Plant Archives Vol. 25, Supplement 1, 2025 pp. 1003-1008 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org
DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2025.v25.supplement-1.136

IMPACT OF SHOOT PRUNING ON THE PREVALENCE OF MANGO ANTHRACNOSE DISEASE IN SUB-HIMALAYAN TERAI REGION OF WEST BENGAL INDIA

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(Date of Receiving : 20-08-2024; Date of Acceptance : 16-10-2024)

ABSTRACT

Three mango cultivars viz., Himsagar, Bombai and Langra was selected based on their maturity time as early, mid, late seasons to study the anthracnose infection under natural field conditions without any control measures Experiment conducted at the Instructional Farm, Department of Pomology and Post-Harvest Technology, Faculty of Horticulture, Uttar Banga Krishi Viswavidyalaya, located in Pundibari, West Bengal. Disease severity of mango was measured at monthly interval after shoot pruning (30cm from the tip) as compared with unpruned plants. The maximum anthracnose severity was recorded cv. Bombai (67.70% and 59.90%), Langra (53.44% and 50%) and Himsagar (30.87% and 25.24%) in non-pruned (control) and shoot pruned plants in the month of May. Anthracnose severity minimum recorded in Himsagar is 13.69% for unpruned plants and 12.76% for pruned plants in the month of November. Maximum average per cent disease index (Avg. PDI %) was recorded in Bombai (55.35% and 52.23%) followed by Langra (35.97% and 33.50%) and minimum noticed in Himsagar (19.94% and 18.22%) unpruned plants and pruned plants for two consecutive years specially 2019-20 and 2020-21 respectively. Incidence of anthracnose severity minimum in shoot pruned plants plants compared to control. None of these three cultivars showed resistant disease reaction on both fruits and leaves against the anthracnose. Cultivar Himsagar showed moderately resistant disease reaction, Langra showed susceptible disease reaction to anthracnose and cultivar Bombai exhibited highly susceptible reaction in both pruned and unpruned plants.

Keywords: Mango, Anthracnose, Disease reaction, Screening

Introduction

Mango (*Mangifera indica* L.) is a widely cultivated fruit crop in India, famous for its unique sweetness and high levels of phytochemicals and nutrients, making it the title "King of Fruits." Its superb flavor, enticing aroma, delightful taste, vibrant colors, and nutritional benefits have captivated the global market. According to Ploetz (2001), mangoes are highly susceptible to various fungal diseases, leading to substantial yield losses. Anthracnose (*Colletotrichum gloeosporioides*) is one of the most severe mango diseases, affecting both pre- and post-harvest stages and limiting the global supply of the fruit by Arauz (2000). The fungus is a pathogen that dangerous to leaves, inflorescences, and fruits both before and after harvest. Anthracnose has been reported to result in losses of 5 to 20% at the postharvest stage by Kumar *et al*. (2013). The disease is generally favored by wet, humid, and warm weather (Nelson, 2008). Anthracnose severity maximum recorded on fruits than on leaves. The availability of substrates like pectin and cellulose is greater on leaf surfaces than on fruit surfaces. This, along with the secretion of cell wall-degrading or cutinolytic enzymes by the pathogen, contributes to the disease. (Dickman, 1994). Prusky and Plumbley (1992) proposed that the susceptibility of fruits to anthracnose

is linked to the concentration of antifungal inhibitors within the fruits.

Pruning is a crucial practice for maintaining tree vigor, enhancing fruit productivity, and improving the yield of fruit crops (Singh and Dhaliwal, 2004). It provides better ventilation, high access of sunlight and easy in plant protection managements. Pruning upto10-20 cm from the tip of the branch by annually or biannually after the harvesting of fruits give better result in high density planted mango cv. Kesar (Annon., 2009). Shoot pruning of dense mango orchards increases the light interception and air circulation which improve photosynthetic efficiency, fruit yield and superiority as well as decreases the incidence of pest and diseases (Medina *et al.,* 2005). Shoot pruning is reported as important practice to sustain tree vigor, boost fruit productivity and increase yield of fruit crops (Singh and Dhaliwal, 2004). However, several earlier attempts were made to mitigate the pest infestation through pruning operation (Hasan *et al*., 2009; Das *et al*., 2013).

