

Original Research Article

<https://doi.org/10.20546/ijcmas.2017.607.329>

Foraging Behavior and Differences in Host Plant Selection of Mustard Saw Fly, *Athalia lugens proxima* Klug. on Different *Brassica* Species

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A B S T R A C T

Keywords

Athalia proxima lugens, Foraging, Host plant, *Brassica*.

Article Info

Accepted: 26 June 2017

Available Online: 10 July 2017

The present investigation was undertaken to investigate the Foraging behavior and differences in host plant selection of mustard saw fly, *Athalia lugens* on different *Brassica* spp. The highest grubs population of *A. proxima* were recorded at 6.00 PM (2.68 grubs per linear meter row of plants) followed by at 6.00 AM (2.55), 9.00 AM (2.07), 12.00 PM (1.06) and lowest at 3.00 PM (1.06) and among different *Brassica* species, *Crambe abyssinica* (0.47) and *E. sativa* (0.38) were more resistant to *A. proxima lugens* and *B. campestris* (2.75) and *B. juncea* (2.90) were more susceptible.

Introduction

The mustard saw fly *Athalia proxima lugens* Klug. Is reported a serious crop pest causing extensive damage to different cruciferous plants in India (Butani and Jotwani 1984; Singh *et al.*, 2007). Reduction in seed yield due to saw fly may go upto 100 (Sachan 1990). It appears in the pest form in early stage of the crop stage *i.e.* October and November. Reduction in yield due to saw fly on an average is about 25 per cent but it may go up to 100 per cent.

Sawfly activity was mostly found during seedling stage of the crop (Choudhury and Pal 2006). Larvae feed on leaves in groups of 3-6

larvae during the morning and evening periods.

In day time the grubs are found hidden in leaves (Upadhyay 2010). *Athalia lugens proxima* grubs feed on leaves of only family Cruciferae (Srivastava and Singh 1997).

The present investigation was undertaken to investigate the Foraging behavior and differences in host plant selection of mustard saw fly, *Athalia lugens* on different *Brassica* spp on crop which help us to apply control measures.

Materials and Methods

The seeds of different *Brassica* species were sown in the month of October on the field of Crop Research Centre (CRC) of G. B. Pant University of Agriculture and Technology, Pantnagar 263145, India and recommended agronomic practices were applied and it was replicated thrice.

The observations on incidence started from 23 day after sowing (DAS) on the grubs population of *A. proxima* per linear meter rows of test plants at 6.00 AM, 9.00 AM, 12.00 PM, 3.00 PM and at 6.00 PM. Data analysis was done statistically.

Results and Discussion

The results revealed that the highest cumulative mean grubs population of *A. proxima* were recorded 4.65 per linear meter row of plants on *B. campestris* cv. PT-30 followed by 4.42 on *B. juncea* cv. Varuna, 4.24 on *B. nigra* cv. PBR-I, 3.76 on *B. campestris* cv. BSH-I, 2.33 on *B. napus* cv. Sheetal, 2.06 on *B. carinata* cv. CCN-06-01, 2.00 on *B. campestris* cv. YST-151, 1.56 on *B. alba* cv. PSB-I, 0.33 on *E. Sativa* cv. T-27 and lowest 0.13 on *Crambe abyssinica* cv. CAI at 6.00 AM (Table 1).

At 9.00 AM it was highest on PBR-I (3.65) followed by Varuna (3.19), PT-30(3.18), BSH-I(2.88), CCN-06-01(2.21), Sheetal (2.15), YST-151(1.49), PSB-I(1.01), T-27(0.65), CAI(0.24) (Table 2).

At 12.00 PM the highest population was PBR-I (1.74) followed by PT-30(1.72), Varuna (1.46), BSH-I (1.36), YST-151 (1.13), Sheetal (1.06), CCN-06-01 (0.99), PSB-I (0.82), T-27 (0.21) and again lowest on CAI (0.08) (Table 3). At 3.00 PM (Table 4) the population of grub was highest on BSH-I(0.96) followed by PBR-I(0.71), Varuna(0.67), YST-151(0.67), PT-30(0.63),

Sheetal(0.53), CCN-06-01(0.43), PSB-I(0.40), T-27(0.18), CAI(0.05) whereas at 6.00 PM the highest population was 4.78 per liner meter row of plants on Varuna followed by 4.37 on BSH-I, 4.13 on PBR-I, 3.58 on PT-30, 2.81 on Sheetal, 2.35 on CCN-06-01, 2.00 on YST-151, 1.24 on PSB-I, 1.04 on CAI and lowest 0.54 on *E. sativa* cv. T-2-7 (Table 5).

