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Evaluation of brinjal varieties against red spider mite, *Tetranuchus urticae* Koch

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Abstract
The field experiment was conducted to evaluate twenty varieties of brinjal against red spider mite under field conditions at research form Gwalior, RVSKVV, during summer 2021. The incidence of red spider mite was assessed at 22 DAT (Days after transplanting) and continued till the maturity of the crop at weekly intervals. The result revealed that a significant minimum mean incidence of red spider mite (6.90) was recorded in varieties Navina and Kashi Taru in comparison to Pusa Vaibhav, JB-8, Pusa Kranti, PPR, Pusa Ankur, Pusa Syamla, CH-215, IVBHL-20, Pusa Oishikhi, Pusa Uttam, PPC, JB-7, Pusa Safed Baigen, DBR-8, IVBR-17, CHBR-2 and Kashi Himani, while it was at par with CHBR-1. Whereas the significant maximum mean incidence of red spider mite (12.68) was recorded in Pusa Purple Cluster which was at par with Pusa Purple Round, Pusa Ankur and Pusa Oishikhi.

Keywords: Brinjal, *Tetranuchus urticae* Koch, varietal screening, host plant resistance

Introduction
Brinjal (*Solanum melongena* Linnaeus) also known as eggplant is referred to as the "King of vegetables", and originated from the Indian sub-continent, as the probable centre of origin (Gleddie *et al.*, 1986; Omprakash and Raju 2014) [5, 10]. It is highly productive and occupies its place as the poor man's crop in the country being consumed by and large as a cooked vegetable in a variety of ways. Its fruits are a fairly good source of carbohydrates, proteins, vitamins and minerals. The white brinjal is reportedly good for diabetic patients (Choudhary 1970) [4]. In India 727 thousand ha. Area and 126.80 lakh MT production in 2018-19 and 736 thousand ha. Area and 127.77 lakh MT production in 2019-20 of brinjal crop. (NHB 2019-20) [9]. Brinjal crop is under constant assault by biotic agents including various pathogens and insect herbivores, with enormous economic and ecological impact and the most extensive damage to brinjal fruit yield is caused by fruit & shoot borer and diseases like Phomopsis blight and little leaf which reduces the yield and inflicts colossal loss in production. The most extensive pest of this vegetable is the brinjal shoot and fruit borer (*Lucinodes orbonalis* Guenee) which reduces the yield and inflicts colossal loss in production (Khan and Singh, 2014). Red spider mite, *Tetranuchus urticae* Koch (Tetranychidae: Acarina) is another pest that has been ranked as a major pest next to fruit and shoots borer in brinjal (Monica *et al.*, 2014) [8]. Patil and Nandihali (2008) [12] estimated the yield losses in the range of 12.18 to 32.21 per cent due to the infestation of mites at Dharwad. Palanisamy and Chelliah (1987) [11] noticed the reduction of 28.00 per cent fruit yield due to spider mite infestation in brinjal. Both nymphs and adults of mites suck the sap usually from the lower surface of leaves producing small white specks, which gradually dry and drop off. Infested plants become yellowish, wilted and droop rapidly, particularly during dry periods. The dense web produced by spider mites often covers the plant where dust particles adhere in windy weather which in turn affects the physiological activity of the plant, making it stunted. The entire plant becomes yellowish giving a poor unhealthy look. Infested leaves wither and eventually fall off. In severe infestation, it webs profusely and may form a thick sheath of webbing that covers the entire plant (Butani and Mittal, 1992) [3]. Resistant varieties provide insect control without additional cost, act as a preventive measure against the build-up of insects with another method of pest control and are free from environmental pollution problems (Atwal and Dhaliwal 1999) [1].

Materials and methods
The experiment was carried out at the research farm, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, Madhya Pradesh, India.

