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Kalpana Bisht
Department of Entomology and Agricultural Zoology, B.H.U, Varanasi, Uttar Pradesh, India

NN Singh
Department of Entomology and Agricultural Zoology, B.H.U, Varanasi, Uttar Pradesh, India

SVS Raju
Department of Entomology and Agricultural Zoology, B.H.U, Varanasi, Uttar Pradesh, India

Correspondence
Kalpana Bisht
Department of Entomology and Agricultural Zoology, B.H.U, Varanasi, Uttar Pradesh, India

Evaluation of comparative resistance in tomato varieties/germplasms against fruit borer, *Helicoverpa armigera* (Hubner)

Kalpana Bisht, NN Singh and SVS Raju

Abstract
Twenty two varieties/germplasms viz., VRT-2, Sel-7, VRT-51, VRT-01, KT-8, VRT-50, ToLCV-32, ToLCV-28, VRT-13, ToLCV-16, VRT-19, H-86, VKT-06, Pb Barkha-1, Pb Barkha-2, Sankranti, Nandi, Vaibhav, DVRT-1, DVRT-2, Kashi Sharad and Pusa Rohit were studied for the evaluation of comparative resistance among them for consecutive two years i.e 2017-18 and 2018-19. To draw the conclusions the observations were obtained on number of *H. armigera* eggs per plant, *H. armigera* larva per plant, per cent fruit damage and per cent fruit weight loss. As per the two years experimental results none of the variety/germplasm was recorded Immune, the varieties/germplasms Pb Barkha-1, Pb Barkha-2, DVRT-1, DVRT-2, Kashi Sharad, Pusa Rohit were found Resistant (R) as they recorded per cent fruit damage between 0.1-10, the varieties/germplasms Sel-7, ToLCV-32, ToLCV-28, ToLCV-16, Sankranti were categories as moderately resistant (MR) by recording per cent fruit damage between 10.1-20, however moderately susceptible (MS) varieties/germplasms were VRT-2, VRT-51, VRT-01, VRT-50, VRT-13, VRT-19, while varieties/germplasms VKT-06, Nandi, Vaibhav were scaled as susceptible (S) with 30.1-40 per cent fruit damage, moreover, KT-8 and H-86 recorded 40.1 & above per cent fruit damage and categorized as highly susceptible (HS) varieties/germplasms.

Keywords: Tomato, *Helicoverpa armigera*, relative resistance, seasonal incidence, standard meteorological week

1. Introduction
Vegetables are not only the important source of balance dietary contents *viz.*, proteins, unsaturated fat, carbohydrate, minerals and vitamins but also give good returns per unit area as compared to cereals in minimum of time. It is one of the most preferred vegetable crop with the total global area of 45,82,438 ('000 ha), production 15,05,13,813 ('000 tonnes) and productivity is around 32.84 (t/ha). China ranks first by occupying 8,71,235 ('000 ha) area, production 4,18,79,684 ('000 tonnes) and productivity 48.1 (t/ha) while India ranks second by accounting the total area of 8,65,000 ('000 ha), production of 168,26,000 ('000 tonnes) and productivity 19.5 (t/ha) [1]. The main reason is for low productivity is its proneness to insect pests *viz*., tomato fruit borer, green house whitefly, serpentine leaf miner, etc. due to its tenderness and softness as compared to other crops [9, 12]. Among them, the tomato fruit borer, *Helicoverpa armigera* (Hubner) is main bottle neck and causes heavy loss in yield. Due to its high fecundity, polyphagous nature, hiding behaviour and development of quick resistance against insecticides make their management quiet difficult, rather impossible. The versatility of this species may be due to the presence of a strong genetic variability governing the behaviour of *H. armigera* making it a serious pest on several crops [11, 15]. Hence, host plant resistance proves an effective component of IPM, which refers to the heritable qualities of a cultivar to counteract the activities of insects to cause minimum per cent reduction in yield as compared to other cultivars of the same species under similar conditions [4, 12]. The development of tomato fruit borer resistant/tolerant cultivars will be a great idea in overall management of this pest. Therefore, with the above background, present investigations were carried out to determine the source of resistance with following objective i.e. evaluation of comparative resistance in tomato varieties/germplasms against fruit borer *Helicoverpa armigera* (Hubner)

2. Materials and Methods
The experiment was carried out under field conditions at Vegetable Research Farm, Institute of Agricultural Sciences, B.H.U. Varanasi, during rabi season of the year 2017-18 and 2018-19.

It was laid out in Randomized Block Design (RBD) in four replications, the seedlings of twenty two varieties/germplasms viz., VRT-2, Sel-7, VRT-51, VRT-01, KT-8, VRT-50, ToLCV-32, ToLCV-28, VRT-13, ToLCV-16, VRT-19, H-86, VKT-06, Pb Barkha-1, Pb Barkha-2, Sankranti, Nandi, Vaibhav, DVRT-1, DVRT-2, Kashi Sharad and Pusa Rohit were transplanted at 5-6 leaves stage in the main field at the spacing of 60cm x 45cm. The screening of different varieties/germplasms of tomato against *H. armigera* was done for two years for which the observations were obtained on number of *H. armigera* eggs per plant, *H. armigera* larva per plant, per cent fruit damage and per cent fruit weight loss. The observations were recorded on ten randomly selected plants from each row starting with first week till harvesting of the crop at weekly interval on both the years of studies. The per cent fruit damage and per cent fruit weight loss the observations were recorded at the time of each picking by using the formula suggested by Pradhan (1969). Later on the basis of per cent fruit weight loss, the variety/germplasm was rated for different levels of resistance as suggested by Kashyap and Verma, 1987 [7].

$$\text{Per cent fruit damage} = \frac{\text{Number of damaged fruits}}{\text{Total number of tomato fruits}} \text{x100}$$

$$\text{Per cent fruit weight loss} = \frac{\text{Weight of damaged fruits}}{\text{Total weight of tomato fruits}} \text{x100}$$

2.1 Statistical analysis
The data recorded during the course of investigation, were also analysed with the help of computer software "OPSTAT1" developed by O.P. Sheroran (1998).

3. Results and Discussion
The pooled data of two experimental years 2017-18 and 2018-19 on number of *H. armigera* eggs per plant, *H. armigera* larva per plant, per cent fruit damage and per cent fruit weight loss are presented in the Table 1 to 4 and figure 1, 2 respectively.

3.1 Observations on number of *H. armigera* eggs per plant
The initial appearance of *H. armigera* egg population started with the start of November i.e. 4th week after transplanting in both the years. On the first week of observation the egg population was recorded between 0.41 to 1.86 eggs/plant in different varieties/germplasms **(**Table -2). The lowest egg population of *H. armigera* on different variety/germplasms of tomato during first week of observation was recorded on variety/germplasm Sankranti (0.41 eggs/plant) which was at par with Pb-Barkha-1 (0.42 eggs/plant). The highest mean egg population of fruit borer was recorded in KT-8 (1.86 eggs/plant) and next highest egg population was recorded on variety/germplasm H-86 (1.63 eggs/plant). The rest of the varieties/germplasms *viz*., Pb-Barkha-2, DVRT-2, DVRT-1, Kashi Sharad, Pusa Rohit, ToLCV-32, Sel-7, ToLCV-28,ToLCV-16, VRT-2, VRT-51, VRT-01, VRT-50, VRT-13, VRT-19, VKT-06, Nandi and Vaibhav exhibited a mean of 0.45, 0.47, 0.52, 0.52, 0.55, 0.60, 0.64, 0.73, 0.79, 1.19, 1.09, 1.19, 1.21, 1.21, 1.18, 1.25, 1.16 and 1.20 eggs/plant respectively. The egg population of fruit borer was observed to be increasing till mid of January **(**10th week) recording 0.87 to 2.39 eggs/plant in Sankranti and H-86 respectively and then gradually decreased upto last week of observation. During the last week of February the variety/germplasm Pb Barkha-1 registered minimum egg population with 0.80 eggs/plant among all the varieties/germplasms screened which was statistically at par with Sankranti (0.82 eggs/plant), Pb-Barkha-2 (0.83 eggs/plant) and DVRT-2 (0.87 eggs/plant). Significantly highest egg population was found in KT-8 (1.83 eggs/plant) while rest of the varieties/germplasms *viz*., Pusa Rohit, DVRT-1, Kashi Sharad, ToLCV-32, Sel-7, VRT-51, VRT-01, VRT-50, ToLCV-28, ToLCV-16, H-86, VKT-06, Nandi, VRT-19, Vaibhav, VRT-13 and VRT-2 displayed mean egg population range between 0.91 to 1.63 eggs/plant.

