

Original Research Article

Effect of Seasons on Fruit Yield, major Insect Pests and Diseases in Selected Cultivars of Brinjal under Jammu Conditions (J&K)

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ABSTRACT

The present investigation was carried out at Vegetable Research Farm, Division of Vegetable Science & Floriculture, FoA, Chatha, SKUAST-Jammu during three sowing seasons viz., autumn-winter, spring-summer and rainy seasons for two years during 2014 to 2016 to identify the resistant types as well as most suitable season of growing brinjal crop in Jammu region. A total of fifteen open pollinated brinjal cultivars namely, Punjab Sadabahar, Arka Shirish, Arka Kusumkar, Arka Keshav, Arka Nidhi, Arka Neelkanth, Pusa Shyamala, Pusa Kranti, Pusa Ankur, Pusa Uttam, PPL, PPR, PPC, BR-14 and Puneri Kateri collected from different parts of the country were screened under the present study. The results revealed Pusa Kranti and Pusa Ankur recorded significantly highest fruit yield per plant (1.77 and 1.73 kg, respectively) followed by Punjab Sadabahar (1.36 kg) and Pusa Uttam (1.34 kg). Significantly minimum shoot borer and fruit borer incidence was recorded in three cultivars viz., Arka nidhi, Pusa Uttam and BR-14 whereas minimum spider mite infestation was observed four cultivars viz., Arka Neelkanth, Arka Nidhi, Punjab Sadabahar and Arka Keshav which was significantly lower than all other cultivars. Among all the three growing seasons, autumn-winter recorded overall minimum phomopsis incidence followed by spring-summer whereas rainy season recorded maximum disease incidence. Similarly, autumn-winter recorded overall minimum little leaf incidence (3.06%) followed by rainy season (7.97%) whereas spring-summer recorded maximum disease incidence (14.95%).

Keywords

Brinjal, Fruit yield, Shoot & Fruit borer, Spider mite, Phomopsis blight, Little leaf

Introduction

Brinjal (*Solanum melongena* L.), belonging to the angiospermic family 'Solanaceae'. It is one of the most popular and versatile vegetable crop adapted to different agro-climatic regions of India and can be grown throughout the year right from sea level to snowline. India is the second largest producer of brinjal in the world next to China and

produces 12801 '000 MT from an area of 730 '000 ha (NHB, 2018). 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 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 is another pest that has been ranked as a major pest next to fruit and shoot borer in brinjal (Monica *et al.*, 2014). In Jammu region also, prevalence of spider mite has been observed brinjal growing areas, damaging brinjal crop and reducing economic yield. Brinjal is known to suffer from 12 diseases and among them phomopsis blight and fruit rot, caused by *Phomopsis vexans* and little leaf caused by Phytoplasma and transmitted through Leaf hopper vector, *Cestius phycitis*, *Hishimonus phycitis* and *Empoasca devastans* have been considered as major constraints to brinjal cultivation. In J&K, brinjal is grown over an area of 22,00 ha, out of which Jammu region accounts for 1144 ha area with total production of 2,33,661.50 MT (Anonymous, 2014). There are umpteen numbers of commercially grown varieties are available in the market, released by both public and private sector. Moreover, there is an utmost need for identification / development of high yielding stable varieties for specific seasons (Vaddoria *et al.*, 2009). Moreover, the brinjal crop is susceptible to a wide range of diseases which causes severe loss in all stages of growth and development in the subtropical plains of Jammu region where it is mainly grown during two main seasons i.e., spring-summer and rainy seasons. However, due to heavy losses suffered by the farmers during these two seasons, a third season i.e., autumn-winter cultivation of brinjal was also propagated by our university based on our previous research (Bhushan *et al.*, 2017). The cultivars recommended in Jammu region are most suitable for growing during summer and rainy season only. There is an urgent need for identification of new brinjal cultivars suited for growing under different seasons to achieve the stability in production and

productivity. Therefore, keeping in view the importance of brinjal crop and challenges post by biotic stresses, the present investigation was planned to identify the resistant/tolerant types as well as most suitable season with lowest occurrence of biotic stresses in brinjal crop in Jammu region,.