Randomized Block Design (RBD) with 3 replications was deployed for screening twenty varieties, *viz.*, Pusa Vaibhav, JB-8, Pusa Kranti, Pusa Purple Round, Pusa Ankur, Pusa Syamla, CHBR-1, CH-215, IVBHL-20, Navina, Pusa Oishikhi, Pusa Uttam, Kashi Taru, PPC, JB-7, Pusa Safed Baigen, DBR-8, IVBR-17, CHBR-2 and Kashi Himani during *summer*, 2021. The row-to-row and plant-to-plant spacing were 60 cm X 60 cm respectively and the plot size was 3.6 m X 3 m. For recording observations of mites, six plants were randomly selected and tagged in each net plot area. The observations on the mite population were recorded from a marked 2 x 2 cm^2 area in three leaves (upper, middle and lower) of the same selected plants. The observations were recorded at weekly intervals starting from the third week after transplanting till to the harvest of the crop. The whole experimental plot was kept free from any acaricides. The data was collected as the mean number of mites/4 cm^2 leaf area per plant and were square-root transformed as per the standard requisites. Then experimental data were subjected to statistical analysis using analysis of variance (ANOVA).

Results and discussion

The significant difference among the evaluated twenty varieties was reported with respect to the mite populations per 4 cm^2 leaf area per plant and is presented in Table 1 and depicted in Fig. 1. Studies on varietal screening on brinjal indicated the onset of incidence of mite populations was started from the 3rd week of transplanting and population prevailed till harvest of the crop.

Red spider mite infestation first appeared in brinjal crop after 22 days after transplanting at this stage red spider mite 4 cm^2 leaf area per plant population range from 0.02 to 1.46 population of red spider mite and minimum population (0.02) of red spider mite was recorded in Navina and CHBR-1 variety which was statically at per with Kashi Taru (0.04) and Pusa Vaibhav (0.13), while maximum population (1.46) of red spider mite and significantly higher than all other varieties was recorded in IVBR-17. After this red spider population gradually increases from the next observation to continue up to 85-92 days after transplanting and then gradually decreases till the last observation at 106 days after transplanting. At 85 days after transplanting red spider mite 4 cm^2 leaf area per plant population highest range, 12.11 to 20.37 was found out in which minimum population (12.11) of red spider mite and significantly lower than all other varieties, whereas maximum and significantly higher population (20.37) than all other varieties found out in Pusa Oishikhi. The present studies were supported by the findings of Sonika *et al.,* (2017) [14] and Walia *et al.,* (2012) [15].

The lowest mean population of red spider mite 4 cm^2 leaf area per plant (6.90) was recorded on Navina and Kashi Taru varieties which were significantly minimum than the rest of the varieties viz., Pusa Vaibhav, JB-8, Pusa Kranti, PPR, Pusa Ankur, Pusa Syamla, CH-215, IVBHL-20, Pusa Oishikhi, Pusa Uttam, PPC, JB-7, Pusa Safed Baigen, DBR-8, IVBR-17, CHBR-2 and Kashi Himani except CHBR-1 (6.99) whereas the significant maximum mean incidence of red spider mite (12.68) was recorded in Pusa Purple Cluster than rest of the varieties except Pusa Purple Round (12.56), Pusa Ankur (12.59) and Pusa Oishikhi (12.63). This is concerned with the finding of Mahendrakumar and Shukla (2016) [7], Ayyanar (2017) [2] and Siddhartha *et al.,* (2021) [13].

In the present experiment screened varieties of brinjal, none of these twenty varieties was found unaffected by red spider mite also not find out the resistant variety for red spider mite, Navina, Kashi Taru and CHBR-1 were found out the moderate resistance, Pusa Vaibhav, JB-8, Pusa Kranti, Pusa Syamla, CH-215, IVBHL-20, Pusa Uttam, JB-7, Pusa Safed Baigen, DBR-8, IVBR-17, CHBR-2 and Kashi Himani found out the tolerant varieties against red spider mite, while Pusa Purple Cluster, Pusa Purple Round, Pusa Ankur and Pusa Oishikhi found out the susceptible varieties. These results conform with the findings of Kumar *et al.,* (2018) [6].

Table 1: Evaluation of brinjal varieties for the incidence of red spider mite, *Tetranuchus urticae* Koch during summer, 2021.