On the basis of grand total find out that the highest grubs' population of *A. proxima* was recorded at 6.00 PM (2.68) followed by at 6.00 AM (2.55 per linear meter row of plants), 9.00 AM (2.07), 12.00 PM (1.06) and lowest at 3.00 PM (1.06) (Fig. 1).

It also concluded that among different species of Rapeseed-mustard, *Crambe abyssinica* (0.47) and *E. sativa* (0.38) were more resistant to *A. proxima* and *B. campestris* (2.75) and *B. juncea* (2.90) were more susceptible.

Three *Athalia* sawflies [*A. japonica* (Klug), *A. rosae ruficornis* Jakovlev, and *A. infumata* (Marlatt)] chose microhabitats, the suitability of each host plant for female oviposition and larval growth was similar.

Because of the divergent preferences for microhabitats, the host plants that were suitable for all the three steps were restricted to different sets of plants among the sawflies: *Cardamine* for *A. japonica*, cultivated crucifers (*Raphanus* and *Brassica*) for *A. rosae*, and *Rorippa* for *A. infumata*.

These plants could be recognised as the respective primary host plants (Koukichi and Naota 2002).

Significant negative impact of crop age was observed by Singh *et al.*, 2008. Larvae feed on leaves in groups of 3-6 larvae during the morning and evening periods. In day time the grubs are found hidden in leaves (Mathur and Upadhyay 2010).

Table.1 Population of active grubs of *Atahlia proxima* on different *Brassica* species at 6:00 A.M.

<i>Brassica</i> species	23 DAS	24 DAS	25 DAS	26 DAS	27 DAS	28 DAS	29 DAS	30 DAS	31 DAS	32 DAS	33 DAS	34 DAS	Mean
<i>B. alba</i> cv. PSB-I	3.33(10.37)	3.33(10.37)	2.00(7.80)	2.50(7.24)	1.67(5.94)	2.17(7.18)	0.50(2.87)	1.50(5.49)	0.50(2.87)	0.33(1.91)	0.50(2.87)	0.33(1.91)	1.56(5.54)
<i>E. sativa</i> cv.T-27	0.83(4.22)	0.50(2.87)	0.33(1.91)	0.00(0.00)	0.17(0.96)	0.67(2.62)	0.83(2.88)	0.00(0.00)	0.17(0.96)	0.33(1.91)	0.00(0.00)	0.17(0.96)	0.33(1.91)
<i>B. campestris</i> cv. BSH-I	11.17(17.83)	9.00(17.13)	5.50(13.49)	7.50(15.82)	6.33(14.36)	1.83(5.27)	1.17(4.93)	1.17(4.93)	0.83(4.78)	0.50(2.87)	0.00(0.00)	0.17(0.96)	3.76(8.53)
<i>B. napus</i> cv. Sheetal	5.67(13.69)	4.83(12.50)	3.67(10.56)	4.17(9.49)	2.50(7.40)	1.50(6.93)	1.67(5.58)	2.33(8.43)	0.67(3.27)	1.17(4.93)	0.17(0.96)	0.17(0.96)	2.33(7.05)
<i>B. carinata</i> cv. CCN-06-01	5.83(13.81)	4.17(11.62)	3.17(9.97)	2.67(8.45)	3.33(9.20)	2.33(8.69)	1.33(5.98)	0.83(4.22)	0.83(4.22)	0.17(0.96)	0.00(0.00)	0.00(0.00)	2.06(6.38)
<i>B. juncea</i> cv. Varuna	14.83(22.56)	11.67(19.64)	7.67(15.61)	4.83(12.51)	6.00(14.04)	3.33(9.34)	2.00(6.60)	1.67(5.02)	0.67(2.71)	0.50(2.87)	0.33(1.91)	0.00(0.00)	4.42(9.40)
<i>B. nigara</i> cv. PBR-I	12.67(20.03)	8.33(16.08)	5.33(13.23)	7.33(15.43)	6.67(14.76)	2.00(7.25)	2.00(7.25)	2.67(8.36)	1.00(3.97)	1.33(5.33)	0.50(2.87)	1.00(5.18)	4.24(10.04)
<i>Crambe abyssinica</i> cv. CA-I	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.17(0.96)	0.00(0.00)	0.83(3.02)	0.33(1.91)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.17(0.96)	0.00(0.00)	0.13(0.57)
<i>B. campestris</i> cv. YST-151	5.17(12.87)	4.17(11.64)	2.83(9.48)	4.17(11.52)	2.83(9.35)	0.17(0.96)	0.67(3.27)	1.00(4.62)	0.67(3.27)	1.50(6.84)	0.50(2.87)	0.33(1.91)	2.00(6.55)
<i>B. campestris</i> cv. PT-30	11.33(19.49)	7.83(16.04)	8.00(15.97)	12.83(20.42)	3.83(11.17)	3.33(8.41)	3.33(9.99)	3.33(10.32)	1.17(5.57)	0.83(4.78)	0.00(0.00)	0.00(0.00)	4.65(10.18)
Mean	7.08(13.49)	5.38(11.75)	3.85(9.80)	4.62(10.18)	3.33(8.71)	1.82(5.97)	1.33(5.19)	1.40(5.14)	0.65(3.11)	0.67(3.24)	0.22(1.24)	0.22(1.19)	2.55(6.59)
	<i>Brassica</i> species		DAS		<i>Brassica</i> species x DAS								
SEm±	0.229		0.251		0.794								
CD at 5%	0.637		0.698		2.206								

