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Antibacterial activity of leaf extracts of *Ocimum sanctum* L. against *Xanthomonas campestris* pv. *mangiferaeindicae*

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Abstract

Mango bacterial canker disease (MBCD) caused by *Xanthomonas campestris* pv. *mangiferaeindicae* (*Xcmi*) is one of the important diseases of mango affecting a number of commercial cultivars. The pathogen affects different plant parts like leaf, stem and fruit. Favorable environmental conditions cause severe loss to the crop. Leaf extract of 37 plants were tested against *Xcmi*; out of them, leaf extract of *Ocimum sanctum* L. gave promising results. Hence, leaf extracts of *O. sanctum* tested for its antibacterial activity against 25 strains of *Xcmi* collected from different parts of Konkan region of Maharashtra. The *in vitro* studies have been performed by using cup-plate method to examine the activity. Fresh leaf extracts of *O. sanctum* plants were screened against 25 strains of *Xcmi.* The maximum activity was recorded against *Xcmi*.21 (Mean activity zone–20.36 mm) followed by *Xcmi*.07 (Mean activity zone – 20.11 mm) and minimum against *Xcmi.*14 (Mean activity zone–16.27 mm) strain under investigation. The ultimate aim of the research work was to develop economically and technically viable field formulations for the farmers, which will be Bio-ecologically compatible for management of plant bacterial diseases.

Keywords: Antibacterial, *Xanthomonas campestris* pv. *mangiferaeindicae, Ocimum sanctum*.

Introduction

Bacterial diseases of fruit plants are known to cause great damages all over the world. Mango (*Mangifera indica* L.) is the most ancient among the tropical fruits. Among the bacterial diseases, bacterial canker is the most severe disease on Mango, which is caused by *Xanthomonas campestris* pv. *mangiferaeindicae* (*Xcmi*). The pathogen affects different plant parts like leaf, stem and fruit. Favorable environmental conditions cause severe loss to the crop. Fruit cracking due to the disease causes extensive loss to the cultivator.

For the management plant diseases, various chemicals are used since last several years, the world over. They tend to accumulate in animal tissues posing threat to human health. Green plants represent a reservoir of effective chemotherapeutants and can provide valuable sources of natural pesticides[1, 2]. Medicinal properties of leaf extracts have been reported by many workers[3, 4, 5]. The medicinal properties of leaf extracts have also been mentioned by Kirtikar and Basu[6]. Antibacterial activity of 37 medicinal plants were assessed against Xcmi strains and observed that activity of *O. sanctum* (Tulsi) was better than remaining leaf extracts. Tulsi is considered as 'Indian holy basil' which is important in various human diseases and recommended for the treatment of bronchitis, bronchial asthma, malaria, diarrhea, dysentery, skin diseases, arthritis, painful eye diseases, chronic fever, insect bite etc[7]. Research workers have mentioned *in-vitro* and *in-vivo* antimicrobial and antibacterial activity of *O. sanctum* [8, 9, 10, 11, 12, 13]. Singh *et al.,*[14] have reported antibacterial activity of seed oil of *O. sanctum*. Varshney *et al.,*[15] studied *in vitro* and *in vivo* antiviral potential of hot aqueous extract of *O. sanctum* and *Argemone mexicana* leaves. However, during this research work antibacterial activity of leaf extract of *O. sanctum* has been assessed against 25 strains of *Xcmi* to observe the behavior of these strains.

Material and Methods

The strains of causal organism of MBCD i.e. *Xcmi* were collected from Konkan region of Maharashtra. Diseased Mango samples were collected from various districts (Raigad, Ratnagiri and Sindhudurg) of Konkan region and brought to the laboratory for further investigation. Studies were performed using these samples and maintained various 25 *Xcmi* strains on Nutrient Agar (NA) medium.

Preparation of leaf extract: The leaves of the plants were collected, thoroughly washed with tap water and then rinsed with sterile distilled water. For the study, leaf extract was used. They were dried in shade until all moisture evaporated. These leaves were powdered by using electric grinder and packed into polythene bags. One gm of the powder was taken and added to 10 ml of sterile distilled water. Then it was subjected to ultracentrifuge for 20 min at –4°C at the 11000 rpm[16].

Cup Plate Method: It is a method of testing antibacterial activity. For this, the bacterial suspension was prepared by adding 10 ml sterile distilled water to 2 days old NA slope culture. Five drops of bacterial cell suspension were poured in sterilized petridishes (9 cm diameter) onto which 20 ml of nutrient agar was poured and thoroughly mixed. It was allowed to solidify[17].