Varieties	Mean number of mites/4 cm^2 leaf area per plant													
	22 DAT*	29 DAT	36 DAT	43 DAT	50 DAT	57 DAT	64 DAT	71 DAT	78 DAT	85 DAT	92 DAT	99 DAT	106 DAT	Mean
Pusa Vaibhav	0.13 (0.86)**	1.09 (1.54)	3.15 (2.27)	6.11 (2.97)	7.39 (3.22)	7.93 (3.32)	12.06 (3.97)	13.56 (4.18)	14.56 (4.32)	14.07 (4.25)	14.30 (4.28)	12.02 (3.97)	10.83 (3.79)	9.01 (3.5)
JB-8	0.61 (1.28)	2.09 (1.95)	3.65 (2.41)	8.07 (3.34)	11.39 (3.87)	10.46 (3.72)	14.67 (4.33)	15.89 (4.49)	15.91 (4.49)	17.11 (4.64)	16.93 (4.61)	14.33 (4.29)	12.07 (3.97)	11.01 (3.82)
Pusa Kranti	0.91 (1.45)	2.80 (2.17)	4.61 (2.65)	9.59 (3.6)	12.17 (3.99)	13.50 (4.17)	15.22 (4.4)	16.17 (4.52)	17.39 (4.67)	19.94 (4.97)	19.13 (4.87)	16.00 (4.5)	13.13 (4.12)	12.35 (4.01)
Pusa Purple Round	0.98 (1.49)	2.91 (2.21)	4.85 (2.7)	9.94 (3.65)	12.33 (4.01)	13.59 (4.19)	15.41 (4.43)	16.24 (4.53)	17.72 (4.71)	20.26 (5)	19.22 (4.88)	16.46 (4.56)	13.31 (4.15)	12.56 (4.04)
Pusa Ankur	1.09 (1.54)	3.02 (2.24)	5.67 (2.88)	9.91 (3.65)	12.39 (4.02)	13.80 (4.21)	15.37 (4.42)	16.39 (4.55)	17.56 (4.69)	20.06 (4.98)	19.02 (4.86)	16.20 (4.53)	13.19 (4.13)	12.59 (4.05)
Pusa Syamla	0.67 (1.32)	2.35 (2.03)	4.69 (2.66)	7.98 (3.33)	11.33 (3.87)	11.72 (3.92)	14.52 (4.31)	15.72 (4.47)	15.83 (4.48)	16.81 (4.6)	16.78 (4.6)	14.17 (4.26)	12.06 (3.97)	11.13 (3.84)
CHBR-1	0.02 (0.58)	0.91 (1.45)	2.43 (2.06)	4.70 (2.67)	5.81 (2.91)	7.33 (3.21)	8.39 (3.4)	9.61 (3.6)	11.43 (3.88)	12.37 (4.02)	10.94 (3.81)	9.63 (3.6)	7.31 (3.2)	6.99 (3.14)
CH-215	0.50 (1.21)	2.31 (2.02)	4.28 (2.57)	7.48 (3.24)	9.13 (3.51)	10.94 (3.81)	14.56 (4.31)	15.78 (4.47)	15.72 (4.47)	16.56 (4.57)	15.83 (4.48)	13.74 (4.21)	11.61 (3.91)	10.65 (3.76)
IVBHL-20	0.30 (1.04)	1.80 (1.84)	3.94 (2.49)	7.24 (3.19)	8.17 (3.36)	8.26 (3.37)	12.30 (4.01)	14.07 (4.25)	15.41 (4.42)	14.35 (4.29)	14.06 (4.25)	12.33 (4.01)	10.87 (3.8)	9.47 (3.58)
Navina	0.02 (0.58)	0.76 (1.37)	2.07 (1.94)	4.85 (2.7)	5.61 (2.87)	7.39 (3.22)	8.28 (3.38)	9.70 (3.62)	11.09 (3.83)	12.26 (4)	11.11 (3.83)	9.28 (3.55)	7.26 (3.19)	6.90 (3.13)
Pusa Oishikhi	1.06 (1.53)	3.19 (2.28)	6.33 (3.02)	10.09 (3.68)	12.33 (4.01)	13.46 (4.17)	15.33 (4.42)	16.09 (4.51)	17.43 (4.67)	20.37 (5.01)	19.30 (4.89)	16.00 (4.5)	13.24 (4.14)	12.63 (4.05)
Pusa Uttam	0.59 (1.27)	2.24 (2)	4.61 (2.65)	7.65 (3.27)	10.94 (3.81)	11.06 (3.82)	14.67 (4.33)	15.89 (4.49)	15.80 (4.47)	16.44 (4.56)	16.70 (4.59)	14.06 (4.25)	12.02 (3.97)	10.97 (3.81)
Kashi Taru	0.04	0.70	2.22	5.19	5.39	7.28	8.39	9.78	11.00	12.11	10.89	9.54	7.13	6.90

