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Phylloplane microflora of bhendi

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ABSTRACT

Studies on the phylloplane microflora of bhendi showed that the bacterial population is more than the fungal population in all the locations, varieties and stages. Among the stages of the crop, the fungal population was the highest during vegetative stage (3.72×10^2 cm^{-2}) while the bacterial population was the highest during harvesting stage (19.17×10^2 cm^{-2}) of bhendi crop. Of the three cultivars Arka Anamika harboured the highest bacterial and fungal population.

Key words : Bhendi, Phylloplane microflora, Bacterial population, Harvesting stage, Fungal population, Vegetative stage.

INTRODUCTION

In recent years efforts have been made to exploit the use of phylloplane microorganisms for the control of foliar diseases. Indigenous fungi and bacteria are recognized as common contributors to disease suppression by reducing pathogen population and limiting disease severity. Biological control on phylloplane is not developed as much as in rhizosphere environment because of the differences in the surface features of leaves and roots and variable environment. The surface of aerial plant parts provides a habitat for epiphytic microorganisms, many of which are capable of influencing the growth of pathogens. Bacteria, yeasts and filamentous fungi may form resident populations on leaves. In the present study efforts were taken to quantify the phylloplane microorganisms in bhendi.

MATERIALS AND METHODS

To estimate phylloplane microflora of bhendi, a modified leaf washing technique was adopted (Dickinson, 1971). Bhendi leaf samples were collected from five different locations in three different varieties and at three different stages. Discs of 4 mm diameter were cut randomly from five leaves of the same cultivar with sterile cork borer. Fifty discs were placed in 250 ml conical flask containing 100 ml sterile distilled water and shaken for 20 minutes to get a homogenous suspension of the microbial propagules. From this, one ml suspension was pipetted out into sterilized Petri plates and Czapek's dox agar medium (for fungi) or Nutrient agar medium (for bacteria) was poured into them and mixed thoroughly. The plates were incubated at room temperature. Fortyeight hours after incubation, the bacterial colonies were counted, subcultured and subsequently purified by streak plate method (Rangaswami and Soumini Rajagopalan, 1973). The fungal colonies were counted and subcultured three to five days after incubation and purified by single hyphal tip method (Rangaswami, 1972). Total microbial population per square cm of leaf surface of bhendi was calculated using the following formula.

$$\text{Total number of microbes} = \frac{\text{Total number of microbes in 1 ml} \times 100}{\text{Total area of 50 discs} \times 2}$$

(Area of 1 disc = πr^2, where r is the radius of disc in cm)

RESULTS AND DISCUSSION

Phylloplane fungal and bacterial populations of three bhendi varieties in three different growth stages in five locations were assessed.

Fungal flora

The fungal populations in the phylloplane of bhendi are presented in table 1.Mean phylloplane fungal population ranging from 0.21 to $4.46 \times 10^2/cm^2$ leaf area. Among the locations wherein the studies were conducted Chatrapatti and Srivilliputtur had equally higher population than at Mamsapuram, Malliputhur and Mangapuram. The latter three were on par with each other. The trend was almost similar with all the cultivars evaluated . Of the three cultivars evaluated, Rasi recorded significantly higher fungal population than the local variety but lesser than the population in Arka Anamica. The trend was similar at each locality. Overall mean indicated that among the three stages of the crop, population was significantly higher during flowering stage (3.72) followed by vegetative (1.10) and harvesting phase (0.43). Similar was the trend with all the entries at every location.

Bacterial flora

The data presented in table 2 indicate the variability in bacterial populations among the stages of crop, cultivars and localities. Mean pyhllolplane bacterial population ranged from 7.07 to $25.10 \times 10^2/cm^2$ leaf area. With regard to location, the highest bacterial population was recorded in Srivilliputtur in all the varieties, followed by Malliputhur, Mangapuram and Chatrapatti. Among the three cultivars Arka Anamica recorded the highest bacterial population followed by Rasi and the local variety. The same trend was observed in each location. The population was minimum during vegetative phase in local variety at Chatrapatti. While the population was maximum during harvesting stage in Arka Anamica in Malliputhur. Overall mean indicated that bacterial population was the least during vegetative phase (11.16) and the highest population level was observed during harvesting phase (19.17). Similar was the trend in each variety as well as in every locality.

Microbial population dynamics on leaves in time and space are a function of immigration, emigration, growth and death (Kinkel, 1997). Excretions on the surface of leaves contain stimulatory/inhibitory substances and regulate the colonization of leaf surface organisms (Fating and Khare, 1978). Leaf infected with a pathogen modifies the surface microflora, which may partially or completely protect the leaf against subsequent infection by other pathogen (Sharma *et al*., 1985). The phylloplane microflora is subject to the influence of various environmental factors and physiological changes in the plants and that too due to onset of disease (Sinha, 1965). An attempt was made in the present study to quantify the phylloplane microflora of bhendi. Maximum fungal population was recorded in Arka Anamica during flowering phase at Chatrapatti as well as Srivilliputtur. The prevalence of fungal population in higher number during flowering stage is similar to the earlier result recorded by Kulkarni *et al*. (1973). These trends may be due to the changing biology or microenvironment of the leaves, microbial interactions on the leaf surface, or simply to a changing immigration pool (air spora). Both conceptually and physically a leaf is an island for microbe colonists from its relatively uncolonised state at bud break until abscission. Leaves are accessible and easily replicated natural islands. They possess relatively simple microbial communities compared to other habitats such as soil and can be easily manipulated.