Considering this fact, the current experiment was conducted to determine the incidence percentage of mango anthracnose on mango cultivars grown in the Sub-Himalayan Terai region of West Bengal.

Materials and Methods

The experiment was conducted for two consecutive years (2019-2020 and 2020-2021) at the Instructional Farm of the Department of Pomology and Post-Harvest Technology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. The climate of the Sub-Himalayan Terai region features significant rainfall from April to September, followed by a prolonged dry period from October to March, with moderate temperatures throughout the year. Mango cultivars viz., Himsagar, Bombai and Langra were selected based on their fruit maturity period and considered as early, medium and late variety, respectively. The mango plants were 12 years old and planted 8×8m distance. Five plants from each of the varieties were selected for pruned and unpruned treatments. Shoot pruning was practiced at 30 cm from the tip under pruned treatments. Observations were noted on the incidence of anthracnose on these both pruned and unpruned plant at monthly interval from the month of August to July for each season.

Disease severity of mango was measured at monthly interval after shoot pruning. Shoot pruning was done after harvesting of previous seasons fruit during 2019-20 and 2020-21, respectively by pruning measuring a length of 30cm from the tip and pruned with the help of secateurs. The recommended dose of fertilizers, manures and timely irrigation were provided. The cultivars were categorized into varying levels of resistance based on the percent disease index (PDI), using a 0-5 scale by Narasimhudu, (2007). The observations on per cent disease index (August to July) were recorded. Severity of anthracnose on mango was measured at monthly interval from shoot pruned plants with following standard procedure.

a) Disease scoring scale for Anthracnose (0-5scale) on leaves Narasimhudu , (2007)

Sl.	Disease reaction	Rating	Infected area in Percentage
1.	Immune	0	Zero or No infection
2.	Resistant	1	1-10
3.	Moderately Resistant	2	11-20
4.	Moderately susceptible	3	21-30
5.	Susceptible	4	31-50
6.	Highly Susceptible	5	Above 50

- Five uniform twigs from each variety, each twig having with 8-10 leaves, were marked for screening and observations were recorded monthly intervals.
- Disease severity was calculated by the formula.

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of all the disease rating}}{\text{Number of leaves observed} \times \text{Maximum disease grade}} \times 100$$

b) Disease scoring scale for Anthracnose (0-4 scale) on fruits Prabhakar et *al.* (2012)

Sl.	Rating	No. of lesions/ fruit
1.	0	No lesions
2.	1	1-3 lesions
3.	2	4-6 lesions
4.	3	7-15 lesions
5.	4	Above 15

- Ten fruits of each variety were considered for observation which were recorded at monthly interval.

A) Disease severity were calculated on Fruit

$$\text{Percent Disease Index (PDI)} = \frac{\text{Sum of all the disease rating}}{\text{No. of fruits observed} \times \text{Maximum disease grade}} \times 100$$

Results and Discussion

1. Impact of shoot pruning on severity of anthracnose of mango leaves

Three mango cultivars viz., Himsagar, Bombai and Langra showed different reactions against anthracnose under natural field condition without any control measures. The maximum anthracnose severity (Table 1) was recorded in the Mango cv. Bombai (67.70% and 59.90%) followed by Langra (53.44% and 50%) and Himsagar (30.87% and 25.24%) during month of May (unpruned and pruned plants). Whereas, minimum anthracnose severity was observed in Himsagar (13.69% and 12.76%) followed by Langra (18.60% and 17.62%) and Bombai (43.11% and 42.94%) in (unpruned and pruned plants) the month of November (Fig 1). The results of present investigation were similar by Bhagwat *et al*., (2016) who conducted a survey for seven months on mango cv. Kesar and reported that maximum incidence of anthracnose recorded in the month of May and minimum incidence observed in November.

Among the three cultivars, the highest average percent disease index (Avg. PDI %) was recorded in Bombai (55.35% and 52.23%), followed by Langra (35.97% and 33.50%). The minimum PDI was observed in Himsagar (19.94% and 18.22%) for both unpruned and pruned plants, respectively. These results indicate that Himsagar is moderately resistant, Langra is susceptible, and Bombai is highly susceptible in both unpruned and pruned plants. These findings are consistent with the results of Bhagwat *et al*. (2015) and Sharma and Badiyala (1998).