These results concord with those reported by Jagdish *et al* (2017), who recorded maximal and minimal number of mean egg population recorded of 12.86, 8.33 on ICC3137, D059 and 5.43, 3.60 on ICCV92944, respectively for 2012-13, 2013-14 seasons from selected five plants. Similar results were reported by Thakur (2015) where the egg count of the pest ranged from 2.41 to 0.65 egg/plant. The lowest egg count (0.65 egg/plant) was recorded on 'Naveen 2000+' which was statistically at par with 'Palam Pink' (0.96 eggs/plant) and 'Solan Lalima' (0.77 egg/plant). The results drawn by Jagdish and Thakur were found in favour of present investigations.

3.2 Observations on number of *H. armigera* larva per plant
Similar trend was observed for larva per plant where the appearance of *H. armigera* larva started in mid of November (Table 3 and Figure 1). The lowest larval population of *H. armigera* on different variety/germplasms of tomato during first week of observation was recorded on variety/germplasm Pb Barkha-2 (0.18 larva/plant) followed by Sankranti, DVRT-2 and Pusa Rohit i.e. 0.26 larva/plant on each variety/germplasm. The highest larval population of fruit borer was recorded in KT-8 (1.57 larva/plant) while rest of the varieties/germplasms *viz.*, VRT-2, Sel-7, VRT-51, VRT-01, VRT-50, ToLCV-32, ToLCV-28, VRT-13, ToLCV-16, VRT-19, H-86, VKT-06, Pb Barkha-1, Nandi, Vaibhav, DVRT-1 and Kashi Sharad ranged between 0.37 to 1.22 larva/plant. The population of fruit borer larvae gradually increased from mid November to end of January or the start of February and then it gradually decreased by the start of March. At eleventh week, the larval population ranged between 0.48 to 1.86 in Pb Barkha-1 and H-86 respectively. The last week of observation registered minimum larval population i.e. 0.34 larva/plant in Pb Barkha-2 which was statistically at par with Pb-Barkha-1 (0.36 larva/plant), Sankranti (0.38 larva/plant), Pusa Rohit (0.43 larva/plant) and DVRT-2 (0.45 larva/plant). Significantly, highest larval population was found in KT-8 (1.64 larva/plant) which was found to be statistically at par with H-86 (1.51 larva/plant). The rest of the varieties/germplasms *viz.*,VRT-2, Sel-7, VRT-51, VRT-01, VRT-50, ToLCV-32, ToLCV-28, VRT-13, ToLCV-16, VRT-19, VKT-06, Nandi, Vaibhav, DVRT-1 and Kashi Sharad displayed an intermediate range between 0.60 to 1.34 larva/plant.

Previously the studies done by, Jamadar (2006) [6] observed that variety PKM-1 existed lowest larval population (0.68 larva/plant) of fruit borer. Selvanarayanan and Narayanasamy (2006) [10] noticed that PT 4287, Seijima Jeisei, Varushanadu Local and I 979 ('S' check) exhibited 0.23, 0.30, 0.20 and 0.82 larval population/plant respectively. Sajjad *et al*. (2011) [9] revealed that the genotypes Sahil, Pakit and Nova Mecb had 0.42, 10.42 and 0.43 per cent larval population, respectively. Ashfaq *et al*. (2012) [3] screened nine tomato varieties to check the susceptibility against *H. armigera*.

Usman *et al*. (2013) [14] observed that the genotype Chinar, Mission 102 and RK 101 existed 1.52, 1.60 and 1.61 larvae/plant, respectively. Ambule (2013) observed minimum larval population was recorded on NTL-14(0.71 larva/plant) followed by NTL-7 (0.92 larva/plant), NTL-2 (0.96 larva/plant) and NTL-11 (1.06 larvae/plant). The next minimum larval
population of *H. armigera* was observed on NTL-13, NTL-6 and NTL-12 with 1.19, 1.23 and 1.25 larvae/plant, respectively. Thakur (2017) [13] reported larval count per plant ranged from 1.45 to 0.17 larvae/plant. In all the studies the larval population had negative correlation with the resistance of the variety, which was found in favour of the present investigation.

3.3 Observations on Per cent fruit damage

During first picking the significantly highest fruit borer attack was observed in variety/germplasm KT-8 which showed 28.24 per cent fruit damage while the variety/germplasm Pb Barkha-1 recorded significantly lowest fruit infestation (3.01%) (Table 4). Rest of the varieties/germplasms *viz*., Kashi Sharad, DVRT-2, Pusa Rohit, Pb Barkha-2, Sel-7, DVRT-1, ToLCV-32, ToLCV-28, ToLCV-16, Sankranti, VRT-51, VRT-50, VRT-19, VRT-01, VRT-13, VRT-2, Vaibhav, Nandi, VKT-06 and H-86 exhibited 3.37, 4.36, 4.49, 6.05, 6.79, 8.34, 9.43, 12.09, 12.41, 12.43, 13.11, 13.18, 14.18, 14.32, 16.98, 16.80, 21.76, 22.47, 23.23, 25.88 per cent fruit infestation, respectively at first picking of tomato fruits. The fruit infestation by *H. armigera* in tomato variety/germplasm was gradually increased from first week of December to mid February and then gradually decreased up to last week of March. During the last week of picking lowest fruit infestation was found in Pb Barkha-1 (4.09%) while the highest fruit infestation was found in KT-8 (31.62%). The varieties/germplasms *viz*., VRT-2, Sel-7, VRT-51, VRT-01, VRT-50, ToLCV-32, ToLCV-28, VRT-13 ToLCV-16, VRT-19, H-86, VKT-06, Pb Barkha-2, Sankranti, Nandi, Vaibhav, DVRT-1, DVRT-2, Kashi Sharad and Pusa Rohit registered fruit infestation ranged between (4.68 to 28.38%) caused by *H. armigera* on both the years of the study.

3.4 Observations on Per cent fruit weight loss

During the first picking, i.e. first week of December the lowest fruit infestation on weight basis was recorded on variety/germplasm Kashi Sharad (3.12%) while the next low fruit infestation on weight basis was recorded on Pb Barkha-1 (4.68%) which was found to be at par with DVRT-1 (4.83%) (Table 5 and Figure 2). The variety/germplasm KT-8 showed the highest fruit infestation (43.02%). Moreover, the varieties/germplasms *viz.*, H-86, Nandi, VKT-06, Vaibhav, VRT-13, VRT-50, VRT-2, VRT-01, VRT-19, VRT-51, Sankranti, ToLCV-16, ToLCV-28, ToLCV-32, DVRT-2, Pb Barkha-2, Pusa Rohit and Sel-7 reflected 40.88, 33.89, 29.92, 27.71, 25.07, 22.88, 21.48, 17.52, 17.16, 16.23, 13.47, 12.19, 9.79, 9.57, 6.71, 6.95, 7.93 and 9.30 per cent fruit infestation, respectively. The fruit infestation by *H. armigera* in tomato variety/germplasm was gradually increased from first week of December to mid February picking and gradually decreased up to mid march on all the varieties/germplasms. At eleventh picking significantly highest infestation was showed by variety/germplasm KT-8 (46.12%) and the lowest infestation was recorded on Kashi Sharad (6.17%). During the last week of observation the lowest fruit infestation was found in Kashi Sharad (6.47%). Whereas, the significantly highest fruit infestation was found in KT-8 (44.08%). which was comparable with varieties/germplasms. Rest of the varieties/germplasms *viz*., VRT-2, VRT-51, VRT-01, VRT-50, ToLCV-32, ToLCV-28, VRT-13, ToLCV-16, VRT-19, H-86, Nandi, VKT-06, Pb Barkha-1, Pb Barkha-2, Vaibhav, DVRT-1, Sankranti, Sel-7, DVRT-2 and Pusa Rohit registered fruit borer on weight basis in the range of 7.53 to 42.13 per cent.

Kashyap and Verma (1987) [7] reported that Pusa-Ruby was found to susceptibility against *H. armigera* among the various genotypes screened. However, Ambule (2014) [2] reported lowest fruit weight loss in moderatey resistant germplasms NTL-14 (10.32%) which was at par with NTL-7 (11.72%) and NTL-2 (13.17%) while the highest fruit weight loss was recorded on susceptible germplasm GT -2 (31.05%) and it was comparable with NTL-10 (27.52%), which depicted negative correation with per cent fruit weight loss and degree of resistance. These previous studies were found similar to present studies.

