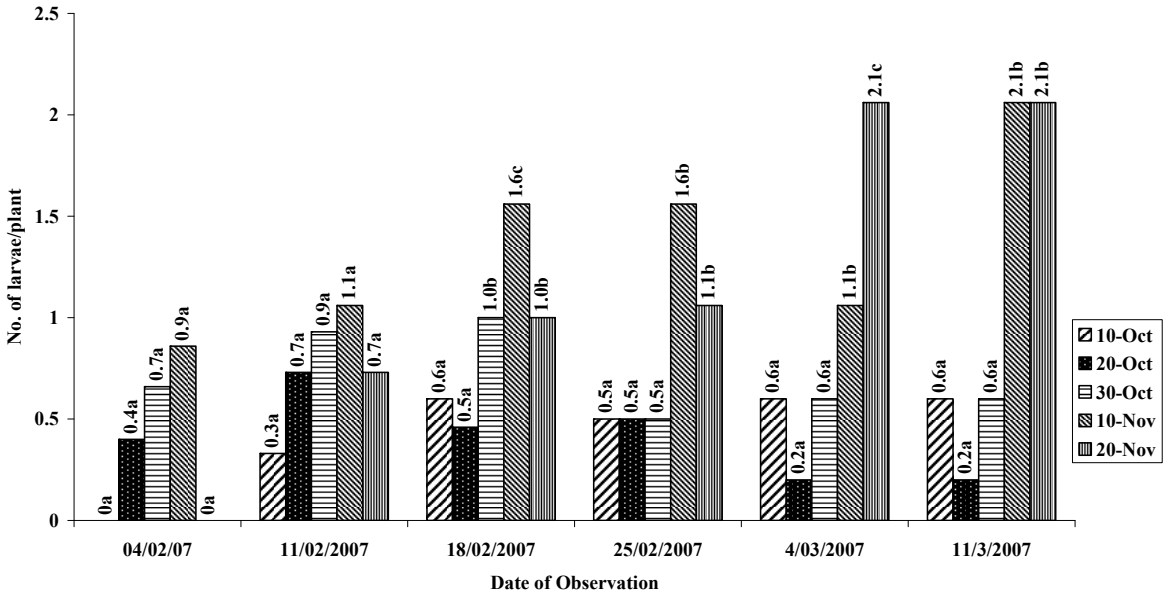

Figure 3. Effect of different sowing dates of *Brassica juncea* on the population build up of *Coccinella septempunctata* larvae. Significant difference are shown by different letters according to LSD at 5 % level of significance.

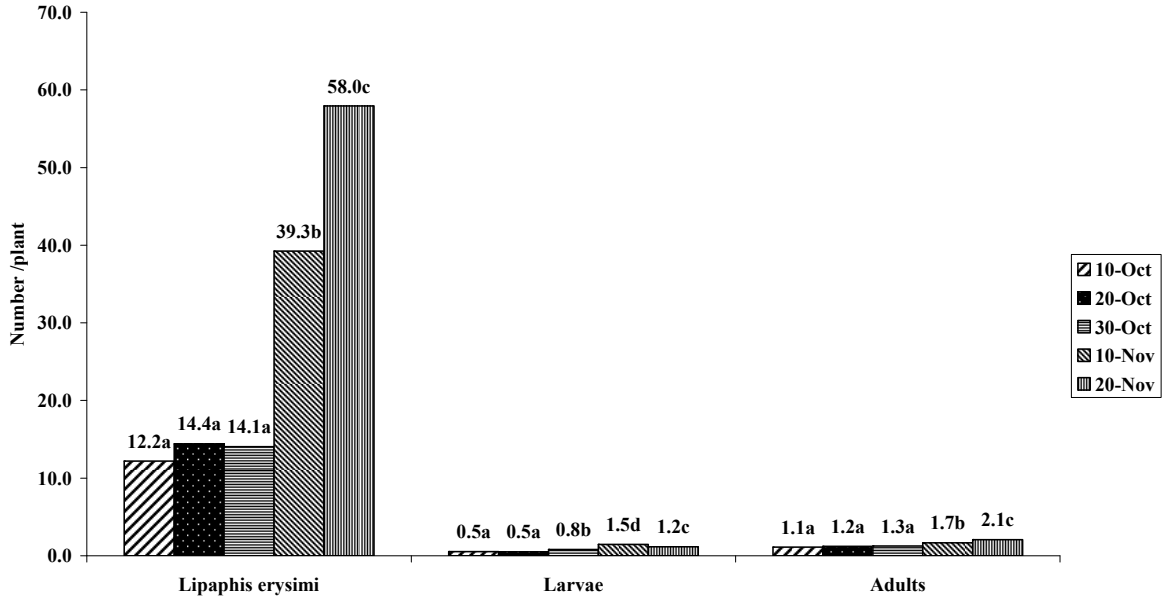

Figure 4. Mean population of *Lipaphis erysimi* and larvae and adults of *Coccinella septempunctata* on *Brassica juncea* shown on differents dates. Significant difference are shown by different letters according to LSD at 5 % level of significance.

on the crop during second week of January, the larval population was first recorded during first week of February. It gives an idea that the adults that were first observed in the field were the immigrants while the larvae observed were from the subsequent generation that started thereafter. Open fields are reported to allow the immigration of generalist predators that feed on insect herbivores (Ostman and Ives 2003). The larval population was statistically non-significant initially for the first two weeks of observations in different sowing dates but as the season advanced, the differences became significant (Figure 3). Significantly highest larval population of 2.1 larvae/plant were recorded on March 4 on late sown crop i.e. November 20 as compared to crop sown on November 10 (1.1), October 30 (0.6), October 20 (0.2) and October 10 (0.6).