Among the three mango cultivars (Himsagar, Bombai and Langra) minimum anthracnose severity was recorded in pruned plants than un-pruned plants. Un-pruned tree grows extremely tall, which prevents light from penetrating the canopy, reduces the rate at which new leaves sprout, maintains low photosynthetic activity, and increases the chance of diseases and pests because of the high relative humidity (Asrey *et al*., 2013).

2. The impact of shoot pruning on the severity of anthracnose in mango fruits

The maximum anthracnose incidence was recorded on the fruits (Table 2) of cv. Bombai (64.09% and 43.79%) followed by Langra (41.96% and 32.20%) and Himsagar (30.80% and 23.23%) in the month of May. Minimum incidence was recorded in cv. Himsagar (15.61% in July and 14.27% in April) in unpruned and pruned plants for both the years (2019-20 and 2020-21) respectively (Fig 3). Among the three cultivars, maximum average per cent disease index (Avg. PDI %) was recorded in Bombai (50.19 % and 35.95 %) followed by Langra (35.87% and 25.59 %) and minimum recorded in cv. Himsagar (22.86% and 17.97%) in unpruned and pruned plants in both the season (Fig 4).

In the present study, a higher incidence of anthracnose severity was recorded on fruits compared to leaves. The mango fruit's ability to protect against infections may be linked to the combination of antifungal substances found in the peel and fruit (Droby *et al.,* 1986; Prusky *et al*., 1997; Kobiler *et al*., 1998). This might be due to the greater accessibility of substrates such as pectin and cellulose on the leaf surface compared to the fruit surface, and the secretion of cell wall-degrading enzymes or cutinolytic enzymes by the pathogen (Dickman, 1994).

The high humidity and rain fall at the *Terai* region of West Bengal aggravates the problem of incidence of disease. Among the three mango cultivars studied maximum anthracnose incidence recorded in Bombai followed by Langra and minimum anthracnose severity was recorded cultivar Himsagar. These results also indicated that Himsagar showed a moderately resistant reaction, while Langra showed a susceptible reaction. However, the Bombai cultivar exhibited a highly susceptible reaction in both unpruned and pruned plants.

Table 1: Impact of shoot pruning on severity of anthracnose of leaves on mango

Months	Himsagar						Bombai						Langra					
	PDI			PDI			PDI			PDI			PDI			PDI		
	Control			Shoot Pruning			Control			Shoot Pruning			Control			Shoot Pruning		
	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean
September	19.01	14.56	16.79	20.18	13.86	17.02	55.37	57.46	56.42	53.54	54.09	53.81	32.22	36.94	34.58	31.61	24.89	28.25
October	16.04	17.84	16.94	15.00	17.90	16.45	50.40	54.86	52.63	50.34	51.50	50.92	42.81	42.81	42.81	37.05	27.67	32.36
November	14.00	13.38	13.69	12.86	12.66	12.76	43.75	42.47	43.11	44.40	41.49	42.94	20.53	16.66	18.60	19.66	15.59	17.62
December	17.03	18.02	17.53	15.10	14.06	14.58	58.63	59.74	59.19	49.38	48.58	48.98	49.44	22.82	36.13	46.96	32.71	39.83
January	15.27	21.54	18.41	17.67	17.96	17.82	53.22	57.89	55.55	51.45	54.63	53.04	50.00	33.05	41.53	39.54	32.37	35.95
February	17.42	16.59	17.00	18.33	16.23	17.28	54.31	57.12	55.72	53.24	55.72	54.48	35.33	24.78	30.06	28.96	25.44	27.20
March	19.06	22.14	20.60	20.00	20.74	20.37	55.03	53.70	54.36	53.53	54.48	54.01	32.22	24.08	28.00	31.54	31.89	31.72