*Figure in Parenthesis are Angular Transformed Values, DAS= Days After Sowing

Table.2 Population of active grubs of *Atahlia proxima* on different *Brassica* species at 9:00 A.M.

<i>Brassica</i> species	23 DAS	24 DAS	25 DAS	26 DAS	27 DAS	28 DAS	29 DAS	30 DAS	31 DAS	32 DAS	33 DAS	34 DAS	Mean
<i>B. alba</i> cv. PSB-I	0.67(3.27)	1.50(4.67)	2.50(6.40)	1.33(4.54)	0.83(3.02)	1.17(3.51)	1.17(4.93)	1.50(5.64)	0.67(3.27)	0.17(0.96)	0.33(1.91)	0.33(1.91)	1.01(3.67)
<i>E. sativa</i> cv.T-27	0.33(1.91)	0.50(2.31)	1.83(5.43)	0.50(2.31)	0.17(0.96)	0.83(4.22)	0.50(2.31)	1.50(4.63)	0.83(4.22)	0.33(1.91)	0.33(1.91)	0.17(0.96)	0.65(2.84)
<i>B. campestris</i> cv. BSH-I	3.00(9.48)	7.33(15.31)	6.00(13.83)	5.67(13.41)	5.17(12.82)	1.83(6.94)	1.33(4.54)	1.33(5.75)	1.00(4.33)	1.17(5.58)	0.50(2.87)	0.17(0.96)	2.88(8.00)
<i>B. napus</i> cv. Sheetal	2.67(8.36)	5.83(13.57)	5.00(12.43)	3.17(9.97)	1.67(6.68)	0.83(3.67)	1.17(4.93)	2.67(9.09)	1.83(7.55)	0.83(3.67)	0.17(0.96)	0.00(0.00)	2.15(6.74)
<i>B. carinata</i> cv. CCN-06-01	3.50(10.49)	4.33(11.57)	5.00(12.49)	3.33(10.29)	3.50(10.24)	0.83(3.58)	2.17(8.35)	1.67(6.59)	0.67(2.62)	1.00(4.62)	0.50(2.87)	0.00(0.00)	2.21(6.98)
<i>B. juncea</i> cv. Varuna	5.33(12.98)	6.33(13.59)	6.67(14.56)	5.33(12.30)	4.83(12.06)	1.50(6.29)	2.83(9.15)	1.67(6.68)	1.50(6.19)	1.33(5.33)	0.67(3.27)	0.33(1.91)	3.19(8.69)
<i>B. nigara</i> cv. PBR-I	6.17(13.55)	5.17(12.40)	7.17(14.82)	6.83(14.96)	6.33(14.25)	2.17(6.69)	3.67(9.54)	2.50(8.05)	1.00(4.62)	1.33(5.98)	1.00(4.62)	0.50(2.87)	3.65(9.36)
<i>Crambe abyssinica</i> cv. CA-I	0.00(0.00)	0.17(0.96)	0.33(1.36)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.33(1.91)	1.00(3.97)	0.17(0.96)	0.33(1.91)	0.00(0.00)	0.33(1.91)	0.24(1.11)
<i>B. campestris</i> cv. YST-151	1.33(4.54)	2.50(7.67)	3.33(10.12)	2.83(9.45)	1.67(6.45)	1.33(5.98)	1.00(3.97)	2.00(7.95)	1.17(5.02)	0.33(1.91)	0.17(0.96)	0.17(0.96)	1.49(5.42)
<i>B. campestris</i> cv. PT-30	2.83(9.48)	6.33(14.05)	7.50(15.40)	5.50(13.15)	4.33(11.16)	2.00(6.53)	4.67(12.41)	2.67(9.22)	1.00(3.97)	1.00(4.07)	0.33(1.91)	0.00(0.00)	3.18(8.45)
Mean	2.58(7.41)	4.00(9.61)	4.53(10.68)	3.47(9.14)	2.85(7.77)	1.25(4.74)	1.88(6.15)	1.85(6.86)	0.98(4.29)	0.78(3.59)	0.40(2.13)	0.20(1.15)	2.07(6.13)
	<i>Brassica</i> species		DAS		<i>Brassica</i> species x DAS								
SEm±	0.219		0.20		0.759								
CD at 5%	0.609		0.667		2.110								