3.5 Categorization of tomato varieties/germplasms for susceptibility to fruit borer

All the tomato varieties/germplasms taken for studies were rated into six categories of resistance/susceptibility to *H. armigera* viz., Immune, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible.

Table 1: Categorization of tomato varieties/germplasms based on the mean per cent fruit weight loss

S. No.	Damage level	Varieties/Germplasms	Rating
1	No damage	Nil	Immune (I)
2	0.1-10	Pb Barkha-1, Pb Barkha-2, DVRT-1, DVRT-2, Kashi Sharad, Pusa Rohit	Resistant (R)
3	10.1-20	Sel-7, ToLCV-32, ToLCV-28, ToLCV-16, Sankranti	Moderately resistant (MR)
4	20.1-30	VRT-2, VRT-51, VRT-01, VRT-50, VRT-13, VRT-19	Moderately Susceptible (MS)
5	30.1-40	VKT-06, Nandi, Vaibhav	Susceptible (S)
6	40.1 & above	KT-8, H-86	Highly susceptible (HS)

4. Conclusion

The results revealed that the initial appearance of *H. armigera* in Varanasi region started from 45th SMW and population builds up continues till 12th SMW. However, all twenty two varieties/germplasms were categorized on scale *viz.*, Immune (I): None, Resistant (R): Pb Barkha-1, Pb Barkha-2, DVRT-1, DVRT-2, Kashi Sharad, Pusa Rohit, Moderately resistant (MR): Sel-7, ToLCV-32, ToLCV-28, ToLCV-16, Sankranti, Moderately Susceptible (MS): VRT-2, VRT-51, VRT-01, VRT-50, VRT-13, VRT-19, Susceptible (S): VKT-06, Nandi, Vaibhav and Highly susceptible (HS): KT-8 and H-86

Table 2: Ovipositional response of *H. armigera* on different tomato varieties/germplasms during 2017 – 18 and 2018-19 (Pooled Data)

Varieties /Germplasms	*Average number of *H. armigera* eggs/plant at weekly interval															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Overall Mean
VRT-2	1.19 (1.45)	1.23 (1.46)	1.35 (1.52)	1.46 (1.55)	1.49 (1.56)	1.56 (1.59)	1.63 (1.62)	1.67 (1.63)	1.69 (1.63)	1.71 (1.64)	1.73 (1.67)	1.69 (1.69)	1.49 (1.57)	1.30 (1.50)	1.10 (1.40)	1.42 (1.50)
Sel-7	0.64 (1.28)	0.80 (1.32)	0.84 (1.35)	0.87 (1.36)	0.90 (1.35)	0.96 (1.36)	0.99 (1.37)	1.01 (1.23)	1.04 (1.39)	1.16 (1.42)	1.03 (1.36)	0.98 (1.33)	0.85 (1.25)	0.74 (1.18)	0.55 (1.06)	0.99 (1.60)
VRT-51	1.09 (1.42)	1.24 (1.48)	1.28 (1.48)	1.35 (1.52)	1.47 (1.58)	1.51 (1.59)	1.60 (1.64)	1.63 (1.48)	1.70 (1.68)	1.78 (1.71)	1.56 (1.56)	1.49 (1.55)	1.33 (1.47)	1.28 (1.45)	1.16 (1.39)	1.36 (1.66)
VRT-01	1.19 (1.46)	1.27 (1.50)	1.32 (1.51)	1.35 (1.52)	1.38 (1.54)	1.44 (1.56)	1.49 (1.58)	1.50 (1.62)	1.63 (1.64)	1.69 (1.67)	1.64 (1.61)	1.41 (1.52)	1.37 (1.51)	1.27 (1.46)	1.13 (1.37)	1.39 (1.43)
KT-8	1.86 (1.76)	1.86 (1.78)	1.94 (1.79)	1.94 (1.78)	2.03 (1.79)	2.10 (1.78)	2.11 (1.78)	2.18 (1.66)	2.27 (1.83)	1.89 (1.63)	1.94 (1.63)	1.80 (1.64)	2.02 (1.72)	1.59 (1.60)	1.58 (1.62)	1.83 (1.35)
VRT-50	1.21 (1.47)	1.24 (1.49)	1.22 (1.47)	1.26 (1.48)	1.31 (1.51)	1.34 (1.52)	1.39 (1.55)	1.41 (1.88)	1.45 (1.57)	1.51 (1.61)	1.50 (1.58)	1.43 (1.56)	1.31 (1.49)	1.23 (1.45)	1.08 (1.35)	1.35 (1.37)
ToLCV-32	0.60 (1.17)	0.63 (1.18)	0.66 (1.20)	0.75 (1.25)	0.80 (1.27)	0.85 (1.28)	0.91 (1.32)	0.97 (1.49)	1.06 (1.42)	1.09 (1.42)	1.15 (1.46)	1.14 (1.46)	1.01 (1.39)	0.93 (1.36)	0.86 (1.32)	0.95 (1.34)
ToLCV-28	0.73 (1.28)	0.80 (1.32)	0.86 (1.35)	0.88 (1.36)	0.88 (1.35)	0.91 (1.36)	0.95 (1.37)	0.99 (1.28)	1.02 (1.39)	1.13 (1.46)	1.07 (1.36)	0.98 (1.33)	0.84 (1.25)	0.70 (1.18)	0.53 (1.06)	1.01 (1.28)
VRT-13	1.21 (1.45)	1.24 (1.48)	1.29 (1.48)	1.36 (1.52)	1.41 (1.55)	1.42 (1.56)	1.51 (1.58)	1.72 (1.25)	1.74 (1.66)	1.79 (1.67)	1.85 (1.69)	1.87 (1.69)	1.62 (1.62)	1.50 (1.58)	1.32 (1.52)	1.43 (1.54)
ToLCV-16	0.79 (1.28)	0.85 (1.32)	0.90 (1.35)	0.95 (1.36)	0.95 (1.35)	0.98 (1.36)	1.01 (1.37)	1.02 (1.14)	1.05 (1.39)	1.17 (1.46)	1.06 (1.36)	0.96 (1.35)	0.76 (1.25)	0.60 (1.18)	0.42 (1.06)	1.04 (1.67)
VRT-19	1.18 (1.46)	1.24 (1.48)	1.27 (1.49)	1.33 (1.52)	1.43 (1.56)	1.47 (1.58)	1.60 (1.58)	1.69 (1.67)	1.76 (1.66)	1.82 (1.68)	1.96 (1.74)	2.01 (1.77)	1.78 (1.67)	1.63 (1.62)	1.50 (1.58)	1.46 (1.51)
H-86	1.36 (1.48)	1.40 (1.50)	1.50 (1.53)	1.64 (1.58)	1.95 (1.73)	2.16 (1.82)	2.33 (1.83)	2.32 (1.46)	2.38 (1.89)	2.39 (1.90)	2.41 (1.90)	2.25 (1.89)	1.78 (1.70)	1.67 (1.67)	1.49 (1.60)	1.63 (1.47)
VKT-06	1.25 (1.50)	1.27 (1.51)	1.30 (1.52)	1.45 (1.57)	1.48 (1.58)	1.60 (1.61)	1.70 (1.64)	1.82 (1.48)	1.90 (1.70)	2.10 (1.76)	2.14 (1.77)	2.15 (1.78)	2.12 (1.77)	1.15 (1.47)	1.17 (1.47)	1.51 (1.55)
Pb Barkha-1	0.42 (1.10)	0.45 (1.11)	0.48 (1.13)	0.55 (1.14)	0.65 (1.21)	0.70 (1.24)	0.73 (1.26)	0.78 (1.55)	0.86 (1.32)	1.41 (1.68)	1.02 (1.38)	1.05 (1.37)	0.85 (1.28)	0.61 (1.22)	0.35 (1.15)	0.80 (1.63)
Pb Barkha-2	0.45 (1.14)	0.48 (1.15)	0.50 (1.16)	0.53 (1.18)	0.67 (1.24)	0.72 (1.25)	0.77 (1.25)	0.81 (1.88)	0.84 (1.28)	0.89 (1.31)	0.99 (1.38)	1.01 (1.39)	0.67 (1.20)	0.56 (1.15)	0.47 (1.11)	0.83 (1.46)
Sankranti	0.41 (1.08)	0.48 (1.15)	0.50 (1.10)	0.54 (1.13)	0.56 (1.14)	0.60 (1.16)	0.65 (1.19)	0.73 (1.52)	0.80 (1.27)	0.87 (1.31)	0.95 (1.72)	0.99 (1.33)	0.78 (1.27)	0.67 (1.19)	0.60 (1.16)	0.82 (1.78)
Nandi	1.16 (1.47)	1.18 (1.47)	1.20 (1.48)	1.37 (1.54)	1.41 (1.55)	1.49 (1.58)	1.82 (1.68)	1.91 (1.33)	1.95 (1.72)	2.00 (1.73)	2.15 (1.79)	2.17 (1.81)	1.82 (1.68)	1.68 (1.61)	1.53 (1.59)	1.47 (1.79)
Vaibhav	1.20 (1.45)	1.25 (1.47)	1.29 (1.48)	1.35 (1.52)	1.53 (1.61)	1.57 (1.61)	1.65 (1.63)	1.75 (1.15)	1.78 (1.66)	1.85 (1.69)	1.95 (1.72)	1.99 (1.73)	1.82 (1.68)	1.50 (1.58)	1.00 (1.41)	1.45 (1.68)
DVRT-1	0.52 (1.20)	0.62 (1.25)	0.70 (1.27)	0.77 (1.32)	0.84 (1.35)	0.87 (1.36)	0.93 (1.37)	1.05 (0.98)	1.11 (1.40)	1.16 (1.41)	1.21 (1.45)	1.22 (1.46)	0.90 (1.25)	0.78 (1.17)	0.57 (1.06)	0.94 (1.60)
DVRT-2	0.47 (1.12)	0.54 (1.15)	0.60 (1.19)	0.65 (1.20)	0.69 (1.22)	0.71 (1.23)	0.79 (1.25)	0.85 (0.88)	0.92 (1.31)	1.00 (1.35)	1.15 (1.43)	1.11 (1.46)	0.93 (1.36)	0.78 (1.26)	0.50 (1.22)	0.87 (1.48)
Kashi Sharad	0.52 (1.24)	0.62 (1.27)	0.70 (1.27)	0.71 (1.28)	0.77 (1.31)	0.78 (1.31)	0.85 (1.32)	1.01 (1.63)	1.07 (1.37)	1.12 (1.38)	1.15 (1.44)	1.26 (1.45)	1.01 (1.32)	0.83 (1.22)	0.58 (1.06)	0.95 (1.53)
Pusa Rohit	0.55 (1.16)	0.57 (1.17)	0.63 (1.19)	0.72 (1.25)	0.76 (1.27)	0.84 (1.32)	0.89 (1.34)	0.95 (1.56)	1.05 (1.38)	1.13 (1.43)	1.19 (1.45)	1.21 (1.47)	0.76 (1.27)	0.63 (1.18)	0.43 (1.06)	0.91 (1.55)
S. Em. ±	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.07	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.04
C. D. at 5%	0.03	0.05	0.03	0.03	0.04	0.04	0.03	0.20	0.02	0.03	0.02	0.02	0.03	0.03	0.02	0.10
C.V. (%)	1.60	2.66	1.69	1.35	1.80	1.80	1.30	9.93	1.07	1.41	0.90	0.86	1.68	1.53	1.24	4.63