April	23.15	21.76	22.45	18.13	23.20	20.67	57.25	55.57	56.41	46.69	52.96	49.82	43.11	41.30	42.00	42.89	40.72	42.00
May	30.15	31.58	30.87	24.17	26.31	25.24	66.34	69.05	67.70	58.05	61.75	59.90	53.44	53.44	53.44	53.21	47.69	50.00
June	24.15	24.56	24.36	20.15	22.23	21.19	51.45	50.78	51.11	50.71	55.12	52.92	33.89	30.55	32.22	34.47	22.67	28.57
July	22.30	19.07	20.68	16.87	17.30	17.09	55.57	57.77	56.67	53.11	54.30	53.71	38.78	33.23	36.00	39.54	29.89	34.71
Avg. PDI	19.78	20.09	19.94	18.04	18.41	18.22	54.66	56.04	55.35	51.31	53.15	52.23	39.25	32.70	35.97	36.86	30.14	33.50
Reaction	---	---	MR	---	---	MR	---	---	HS	---	---	HS	---	---	S	---	---	S

*R = Resistant; MR = Moderately Resistant; MS = Moderately Susceptible; S = Susceptible; HS = Highly Susceptible

Table 2: Impact of shoot pruning on severity of anthracnose of fruits on mango

Months	Himsagar						Bombai						Langra					
	PDI			PDI			PDI			PDI			PDI			PDI		
	Control			Shoot Pruning			Control			Shoot Pruning			Control			Shoot Pruning		
	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean	2019-20	2020-21	Mean
April	20.87	25.36	23.12	18.28	10.26	14.27	41.66	37.5	39.58	26.19	29.16	27.675	25.08	28.03	26.555	25	17.45	21.225
May	33.33	28.26	30.80	21.46	25	23.23	56.31	71.87	64.09	35	52.58	43.79	37.5	46.42	41.96	31.08	33.33	32.205
June	24.38	19.47	21.925	16.23	19.8	18.02	49.87	53.12	51.495	31.24	46.01	38.625	34.78	32.14	33.46	18.45	23.87	21.16
July	16.47	14.75	15.61	10.36	22.36	16.36	46.45	44.76	45.605	28.7	38.74	33.72	50	33.03	41.515	30.55	25	27.775
Avg. PDI	23.76	21.96	22.86	16.58	19.36	17.97	48.57	51.81	50.19	30.28	41.62	35.95	36.84	34.91	35.87	26.27	24.91	25.59
Reaction	---	---	MS	---	---	MR	---	---	HS	---	---	S	---	---	S	---	---	MS

*R = Resistant; MR = Moderately Resistant; MS = Moderately Susceptible; S = Susceptible; HS = Highly Susceptible