The bacterial population in the phylloplane of bhendi was maximum during harvesting stage in Arka Anamica at Malliputhur.This is in conformity with the observation by Kulkarni *et al*. (1973). Enhanced population of bacteria may be due to the fact that older leaves are more "leaky", resulting in greater nutrient concentrations on their

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Table1 : Phyllofungal flora of bhendi

S	Fungal population ($x10^2/cm^2$ of leaf area) *															Mean
	Arka Anamika					Rasi					Local					
	SR	MM	CI	MR	MP	SR	MM	CI	MR	MP	SR	MM	CI	MR	MP	
V	1.46^{j}	1.33^{kl}	1.65^{i}	1.41^{jk}	1.25^{lm}	1.17^{m}	1.06^{n}	1.17^{m}	0.88^{p}	0.93^{op}	0.93^{op}	0.82^{pq}	1.01^{no}	0.66^{s}	0.58^{st}	1.10^{b}
F	4.51^{a}	3.89^{d}	4.56^{a}	4.11^{bc}	4.21^{b}	4.03^{c}	3.49^{e}	3.89^{d}	3.60^{e}	3.49^{e}	3.52^{e}	2.96^{h}	3.38^{f}	2.96^{h}	3.15^{h}	3.72^{a}
H	0.67^{rs}	0.58^{st}	0.74^{qr}	0.58^{st}	0.58^{st}	0.42^{uv}	0.34^{vwx}	0.50^{tu}	0.34^{vwx}	0.37^{vwx}	0.29^{wxy}	0.26^{xy}	0.29^{wxy}	0.26^{xy}	0.21^{y}	0.43^{c}
L X C	2.21^{B}	1.6^{D}	2.32^{A}	2.04^{C}	2.02^{CD}	1.88^{E}	1.64^{D}	1.86^{E}	1.61^{FG}	1.60^{FG}	1.58^{EF}	1.33^{H}	1.56^{B}	1.30^{H}	1.32^{H}	

SR	:	Srivilliputtur	S	:	Stage
MM	:	Mamsapuram	L	:	Location
CI	:	Chatrapatti	C	:	Cultivar
MR	:	Malliputtur	V	:	Vegetative
MP	:	Mangapuram	F	:	Flowering
			H	:	Harvesting

* Mean of three replications

In the column/row means followed by a common letter are not significantly different at 5% level by DMRT

Table 2 : Phyllobacterial flora of bhendi

S	Bacterial population ($x10^2/cm^2$ of leaf area) *															Mean
	Arka Anamika					Rasi					Local					
	SR	MM	CI	MR	MP	SR	MM	CI	MR	MP	SR	MM	CI	MR	MP	
V	14.94	12.22	13.74	14.54	14.14	12.36	10.28	11.48	12.41	12.14	8.52	7.33	7.07	8.14	8.01	11.16^{c}
F	16.87	15.34	16.35	17.08	16.19	14.22	12.17	13.48	14.68	13.74	8.70	7.20	7.60	8.94	8.01	14.34^{b}
H	24.56	23.49	24.56	25.10	24.43	22.47	21.10	21.62	22.29	22.19	17.17	15.75	15.34	15.75	16.02	19.17^{a}
L X C	18.79^{A}	17.02^{C}	18.22^{B}	18.91^{B}	18.19^{B}	16.35^{D}	14.51^{G}	15.52^{F}	16.46^{D}	16.06^{E}	11.46^{H}	10.10^{J}	10.00^{I}	10.95^{I}	10.68^{I}	

SR	:	Srivilliputtur	S	:	Stage
MM	:	Mamsapuram	L	:	Location
CI	:	Chatrapatti	C	:	Cultivar
MR	:	Malliputtur	V	:	Vegetative
MP	:	Mangapuram	F	:	Flowering

*Mean of three replications

In the column/row means followed by a common letter are not significantly different at 5% level by DMRT

surface as opined by Beattie and Lindow (1995). The variation in nature of phylloplane microflora of three cultivars encountered in the present study may be due to their difference in their genetic make up and other morphological characteristics as discussed by Sharma and Mukerji (1973) and Jindal and Thind (1989). In recent years efforts have been made to exploit the use of phylloplane microorganisms for the control of foliar diseases with the increasing awareness of the problems and expenses of conventional methods of disease control, including fungicides as well as the costly and time consuming breeding programmes. The usual start is to search for potential antagonists in the habitat in which the pathogen is normally found.

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