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Incidence of insect pests associated with brinjal (*Solanum melongena* L.) crop at Ayodhya region

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Abstract
The present investigation entitled "Seasonal abundance of major insect pests and Integrated Pest Management of Brinjal Shoot and Fruit borer (*Lucinodes orbonalis* Guenee)" has been proposed to be carried out at Students' instructional Form of A.N.D.U.A. & T., Kumarganj, Ayodhya (U.P.) *Kharif* season 2019 and 2020. The maximum shoot infestation 31.85 and 36.84 per cent was observed during 43rd SW of *Kharif* 2019 and 2020. The maximum fruit infestation 34.26 and 38.24 per cent was recorded during 46th SW of 2019 and 2020. Hadda beetle was highest incidence 16.69 and 19.96 grubs and adults/plant during 43rd SW of *Kharif* 2019 and 2020. Whitefly was reached at the peak level of 20.56 and 27.34 whiteflies/3leaves on 40th SW recorded during *Kharif* 2019 and 2020. The minimum population (3.46 and 38.46 aphids/3leaves) was recorded during 45th SW of Kharif 2019 and 2020. Jassid population was reached at peak (19.12 and 2020 jassids/3leaves) during 39th SW *Kharif*, 2019 and 2020.

Keywords: shoot and fruit borer, shoot infestation, fruit infestation, incidence and brinjal

Introduction
Brinjal (*Solanum melongena* L.) belongs to the Solanaceae family and so-called by various names *viz*., eggplant, aubergine, garden egg, baingan, vankai, etc. It is one of the most important principal vegetable extensively grown in temperate (during summer) and tropical regions of the globe. India is considered as Centre of origin and diversity of brinjal. Leaves and seed of brinjal are also used as necrotic and stimulants individually (Nadkarni, 1927). In India, brinjal is a main commercial vegetable crop grown through-out the year over the country (Pareet, 2009). In India, brinjal is cultivated on an area of 72.7 million ha with an annual production of 12680 thousand million tones with productivity of 17.30 tonnes ha-1 during 2018-19. Brinjal is infested by a numeral of insect pests that cause significant yield loss. Amongst them brinjal shoot and fruit borer is the most serious pest occurring either occasionally or as outbreak every year affecting quality and quantity of brinjal unfavorably. The losses incurred due to its infestation are occasionally reported to be more than 90% (Kalloo, 1988). In young plants, the larvae bore into the petioles and midribs of large leaves and young shoots. After entering into the host the larvae close the entrance holes with their excreta and feed inside (Butani and Jotwani, 1984). The significant pests are shoot and fruit borer, *Leucinodes orbonalis* (L.) Guen.; jassid, *Amrasca biguttula biguttula* (Ishida); Fab.; aphid, *Aphis gossypii* Glover; epilachna beetle, *Epilachna vigintioctopunctata* whitefly, *Bemisia tabaci* (Gennadius.) and red spider mite, *Tetranychus telarius* (L.) (Borad *et al*., 2002). Brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee is very significant pest on brinjal owing to its feeding habit. By routine, it is an inside borer which injuries the tender shoots and fruits, which causes severe damage especially throughout the fruiting stage. The percent fruit infestation caused by the pest reached up to 90.86% (Rahman 1997).

Method and Materials
Field experiments were carried out at Students' instructional Form of A.N.D. University of Agriculture & Technology, Kumarganj, and Ayodhya (U.P.) *Kharif* season 2019 and 2020 which is located at subtropical climatic zone of Indo-Gangetic plains and situated at 26.47^{0}N latitude and 82.12^{0}E longitude at an altitude of 113 meters from mean sea level, by following common agronomic practices prescribed in (package of practices for high yielding verities). An unprotected crop of brinjal cultivar Narendra brinjal-2 was raised in 5 X 3m plots replicated thrice. The occurrence / incidence of selected pests were recorded from sowing to harvest of the crop. Observations on the population of insect pests were recorded on three

leaves one each from top, middle and bottom canopy of the five plants selected randomly in each replication. The incidence of BSFB on shoot and fruit was recorded by counting total number of shoots and fruits with the damaged ones and the incidence of hadda beetle, whitefly, aphid and jassid were recorded in terms of damage to leaves. Weekly data on different abiotic parameters were recorded and subjected to simple correlation studies.