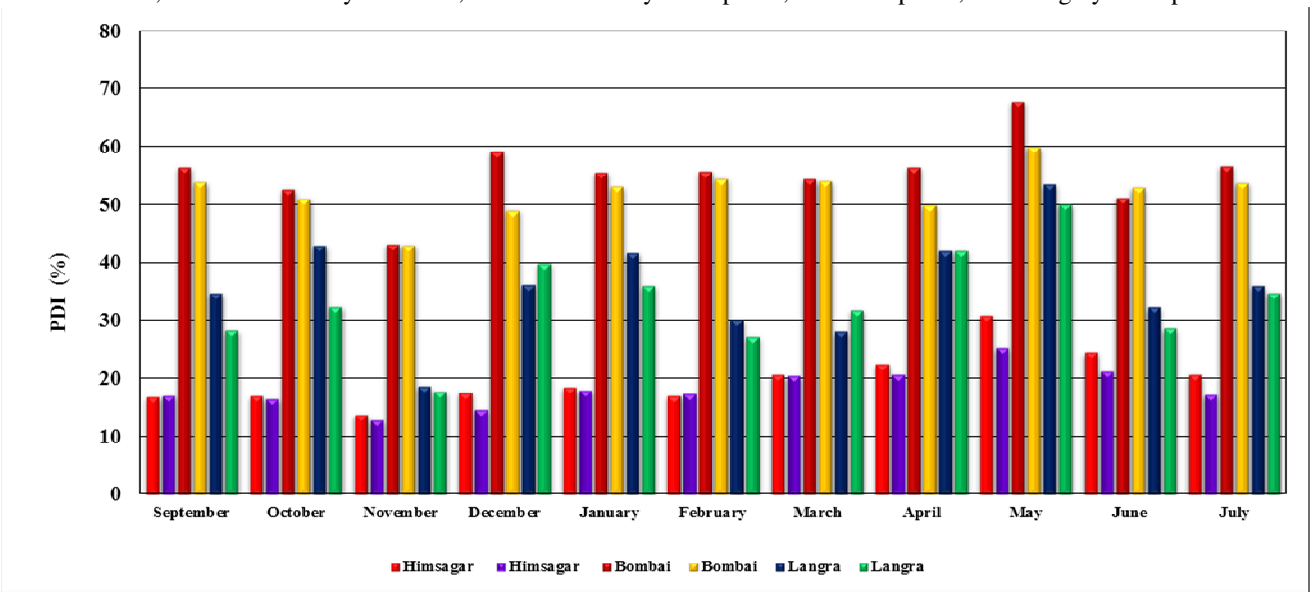

Fig 1: Impact of shoot pruning on monthly severity of anthracnose of leaves on mango

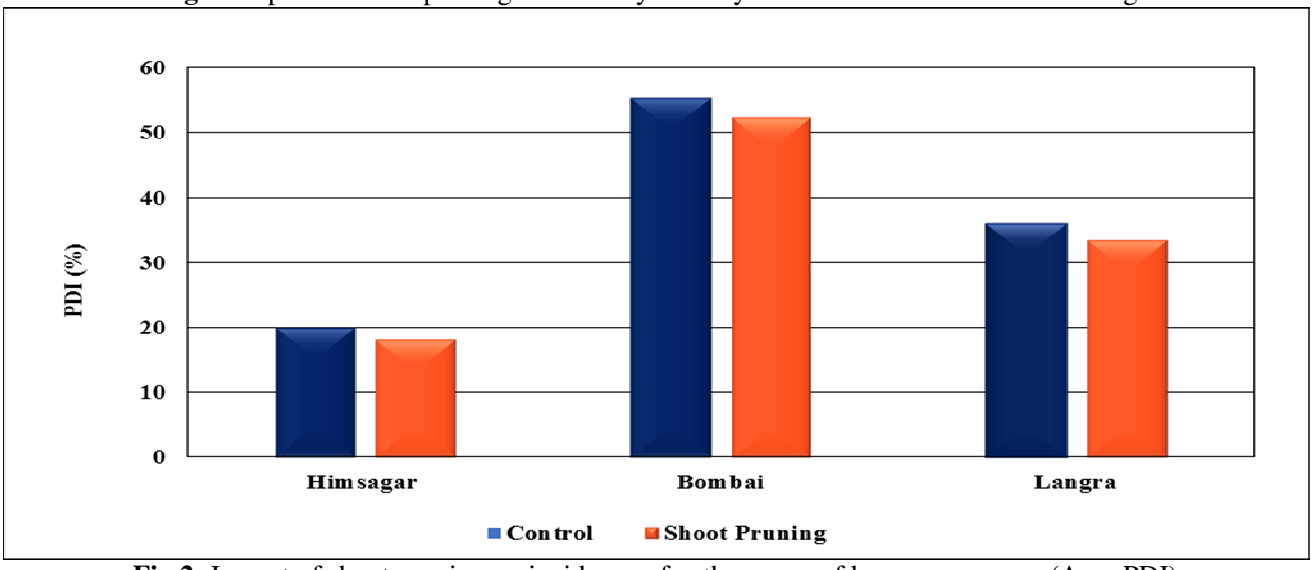

Fig 2: Impact of shoot pruning on incidence of anthracnose of leaves on mango (Avg. PDI)