The pooled analysis revealed that significantly highest aphid population of 58.0 aphids/plant was recorded on late sown crop (November 20) as compared to all other sowing dates (Figure 4). Significantly lowest population of 12.5 aphids/plant was recorded on crop sown on October 10 as compared to crop sown on November 10 (39.3), however, it was on a par with sowing date of October 20 (14.4) and October 30 (14.0). Similarly, significantly highest larval population of 1.4 and 1.2 larvae/plant was recorded on crop sown on November 10 and November 20, respectively, as compared to other sowing dates. As far as adult population is concerned, significantly highest population of 2.0 adults/plant was recorded on crop sown on November 20 as compared to other sowing dates.

Figure 5 shows the density dependent changes in the population of *C. septempunctata* in response to changes in aphid population densities. The

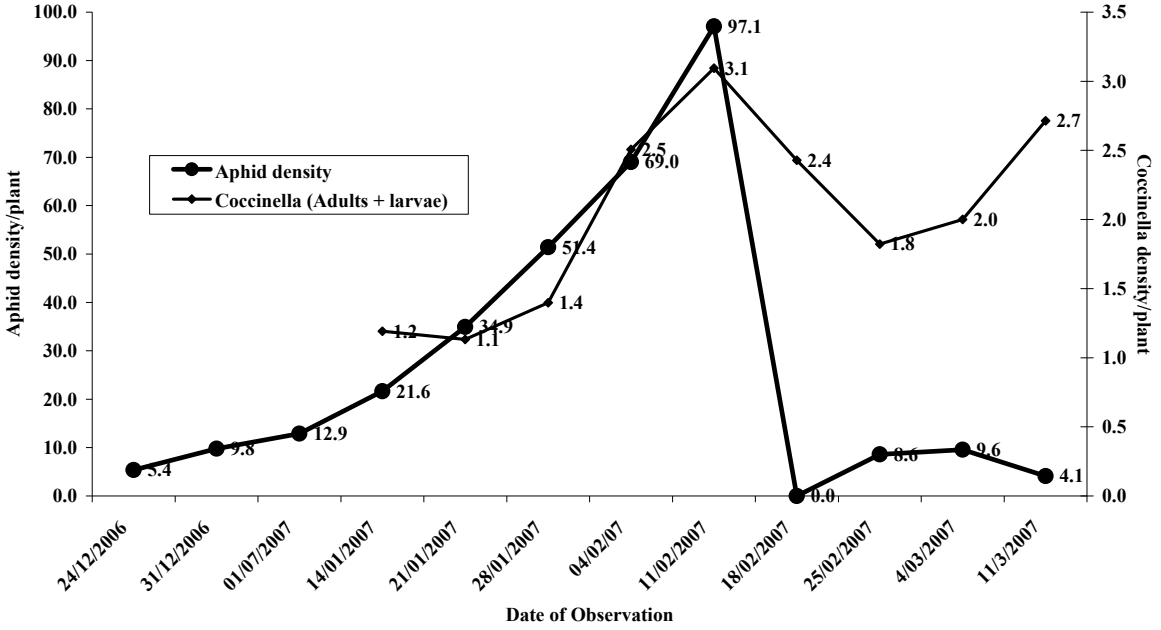

Figure 5. Average population of mustard aphids and lady bird beetle during the observation period.

predator population started increasing with the increase in the aphid population and reached its peak of 3.1 predators/plant (both adults and larvae) in the second week of February coinciding with the peak population of aphids (97.1 aphids/plant). Thereafter, a sudden decline in the aphid population was observed followed by decline in the predator population. This type of boom-and-bust predator-prey cycles are very common in undisturbed agroecosystems (Nicholson and Bailey 1935; Huffaker 1958; Hassell 1978; Ives 1995). The generalist predators including *C. septempunctata* suppress aphid populations in a density dependent manner (Ostman and Ives 2003) and hence, can prove to be very good biological control agent of mustard aphid.

Conclusions

Hence, it was concluded from the study that the early sown crop escaped the aphid damage due to asynchrony in the susceptible crop growth stage and peak aphid population. Consequently, the predator population was also low in the early sown crop compared to late sown. Since the crop escapes the pest damage, high predator population in early sown crop is of little importance. Growers, therefore, should sow the crop early in the month of October preferably by third week of October to get optimum yield. On the other hand, the aphid population was high in the late sown crop which fortunately also harboured high population of predators. Thus, in late sown crop, though pest damage is high, there is need for an effective decision making by the growers for the delayed application of insecticides and measures to conserve these already present natural enemies.

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