In the centre of the medium, a cup cavity of 8 mm diameter was made with sterilized No. 4 cork borer. This cup was filled with 0.1 ml of the leaf extract. The petridishes were incubated for 24 hrs at 25±2°C and the observations were recorded as diameter of inhibitory zone in mm. Diameter of the activity zone was measured in 3-4 angles and mean was considered for accuracy. Cup cavity filled with sterile distilled water was used as control in all the experiments. All experiments were repeated for four times (Experiment. A, B, C and D).

Result and Discussion

It is observed from table 01 that *O. sanctum* showed antibacterial activity against all 25 strains of *Xcmi* under investigation. The maximum activity was recorded against *Xcmi*.21 (Mean activity zone – 20.36 mm) followed by *Xcmi*.07 (Mean activity zone – 20.11 mm) and minimum against *Xcmi.*14 (Mean activity zone – 16.27 mm) strain under investigation. Average activity of all *Xcmi* strains was 19.05 mm. Activity of *O. sanctum* ranges between 16 to 21 mm. (Figure-1). Fourteen *Xcmi* strains (*Xcmi.3, Xcmi*.7, *Xcmi*.8, *Xcmi*.9, *Xcmi*.11, *Xcmi*.12, *Xcmi*.15, *Xcmi*.18, *Xcmi*.19, *Xcmi*.20, *Xcmi*.21, *Xcmi*.22, *Xcmi*.24 and *Xcmi*.25) have showed more activity than average activity of all strains i.e. 19.05 mm; while 11 *Xcmi* strains (*Xcmi*.1, *Xcmi*.2, *Xcmi*.4, *Xcmi*.5, *Xcmi*.6, *Xcmi*.10, *Xcmi*.13, *Xcmi*.14, *Xcmi*.16, *Xcmi*.17 and *Xcmi*.23) showed less activity.

Antibacterial activity of *O. sanctum* against *Xanthomonas citri* was recorded by Jadhav and Deobhankar[12]. Britto and Gracelin[9] studied antibacterial activity of methanol extracts of leaves of eight different medicinal plants, *Leucas aspera,Calotropis gigentia, O. sanctum, Adathoda vasica, Hyptis suaveolens, Teprosia purpurea, Cleome gynandra* and *Cleome viscose* against a phytopathogenic bacteria namely *Xanthomonas campestris.* Antibacterial activity of *O. canum* and *O. tenuiflorum* was evaluated by Biswas[18]. Sharma *et al.*,[19] reported antibacterial activity of *O. basilicum*, *O. sanctum* and *M. anventis* against two pathogenic bacteria.