Materials and Methods

The experimental field of Division of Vegetable Science and Floriculture, SKUAST, Jammu is situated at 32° 40'N latitude and 74° 58' E longitude and has an elevation of 332 m above mean sea level. Agro-climatically, the location represents Zone V of Jammu and Kashmir and is characterized by subtropical climate. The place experiences hot dry summer, hot and humid rainy season and cold winter months, the maximum temperature goes up to 45° C during summer (May to June) and minimum temperature falls to 1° C during winters. The mean annual rainfall is about 1000-1200 mm.

The experimental material comprised of fifteen brinjal cultivars namely Punjab Sadabahar, Arka Shirish, Arka Kusumkar, Arka Keshav, Arka Nidhi, Arka Neelkanth, Pusa Shyamala, Pusa Kranti, Pusa Ankur, Pusa Uttam, Pusa Purple Long, Pusa Purple Round, Pusa Purple Cluster, BR-14 and Puneri Kateri collected from different parts of the country. The selected cultivars were evaluated during three sowing seasons viz., autumn-winter, spring-summer and rainy seasons for two years during 2014 to 2016. The individual experiment was conducted in Randomized Block Design with three replications. The uniform, healthy seedlings were transplanted on ridges maintaining inter and intra row spacing of 90 cm x 60 cm, respectively. All the recommended package of practices for raising a healthy crop was followed. Observation on fruit yield per plant

was calculated on the basis of total weight of fruits. The total weight of fruits from five randomly selected plants was obtained from each picking and the average fruit yield per plant was worked out whereas total weight of fruits from each plot was obtained from each picking and pooled and fruit yield per hectare was calculated on the basis of total plot yield. Data on phomopsis blight, little leaf, shoot borer, fruit borer and spider mite was recorded from randomly selected five plants and the percent was worked out accordingly.

Results and Discussion

Effect of seasons on mean performance of brinjal varieties

From the data presented in Table 1 and Fig. 1&2, it was revealed that based on mean data of all the three seasons across two years, two varieties viz., Pusa Kranti and Pusa Ankur recorded significantly highest fruit yield per plant (1.77 and 1.73 kg, respectively) followed by Punjab Sadabahar (1.36 kg) and Pusa Uttam (1.34 kg). Rest of the varieties performed average or below average as compared to top performing varieties. However, as far as fruit yield per hectare was concerned, among all the varieties significantly highest value was recorded in Pusa Kranti (170.34 q) followed by Pusa Ankur (158.19 q) and then Punjab Sadabahar (140.14 q). Rest of the varieties performed average or below average as compared to top performing varieties.

It was also evident from the data that presented in Table 1 that among three growing season autumn-winter recorded significantly lower yields as compared to other two seasons viz., spring-summer and rainy season. However, there exists low variation in performance of varieties in these two seasons and eight varieties viz., Punjab Sadabahar, Arka Kusumkar, Arka Nidhi,

Pusa Kranti, Pusa Ankur, PPR, PPC, BR-14 and Puneri Kateri showed best per plant and per hectare yields during rainy season whereas seven varieties viz., Arka Shirish, Arka Keshav, Pusa Shyamla, Pusa Uttam, PPL and Arka Neelkanth recorded highest per plant and per hectare yields during spring-summer season.

In a similar study, Kikuchi *et al.*, 2008 reported AE-P03 and AE-P01 to be the best lines under autumn-winter cultivation when grown under different seasons with varied temperatures i.e. autumn-winter, early summer and winter cultivation in growth chambers under natural light under Kusawa, Japan conditions. However, Mehta *et al.*, 2011 while evaluating seven open pollinated genotypes of long brinjal in the three environments of rainy season under irrigated conditions of Chhattisgarh plains and observed that IBWI-2007-1 was the most stable genotype under irrigated conditions for *kharif* planting whereas, a local genotype was suitable for fruit yield under low yielding environment.

Effect of seasons on insect pest infestation in brinjal cultivars

Overall mean data on shoot borer, fruit borer and spider mite infestation during all the three seasons across two years was presented in Table 2 and Fig. 3, 4 & 5. The results revealed significantly minimum shoot borer and fruit borer incidence in three cultivars viz., Arka Nidhi, Pusa Uttam and BR-14 (10.79 & 10.33%, 12.98 and 12.48% and 13.57 and 13.27%, respectively).

Significantly highest shoot and fruit borer infestation was observed in PPL (26.09% and 25.36%, respectively) followed by PPC (23.99% and 22.76%, respectively), Arka Kusumkar (21.41% and 19.97%, respectively) and Pusa Shymala (20.95% and

19.31%, respectively). Among all the cultivars, minimum spider mite infestation was observed four cultivars viz., Arka Neelkanth (3.47%), Arka Nidhi (3.82%), Punjab Sadabahar (5.21%) and Arka Keshav (5.21%) which was significantly lower than all other cultivars.