Result and Discussion

Brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee)

Shoot infestation of BSFB was further noticed that the infestation of shoot and fruit borer infested shoots per cent was increased from 35th to 43rd SW thereafter, the infestation of shoot and fruit borer infested shoot per cent was declined up to 52nd SW in both years. The maximum shoot infestation 31.85 per cent was observed during 43rd SW of Kharif 2019. The minimum Shoot infestation 1.32 per cent was observed during 35th SW of 2019. During *Kharif* 2020, the maximum shoot infestation 36.84 per cent during 43rd SW. The minimum shoot infestation 0.80 percent was recorded 35th SW during *Kharif* 2020. Brinjal to shoot and fruit infested shoots recorded 33rd to 52nd SW during *Kharif* 2019 and *Kharif* 2020. The maximum fruit infestation 34.26 per cent was recorded during 46th SW of 2019. The minimum fruit infestation 2.35 percent infestation was recorded during *Kharif* 2019. The maximum fruit infestation 38.24 per cent was observed during 46rd SW of *Kharif*, 2020. During *Kharif*, 2020 the minimum fruit infestation 2.12 per cent was observed during 39th SW. These result also similar to Singh *et al*., (2006); Bodkhe *et al.*, (2007); Shukla and Khatri (2010); Kaur and Singh (2013); Kaur *et. al.* (2014); Lokare *et al.*, (2015).

Hadda Beetle (*Henosepilachna vigintiopunctata* F.)

The activity of hadda beetle was noticed for the first time in the 36th SW during *Kharif* 2019 and 36th SW during *Kharif* 2020. It was further noted that the infestation of hadda beetle population was increased from 36th to 43rd SW thereafter, the infestation of hadda beetle population was declined up to 49th SW in both years. Data presented on the incidence of hadda beetle revealed that the pest incidence was highest 16.69 grubs and adults/plant during 43rd SW of *Kharif* 2019. Minimum pest incidence 1.02 per cent were recorded during 49th SW of *Kharif*, 2019. During *Kharif*, 2020 the maximum hadda beetle incidence 19.96 grabs and adults/plant were observed in 43rd SW. During *Kharif*, 2020, the minimum hadda beetle incidence 1.12 grabs and adults/plant was recorded at 49th SW. The incidence of *Epilachna vigintioctopunctata* started in the 3rd week of August (34th standard week) and reached peak in second and third week of September (37th, 38th standard week) reported by (Kumar *et al.* 2014; Bharadiya and Patel, 2009; Latif *et al.*, 2009; Edpuganti and Kattula 2018; Manikandan *et al.* 2019).

White fly (*Bemisia tabaci* G.)

The data presented showed that activity of both nymph and adults of *Bemisia tabaci* were noticed for the first time in in 33 SW during both years. Constantly higher population was maintained through crop growth period and reached at the peak level of 20.56 whitefly/3leaves on 40th SW recorded during *Kharif* 2019. The minimum population of whitefly 0.66 whitefly/3leaves was recorded during 52nd SW of *Kharif* 2019. The maximum population of whitefly 27.34/3leaves was recorded during 40 SW of 2020. The minimum population of whitefly 0.56/3leaves was recorded during 52 SW of 2020. The present investigation has also been supported by (Meena *et al*. 2017; Latif *et al.*, 2009; Edpuganti and Kattula 2018. Peak population of whitefly was recorded higher during 5th week of October (44th SMW) reported by Berani and Patel, 2020).

Aphid, *Aphis gossypii* (Glover)

The activity of both nymphs and adults of aphid was noticed for the first time in the 33rd SW of during 2019 and 33rd SW during 2020. Maximum population (46.26 aphid/3 leaves) was recorded in 39th SW during *Kharif* 2019. During *Kharif*, 2019 the minimum population (3.46 aphid/3leaves) was recorded in 45th SW. During 2020 maximum population (38.46 aphid/3 leaves) was recorded in 39th SW. During *Kharif*, 2020 the minimum population (1.53 aphid/3leaves) was recorded in 46th SW. Incidence of aphid are also in similar manner to present findings with (Berani and Patel, 2020; Meena *et al*. 2017; Bharadiya and Patel, 2009) had also the highest peak activity of aphid was exhibited during 1st week of November (45th SW). (Berani and Patel, 2020; Meena *et al*. 2017; Bharadiya and Patel, 2009) had also reported it infesting brinjal in the same manner.

Jassid (*Amrasca biguttula biguttula* Ishida.)

The activity of both nymphs and adults of jassid (*A. biguttula biguttula*) was noticed for the first time in the 33rd SW during 2019 and 33rd SW during *Kharif*, 2020. Invariably the pest population prevailed throughout crop growth period and reached its peak (19.12 jassids/3leaves) during 39th SW *Kharif*, 2019. During *Kharif*, 2019 the minimum population (2.46 jassids/3leaves) was recorded. During *Kharif*, 2020 the maximum population (19.46 jassids/3leaves) was recorded in 39th SW. During *Kharif* 2020 the minimum population (0.65 jassids/3leaves) was recorded in 48 SW. The present findings in contrary with the finding of Kant (Latif *et al.*, 2009; Berani and Patel, 2020). The population build up gradually and arrived at peak on 39th SW 45.2 (jassids) reported by (Meena *et al*. 2017; Kumar *et al.* 2014) had also observed similar incidence.

