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Screening the Clones of *Nothapodytes nimmoniana* against Leaf Spot Disease

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ABSTRACT

Nothapodytes nimmonianais one of high Camptothecin (CPT) yielding tree. Though the incidence of fungal leaf spot disease has been reported, except the recordance of the disease there was no systematic work carried out on various aspects of the leaf spot disease of N. *nimmoniana*. The pathogen associated with the leaf spot disease of N. *nimmoniana* was isolated and identified as *Cylindrosporium mappiae*. For the first time screening of the forty four clones of N. *nimmoniana* against leaf spot disease was carried out in the clonal orchard of College of Forestry, Sirsi. The clones P_x and O from Pune and Mahabaleshwara respectively were moderately resistant to Cylindrosporium leaf spot disease. After two years of screening it was found that two clones were moderately resistant, seven clones were susceptible and 35 clones were highly susceptible to Cylindrosporium leaf spot disease.

Keywords: *Camptothecin, Fungal leaf spot, Nothapodytes nimmoniana and Screening.*

Plants have been used for medicinal purposes long before prehistoric period. India has been known to be a rich repository of medicinal plants. Recently, WHO (World Health Organization) estimated that 80 per cent of people worldwide rely on herbal medicines for their primary health care needs. According to WHO, around 21,000 plant species have the potential to use as medicinal plants. (*www.drugs.com/forum/alternative-medicine/importance-herbal-medicines-58521.html*) One such medicinal tree is *N nimmoniana* (Syn: *Mappia foetida)*. *N nimmoniana* belongs to Icacinacceae family. It is the source of the chemical camptothecin and is a potent anti-tumour iso-quinoline alkaloid used extensively in the treatment of several cancers (Hombegowda *et al.,* 2002).

Among several plant species known to contain the compound, by far the highest concentration of about 0.3% (w/w) has been reported from *Nothapodytes nimmoniana* (Suhas *et al.,* 2006). This is among the top three drugs in demand in the world right now for cancer treatment. Camptothecin extracted from the plant is an essential component for chemotherapy, each dose of which costs Rs. 1.5 to 2 lakh in India. Every year 1,500 to 2,000 tonnes of logs are consumed in India and almost the same quantity exported to other countries in powdered form (Ramesha *et al.,* 2008). Of late the species is being found to suffer from fungal leaf spot disease causing cent per cent defoliation. This disease is reported to be due to the soil borne pathogen *Cylindrosporium mappiae*. Considering the importance of *Nothapodytes nimmoniana* as an emerging industrially important tree species, the present study was undertaken. All the investigations were conducted for the first time based on the reports available in other crop and diseases.

MATERIAL AND METHODS

N. nimmoniana steals attention of pharmaceutical industry world over. Generating and identifying resistant material for disease is of paramount importance. Keeping this in view 44 clones of *N. nimmoniana* maintained in the clonal bank of department of Forest Biology and Tree Improvement at College of forestry, Sirsi were selected for screening against leaf spot disease. The screening was conducted for two consecutive years (2015-16 to 2016-17) during high disease pressure period (October-December). Disease index is the percentage of relevant host tissue or organs covered by symptoms or lesions or damaged by disease which signifies the extent of damage caused by the disease. The severity or per cent disease index of various clones was recorded by using 0-5 scale developed by Sharma and Mohanan (1984) where No symptom-'0'; 1 % leaf area affected -'1'; 1-10 % leaf area affected - '2'; 11-25 % leaf area affected - '3'; 26-50 % leaf area affected - '4'; >50 % leaf area affected - '5' disease severity grade respectively.

Recording of observations

Per cent disease index (PDI) for all the clones were calculated, with the help of formula given by Wheeler (1969).

Table 1. Screening of *N. nimmoniana* clones for leaf spot disease severity during 2015-16 and 2016-17

S .No.	Clone I D	Percent disease index(PDI)		Sl.No.	Clone ID	Per cent disease index(PDI)	
		2015-16	2016-17			2015-16	2016-17
1	P_X	22.75 (28.49)*	23.01 (28.66)*	23	P_0	62.86 (52.45)*	62.45 (52.21)*
2	O	24.74 (29.83)	24.67 (29.78)	24	M	63.66 (52.93)	63.61 (52.90)
3	D	36.97 (37.45)	39.32 (38.83)	25	X	64.86 (53.64)	63.45 (52.80)
4	Z	39.90 (39.17)	42.42 (40.64)	26	S	64.93 (53.69)	65.56 (54.07)
5	Y	44.76 (41.99)	43.36 (41.18)	27	L	64.95 (53.70)	65.65 (54.12)
6	B	45.61 (42.48)	47.43 (43.53)	28	F	65.45 (54.00)	67.65 (55.34)
7	N_0	47.54 (43.59)	47.54 (43.59)	29	W	66.00 (54.33)	66.98 (54.93)
8	EBR_2	48.74 (44.28)	46.32 (42.89)	30	N_R	66.52 (54.65)	66.23 (54.47)
9	A	48.98 (44.42)	52.23 (46.28)	31	G	67.52 (55.26)	69.23 (56.31)
10	R	50.44 (45.25)	49.46 (44.69)	32	H	67.95 (55.52)	69.73 (56.62)
11	E	50.59 (45.34)	50.27 (45.15)	33	N_2	68.68 (55.97)	68.29 (55.73)
12	C	52.35 (46.35)	54.67 (47.68)	34	$N11_R$	68.94 (56.13)	67.65 (55.34)
13	A_1	53.78 (47.17)	56.78 (48.90)	35	J	71.72 (57.87)	73.56 (59.06)
14	V	55.54 (48.18)	58.23 (49.74)	36	PN_{15}	71.79 (57.92)	76.45 (60.97)
15	U	56.39 (48.67)	58.31 (49.78)	37	EBR_1	72.21 (58.19)	73.34 (58.91)
16	Q	57.68 (49.42)	56.23 (48.58)	38	EBR_3	72.29 (58.24)	76.45 (60.97)
17	K	58.65 (49.98)	58.45 (49.86)	39	P_4	75.00 (60.00)	75.21 (60.14)
18	B_1	58.89 (50.12)	58.45 (49.86)	40	NR_1	80.63 (63.89)	80.97 (64.14)
19	EBR_4	59.97 (50.75)	59.67 (50.58)	41	P_2	84.00 (66.42)	85.65 (67.74)
20	N_X	60.80 (51.24)	63.45 (52.80)	42	N_9	84.38 (66.72)	84.24 (66.61)
21	T	60.87 (51.28)	60.34 (50.97)	43	N_{15}	84.95 (67.17)	85.64 (67.73)
22	I	61.24 (51.50)	59.45 (50.45)	44	N_8	85.05 (67.25)	88.86 (70.50)
2015-16	SEm±	0.01		2016-17	SEm±	0.05	
	CD @ 5%	0.03			CD @ 5%	0.15	