It was also clearly indicated in the data presented in Table 3, shoot & fruit borer and spider mite infestation was significantly lower in autumn-winter season in all the cultivars followed by spring-summer whereas rainy season recorded maximum attack of shoot & fruit borer and spider mite.

The reason for low pest infestation in autumn-winter season can be attributed due to the climatic factors like low temperature and humidity during winter months whereas high temperature and high humidity during spring-summer and rainy season favour pest multiplication and growth thereby causing great damage to the standing crop especially after the onset of the monsoon.

Gautam *et al.*, 2019 also emphasized the yield losses due shoot and fruit borer vary from season to season due to hot and high humidity conditions during summers and rainy season. Nayak, 2014 studied the population dynamics and infestation pattern of brinjal shoot and fruit borer in relation to different environmental factors during winter seasons of 2009-10 and 2010-11 at Keonjhar, Odhisa and reported that temperature factors exerted a positive influence and relative humidity had a negative effect on the population build up and infestation of the shoot & fruit borer.

Chaudhary and Sharma, 2000 screened nine genotypes of brinjal against shoot and fruit borer and revealed that 2.88% (Arka Keshav) to 5.64% (SM-6-6) borer infestation where as

PPL followed by PPC recorded maximum borer infestation (28.74% and 19.49%) respectively. Rai *et al.*, 2001(b) reported minimum average infestation in long types ranging from 20.61-31.57% whereas round types exhibit maximum infestation ranging from 28.57-40.68% during 1994-98 at Raipur conditions. Sarma, 2010 revealed brinjal mite, *Tetranychus* spp. incidence was more during summer followed by *rabi* and *kharif* seasons under Dharwad conditions whereas among the twelve varieties screened, Arka Nidhi recorded lowest mite population during both the years and also recorded on par yield with the best yielded variety Kalyan and Arka Nidhi and Arka Keshav were found moderately resistant.

Effect of seasons on disease incidence in brinjal cultivars

Overall mean data on phomopsis blight and little leaf incidence during all the three seasons across two years was presented in Table 3 and Fig. 6 & 7. The data revealed significantly minimum phomopsis blight incidence in Puneri Kateri (9.88%) followed by Pusa Kranti (13.77%) whereas Arka Shirish (27.91%) followed by Arka Kusumkar (23.59%) recorded maximum phomopsis blight incidence.

Rest of the cultivars were found to be moderately tolerant or susceptible. With respect to little leaf, significantly minimum incidence was recorded in Puneri Kateri (2.43%) followed by PPC (4.51%), Arka Nidhi and Arka Kusumkar (5.56%) and Pusa Kranti (7.29%).

However, amongst all the cultivars, significantly maximum little leaf incidence was observed in two cultivars viz., BR-14 (12.85%) and PPR (12.50%) followed by Arka Shirish and Pusa Shyamla (10.07%).

Table.1 Average fruit yield/ plant and Fruit yield /ha of brinjal varieties in three growing seasons of Jammu region

S No.	Variety	Fruit yield per plant (Kgs)				Fruit yield per ha (q)			
		Autumn-winter	Spring-summer	Rainy season	Mean	Autumn-winter	Spring-summer	Rainy season	Mean
1	Punjab Sadabahar	1.30	1.50	1.62	1.36	122.25	145.14	153.59	140.14
2	Arka Shirish	0.39	1.01	0.97	0.74	37.51	106.17	91.22	77.07
3	Arka Kusumkar	0.22	0.43	0.56	0.36	22.38	42.56	51.34	37.61
4	Arka Keshav	0.34	0.70	0.65	0.52	33.47	62.33	61.04	50.24
5	Arka Nidhi	0.50	0.82	1.02	0.74	48.56	83.02	92.12	70.68
6	Pusa Shyamla	0.32	0.55	0.53	0.42	28.87	56.64	51.71	45.09
7	Pusa Kranti	0.94	2.11	2.32	1.77	90.93	206.68	226.41	170.34
8	Pusa Ankur	1.30	1.79	1.95	1.73	127.47	177.98	179.11	158.19
9	Pusa Uttam	1.09	2.02	1.59	1.34	105.68	197.56	171.48	132.78
10	PPL	0.68	1.10	0.93	0.83	65.20	110.90	94.36	82.69
11	PPR	0.51	0.80	0.84	0.67	51.77	72.30	76.15	62.97
12	PPC	0.34	0.47	0.54	0.46	32.59	46.00	48.77	45.19
13	BR-14	0.75	1.21	1.59	1.08	67.73	126.62	149.43	104.61
14	Puneri kateri	0.18	0.23	0.29	0.20	15.83	23.39	26.70	18.61
15	Arka Neelkanth	0.14	0.31	0.30	0.22	12.54	31.22	28.57	21.21
CD (0.05)		0.31	0.32	0.38	0.34	8.70	7.21	5.97	7.35