Conclusion

From the study it can be concluded that in *Kharif* sown brinjal crop, insect pests reached peak level during October. Hence, for an effective management of these pests control measures can be initiated during August, which are desirable. Chemical sprays should be avoided during peak activity of natural enemies to augment the same.

Table 1: Mean population of major insect pests on brinjal during *Kharif*, 2019.

Standard weeks	Mean population of major insect pests						Temperature (ºC)		Relative humidity (%)	Rainfall (mm)
	Defoliator insects			Sucking insects			Min.	Max.		
	Shoot infestation (%)	Fruit infestation (%)	Hadda beetle per plant	White fly per 3leaves	Aphid per 3leaves	Jassid per 3 leaves				
33	0.00	0.00	0.00	2.46	5.66	2.60	26.70	32.70	86.20	4.00
34	0.00	0.00	0.00	5.85	12.42	5.76	24.70	31.10	86.20	84.60
35	1.32	0.00	0.00	8.52	16.66	8.66	26.70	34.00	79.90	0.00
36	3.68	0.00	4.16	12.94	28.84	11.46	26.30	33.00	81.60	10.00
37	6.37	0.00	4.76	16.64	34.64	15.54	26.50	32.70	86.80	104.00
38	10.22	0.00	7.82	20.34	39.66	17.46	24.20	30.00	89.10	103.00
39	13.68	2.35	10.74	22.36	46.26	19.12	22.90	27.50	91.70	179.00
40	18.26	6.38	11.14	26.46	38.23	16.45	22.40	30.30	82.50	10.00
41	24.38	12.16	13.66	20.56	28.48	14.65	20.90	32.50	74.10	0.00
42	28.65	16.63	14.28	17.35	19.46	13.26	21.00	31.80	77.70	0.00
43	31.85	19.38	16.69	15.56	12.26	11.46	17.40	29.20	75.90	0.00
44	28.66	25.35	12.34	11.46	8.24	8.34	16.90	29.20	78.80	0.00
45	23.85	29.85	9.46	8.45	3.46	6.54	15.50	29.70	74.00	0.00
46	21.65	34.26	6.02	4.38	0.00	3.56	13.10	29.40	81.60	0.00
47	19.14	32.16	4.12	1.84	0.00	2.34	12.50	27.20	75.40	0.00
48	16.77	28.02	3.34	0.96	0.00	0.86	14.20	26.80	77.50	0.00
49	14.54	24.16	1.02	1.02	0.00	0.00	9.70	24.90	70.70	0.00
50	12.22	17.46	0.00	1.24	0.00	0.00	11.20	23.10	74.40	2.00
51	11.46	15.26	0.00	0.84	0.00	0.00	8.50	17.60	82.70	0.00
52	9.85	12.34	0.00	0.66	0.00	0.00	5.30	14.00	84.70	0.00

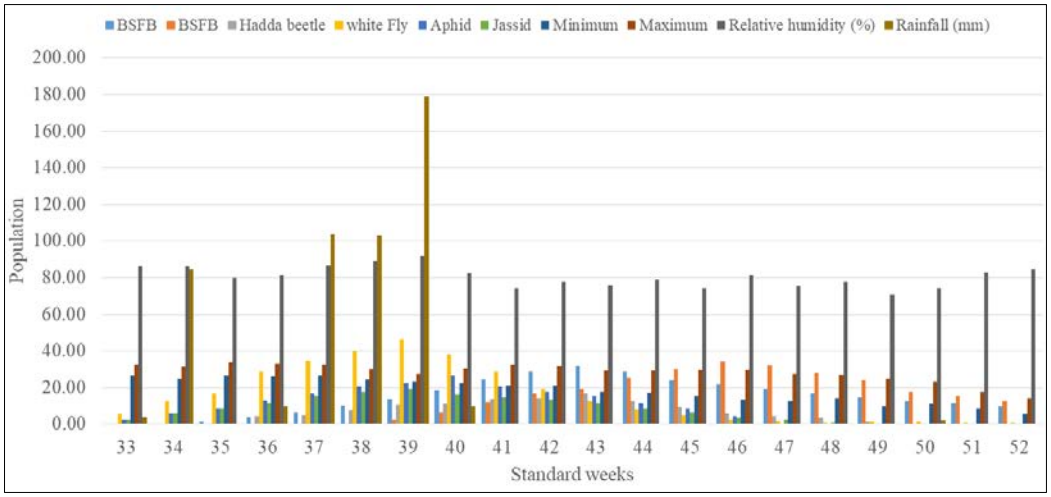

Fig 1: Mean population of major insect pests on brinjal during *Kharif*, 2019

Table 2: Mean population of major insect pests on brinjal during *Kharif* season, 2020.

