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Short Communication

Effect of interaction of *Xanthomonas axonopodis* pv. *betlicola* and *Pseudomonas betle* on the extent of lesion development on betelvine leaf

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Betelvine (*Piper betle* L.) is an important cash crop in West Bengal, India. This crop is commonly affected by stem rot and leaf spot disease (4) caused by two different genera of bacteria - *Xanthomonas axonopodis* pv. *betlicola* Patel *et al.* (Vauterin *et al*.) and *Pseudomonas betle* Ragunathan (Săvulescu). Two bacterial pathogens enter into the host through stomata, hydathode and injury. Both the bacteria produce prominent dark brown lesions at any portion of the vine stem. Surface of such lesion becomes sticky in humid condition.

On the leaf, small to large, circular to irregular and/or angular brown coloured spots and marginal leaf blight symptoms are produced by both the bacteria. All types of spots are surrounded by yellow halo or the halo is present in between brown and green tissue. At the underside of the leaf, the brown lesion is encircled by a water soaked zone or water soaked area which is found in between brown lesion and green tissue in marginal blight. Frequently both the bacteria have been detected from the same leaf spot or stem lesion (3, 4) in different plantation. This fact created an interest to find out whether the interaction of the two bacteria had any effect on the size of lesion.

Leaves of betelvine (cv. *Bangla Pan*) were collected from farmers' *Boroj*. Bacterial suspension was prepared by adding sterile distilled water in the tube containing 48 hrs old slant culture of the bacteria. The tube was properly shaken to form uniform suspension (10^9 cell/ml). Afterwards, with the help of a hypodermic syringe, the bacterial suspension was injected in the veins of betel leaves (6). Upon injection, the leaf tissue adjacent to the injected vein became water soaked. The inoculated leaves were kept in polypropylene bags containing a moist cotton wool. After blowing air into the bags, the mouth of the bag tied with a rubber band. These polypropylene bags were then incubated at 28 ± 1°C in BOD incubator.

Two bacteria (*Xanthomonas axonopodis* pv. *betlicola* and *Pseudomonas betle*) were inoculated separately in individual leaves by injection method. Water soaked area developed after inoculation was more or less same in all the leaves. Fifty per cent of the leaves (20 leaves inoculated with yellow colony forming bacterial (*X. a. pv. betlicola*) culture were painted with white colony forming bacterial culture. After two days (48 hrs) of inocula-

tion, *P. betle* was painted on the lower side of the inoculated leaves with help of a camel hair brush. Painting was restricted within water soaked area developed during inoculation with *X. a.* pv. *betlicola*. Similarly, leaves inoculated with white colony forming bacterium were painted with yellow colony forming bacterial culture. These leaves were kept as earlier. Observation was taken after 5 days (120 hrs) by measuring the diameter of the necrotic brown lesion developed.

Both the bacteria when inoculated separately produced more or less similar spot with yellow halo. When leaves inoculated with white colony forming bacteria subsequently painted with yellow colony forming bacteria, the lesion size increased significantly (138.81%) compared to size of lesion produced by the white colony forming bacteria alone. Similar result (144.40%) obtained when yellow colony forming bacteria inoculated leaves were painted with white colony forming bacteria. Bhale *et al.* (2) and Acharya *et al.* (1) were of opinion that incidence of the disease was severe in betelvine when other pathogen such as *Colletotrichum capsici* (Syd. & P. Syd.) E. J. Butler & Bisby were involved along with *Xanthomonas axonopodis* pv. *betlicola*. The synergistic interaction between root knot nematode (*Meloidogyne* spp.) and *Ralstonia solanacearum* (Smith) Yabuuchi *et al.* on variety of host is widely recognized (5). Banana plants when inoculated with *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *cubense* (E. F. Smith) W. C. Snyder & H. N. Hansen, or *M. incognita* and *Ralstonia solanacearum* or *M. incognita* along with both the fungus and bacterium recorded a significant increase in banana wilt (7). In most case presence of white colony forming bacteria, *Pseudomonas betle* in betelvine plantation is ignored. In recent years, severe damage of the crop was noticed in plantation where both the bacteria were active (2).

The crop is affected by a number of fungal and bacterial diseases. Betelvine leaf is used directly for chewing purpose. So, care should be taken during application of pesticides. Interactions of two or more pathogens may increase or decrease the disease severity. Studies on ecological aspects are very much important. Further research is necessary to know the interaction with other pathogens for developing proper management practices.

Literature Cited

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Table 1.
Effect of interaction of white (*P. betle*) and yellow (*X. a.* pv. *betlicola*) colony forming bacteria on the extent of betelvine leaf area damage

Leaf inoculated* with WCFB only		**Lower leaf surface painted with YCFB 48 hrs after inoculation with WCFB**		**Leaf inoculated with YCFB only**		**Lower leaf surface painted with WCFB 48 hrs after inoculation with YCFB**	
Diameter of spot (cm)	Area of the spot (cm^2)	Diameter of spot (cm)	Area of the spot (cm^2)	Diameter of spot (cm)	Area of the spot (cm^2)	Diameter of spot (cm)	Area (cm^2)
0.60	0.2826	2.20	3.79	0.90	0.636	2.40	4.52
1.20	1.13	1.90	2.83	1.20	1.13	2.20	3.79
1.10	0.949	1.80	2.54	1.25	1.226	2.00	3.14
0.90	0.635	2.20	3.79	1.25	1.226	2.25	3.97
1.20	1.13	2.40	4.52	1.75	2.40	1.80	2.50
1.80	2.54	2.00	3.14	1.15	1.038	1.10	0.949
1.25	1.226	1.40	1.53	1.80	2.50	2.25	3.97
0.80	0.502	2.20	3.79	1.10	0.949	1.10	0.949
1.40	1.53	1.60	2.00	0.80	0.502	1.45	1.65
1.20	1.13	1.40	1.53	0.60	0.282	1.85	2.68
1.30	1.32	2.00	3.14	1.30	1.32	2.20	3.79
1.10	0.949	2.20	3.79	0.40	1.125	1.20	1.13
1.50	1.76	1.60	2.00	0.60	0.282	2.25	3.97
1.70	2.26	2.40	4.52	1.20	1.13	1.45	1.65
1.00	0.785	1.80	2.54	1.40	1.53	2.35	4.33
0.80	0.502	1.40	1.53	0.90	0.635	1.50	1.76
1.20	1.13	1.80	2.54	1.00	0.785	2.00	3.14
1.60	2.00	2.00	3.14	1.20	1.13	1.90	2.87
1.40	1.53	1.70	2.26	1.40	1.53	1.65	2.13
1.10	0.949	2.20	3.79	1.10	0.949	1.43	1.62
			Average				
1.223	1.229	1.91	2.935	1.115	1.115	1.816	2.725
Per cent increase of lesion size over single pathogen							
			138.81				144.40

* Inoculated by injection in the vein covering about 0.04 cm (diameter) water soaked area. WCFB= white colony forming bacteria, YCFB= yellow colony forming bacteria