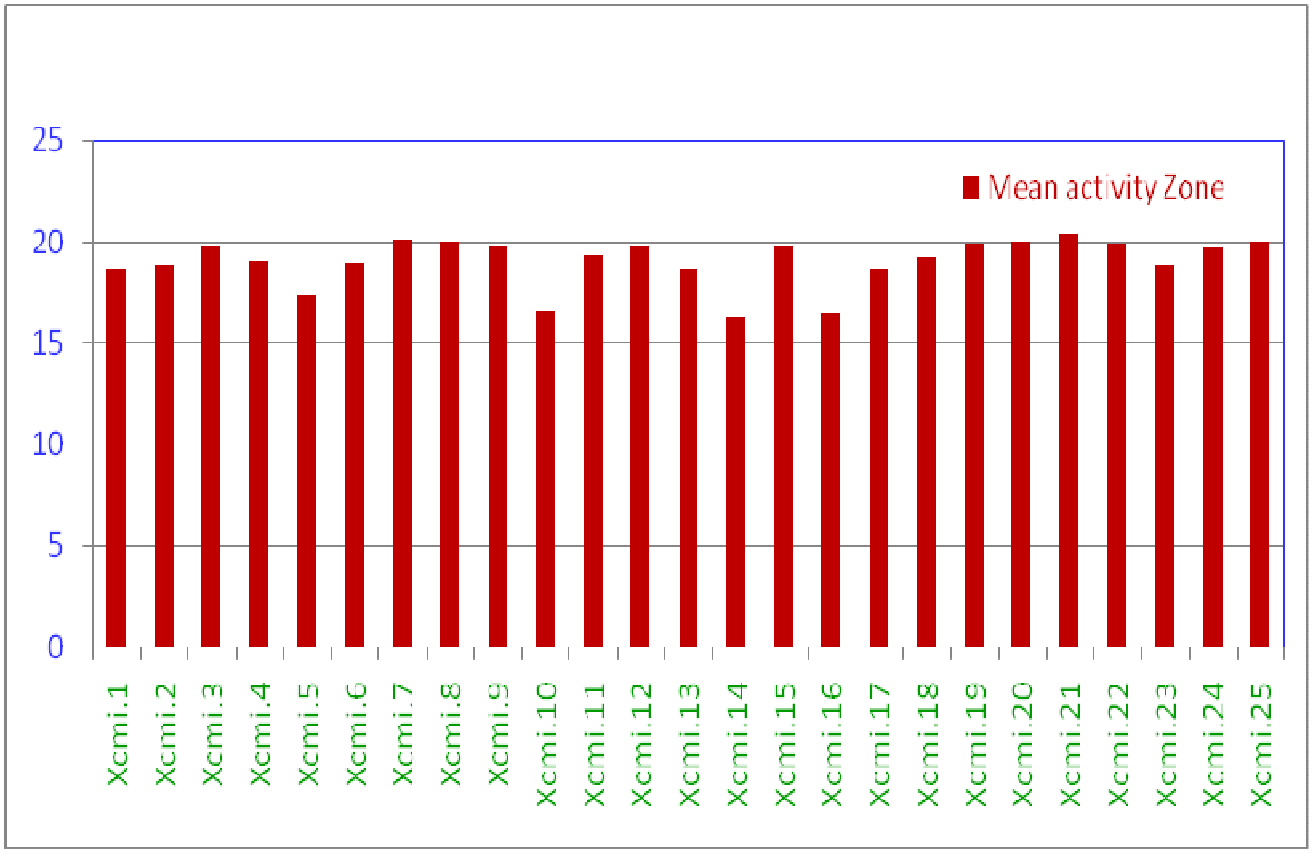

Figure-1
Antibacterial activity of O. sanctum against Xcmi strains

Table-1
Antibacterial Activity of *O. sanctum* against *Xcmi* strains

Sr. No	Name of the *Xcmi* strain	*O. sanctum* Antibacterial activity: Mean Zone of Inhibition (in mm)				
		Exp. A	Exp. B	Exp. C	Exp. D	Mean
1.	*Xcmi.*1	18.35	18.97	19.04	18.21	18.64
2.	*Xcmi.*2	18.47	19.25	18.90	18.82	18.86
3.	*Xcmi.*3	19.42	19.74	20.11	19.81	19.77
4.	*Xcmi.*4	18.47	19.55	18.89	18.99	18.98
5.	*Xcmi.*5	16.95	17.49	17.00	17.92	17.34
6.	*Xcmi.*6	18.45	18.87	19.21	19.15	18.92
7.	*Xcmi.*7	20.57	19.95	20.07	19.84	20.11
8.	*Xcmi.*8	20.46	20.04	20.00	19.75	20.06
9.	*Xcmi.*9	20.09	19.73	19.79	19.87	19.87
10.	*Xcmi.*10	15.99	16.62	16.89	16.95	16.61
11.	*Xcmi.*11	18.90	19.39	19.68	19.36	19.33
12.	*Xcmi.*12	19.47	19.61	20.44	20.00	19.88
13.	*Xcmi.*13	18.00	19.10	18.48	19.00	18.65
14.	*Xcmi.*14	16.25	17.03	15.85	15.95	16.27
15.	*Xcmi.*15	19.28	19.83	20.35	19.84	19.83
16.	*Xcmi.*16	16.00	16.29	16.95	16.59	16.46
17.	*Xcmi.*17	18.94	19.34	17.97	18.46	18.68
18.	*Xcmi.*18	19.56	19.00	18.72	19.54	19.21
19.	*Xcmi.*19	20.51	19.54	19.93	19.83	19.95
20.	*Xcmi.*20	20.45	19.82	19.73	20.00	20.00
21.	*Xcmi.*21	20.87	20.16	19.65	20.74	20.36
22.	*Xcmi.*22	20.71	19.56	19.54	19.83	19.91
23.	*Xcmi.*23	19.56	18.23	18.92	18.82	18.88
24.	*Xcmi.*24	19.45	19.67	19.63	19.94	19.67
25.	*Xcmi.*25	20.57	20.64	19.53	19.29	20.01

Conclusion

It was observed from the research work, that leaf extract of *O. sanctum* is effective against all the strains of *Xcmi*. The leaf extract is eco-friendly, economic and technically viable field formulation, which will be Bio-ecologically compatible for management of various strains of *Xcmi*.

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