Table.2 Shoot and fruit borer and spider mite infestation of brinjal varieties in three growing seasons of Jammu region

S No.	Cultivar	Shoot borer (%)				Fruit borer (%)				Spidermite (%)			
		Autumn-winter	Spring - summer	Rainy season	Mean	Autumn-winter	Spring - summer	Rainy season	Mean	Autumn-winter	Spring-summer	Rainy season	Mean
1	Punjab Sadabahar	10.585	20.635	28.45	19.89	9.25	23.2	24.66	19.04	1.04	7.295	7.29	5.21
2	Arka Shirish	8.35	17.03	24.35	16.58	7.435	18.6	22.18	16.07	3.125	22.92	18.75	14.93
3	Arka Kusumkar	12.615	22.9	28.815	21.44	10.385	24.365	25.15	19.97	5.205	20.83	15.62	13.89
4	Arka Keshav	10.47	13.87	20.7	15.01	8.565	15.8	17.015	13.79	1.04	7.295	7.29	5.21
5	Arka Nidhi	5.15	10.35	16.88	10.79	4.1	12.4	14.5	10.33	1.04	5.21	5.21	3.82
6	Pusa Shyamla	15.22	18.765	28.865	20.95	12.535	20.835	24.55	19.31	4.165	15.625	13.5	11.11
7	Pusa Kranti	8.07	17.535	25.565	17.06	7.42	19.98	23.25	16.88	7.295	18.75	13.545	13.19
8	Pusa Ankur	11.75	17.935	24.83	18.17	8.515	18.7	21.82	16.34	11.46	28.125	19.79	19.79
9	Pusa Uttam	7.82	14.05	17.065	12.98	5.935	15.77	15.75	12.48	6.25	17.705	15.62	13.19
10	PPL	15.585	24.6	38.085	26.09	14.415	29.215	32.43	25.36	10.415	23.96	16.67	17.01
11	PPR	8.83	21.45	23.715	18.00	8.25	24.15	21.85	18.08	8.335	23.96	17.70	16.67
12	PPC	16.07	25.785	30.13	23.99	14.12	26.815	27.35	22.76	12.5	20.83	19.79	17.71
13	BR-14	4.8	15.485	20.43	13.57	4.65	16.965	18.2	13.27	1.04	8.335	7.29	5.56
14	Puneri Kateri	17.085	25.965	36.75	26.60	15.67	27.6	32.46	25.24	5.205	13.545	11.46	10.07
15	Arka Neelkanth	7.85	19.335	23.365	16.85	6.435	21.65	19.8	15.96	1.04	5.21	4.17	3.47
CD (0.05)		2.85	3.71	4.92	3.04	3.02	8.03	7.26	7.45	3.39	6.50	4.07	6.55

Table.3 Phomopsis blight and little leaf disease incidence of brinjal varieties in three growing seasons of Jammu region