* Average of four replications (In each replication 10 plants were observed to record the average egg population)

**Figures in parentheses are $\sqrt{x+1}$ transformed values

Table 3: Response of Larval population of *H. armigera* on different tomato varieties/germplasms during 2017 – 18 and 2018-19 (Pooled Data)

Varieties/ Germplasms	*Average number of *H. armigera* larvae/plant at weekly interval															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Overall Mean
VRT-2	0.96 (1.40)	1.04 (1.43)	1.11 (1.45)	1.15 (1.47)	1.21 (1.49)	1.29 (1.51)	1.33 (1.53)	1.39 (1.54)	1.45 (1.56)	1.49 (1.58)	1.53 (1.59)	1.32 (1.52)	1.12 (1.45)	1.40 (1.55)	0.67 (1.29)	1.23 (1.22)
Sel-7	0.55 (1.25)	0.67 (1.29)	0.74 (1.32)	0.76 (1.33)	0.79 (1.34)	0.82 (1.35)	0.86 (1.36)	0.89 (1.37)	0.90 (1.38)	0.95 (1.40)	1.00 (1.41)	0.92 (1.38)	0.73 (1.31)	0.42 (1.19)	0.59 (1.25)	0.77 (1.37)
VRT-51	0.94 (1.39)	1.00 (1.41)	1.05 (1.43)	1.09 (1.45)	1.14 (1.46)	1.21 (1.48)	1.26 (1.55)	1.34 (1.53)	1.41 (1.55)	1.44 (1.56)	1.49 (1.58)	1.45 (1.56)	1.44 (1.56)	1.11 (1.45)	0.97 (1.40)	1.22 (1.44)
VRT-01	1.03 (1.42)	1.09 (1.45)	1.13 (1.46)	1.17 (1.47)	1.21 (1.49)	1.27 (1.51)	1.33 (1.53)	1.39 (1.55)	1.48 (1.57)	1.52 (1.59)	1.57 (1.60)	1.27 (1.51)	1.18 (1.48)	1.08 (1.44)	0.56 (1.24)	1.22 (1.14)
KT-8	1.57 (1.60)	1.70 (1.64)	1.72 (1.64)	1.72 (1.64)	1.74 (1.65)	1.73 (1.65)	1.75 (1.65)	1.78 (1.67)	1.78 (1.67)	1.74 (1.65)	1.69 (1.64)	1.56 (1.60)	1.43 (1.56)	1.39 (1.54)	1.31 (1.52)	1.64 (1.04)
VRT-50	0.99 (1.41)	1.05 (1.43)	1.07 (1.44)	1.13 (1.46)	1.22 (1.49)	1.26 (1.50)	1.28 (1.51)	1.34 (1.53)	1.37 (1.54)	1.42 (1.56)	1.48 (1.57)	1.30 (1.52)	1.17 (1.47)	1.07 (1.44)	0.92 (1.38)	1.20 (1.12)