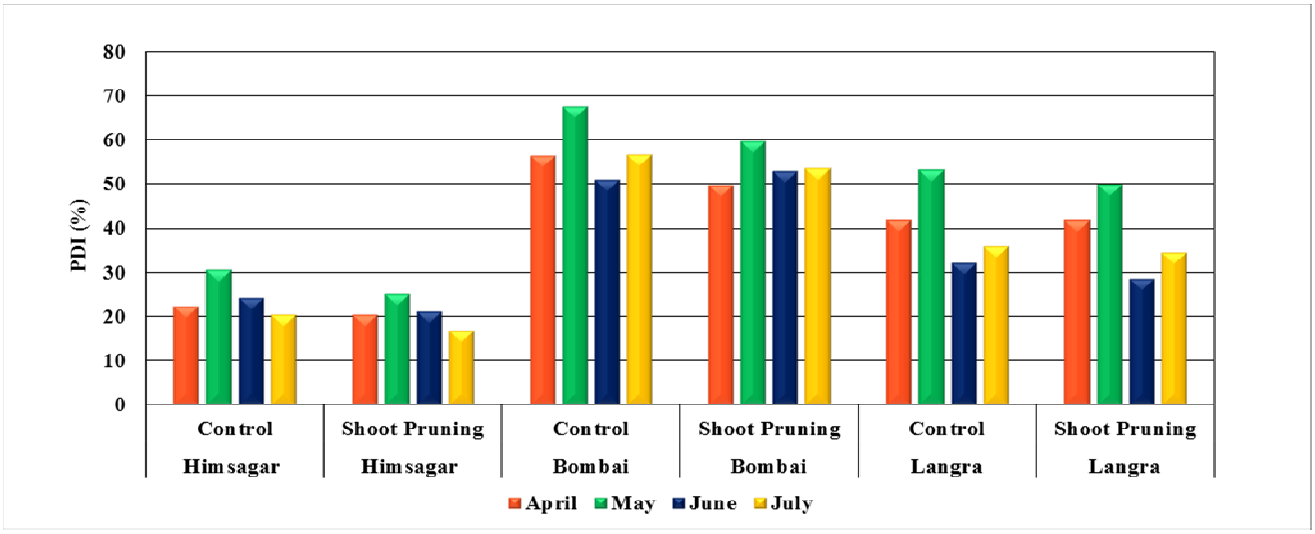

Fig. 3: Impact of shoot pruning on monthly severity of anthracnose on mango fruits

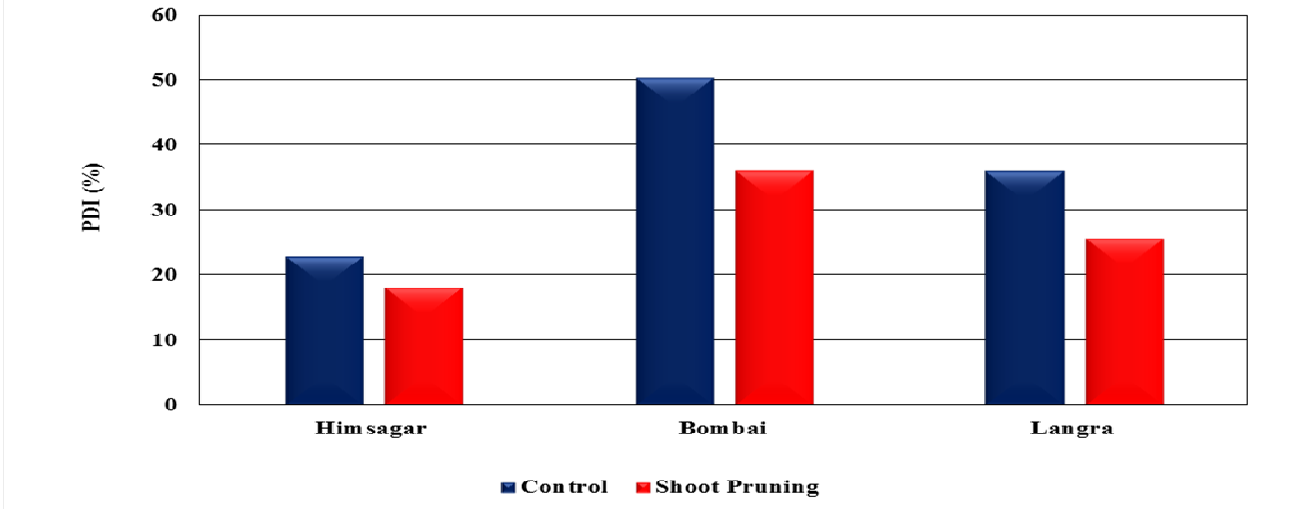

Fig. 4: Impact of shoot pruning on incidence of anthracnose on mango fruits (Avg. PDI)

Acknowledgement: The authors thankful to the Head, Department of Pomology and Post-Harvest Technology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch behar, West Bengal for providing necessary facilities and space for research work.

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