S No.	Cultivar	Phomopsis blight incidence (%)				Little leaf disease incidence (%)			
		Autumn-winter	Spring-summer	Rainy season	Mean	Autumn-winter	Spring-summer	Rainy season	Mean
1	Punjab Sadabahar	7.38	26.52	22.02	17.66	2.08	6.25	2.08	5.56
2	Arka Shirish	13.27	23.55	27.91	23.85	6.25	16.67	4.17	10.07
3	Arka Kusumkar	17.26	21.40	26.20	23.59	2.08	10.42	2.08	5.56
4	Arka Keshav	13.76	20.21	24.69	21.18	2.08	16.67	6.25	5.90
5	Arka Nidhi	14.16	19.57	23.82	21.00	0.00	18.75	2.08	5.56
6	Pusa Shyamla	15.71	13.99	22.60	20.36	4.17	16.67	4.17	10.07
7	Pusa Kranti	8.00	16.17	16.94	13.77	2.08	14.58	8.33	7.29
8	Pusa Ankur	8.75	17.17	24.17	18.60	6.25	20.83	8.33	9.37
9	Pusa Uttam	15.48	24.63	22.62	19.86	2.08	18.75	8.33	10.07
10	PPL	15.46	19.63	24.14	22.10	2.08	16.67	6.25	7.99
11	PPR	14.01	16.13	21.76	18.99	4.17	20.83	10.42	12.50
12	PPC	8.36	20.80	17.98	16.55	0.00	10.42	2.08	4.51
13	BR-14	14.36	9.73	25.58	22.55	6.25	20.83	12.50	12.85
14	Puneri kateri	5.98	16.72	10.11	9.88	0.00	6.25	2.08	2.43
15	Arka Neelkanth	10.88	16.85	15.58	16.57	4.17	16.67	8.33	7.64
CD (0.05)		2.85	3.71	3.92	3.04	1.02	10.03	7.26	4.45

Fig.1 Seasonal effects on fruit yield per plant in different varieties of brinjal

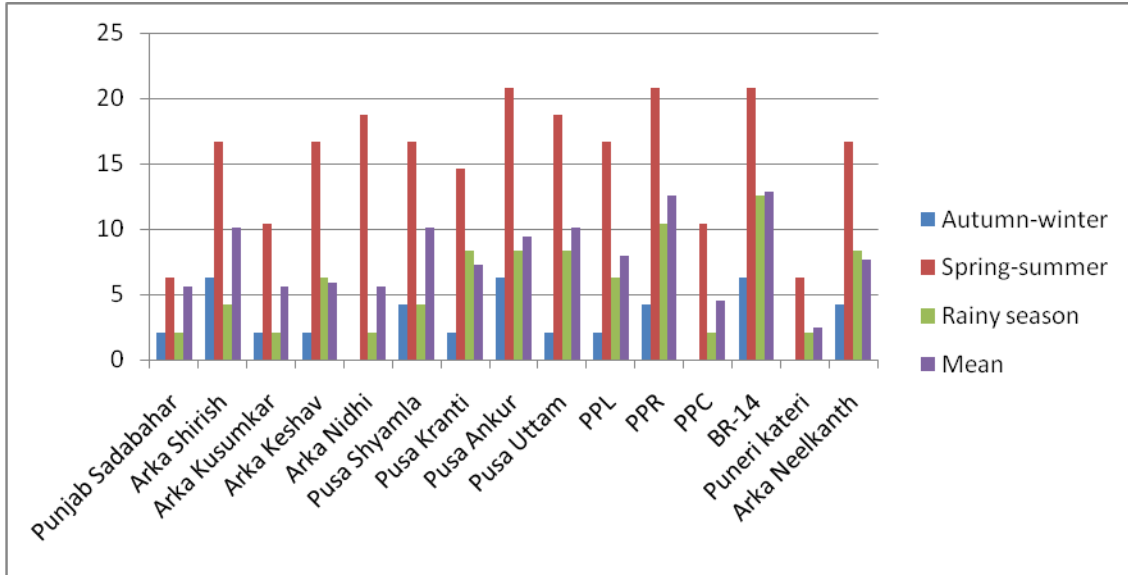


Fig.2 Seasonal effects on fruit yield per hectare in different varieties of brinjal

