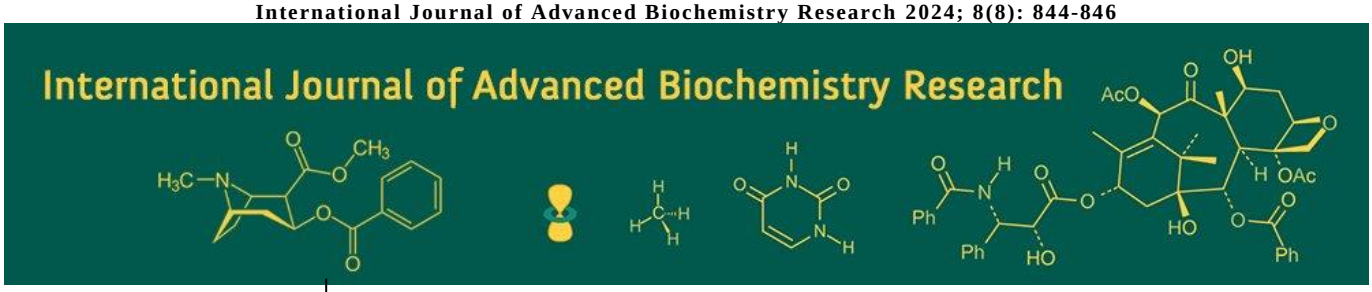

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Assessment of crop loss due to whitefly pests of okra during the years

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Abstract
The investigation was carried out at experimental field at Department of zoology, Purnea University, Bihar. The ten varieties of okra namely, Arka Anamika, Arka Abhaya, Parbhani Kranti, Pusa Sawani, VRO-6 (Kashi Pragati), VRO-5 (Kashi Vivhuti), Pusa Makhmali, IIVR-11, and Hissar Unnat, Pusa A-4 were procured by Purnea University under present research work. The assessment of yield loss on the basis of percent reduction of cumulative yields of healthy and white fly infested set in 2020. Observed that the cultivar Pusa Makhmali was highest yield reduction percent (59.88% yield loss) followed by Arka Anamika (44.44% yield loss), Arka Abhay (38.27% yield loss) and least damaging cultivar IIVR-11 (16.11% yield loss) followed by Hissar Unnat (18.52% yield loss), Pusa A-4 (25.00% yield loss). In 2021, the assessment of yield loss on the basis of percent reduction of cumulative yields of healthy and white fly infested set was done. It was observed that the cultivar Pusa Makhmali was highest yield reduction percent (64.29% yield loss) followed by Arka Abhay (53.19% yield loss) and Arka Anamika (52.38% yield loss). Whereas least damaging cultivar IIVR- 11 (18.21% yield loss) followed by Hissar Unnat (20.37% yield loss) and Pusa A-4 (26.69% yield loss).

Keywords: Experimental field, department of zoology, Purnea University, okra varieties

Introduction
Okra (*Abelmoschus esculentus* L. Moench) belong to the family Malvaceae and also known as lady's finger, or bhindi. It is originated in Ethiopia and an important warm season vegetable crop grown extensively in tropical and subtropical regions of the world**.** It is a short duration vegetable crop propagated by seeds. Tender and immature seeded green fruit is used to prepare different product like curries, soups, or in canned, dehydrated, or frozen forms for off-season consumption (Neeraja *et al*., 2004) [6]. Okra is more remunerative than the leafy vegetables. The roots and stems are useful for clearing cane juice from which gur or jaggery is prepared (Chauhan, 1972) [1]. Its ripe seeds are roasted, ground and used as a substitute for coffee in Turkeyn. Fruits have high nutritional value, containing proteins, calcium, phosphorus, iron, carotene, and vitamins A, B, and C (Singh *et al*., 2001) [7], which are very useful against genito-urinary disorders, spermatorrhoea, and chronic dysentery.
Bemisia tabaci is a polyphagous insect which can cause damage to various crop *viz.* cotton, brinjal, lady's finger, some other vegetables, and ornamental plants. Whiteflies cause damage to plants in two ways firstly by sucking the sap and transmitting viral disease and secondly by excreting honey dew on which black sooty mould grows. Whiteflies have become one of the most serious crop protection problems. (Gangwar and Gangwar, 2018) [2]. Keeping these in view the experiment with the objective of assessment of yield losses due to whitefly was carried out.