ToLCV-32	0.37 (1.17)	0.44 (1.20)	0.48 (1.22)	0.54 (1.24)	0.61 (1.27)	0.64 (1.28)	0.67 (1.29)	0.70 (1.30)	0.84 (1.36)	0.92 (1.39)	1.05 (1.43)	0.95 (1.39)	0.84 (1.36)	0.77 (1.33)	0.63 (1.28)	0.70 (1.19)
ToLCV-28	0.47 (1.21)	0.61 (1.27)	0.67 (1.29)	0.71 (1.31)	0.77 (1.33)	0.83 (1.35)	0.85 (1.36)	0.87 (1.37)	0.89 (1.38)	0.91 (1.38)	0.92 (1.38)	0.81 (1.34)	0.64 (1.28)	0.50 (1.22)	0.38 (1.17)	0.72 (1.05)
VRT-13	1.05 (1.43)	1.08 (1.44)	1.10 (1.45)	1.17 (1.47)	1.25 (1.50)	1.31 (1.52)	1.35 (1.53)	1.39 (1.55)	1.41 (1.55)	1.44 (1.56)	1.47 (1.57)	1.44 (1.56)	1.36 (1.54)	1.31 (1.52)	1.24 (1.49)	1.29 (1.26)
ToLCV-16	0.57 (1.25)	0.68 (1.30)	0.76 (1.33)	0.81 (1.35)	0.82 (1.35)	0.84 (1.36)	0.86 (1.36)	0.87 (1.37)	0.90 (1.38)	0.98 (1.41)	1.03 (1.42)	0.92 (1.39)	0.68 (1.29)	0.64 (1.28)	0.22 (1.10)	0.77 (1.42)
VRT-19	0.99 (1.41)	1.04 (1.43)	1.06 (1.43)	1.09 (1.45)	1.15 (1.46)	1.18 (1.48)	1.27 (1.51)	1.31 (1.52)	1.33 (1.52)	1.38 (1.54)	1.41 (1.55)	1.30 (1.52)	1.17 (1.47)	1.23 (1.49)	1.01 (1.42)	1.19 (1.41)
H-86	1.18 (1.48)	1.26 (1.50)	1.30 (1.52)	1.37 (1.54)	1.48 (1.58)	1.50 (1.58)	1.56 (1.60)	1.71 (1.65)	1.75 (1.66)	1.80 (1.67)	1.86 (1.69)	1.86 (1.69)	1.49 (1.58)	1.36 (1.54)	1.24 (1.49)	1.51 (1.22)
VKT-06	1.22 (1.49)	1.25 (1.50)	1.29 (1.51)	1.30 (1.52)	1.32 (1.52)	1.36 (1.54)	1.38 (1.54)	1.44 (1.56)	1.49 (1.58)	1.53 (1.59)	1.57 (1.61)	1.39 (1.55)	1.30 (1.52)	1.23 (1.49)	1.12 (1.45)	1.34 (1.34)
Pb Barkha-1	0.48 (1.21)	0.17 (1.08)	0.19 (1.09)	0.27 (1.13)	0.28 (1.13)	0.30 (1.14)	0.34 (1.16)	0.38 (1.17)	0.40 (1.18)	0.47 (1.21)	0.50 (1.22)	0.49 (1.22)	0.45 (1.21)	0.39 (1.18)	0.29 (1.14)	0.36 (1.50)
Pb Barkha-2	0.18 (1.08)	0.20 (1.10)	0.23 (1.11)	0.27 (1.12)	0.31 (1.15)	0.35 (1.16)	0.37 (1.17)	0.45 (1.20)	0.46 (1.21)	0.48 (1.22)	0.48 (1.22)	0.43 (1.20)	0.37 (1.17)	0.26 (1.12)	0.24 (1.11)	0.34 (1.18)
Sankranti	0.26 (1.12)	0.28 (1.13)	0.30 (1.14)	0.32 (1.11)	0.33 (1.15)	0.40 (1.18)	0.45 (1.20)	0.47 (1.21)	0.48 (1.22)	0.53 (1.23)	0.61 (1.27)	0.45 (1.20)	0.38 (1.18)	0.29 (1.14)	0.22 (1.10)	0.38 (1.51)
Nandi	1.11 (1.45)	1.15 (1.47)	1.19 (1.48)	1.20 (1.48)	1.23 (1.49)	1.25 (1.50)	1.28 (1.51)	1.35 (1.53)	1.38 (1.54)	1.43 (1.56)	1.48 (1.54)	1.45 (1.57)	1.29 (1.47)	1.16 (1.47)	0.94 (1.39)	1.26 (1.59)
Vaibhav	1.11 (1.45)	1.19 (1.48)	1.23 (1.49)	1.24 (1.50)	1.29 (1.51)	1.31 (1.52)	1.34 (1.53)	1.39 (1.54)	1.42 (1.56)	1.47 (1.57)	1.53 (1.59)	1.51 (1.58)	1.05 (1.43)	0.94 (1.39)	0.82 (1.35)	1.25 (1.61)
DVRT-1	0.49 (1.22)	0.57 (1.25)	0.66 (1.29)	0.66 (1.29)	0.68 (1.30)	0.72 (1.31)	0.74 (1.32)	0.77 (1.33)	0.79 (1.34)	0.84 (1.36)	0.85 (1.36)	0.82 (1.35)	0.62 (1.27)	0.46 (1.21)	0.22 (1.10)	0.66 (1.33)
DVRT-2	0.26 (1.12)	0.32 (1.15)	0.33 (1.15)	0.37 (1.17)	0.40 (1.17)	0.41 (1.19)	0.44 (1.20)	0.47 (1.21)	0.52 (1.23)	0.57 (1.25)	0.61 (1.27)	0.58 (1.26)	0.52 (1.23)	0.49 (1.22)	0.42 (1.19)	0.45 (1.26)
Kashi Sharad	0.49 (1.22)	0.50 (1.23)	0.53 (1.24)	0.54 (1.24)	0.56 (1.25)	0.58 (1.26)	0.61 (1.27)	0.64 (1.28)	0.68 (1.30)	0.71 (1.31)	0.73 (1.32)	0.74 (1.32)	0.69 (1.30)	0.60 (1.27)	0.42 (1.19)	0.60 (1.42)
Pusa Rohit	0.26 (1.12)	0.27 (1.13)	0.32 (1.15)	0.34 (1.16)	0.37 (1.17)	0.41 (1.19)	0.46 (1.21)	0.49 (1.22)	0.52 (1.23)	0.60 (1.26)	0.62 (1.27)	0.57 (1.25)	0.52 (1.23)	0.45 (1.20)	0.24 (1.11)	0.43 (1.44)
S. Em. ±	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.06
C. D. at 5%	0.02	0.03	0.02	0.01	0.01	0.01	0.02	0.01	0.02	0.01	0.01	0.01	0.03	0.02	0.02	0.17
C.V. (%)	1.09	1.65	0.82	0.74	0.73	0.54	0.77	0.63	0.53	0.53	0.55	0.61	1.66	0.86	0.73	9.87

* * Average of four replications (In each replication 10 plants were observed to record the average larval population)

**Figures in parentheses are $\sqrt{x+1}$ transformed values

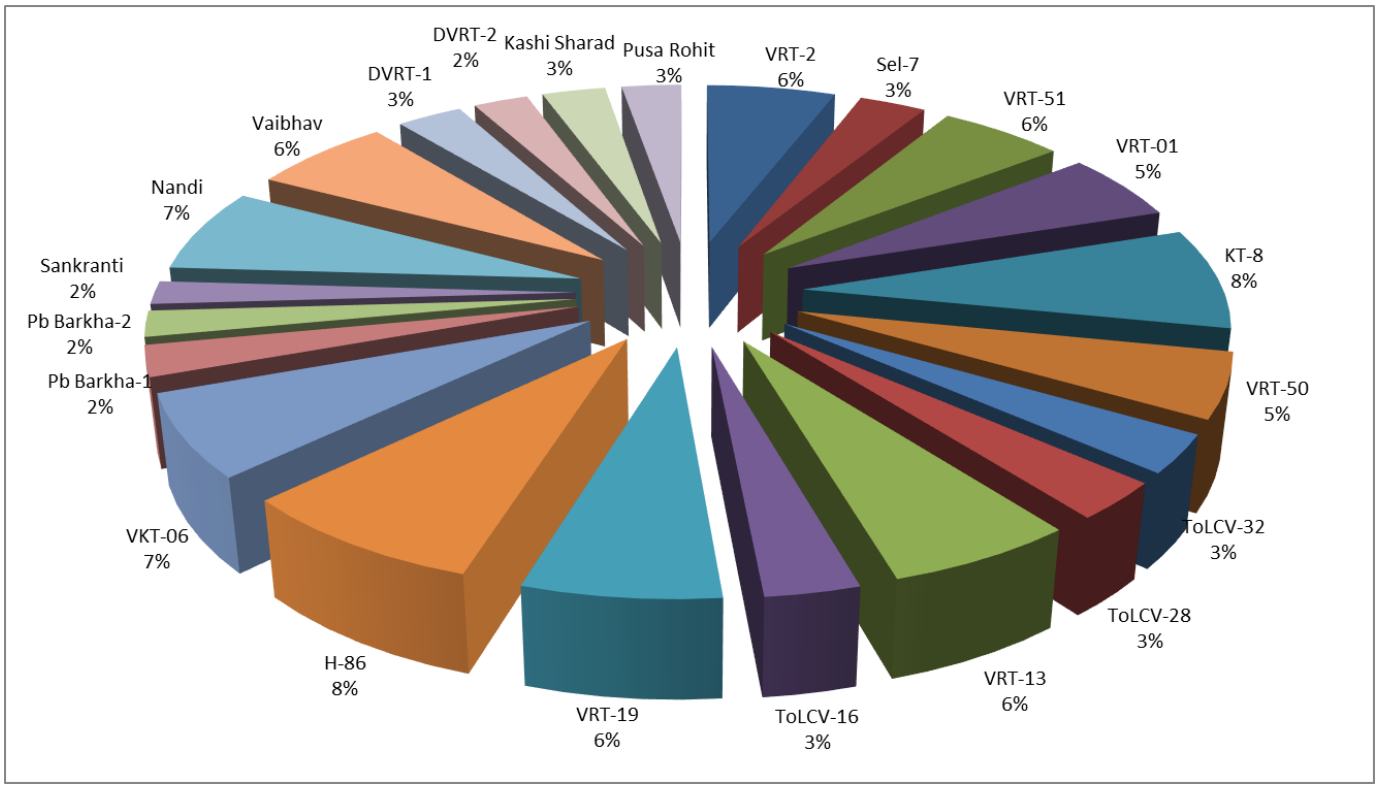

Fig 1: Preferential share in terms of mean larval population of *H. armigera* on different tomato varieties/germplasms during 2017-18 and 2018-19 (Pooled data)