Standard weeks	Mean population of major insect pests						Temperature (ºC)		Relative humidity (%)	Rainfall (mm)
	Defoliator insects			Sucking insects			Min.	Max.		
	Shoot infestation (%)	Fruit infestation (%)	Hadda beetle per plant	White fly per 3leaves	Aphid per 3leaves	Jassid per 3 leaves				
33	0.00	0.00	0.00	1.98	4.67	2.46	27.30	32.60	85.30	114.80
34	0.00	0.00	0.00	6.85	10.56	6.76	26.20	32.20	78.70	34.40
35	0.80	0.00	0.00	9.67	15.54	9.46	26.00	32.60	76.90	6.00
36	1.75	0.00	3.86	13.89	24.56	12.36	26.50	34.20	79.90	16.20
37	4.38	0.00	7.64	17.46	28.46	16.34	26.80	34.60	73.40	0.00
38	8.89	0.00	9.86	21.34	34.43	18.34	26.50	34.00	78.20	0.00
39	14.72	2.12	11.34	24.45	38.46	19.46	24.00	31.90	76.90	76.00
40	19.35	7.68	13.46	27.34	35.78	16.34	23.00	34.40	73.60	3.00
41	23.65	12.64	15.82	21.45	29.46	13.46	21.40	34.30	70.30	0.00
42	29.75	17.34	17.42	18.34	20.26	11.46	21.10	34.20	68.10	0.00
43	36.84	23.48	19.96	16.28	13.46	9.34	16.40	32.90	63.60	0.00
44	33.48	30.86	14.45	10.46	8.38	6.46	13.50	31.30	60.70	0.00
45	31.34	34.64	8.65	8.45	4.48	4.12	11.70	30.00	62.60	0.00
46	28.46	38.24	5.43	4.87	1.53	3.34	14.80	28.10	71.10	6.20
47	24.72	34.12	3.62	1.34	0.00	1.96	10.21	25.93	64.00	0.00
48	21.45	28.68	2.34	0.86	0.00	0.65	8.86	26.82	64.14	0.00
49	18.44	24.65	1.12	1.31	0.00	0.00	10.29	27.32	70.36	0.00
50	14.34	18.65	0.00	1.24	0.00	0.00	11.00	22.75	74.21	0.00
51	11.25	15.46	0.00	0.86	0.00	0.00	5.14	20.46	68.43	0.00
52	9.12	13.88	0.00	0.56	0.00	0.00	5.19	22.94	64.31	0.00

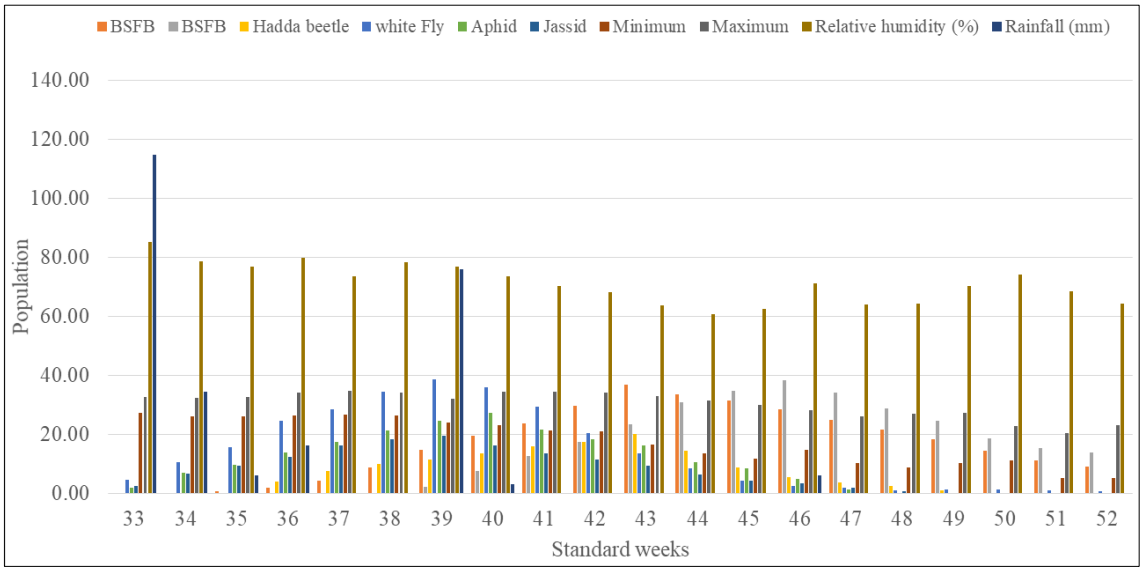

Fig 2: Mean population of major insect pests on brinjal during *Kharif* season, 2020

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