*Figure in Parenthesis are Angular Transformed Values, DAS= Days After Sowing

Table.3 Population of active grubs of *Atahlia proxima* on different *Brassica* species at 12:00 P.M.

<i>Brassica</i> species	23 DAS	24 DAS	25 DAS	26 DAS	27 DAS	28 DAS	29 DAS	30 DAS	31 DAS	32 DAS	33 DAS	34 DAS	Mean
<i>B. alba</i> cv. PSB-I	1.50(5.64)	1.83(5.94)	1.17(3.51)	1.00(3.97)	2.33(7.09)	0.50(2.87)	0.83(2.88)	0.17(0.96)	0.17(0.96)	0.00(0.00)	0.17(0.96)	0.17(0.96)	0.82(2.98)
<i>E. sativa</i> cv.T-27	0.17(0.96)	0.00(0.00)	1.67(5.89)	0.17(0.96)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.33(1.91)	0.00(0.00)	0.00(0.00)	0.21(0.89)
<i>B. campestris</i> cv. BSH-I	4.50(12.01)	3.67(9.93)	2.33(7.49)	2.00(7.25)	2.17(8.35)	0.67(3.27)	0.67(3.27)	0.17(0.96)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.00(0.00)	1.36(4.46)
<i>B. napus</i> cv. Sheetal	2.00(7.73)	1.67(6.68)	1.67(4.98)	2.17(6.91)	2.50(7.24)	1.33(5.75)	0.67(2.71)	0.33(1.36)	0.33(1.91)	0.00(0.00)	0.00(0.00)	0.00(0.00)	1.06(3.77)
<i>B. carinata</i> cv. CCN-06-01	3.33(10.13)	2.67(8.91)	1.00(4.53)	2.33(7.82)	1.17(4.37)	0.17(0.96)	0.33(1.36)	0.00(0.00)	0.83(3.02)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.99(3.42)
<i>B. juncea</i> cv. Varuna	4.17(11.49)	3.00(8.96)	3.17(8.89)	1.83(6.85)	2.00(7.95)	1.33(4.54)	1.17(4.93)	0.17(0.96)	0.33(1.91)	0.33(1.91)	0.00(0.00)	0.00(0.00)	1.46(4.87)
<i>B. nigara</i> cv. PBR-I	3.17(9.11)	4.00(11.22)	3.17(10.01)	3.00(9.80)	1.83(6.99)	1.50(6.29)	0.67(2.71)	1.17(3.59)	0.50(2.31)	0.50(1.66)	0.83(3.02)	0.50(2.31)	1.74(5.75)
<i>Crambe abyssinica</i> cv. CA-I	0.00(0.00)	0.00(0.00)	0.33(1.91)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.50(1.66)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.17(0.96)	0.00(0.00)	0.08(0.38)
<i>B. campestris</i> cv. YST-151	2.17(8.04)	2.50(7.24)	3.17(7.84)	1.33(5.33)	1.17(4.37)	1.00(4.53)	1.17(4.93)	0.17(0.96)	0.17(0.96)	0.00(0.00)	0.33(1.91)	0.33(1.91)	1.13(4.05)
<i>B. campestris</i> cv. PT-30	4.33(11.67)	4.00(11.26)	2.83(8.57)	3.00(9.49)	2.00(7.95)	0.83(4.22)	2.00(6.43)	0.67(2.62)	0.83(3.58)	0.17(0.96)	0.00(0.00)	0.00(0.00)	1.72(5.56)
Mean	2.53(7.68)	2.33(7.01)	2.05(6.36)	1.68(5.83)	1.53(5.58)	0.73(3.24)	0.80(3.09)	0.28(1.14)	0.33(1.91)	0.13(0.64)	0.15(0.68)	0.10(0.52)	1.06(3.61)
	<i>Brassica</i> species		DAS		<i>Brassica</i> species x DAS								
SEm±	0.148		0.162		0.513								
CD at 5%	0.411		0.451		1.425								