Materials and Methods
The ten varieties of okra namely, Arka Anamika, Arka Abhaya, Parbhani Kranti, Pusa Sawani, VRO-6 (Kashi Pragati), VRO-5 (Kashi Vivhuti), Pusa Makhmali, IIVR-11, and Hissar Unnat, Pusa A-4 were procured by Purnea University under present research work.

Seed rate and method of sowing
The seeds were sown at the recommended seed rate of 10 kg per ha in all experimental plots. Before sowing, seeds were treated with captain at the rate of 2.0 g per kg seeds.

The seeds were sown by dibbling method keeping row to row and plant to plant distance of 60 and 30 cm, respectively.

Irrigation schedule and cultural practises

In the *Kharif* season, crops need irrigation during long spells of drought for quick plant growth and fruit formation. The okra crop was irrigated at 10 day intervals. Thinning and gap filling were done during early stage of plant growth and plant-to-plant distance of 30 cm maintained. The other recommended agronomic practises (weeding, hoeing, etc.) were followed as and when needed.

Yield loss assessment

The different okra varieties were assessed for yield loss due to white fly. Ten infested plants and ten healthy plants were taken from each plot in all replications and disease severity due to white fly infestation was recorded at periodical intervals using a 0-4 rating scale. Tagged 10 healthy plants were maintained by covering with 40 mesh nylon net during entire crop period and subsequently applied systemic insecticides against whitefly. The corresponding yields from infested tagged plants as well as healthy plants were taken. Yield loss was calculated on the basis of cumulative yield from infested plant in comparison to healthy plants.

Results

Assessment of crop loss due to Whitefly pests of okra during the year, 2020.

Different cultivars *viz*. Arka Anamika, Arka Abhay, Parbhani Kranti, Pusa Sawani, VRO-6,VRO-5, Pusa Makhmali, IIVR-11, Hissar Unnat and Pusa A-4 of okra were selected for the experiment of yield loss assessment for white fly damage (YVMV disease) (Table 1).

Table 1: Assessment yield losses due to white fly in different cultivars of okra during 2020

Yield/ 10 plants in 2020					
S. No.	**Cultivars**	**Healthy set**	**OYVMV infected set**	**Percent yield loss**	**Grade**
1.	Arka Anamika	1.8	1	44.44	2
2.	Arka Abhay	3.24	2	38.27	2
3.	Parbhani Kranti	1.53	0.95	37.91	2
4.	Pusa Sawani	2.07	1.35	34.78	2
5.	VRO-6 (Kashi Pragati)	2.34	1.55	33.76	2
6.	VRO-5 (Kashi Vivhuti)	3.06	2	34.64	2
7.	Pusa Makhmali	1.62	0.65	59.88	4
8.	IIVR- 11	3.60	3.02	16.11	1
9.	Hissar Unnat	2.16	1.76	18.52	1
10.	Pusa A-4	2.52	1.89	25.00	1

Infested ten plants of one set and one set of healthy plant were selected and disease severity was recorded at periodical interval using 0-4 rating scale. The corresponding yields on tagged diseased plants as well as healthy plants were taken and yield loss was calculated on the basis of cumulative yield on diseased plants in comparison to healthy plants.

The assessment of yield loss on the basis of percent reduction of cumulative yields of healthy and white fly infested set in 2020. Observed that the cultivar Pusa Makhmali was highest yield reduction percent (59.88% yield loss) followed by Arka Anamika (44.44% yield loss), Arka Abhay (38.27% yield loss). And least damaging cultivar IIVR- 11 (16.11% yield loss) followed by Hissar Unnat (18.52% yield loss), Pusa A-4 (25.00% yield loss).