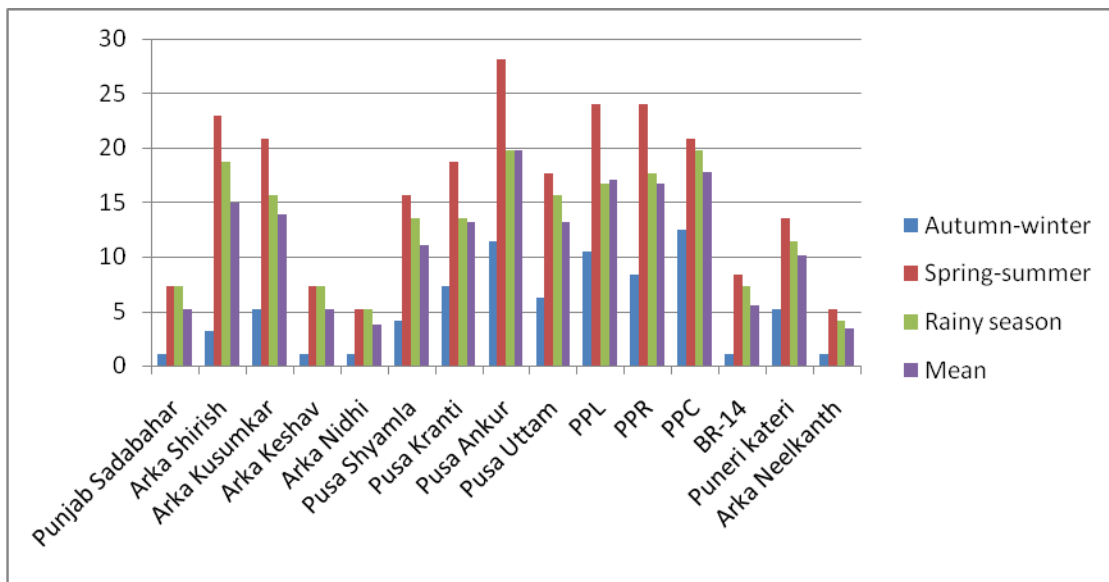


Fig.3 Seasonal effects on shoot borer infestation (%) in different varieties of brinjal

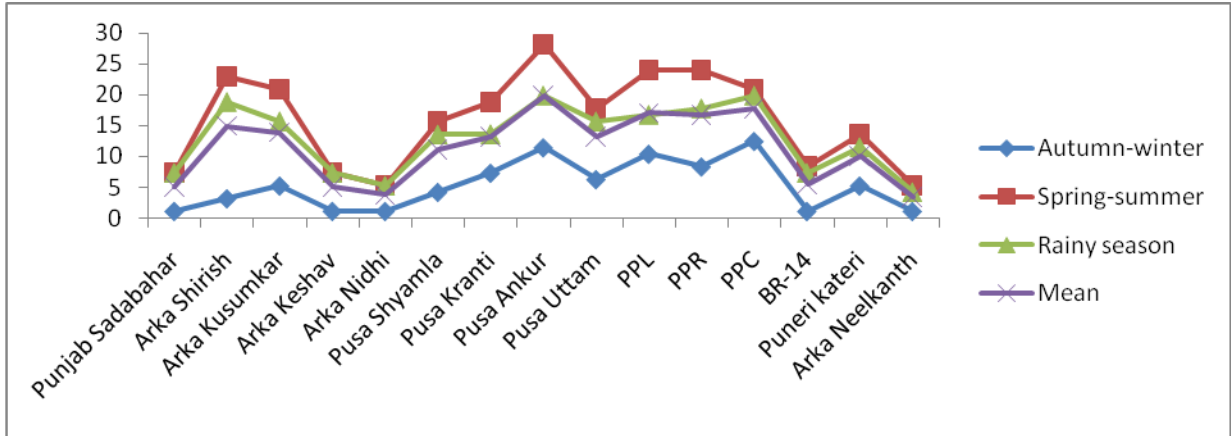


Fig.4 Seasonal effects on fruit borer infestation (%) in different varieties of brinjal