*Figure in Parenthesis are Angular Transformed Values, DAS= Days After Sowing

Table.4 Population of active grubs of *Atahlia proxima* on different *Brassica* species at 3:00 P.M.

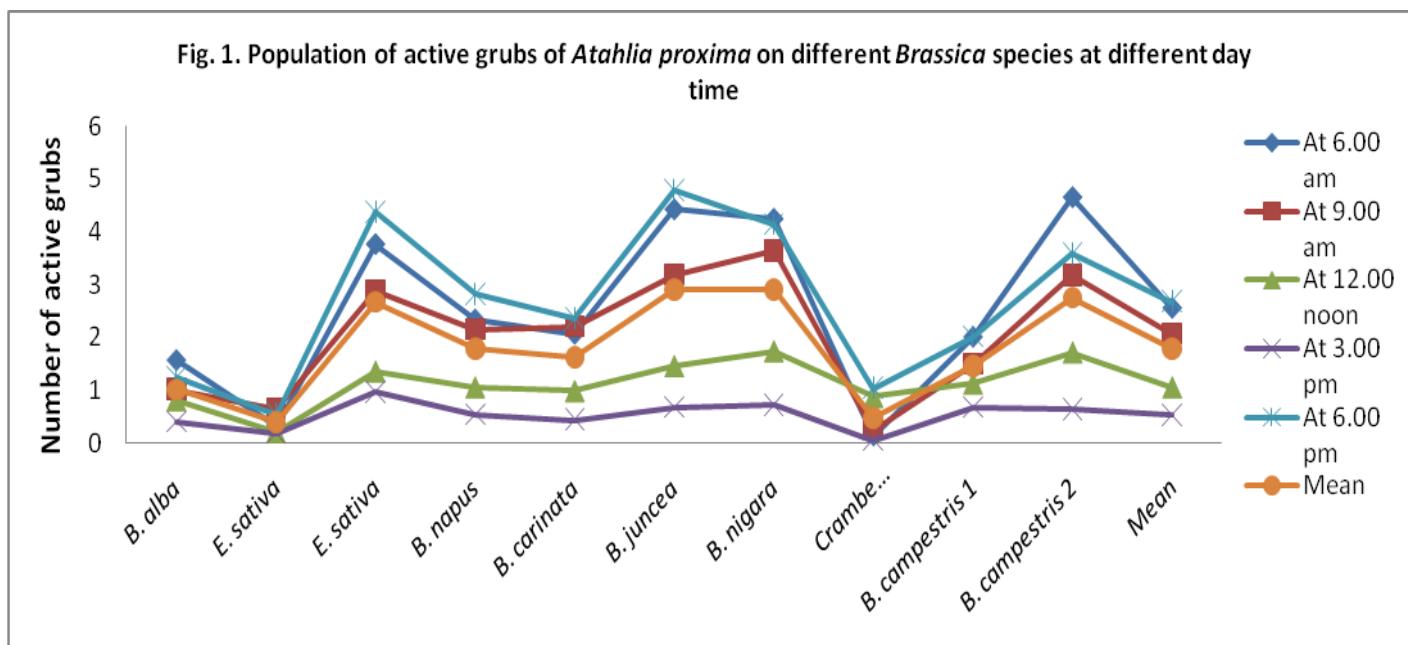
<i>Brassica</i> species	23 DAS	24 DAS	25 DAS	26 DAS	27 DAS	28 DAS	29 DAS	30 DAS	31 DAS	32 DAS	33 DAS	34 DAS	Mean
<i>B. alba</i> cv. PSB-I	0.67(3.27)	0.33(1.91)	0.83(3.02)	0.50(2.31)	1.00(3.97)	0.50(2.31)	0.50(2.31)	0.50(2.31)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.40(1.78)
<i>E. sativa</i> cv.T-27	0.16(0.95)	0.50(2.31)	0.17(0.96)	0.33(1.91)	0.33(1.91)	0.17(0.96)	0.17(0.96)	0.33(1.91)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.18(0.89)
<i>B. campestris</i> cv. BSH-I	1.83(7.64)	1.67(6.59)	1.83(6.99)	1.33(5.33)	2.17(8.35)	1.17(4.93)	0.67(3.27)	0.17(0.96)	0.17(0.96)	0.33(1.91)	0.17(0.96)	0.00(0.00)	0.96(3.94)
<i>B. napus</i> cv. Sheetal	1.00(5.18)	0.67(3.27)	1.00(5.18)	0.83(3.67)	0.83(3.67)	1.00(3.97)	0.33(1.91)	0.50(2.31)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.53(2.51)
<i>B. carinata</i> cv. CCN-06-01	1.17(5.57)	0.67(3.27)	0.33(1.91)	1.00(4.62)	0.50(2.31)	0.50(2.31)	0.00(0.00)	0.17(0.96)	0.33(1.91)	0.17(0.96)	0.33(1.91)	0.00(0.00)	0.43(2.15)