Assessment of crop loss due to Whitefly pests of okra during the year, 2021.

In 2021, the assessment of yield loss on the basis of percent reduction of cumulative yields of healthy and white fly infested set was done (Table 2).

Table 2: Assessment yield losses due to white fly in different cultivars of okra during 2021

Yield/ 10 plants in 2021					
S. No.	**Cultivars**	**Healthy set**	**OYVMV infected set**	**% yield loss**	**Rating scale**
1	Arka Anamika	2.1	1	52.38	2
2	Arka Abhaya	4.23	1.98	53.19	2
3	Parbhani Kranti	1.82	0.92	49.45	2
4	Pusa Sawani	2.56	1.56	39.06	2
5	VRO-6 (Kashi Pragati)	2.61	1.45	44.44	2
6	VRO-5 (Kashi Vivhuti)	3.26	1.74	46.63	2
7	Pusa Makhmali	1.82	0.65	64.29	4
8	IIVR- 11	3.68	3.01	18.21	1
9	Hissar Unnat	2.16	1.72	20.37	1
10	Pusa A-4	2.36	1.73	26.69	1

It was observed that the cultivar Pusa Makhmali was highest yield reduction percent (64.29% yield loss) followed by Arka Abhay (53.19% yield loss) and Arka Anamika (52.38% yield loss). Whereas least damaging cultivar IIVR-11 (18.21% yield loss) followed by Hissar Unnat (20.37% yield loss) and Pusa A-4 (26.69% yield loss).

Discussion

The investigation was carried out to understand the disease severity and the loss in yield cause by the disease. Different cultivars of okra were selected for the experiment of yield loss assessment for white fly damage. Infested ten plants of one set and one set of healthy plant were selected and disease severity was recorded at periodical interval using 0-4 rating scale. The assessment of yield loss on the basis of percent reduction of cumulative yields of healthy and white fly infested set in 2020 revealed that the cultivar Pusa Makhmali recorded highest yield reduction percent (59.88% yield loss) followed by Arka Anamika (44.44% yield loss), Arka Abhay (38.27% yield loss) and least damaging cultivar

IIVR- 11 (16.11% yield loss) followed by Hissar Unnat (18.52% yield loss), Pusa A-4 (25.00% yield loss). Kanwar and Ameta (2007) [4] also reported that the insect pest caused 49.30 percent mean reduction in per plant marketable fruit yield and their findings were similar to the findings of the present investigation. Jamir *et al.* (2019) [9] while working on the various cultivars of okra against the major viral disease of okra observed that the marketable yield loss of YVMV ranged from 17.09 to 96.49% which is much higher in comparison to the cultivars of present investigation which shows that they are better in performance to the other available cultivars. Also, the present experimental results are close approximate to the findings of Suryawanshi *et al.* (2003) [9] and Gupta and Thind (2006) [10].

Conclusion

The study conducted at the experimental field of the Department of Zoology, Purnea University, assessed the impact of whitefly infestation on the yield of ten okra varieties across two years, 2020 and 2021. The research revealed that the cultivar Pusa Makhmali consistently experienced the highest yield reduction, with losses of 59.88% in 2020 and 64.29% in 2021. This was significantly higher compared to other varieties. Conversely, IIVR-11 exhibited the lowest yield loss in both years, with reductions of 16.11% and 18.21% respectively. The other varieties, such as Arka Anamika and Arka Abhaya, also showed considerable yield reductions but were less affected than Pusa Makhmali.

The findings indicate that while some cultivars like Pusa Makhmali are highly susceptible to whitefly damage, others like IIVR-11 are more resilient. These results highlight the need for targeted pest management strategies and the potential benefit of selecting less susceptible cultivars to mitigate yield losses due to whitefly infestations. The study underscores the importance of ongoing research and cultivar assessment to improve crop resilience and ensure sustainable okra production.

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