	(0.61)	(1.34)	(1.99)	(2.78)	(2.82)	(3.2)	(3.4)	(3.63)	(3.82)	(3.98)	(3.8)	(3.59)	(3.17)	(3.13)
Pusa Purple Cluster	1.13 (1.56)	3.26 (2.31)	6.15 (2.98)	10.39 (3.72)	12.28 (4)	13.30 (4.14)	15.44 (4.43)	16.20 (4.53)	17.59 (4.69)	20.04 (4.98)	19.43 (4.91)	16.43 (4.55)	13.19 (4.13)	12.68 (4.06)
JB-7	1.24 (1.61)	2.65 (2.13)	4.28 (2.57)	9.56 (3.59)	12.13 (3.98)	13.39 (4.16)	15.11 (4.39)	5.46 (1.85)	17.46 (4.68)	20.11 (4.98)	19.31 (4.89)	16.17 (4.52)	13.35 (4.15)	12.18 (3.99)
Pusa Safed Baigen	0.15 (0.88)	1.35 (1.66)	3.35 (2.33)	6.35 (3.02)	7.54 (3.25)	7.94 (3.32)	12.50 (4.03)	13.69 (4.2)	14.44 (4.3)	14.39 (4.29)	15.33 (4.41)	12.24 (4)	10.72 (3.77)	9.23 (3.54)
DBR-8	0.19 (0.93)	1.46 (1.71)	3.31 (2.32)	6.78 (3.1)	7.63 (3.26)	8.00 (3.33)	12.17 (3.99)	13.94 (4.23)	14.63 (4.32)	14.59 (4.32)	14.80 (4.35)	12.28 (4)	11.02 (3.82)	9.29 (3.55)
IVBR-17	1.46 (1.71)	3.28 (2.31)	6.69 (3.09)	9.93 (3.65)	12.22 (4)	13.33 (4.14)	15.52 (4.44)	16.17 (4.52)	17.56 (4.69)	20.20 (4.99)	0.00 (0.5)	16.43 (4.55)	13.33 (4.15)	12.18 (3.99)
CHBR-2	0.76 (1.37)	2.50 (2.08)	3.61 (2.4)	8.83 (3.47)	12.06 (3.97)	11.67 (3.91)	14.78 (4.34)	15.87 (4.48)	15.91 (4.49)	17.22 (4.65)	16.89 (4.61)	14.11 (4.26)	11.98 (3.96)	11.25 (3.85)
Kashi Himani	0.22 (0.97)	1.69 (1.8)	3.61 (2.4)	6.74 (3.1)	7.83 (3.3)	8.11 (3.35)	12.17 (3.99)	14.11 (4.26)	14.39 (4.29)	14.56 (4.32)	14.28 (4.28)	12.44 (4.03)	10.93 (3.81)	9.31 (3.55)
SE(m)±	0.04	0.02	0.03	0.03	0.04	0.07	0.02	0.30	0.03	0.02	0.02	0.02	0.02	0.01
CD (5%)	0.12	0.04	0.10	0.08	0.11	0.19	0.05	0.86	0.09	0.07	0.07	0.05	0.04	0.03

*DAT= Days after transplanting; **figures in parentheses are square root transformed values.