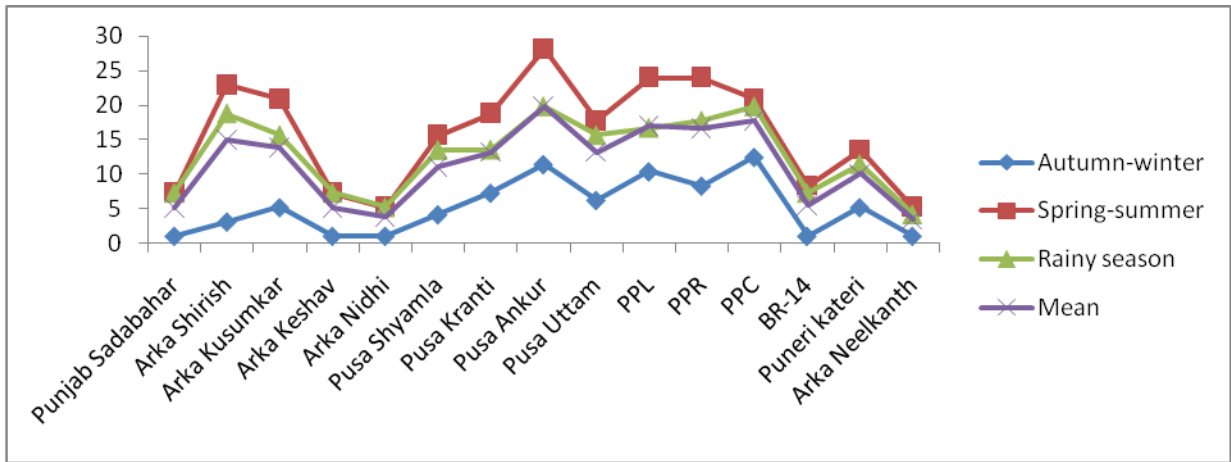


Fig.5 Seasonal effects on spider mite infestation (%) in different varieties of brinjal

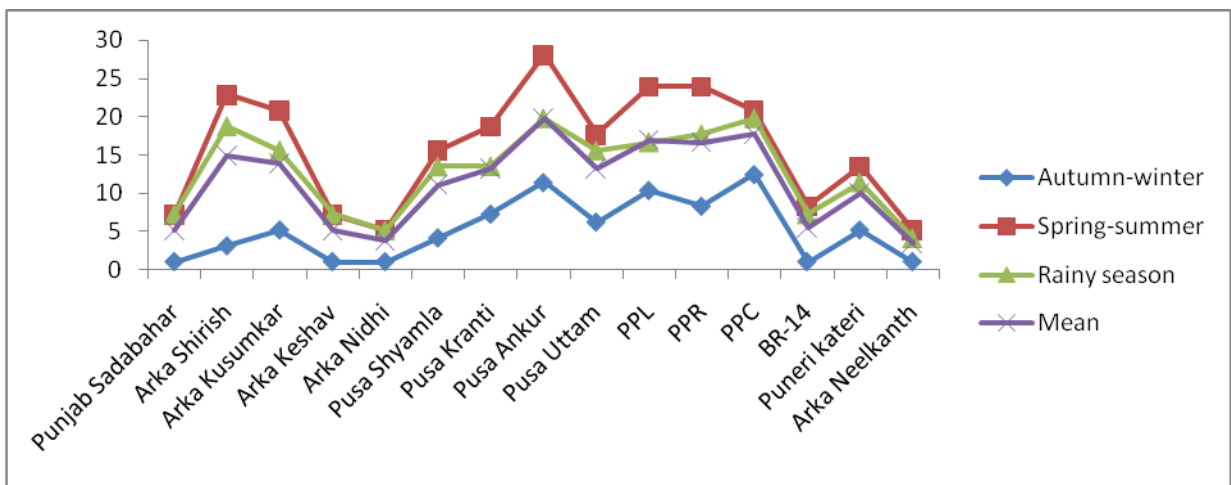


Fig.6 Seasonal effects on Phomopsis blight incidence (%) in different varieties of brinjal