Table 4: Per cent fruit damage on different tomato varieties/germplasms during 2017-18 and 2018-19 (Pooled data)

Varieties/ Germplasms	*Average of per cent fruit damage at each picking																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Overall Mean
VRT-2	16.80 (24.18)	20.92 (24.28)	16.98 (24.32)	17.10 (24.42)	17.57 (24.76)	18.34 (25.35)	18.90 (25.76)	19.06 (25.87)	19.39 (26.11)	19.73 (26.35)	20.55 (26.94)	21.39 (27.53)	20.73 (27.07)	19.35 (26.09)	18.21 (25.25)	14.92 (22.65)	18.74 (24.97)
Sel-7	6.79 (15.09)	11.38 (15.33)	7.06 (15.39)	7.75 (16.13)	8.11 (16.49)	8.70 (17.07)	8.98 (17.38)	9.11 (17.51)	9.76 (18.17)	10.11 (18.51)	10.91 (19.27)	10.85 (19.20)	8.72 (17.15)	8.41 (16.84)	7.63 (16.03)	6.83 (15.14)	8.82 (16.40)
VRT-51	13.11 (21.21)	17.35 (21.28)	13.39 (21.46)	14.04 (22.00)	14.15 (22.08)	14.31 (22.21)	14.75 (22.57)	15.45 (23.14)	15.69 (23.32)	15.84 (23.44)	17.07 (24.39)	16.71 (24.12)	15.93 (23.51)	15.22 (22.95)	14.83 (22.64)	12.80 (20.95)	15.04 (22.07)
VRT-01	14.32 (22.22)	18.63 (22.37)	14.64 (22.48)	14.96 (22.75)	15.07 (22.83)	15.14 (22.89)	15.51 (23.18)	15.70 (23.33)	16.03 (23.59)	16.27 (23.78)	17.38 (24.62)	18.41 (25.39)	17.13 (24.43)	16.07 (23.62)	15.39 (23.08)	14.04 (21.99)	15.92 (22.79)
KT-8	28.24 (32.08)	32.21 (33.12)	30.02 (33.20)	30.18 (33.31)	30.89 (33.74)	30.97 (33.79)	31.84 (34.33)	32.12 (34.51)	32.72 (34.88)	33.22 (35.18)	34..49 (35.95)	34.85 (36.16)	34.80 (36.13)	31.15 (33.91)	30.23 (33.34)	28.03 (31.97)	31.62 (33.86)
VRT-50	13.18 (21.27)	17.99 (21.71)	13.88 (21.86)	14.04 (22.00)	14.21 (22.13)	14.55 (22.41)	14.83 (22.64)	15.87 (23.46)	16.21 (23.73)	16.34 (23.83)	17.00 (24.34)	17.39 (24.62)	16.34 (23.83)	15.39 (23.08)	14.99 (22.76)	13.28 (21.35)	15.34 (22.31)
ToLCV-32	9.43 (17.87)	13.93 (17.96)	9.59 (18.03)	9.78 (18.21)	10.17 (18.58)	10.32 (18.71)	10.49 (18.89)	11.10 (19.43)	11.19 (19.51)	11.43 (19.74)	11.77 (20.05)	12.57 (20.71)	11.65 (19.92)	11.19 (19.52)	10.94 (19.28)	9.81 (18.24)	10.96 (18.51)
ToLCV-28	12.09 (20.33)	16.51 (20.55)	12.40 (20.61)	12.47 (20.67)	12.65 (20.82)	12.80 (20.95)	12.93 (21.07)	13.53 (21.56)	14.43 (22.30)	14.57 (22.42)	15.57 (23.23)	13.55 (21.58)	12.44 (20.62)	12.02 (20.25)	11.65 (19.93)	10.76 (19.12)	13.15 (20.49)
VRT-13	16.98 (24.32)	20.78 (24.43)	17.21 (24.50)	17.35 (24.61)	17.45 (24.68)	17.56 (24.76)	18.26 (25.28)	18.35 (25.35)	19.34 (26.07)	19.29 (26.04)	20.09 (26.61)	21.27 (27.43)	20.24 (26.71)	19.29 (26.04)	18.94 (25.77)	17.74 (25.90)	18.76 (25.01)
ToLCV-16	12.41 (20.61)	17.26 (21.12)	13.09 (21.20)	13.15 (21.25)	13.32 (21.39)	13.48 (21.53)	14.14 (22.08)	14.58 (22.44)	15.07 (22.83)	15.60 (23.25)	16.22 (23.73)	16.22 (23.74)	15.47 (23.15)	14.02 (21.98)	13.68 (21.69)	11.94 (20.19)	14.35 (21.50)
VRT-19	14.18 (22.11)	18.26 (22.24)	14.52 (22.39)	14.99 (22.77)	14.99 (22.77)	15.43 (23.12)	15.66 (23.30)	15.97 (23.54)	16.66 (24.08)	17.24 (24.52)	18.41 (25.39)	18.47 (25.44)	17.99 (25.08)	16.62 (24.05)	16.14 (23.67)	13.69 (21.70)	16.20 (23.01)
H-86	25.88 (30.56)	28.92 (30.72)	26.24 (30.80)	26.28 (30.83)	26.94 (31.25)	27.72 (31.75)	28.24 (32.08)	28.63 (32.33)	29.54 (32.90)	29.97 (33.17)	30.69 (33.62)	31.22 (33.94)	29.73 (33.02)	29.10 (32.62)	28.05 (31.95)	26.95 (31.25)	28.38 (31.76)
VKT-06	23.23 (28.80)	26.21 (28.91)	23.46 (28.96)	23.64 (29.08)	23.71 (29.12)	24.36 (29.56)	24.47 (29.63)	25.23 (30.13)	25.49 (30.30)	25.66 (30.42)	26.34 (30.86)	28.62 (32.32)	27.63 (31.69)	26.51 (30.97)	25.68 (30.43)	23.68 (29.10)	25.24 (29.67)
Pb Barkha-1	3.01 (9.98)	6.61 (10.09)	3.12 (10.17)	3.18 (10.27)	3.22 (10.33)	4.02 (11.55)	4.24 (11.87)	4.35 (12.03)	4.44 (12.16)	4.53 (12.28)	4.81 (12.65)	5.00 (12.90)	4.41 (12.11)	3.76 (11.17)	3.35 (10.54)	3.45 (10.69)	4.09 (10.86)
Pb Barkha-2	6.05 (14.23)	10.28 (14.34)	6.23 (14.45)	6.34 (14.58)	6.42 (14.67)	6.81 (15.12)	7.00 (15.33)	7.36 (15.72)	7.92 (16.32)	7.98 (16.38)	8.72 (17.11)	8.55 (16.99)	7.84 (16.24)	6.88 (15.20)	6.62 (14.90)	5.68 (13.77)	7.29 (14.82)
Sankranti	12.43 (20.63)	17.29 (21.07)	12.99 (21.11)	13.65 (21.65)	13.70 (21.69)	13.84 (21.81)	14.28 (22.18)	14.47 (22.34)	15.23 (22.94)	15.73 (23.35)	16.85 (24.23)	16.89 (24.24)	16.23 (23.73)	15.18 (22.91)	14.67 (22.51)	13.56 (2159)	14.81 (21.86)
Nandi	22.47 (28.28)	25.80 (28.41)	22.76 (28.48)	22.88 (28.56)	23.12 (28.73)	18.78 (25.45)	19.27 (25.85)	20.13 (26.50)	20.43 (26.73)	20.70 (26.93)	21.89 (27.78)	22.27 (27.96)	21.17 (27.21)	20.30 (26.56)	19.36 (25.90)	18.61 (25.32)	21.25 (26.80)
Vaibhav	21.76 (27.79)	25.12 (27.96)	22.12 (28.04)	22.24 (28.13)	22.45 (28.27)	23.58 (29.04)	23.82 (29.20)	24.89 29.91)	25.50 (30.32)	25.84 (30.54)	26.38 (30.89)	26.96 (31.26)	26.17 (30.75)	24.67 (29.76)	24.01 (29.31)	21.79 (27.82)	24.21 (28.93)
DVRT-1	8.34 (16.77)	11.24 (15.74)	7.42 (15.78)	8.02 (16.45)	8.50 (16.94)	9.92 (18.35)	10.15 (18.56)	10.04 (18.46)	10.15 (18.55)	10.69 (19.07)	10.67 (18.99)	10.43 (18.81)	9.46 (17.83)	9.94 (18.36)	9.11 (17.53)	9.13 (17.58)	9.58 (17.21)
DVRT-2	4.36 (11.89)	9.40 (12.35)	4.77 (12.41)	4.94 (12.61)	5.26 (12.98)	5.52 (13.35)	5.65 (13.54)	6.28 (14.32)	6.56 (14.65)	6.71 (14.85)	6.96 (15.14)	7.44 (15.58)	6.37 (14.46)	5.59 (13.53)	4.69 (12.36)	4.39 (11.93)	5.93 (13.03)
Kashi Sharad	3.37 (10.53)	6.88 (10.77)	3.57 (10.85)	3.59 (10.88)	3.72 (11.10)	4.35 (11.93)	4.54 (12.17)	4.73 (12.44)	5.04 (12.86)	5.29 (13.16)	6.27 (14.28)	6.64 (14.86)	4.93 (12.58)	4.54 (12.10)	3.97 (11.28)	3.54 (10.70)	4.68 (11.58)
Pusa Rohit	4.49 (12.21)	8.51 (12.58)	4.83 (12.67)	4.90 (12.78)	4.97 (12.87)	5.35 (13.36)	5.44 (13.46)	5.86 (13.99)	6.15 (14.34)	6.44 (14.68)	7.05 (15.36)	7.27 (15.63)	7.07 (15.41)	6.26 (14.48)	5.47 (13.52)	4.31 (11.98)	5.90 (13.22)
S. Em. ±	0.10	0.09	0.07	0.07	0.08	0.06	0.05	0.03	0.04	0.03	0.04	0.04	0.04	0.03	0.04	0.09	0.06
C. D. at 5%	0.29	0.25	0.21	0.20	0.22	0.18	0.14	0.09	0.12	0.08	0.10	0.11	0.12	0.09	0.11	0.26	0.17
C.V. (%)	1.02	0.85	0.70	0.66	0.73	0.58	0.46	0.28	0.37	0.25	0.31	0.32	0.38	0.29	0.35	1.66	0.67

