

## DISEASE NOTE

**FIRST REPORT OF PANAMA WILT  
DISEASE OF BANANA CAUSED BY  
*FUSARIUM OXYSPORUM* f. sp. *CUBENSE*  
IN PAKISTAN**

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In Pakistan, Dwarf Cavendish bananas are grown on 30,000 ha with an annual production of 141,200 tons. In 2012-13, bananas grown in the district of Thatta (Sindh province) came down with an unknown disease, which was also observed in the Hyderabad region. Severely affected plants showed a conspicuous yellowing, followed by their death. Cross-sectioned pseudostems disclosed the presence of reddish-brown to dark-brown discoloration of vascular tissues and rhizome. Fruits had a reduced size. Isolations carried out on PDA from pseudostem, rhizome and roots yielded the consistent recovery of *Fusarium oxysporum* f. sp. *cubense*, the agent of Panama disease, which was identified based on morphology of: (i) macroconidia, sickle-shaped mostly 3 septate (occasionally 5 septate), pointed at both ends, 30-60×3-5 µm in size, borne on single phialides; (ii) microconidia, kidney shaped, without septation, produced on false heads, 5-12×3-5 µm in size. The optimum temperature for colony growth and sporulation was 25°C and 30°C, respectively. For pathogenicity tests, 12-week-old banana plantlets of cv. Basri were inoculated with 30 ml of a conidial suspension (10<sup>6</sup> conidia/ml). Wilt symptoms developed after 45 days on the inoculated plants from which the same fungus used for inoculation was recovered. Thus, Pakistani banana plantations are affected by Panama wilt, a devastating disease that has damaged thousands of hectares of banana plantations in different parts of the world (Ploetz, 2000). The cultivation of banana in Pakistan is at high risk, as Panama wilt has the potential to cause losses similar to those induced by the epidemic of banana bunchy top disease, which virtually eradicated banana cultivation from the Sindh in 1980s (Khalid *et al.*, 1993).

Khalid S., Soomro M.H., Stover R.H., 1993. First report of Banana bunchy top virus in Pakistan. *Plant Disease* 77: 101.

Ploetz R.C., 2000. Panama Disease: A classic and destructive disease of banana. *Plant Health Progress* doi: 10.1094/PHP-2000-1204-01-HM.

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**CITRUS BACTERIAL CANKER PUSTULES  
ARE ASSOCIATED WITH LEAFMINER  
GALLERIES IN IRAN**

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Citrus bacterial canker is one of the most destructive diseases of citrus in southern Iran. During 2000-2001 and 2005-2006, this disease became endemic showing a reduced severity. This was mainly due to the unfavorable climatic conditions, i.e. low rainfall during the previous years in particular. Control measures included pruning of symptomatic shoots and the use of copper sprays. In Rudan (Hormuzgan province), citrus pustules are usually observed on the lower leaf surface alongside the galleries caused by *Phyllocnistis citrella*. Bacteria were isolated from these pustules and identified as *Xanthomonas citri* pv. *citri* A (*Xac*) based on biochemical and physiological characteristics (Gram and oxidase reactions, nitrate reduction, urease, hydrolysis of aesculin, casein, gelatin, starch, Tween, sodium chloride tolerance, litmus milk, H<sub>2</sub>S generation from cysteine and phosphatase, xanthomonadin production, carbohydrate utilization); differential phenotypic features such as bacterial mass colour on Ayer medium containing L-proline, utilization of glycogen, maltose, dextrin, starch (Mohammadi *et al.*, 2001); broad pathogenicity range on inoculated hosts including Mexican lime, unshu tangerine, sour orange, grapefruit and sweet orange. Larval leafminer damage results in elevated incidence and severity of citrus bacterial canker disease (Belasque *et al.*, 2005). Since *Ph. citrella* is potentially capable of disseminating *Xac*, thus facilitating canker infection, it is suggested that controlling this pest may result in preventing *Xac* outbreaks in citrus groves. The association of bacterial canker pustules with leafminer tunnels has previously been reported from North Yemen and India (Cook, 1988; Belasque *et al.*, 2005) but not in Iran, this constituting the first record.

Belasque J.Jr., Parra-Pedrazzoli A.L., Rodrigues Neto J., Yamamoto P.T., Chagas M.C.M., Parra J.R.P., Vinyard B.T., Hartung J.S., 2005. Adult citrus leafminers (*Phyllocnistis citrella*) are not efficient vectors for *Xanthomonas axonopodis* pv. *citri*. *Plant Disease* 89: 590-594.

Cook A.A., 1988. Association of citrus canker pustules with leafminer tunnels in North Yemen. *Plant Disease* 72: 546.

Mohammadi M., Mirzaee M.R., Rahimian H., 2001. Physiological and biochemical characteristics of Iranian strains of *Xanthomonas axonopodis* pv. *citri*, the causal agent of citrus bacterial canker disease. *Journal of Phytopathology* 49: 65-75.

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