<i>B. juncea</i> cv. Varuna	1.67(7.24)	1.17(5.58)	0.67(3.27)	0.67(3.27)	0.83(3.67)	1.17(4.93)	0.83(3.67)	0.50(2.86)	0.33(1.91)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.67(3.16)
<i>B. nigara</i> cv. PBR-I	1.50(6.93)	1.50(6.29)	0.83(3.67)	0.83(3.67)	0.67(3.27)	0.67(3.27)	0.67(3.27)	0.83(3.67)	0.17(0.96)	0.83(3.67)	0.00(0.00)	0.00(0.00)	0.71(3.45)
<i>Crambe abyssinica</i> cv. CA-I	0.17(0.96)	0.17(0.96)	0.00(0.00)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.05(0.32)
<i>B. campestris</i> cv. YST-151	1.17(5.58)	1.50(6.29)	1.33(5.89)	0.83(3.67)	1.00(4.62)	0.33(1.91)	1.00(4.62)	0.33(1.91)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.67(3.16)
<i>B. campestris</i> cv. PT-30	0.83(3.67)	1.00(4.62)	1.50(6.28)	1.50(6.28)	0.83(3.67)	0.83(3.67)	0.17(0.96)	0.33(1.91)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.63(3.01)
Mean	1.02(4.76)	0.92(4.11)	0.85(3.77)	0.80(3.68)	0.81(3.54)	0.63(2.99)	0.45(2.25)	0.37(1.88)	0.18(1.05)	0.18(0.94)	0.05(0.29)	0.00(0.00)	0.52(2.44)
	<i>Brassica</i> species		DAS		<i>Brassica</i> species x DAS								
SEm±	0.078		0.086		0.271								
CD at 5%	0.217		0.238		0.754								

*Figure in Parenthesis are Angular Transformed Values, DAS= Days After Sowing

Table.5 Population of active grubs of *Atahlia proxima* on different *Brassica* species at 6:00 P.M.