* Average of four replications (In each replication 10 plants were observed to record per cent fruit damage)
**Figures in parentheses are angular transformed values

Table 5: Per cent fruit weight loss on different tomato varieties/germplasms during 2017-18 and 2018-19 (Pooled data)

Varieties/ Germplasms	*Average of per cent fruit weight loss at each picking																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Overall Mean
VRT-2	21.48 (27.59)	21.86 (27.85)	22.08 (28.01)	22.37 (28.20)	22.78 (28.49)	23.23 (28.79)	23.30 (28.84)	23.61 (29.05)	24.32 (29.52)	25.03 (29.98)	25.99 (30.61)	25.41 (30.23)	24.93 (29.91)	24.03 (29.33)	22.91 (28.57)	22.57 (28.34)	24.96 (27.91)
Sel-7	9.30 (17.64)	9.55 (17.98)	9.73 (18.16)	10.14 (18.54)	10.30 (18.69)	10.56 (18.94)	11.06 (19.40)	11.17 (19.50)	11.38 (19.69)	11.81 (20.07)	12.02 (20.26)	11.91 (20.16)	11.42 (19.74)	10.81 (19.18)	10.60 (18.99)	10.13 (18.55)	12.78 (28.79)
VRT-51	16.23 (23.70)	16.48 (23.90)	16.57 (23.97)	16.82 (24.17)	17.30 (24.52)	17.54 (24.71)	18.19 (25.17)	18.39 (25.33)	18.61 (25.49)	19.08 (25.82)	20.17 (26.59)	18.45 (25.37)	18.15 (25.16)	17.79 (24.89)	17.29 (24.52)	16.63 (24.03)	19.60 (30.09)
VRT-01	17.52 (24.69)	17.80 (24.89)	17.99 (25.03)	18.29 (25.26)	18.68 (25.53)	19.51 (26.11)	19.64 (26.21)	19.87 (26.38)	20.06 (26.52)	20.90 (27.11)	21.57 (27.56)	20.72 (26.99)	20.28 (26.67)	19.55 (26.14)	19.03 (25.77)	21.06 (27.31)	21.27 (29.04)
KT-8	43.02 (40.97)	43.10 (41.01)	43.28 (41.12)	43.82 (41.43)	44.07 (41.57)	44.44 (41.79)	44.56 (41.86)	44.81 (42.00)	45.44 (42.36)	45.62 (42.46)	46.12 (42.75)	45.72 (42.52)	45.48 (42.39)	44.77 (41.97)	44.25 (41.68)	43.56 (41.28)	44.08 (18.10)