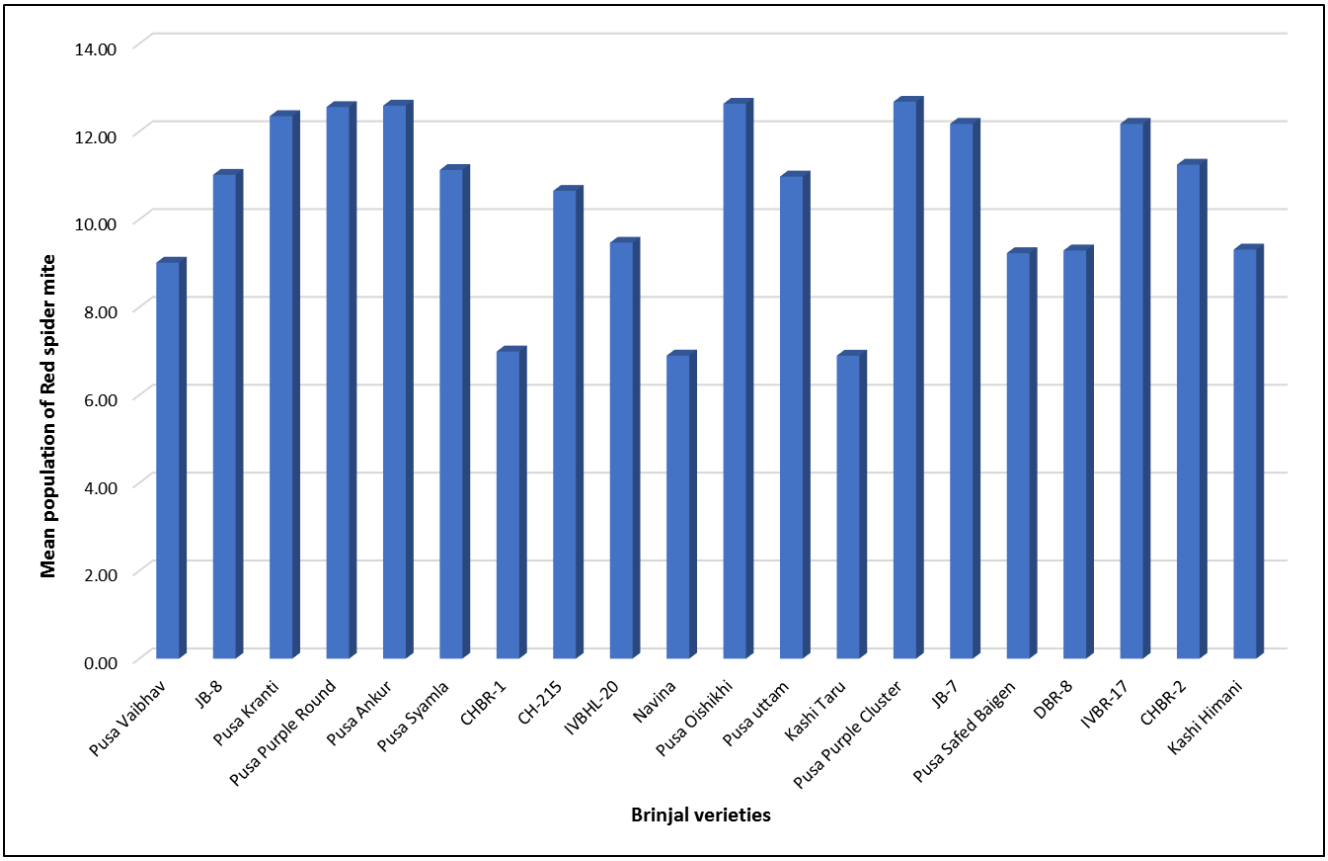

Fig 1: Graphical representation of the mean number of red spider mites/4 cm^2 leaf area per plant in brinjal varieties during summer, 2021.

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