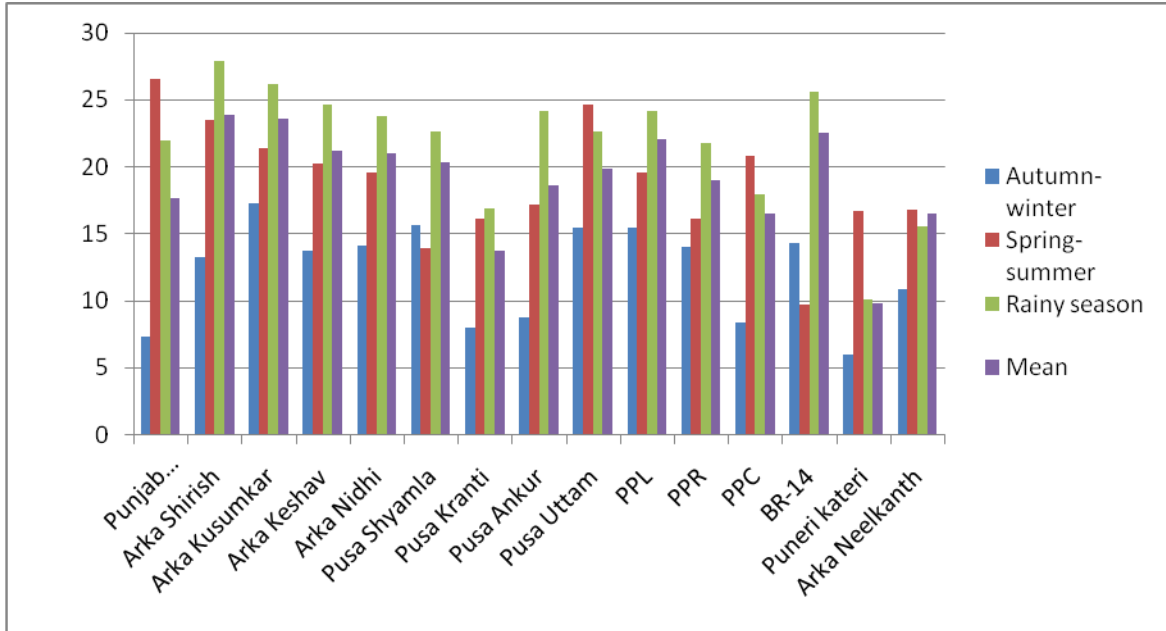
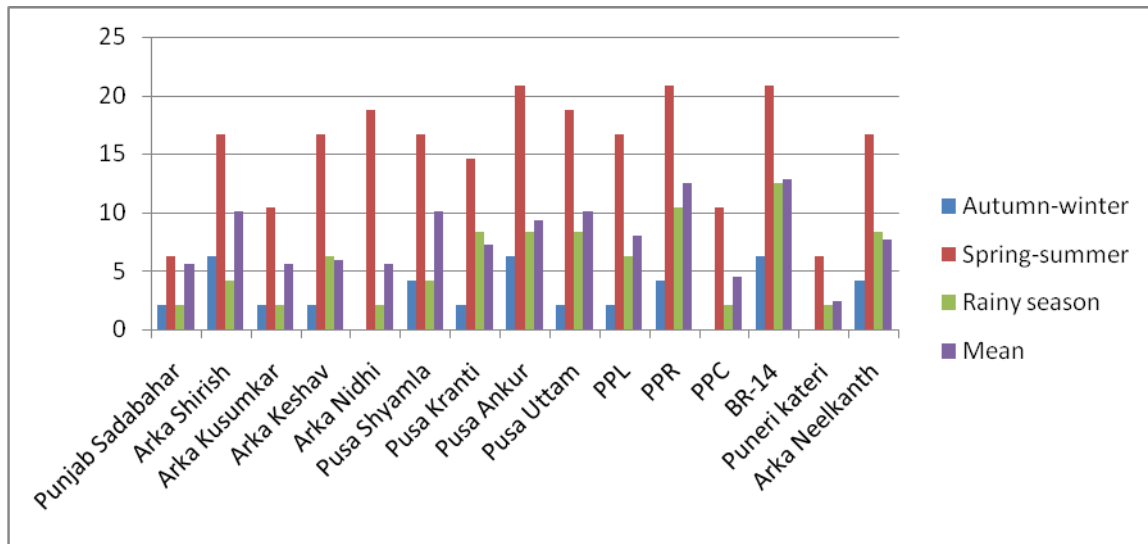


Fig.7 Seasonal effects on little leaf incidence (%) in different varieties of brinjal



It was also evident from the data that presented in Table 2 that among three growing season autumn-winter recorded significantly lower phomopsis blight as compared to other two main seasons viz., spring-summer and rainy season. However, five cultivars viz., Punjab Sadabahar, Pusa Uttam, PPC, Puneri Kateri and Arka Neelkanth recorded low phomopsis incidence

in rainy season and rest of the cultivars showed low phomopsis incidence during spring-summer season. With respect to seasonal effect on little leaf incidence, it was observed that among all the three seasons, maximum little leaf incidence was observed in spring-summer season as compared to rainy and autumn-winter seasons. Sharma *et al.*, (2011) also reported 7.00 to 14.00 percent

disease incidence in district wise survey in Jammu region. Similar results have been reported by Skukla and Khatri, 2010 and Bushan *et al.*, 2011

Based on the findings of the present study it can be concluded that Pusa Kranti, Pusa Ankur recorded followed by Punjab Sadabahar and Pusa Uttam performed very well during all the three seasons whereas among all the three growing seasons, autumn-winter recorded overall minimum biotic stresses followed by spring-summer whereas rainy season recorded maximum pest and disease incidence under. Therefore, in order to get a healthy and disease and pest free fruit yield, autumn-winter cultivation of promising cultivars viz., Pusa Kranti, Pusa Ankur, Punjab Sadabahar and Pusa Uttam can be recommended under Jammu conditions.

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