VRT-50	22.88 (28.55)	23.51 (28.97)	23.76 (29.14)	23.84 (29.20)	23.92 (29.25)	24.38 (29.56)	24.59 (29.70)	24.75 (29.80)	25.05 (30.00)	25.52 (30.31)	26.21 (30.76)	25.32 (30.18)	24.35 (29.55)	23.94 (29.27)	23.40 (28.91)	22.82 (28.51)	25.69 (19.13)
ToLCV-32	9.57 (17.91)	10.39 (18.71)	10.45 (18.77)	10.57 (18.89)	10.62 (18.94)	10.72 (19.04)	11.17 (19.44)	11.53 (19.75)	11.68 (19.88)	11.85 (20.03)	12.55 (20.63)	11.55 (19.73)	11.34 (19.54)	10.96 (19.21)	10.54 (18.83)	9.40 (17.78)	12.99 (20.05)
ToLCV-28	9.79 (18.05)	10.34 (18.56)	10.45 (18.67)	11.26 (19.38)	11.91 (19.91)	12.11 (20.09)	12.29 (20.25)	12.80 (20.66)	12.87 (20.72)	13.34 (20.97)	13.54 (21.30)	13.05 (21.03)	11.94 (20.16)	11.42 (19.56)	10.31 (18.62)	9.43 (17.82)	13.72 (19.11)
VRT-13	25.07 (30.03)	25.18 (30.10)	25.42 (30.26)	25.94 (30.59)	26.43 (30.92)	26.66 (31.06)	27.08 (31.33)	27.41 (31.54)	27.53 (31.62)	27.60 (31.63)	28.12 (31.99)	27.86 (31.84)	27.62 (31.68)	27.36 (31.52)	26.46 (30.94)	25.44 (30.27)	27.88 (23.94)
ToLCV-16	12.19 (20.36)	12.29 (20.45)	12.75 (20.83)	12.87 (20.95)	13.03 (21.08)	13.65 (21.59)	14.06 (21.92)	14.64 (22.38)	15.60 (23.14)	15.84 (23.24)	16.80 (24.04)	15.84 (23.34)	15.66 (23.20)	14.75 (22.50)	14.43 (22.24)	12.76 (20.90)	16.28 (24.93)
VRT-19	17.16 (24.40)	17.44 (24.61)	17.66 (24.77)	17.79 (24.87)	18.33 (25.24)	18.96 (25.69)	19.20 (25.86)	19.29 (25.93)	19.52 (26.10)	20.21 (26.44)	21.21 (27.25)	20.06 (26.48)	19.61 (26.16)	19.23 (25.89)	18.74 (25.55)	21.06 (27.31)	20.87 (25.82)
H-86	40.88 (39.72)	40.99 (39.79)	40.99 (39.78)	41.35 (40.00)	42.23 (40.51)	42.70 (40.79)	42.83 (40.86)	42.90 (40.90)	43.64 (41.33)	44.69 (41.93)	45.37 (42.32)	44.62 (41.89)	44.03 (41.56)	43.09 (41.01)	42.97 (40.94)	39.58 (38.97)	42.13 (24.65)
VKT-06	29.92 (33.13)	30.53 (33.51)	30.91 (33.75)	31.87 (34.34)	32.14 (34.50)	32.58 (34.77)	32.87 (34.95)	33.51 (35.37)	33.82 (35.52)	34.23 (35.77)	34.97 (36.21)	34.22 (35.76)	34.08 (35.66)	33.83 (35.53)	33.71 (35.46)	32.84 (34.93)	33.62 (24.97)
Pb Barkha-1	4.68 (12.32)	4.78 (12.48)	4.96 (12.73)	5.21 (13.08)	5.43 (13.40)	5.42 (13.38)	5.62 (13.64)	5.80 (13.87)	6.19 (14.32)	6.28 (14.44)	7.23 (15.50)	6.49 (14.70)	6.25 (14.58)	5.84 (13.95)	5.82 (13.93)	5.16 (13.12)	7.53 (26.06)
Pb Barkha-2	6.95 (15.15)	6.00 (14.14)	6.67 (14.90)	7.25 (15.53)	7.43 (15.73)	7.49 (15.80)	7.70 (16.03)	8.26 (16.59)	8.69 (17.01)	8.61 (16.96)	9.23 (17.56)	8.02 (16.39)	7.51 (16.06)	7.25 (15.57)	7.20 (15.51)	6.48 (14.72)	9.52 (27.04)
Sankranti	13.47 (21.44)	13.86 (21.76)	13.94 (21.82)	14.66 (22.39)	14.93 (22.61)	14.67 (22.35)	14.99 (22.62)	15.15 (22.75)	15.34 (22.91)	15.79 (23.26)	16.37 (23.69)	15.69 (23.20)	15.21 (22.91)	15.03 (22.69)	14.86 (22.54)	14.58 (22.30)	16.94 (26.47)
Nandi	33.89 (35.58)	34.15 (35.74)	34.24 (35.80)	34.64 (36.03)	34.78 (36.12)	35.17 (36.35)	35.65 (36.64)	36.33 (37.04)	36.59 (37.19)	37.24 (38.58)	38.18 (39.13)	37.22 (37.56)	37.63 (37.80)	35.71 (36.67)	34.85 (36.16)	34.46 (35.93)	36.13 (41.13)
Vaibhav	27.71 (31.75)	28.03 (31.95)	28.33 (32.14)	28.61 (32.32)	28.91 (32.51)	29.21 (32.70)	30.13 (33.27)	30.42 (33.45)	31.25 (33.96)	31.76 (34.21)	32.65 (34.82)	32.29 (34.60)	31.04 (33.84)	29.87 (33.12)	29.56 (32.92)	29.16 (32.67)	30.85 (41.80)
DVRT-1	4.83 (12.66)	5.18 (13.11)	5.31 (13.28)	5.53 (13.57)	5.65 (13.72)	6.68 (14.97)	6.85 (15.16)	7.44 (15.81)	7.58 (15.96)	7.97 (16.37)	8.48 (16.90)	7.81 (16.21)	7.62 (16.00)	7.03 (15.37)	6.33 (14.56)	5.70 (13.79)	8.59 (42.53)
DVRT-2	6.71 (14.84)	6.82 (14.96)	6.91 (15.08)	7.03 (15.22)	7.18 (15.39)	7.49 (15.73)	7.74 (16.00)	7.90 (16.19)	8.37 (16.64)	8.56 (16.85)	9.77 (18.00)	8.89 (17.11)	8.19 (16.43)	7.63 (15.87)	6.93 (15.12)	6.75 (14.90)	9.63 (41.76)
Kashi Sharad	3.12 (10.17)	3.33 (10.51)	4.00 (11.51)	4.07 (11.60)	4.25 (11.87)	4.36 (12.03)	4.80 (12.63)	4.98 (12.88)	5.17 (13.12)	5.70 (13.78)	6.17 (18.00)	5.60 (13.67)	5.47 (13.50)	4.77 (12.60)	4.24 (11.88)	4.06 (11.62)	6.47 (28.97)
Pusa Rohit	7.93 (16.32)	7.07 (15.40)	7.69 (16.09)	8.27 (16.70)	8.32 (16.75)	8.41 (16.84)	8.72 (17.15)	9.16 (17.59)	9.61 (18.01)	9.71 (18.12)	10.63 (19.01)	9.58 (18.50)	9.17 (17.61)	8.97 (17.41)	8.21 (16.64)	7.49 (15.87)	10.74 (29.58)
S. Em. ±	0.27	0.09	0.04	0.04	0.05	0.05	0.04	0.04	0.05	0.03	0.04	0.04	0.06	0.03	0.04	0.06	0.24
C. D. at 5%	0.75	0.26	0.11	0.11	0.13	0.13	0.11	0.11	0.13	0.08	0.11	0.11	0.16	0.09	0.11	0.18	0.69
C.V. (%)	2.20	0.56	0.34	0.33	0.39	0.39	0.31	0.31	0.37	0.21	0.29	0.30	0.43	0.26	0.31	0.50	1.73

* Average of four replications (In each replication 10 plants were observed to record per cent fruit weight loss)
**Figures in parentheses are angular transformed values

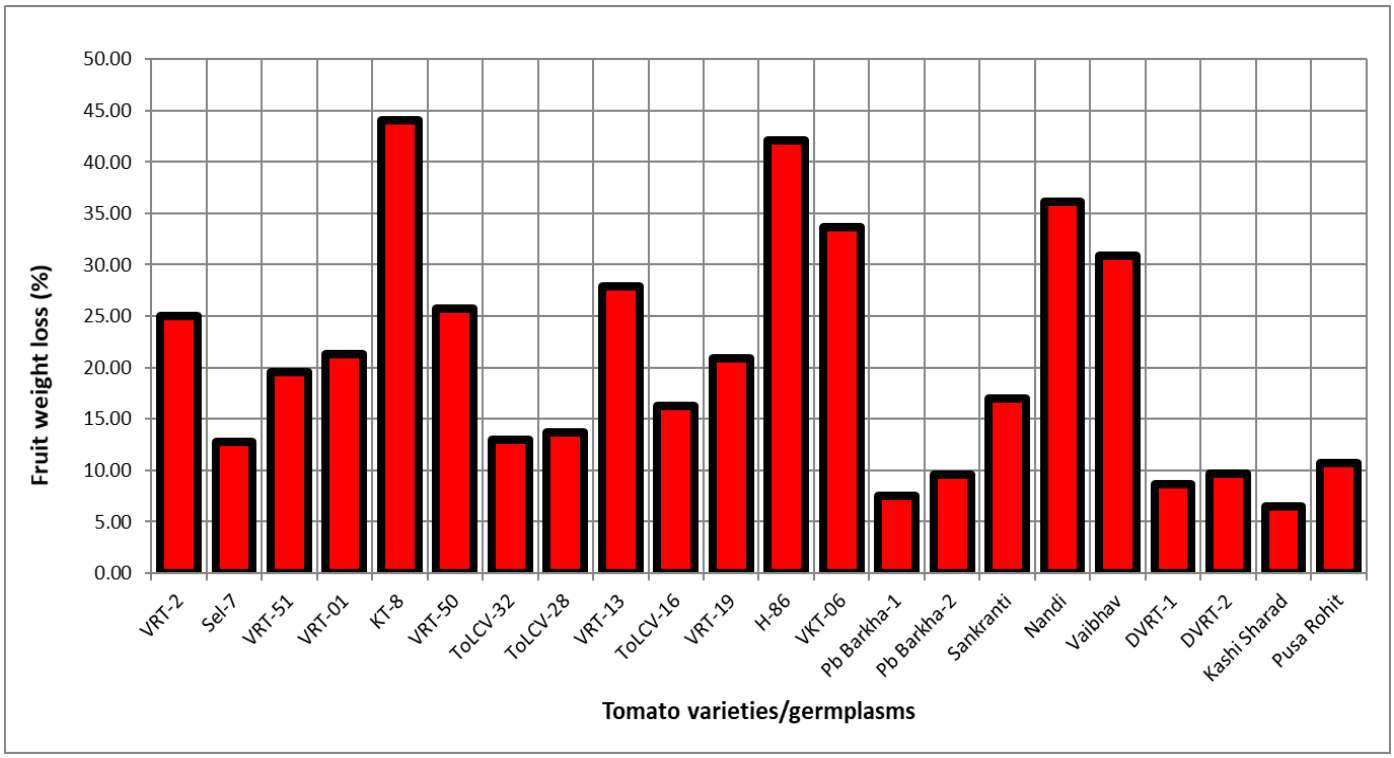

Fig 2: Per cent fruit damage by *H. armigera* on different tomato varieties/germplasms during 2017 -18 and 2018-19 (Pooled data)

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