Table 2. Grouping of *N. nimmoniana* clones into HR, R, MR, S and HS against leaf spot disease

S. No.	Reaction	Clones responded	Number of clones
1	Highly resistant (HR)	0	0
2	Resistant (R)	0	0
3	Moderately resistant (MR)	$P_x$and O	2
4	Susceptible (S)	D, Z, Y, B, N_0, EBR_2, and A	7
5	Highly susceptible (HS)	R, E, C, A_1, V, U, Q, K, B_1, EBR_4,N_X, T, I, P_0, M, X, S, L, F,W, N_R,G, H, N_2, N_{11}R, J, PN_{15}, EBR_1, EBR_3, P_4, NR_1, P_2, N_9, N_{15}, N_8	35

$$PDI = \frac{\text{Sum of numerical ratings}}{\text{Total No. of leaves observed x Max. Grade}} \times 100$$

RESULTS AND DISCUSSIONS

Disease severity was considered as the major parameter to screen the clones and it is expressed as PDI. The screening results were presented in Table-1. Based on the per cent disease index the clones were classified into highly resistant (0%), resistant (1-15%), moderately resistant (21-35%), susceptible (36-50%) and highly susceptible (>50%) and results of same were presented in Table-2. During 2015-16, clones P_x (22.75) and O (24.74) were found moderately resistant and seven clones *viz*.D, Z, Y, B, N_0, EBR_2, and A are observed with PDI ranging from 36.90 to 48.98 per cent and are considered as susceptible clones. The rest of the 35 clones (R, E, C, A_1, V, U, Q, K, B_1, EBR_4,N_X,T, I, P_0, M, X, S, L, F,W, N_R,G, H, N_2, N_{11}R, J, PN_{15}, EBR_1, EBR_3, P_4, NR_1, P_2, N_9, N_{15}, N_8) were recorded to have disease index from 50.35 to 85.05 per cent, and were categorized under highly susceptible reaction.

In 2016-17 the same clones P_x and O had disease index of 23.01 per cent and 24.67 per cent respectively and were grouped under moderately resistant reaction. The seven clones (D, Z, Y, B, N_0, EBR_2, and R) are recorded with a disease index from 39.32 to 49.54 per cent, and are grouped under susceptible reaction. The remaining 35 clones have shown the disease index ranging from 50.27 to 88.86 per cent and were grouped under highly susceptible reaction. During both the years (2015-16 and 2016-17) all the clones have shown consistent reactions with respect to per cent disease index and only two clones P_x and O have shown less per cent disease index and were categorized as moderately resistant clones to leaf spot disease and these clones were obtained from Pune and Mahabaleshwara respectively. This shows that clones are highly genetically controlled (Sharma *et al.*, 1999). However, none of the clones were found under highly resistant and resistant reaction class. Whereas, seven clones were categorized under susceptible reaction and 35 clones were grouped under highly susceptible reaction (Table2). This suggests that there is a variation among clones from different sources for disease resistance. This study is in line with Gupta, (1999) who evaluated Apple germplasm for resistance to *Phytophthora cactorum***.** Hence, such clones which have showed moderate resistance and very low per cent disease index may be multiplied and released as improved source and/or further subjected to rigorous testing.

CONCLUSION

The investigation on screening of various clones of *N. nimmoniana* for leaf spot disease is first of its kind in the country and only two clones *viz*., clone-P_X and clone-O were found to be moderately resistant to leaf spot disease and further these two clones could be effectively explored in resistance breeding programme. One of the reasons for resistance could be the escaping phenology of the clones. The absence of published report on screening against leaf spot disease of *N. nimmoniana* limits the further discussion. Thus, conserving these clones for further propagation and exploring its medicinal qualities is of the highest priority. Two moderately resistant clones (Clone-Px and Clone-O) can be used for resistant breeding programme and other clones can be subjected to integrated disease management.

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