<i>Brassica</i> species	23 DAS	24 DAS	25 DAS	26 DAS	27 DAS	28 DAS	29 DAS	30 DAS	31 DAS	32 DAS	33 DAS	34 DAS	Mean	
<i>B. alba</i> cv. PSB-I	4.83(12.37)	2.83(8.62)	2.17(7.55)	2.50(8.13)	0.33(1.91)	0.33(1.91)	0.33(1.91)	0.67(3.27)	0.17(0.96)	0.33(1.91)	0.17(0.96)	0.17(0.96)	1.24(4.11)	
<i>E. sativa</i> cv.T-27	1.17(4.93)	1.00(3.97)	0.50(2.31)	0.83(3.67)	0.83(3.67)	1.00(3.97)	0.67(2.61)	0.33(1.91)	0.00(0.00)	0.17(0.96)	0.00(0.00)	0.00(0.00)	0.54(2.28)	
<i>B. campestris</i> cv. BSH-I	16.67(24.03)	11.17(19.29)	7.83(15.69)	7.00(14.74)	1.83(7.64)	1.67(7.24)	1.50(6.93)	2.17(7.65)	1.67(5.58)	0.67(3.83)	0.50(2.31)	0.33(1.91)	4.37(9.74)	
<i>B. napus</i> cv. Sheetal	8.17(16.15)	6.50(14.36)	3.67(10.43)	4.17(11.65)	2.17(8.29)	2.17(8.35)	1.83(6.99)	2.83(9.22)	1.50(6.29)	0.50(2.87)	0.33(1.91)	0.00(0.00)	2.81(8.04)	
<i>B. carinata</i> cv. CCN-06-01	11.67(19.68)	2.83(9.49)	2.83(8.83)	3.00(9.80)	1.17(4.93)	1.50(5.73)	1.33(5.33)	2.00(8.04)	1.17(5.56)	0.50(2.31)	0.17(0.96)	0.00(0.00)	2.35(6.72)	
<i>B. juncea</i> cv. Varuna	15.83(23.09)	8.33(16.27)	10.00(17.82)	10.50(18.46)	3.33(9.25)	2.50(8.09)	2.00(7.95)	2.50(8.74)	0.83(3.67)	1.00(4.62)	0.33(1.91)	0.17(0.96)	4.78(10.12)	
<i>B. nigara</i> cv. PBR-I	15.67(23.22)	6.83(13.47)	7.50(15.81)	6.00(12.77)	2.67(8.15)	2.00(7.25)	1.50(6.93)	3.83(9.62)	2.17(6.94)	0.83(3.67)	0.50(2.87)	0.00(0.00)	4.13(9.26)	
<i>Crambe abyssinica</i> cv. CA-I	5.50(9.63)	0.50(2.31)	2.67(6.22)	0.67(2.62)	0.33(1.91)	0.33(1.36)	0.50(2.31)	0.83(3.67)	1.00(4.62)	0.17(0.96)	0.00(0.00)	0.00(0.00)	1.04(2.91)	
<i>B. campestris</i> cv. YST-151	6.33(14.42)	2.67(9.17)	3.00(9.61)	3.83(11.11)	1.83(7.64)	1.67(7.33)	1.33(5.98)	1.67(6.68)	0.50(2.31)	0.67(3.83)	0.33(1.91)	0.17(0.96)	2.00(6.70)	
<i>B. campestris</i> cv. PT-30	11.50(19.71)	9.17(17.13)	6.67(14.23)	6.67(14.41)	2.67(9.31)	2.17(8.35)	1.33(5.89)	1.33(5.19)	0.50(2.31)	0.67(3.83)	0.17(0.96)	0.17(0.96)	3.58(8.52)	
Mean	9.73(16.72)	5.18(11.41)	4.68(10.85)	4.51(10.67)	1.72(6.27)	1.53(5.90)	1.23(5.23)	1.82(6.33)	0.90(3.86)	0.55(2.88)	0.25(1.38)	0.10(0.57)	2.67(6.84)	
<i>Brassica</i> species		DAS		<i>Brassica</i> species x DAS										
SEM±	0.250		0.274		0.867									
CD at 5%	0.695		0.761		2.407									

*Figure in Parenthesis are Angular Transformed Values, DAS= Days After Sowing



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How to cite this article:

Wajid Hasan, Harikesh Singh and Singh, C.P. 2017. Foraging Behavior and Differences in Host Plant Selection of Mustard Saw Fly, *Athalia lugens proxima* Klug. on Different *Brassica* Species. *Int.J.Curr.Microbiol.App.Sci*. 6(7): 2289-2294.
doi: <https://doi.org/10.20546/ijcmas.2017.607.329>