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Stem and root rot of *Telosma cordata* caused by *Phytophthora palmivora* in Vietnam – a newly recognised disease

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Abstract. Severe losses of plants in crops of *Telosma cordata* occurred in Nam Dan District, Nghe An Province, Vietnam, following prolonged wet weather in September 2007. *Phytophthora palmivora* was isolated consistently from the margin of diseased and healthy tissue in underground stems. Koch's Postulates were fulfilled. This is the first report of this disease.

Telosma cordata is a member of the family Apocynaceae s.l., sub-family Asclepiadoideae (Liede-Schumann and Meve 2006). It is known as Thien ly in Vietnam, and by various other common names including Chinese violet, fragrant telosma, Tonkin creeper and pakalana vine. *Telosma cordata* is a native of temperate areas of China as well as the Indian subcontinent and Indo-China. It is a perennial vine which is propagated from rooted stem cuttings and grown on trellises of various kinds. Leaves are opposite.

Telosma cordata is grown as a valuable cash crop in small areas of several provinces in Vietnam. The area under production has been increasing in recent years. The inflorescence (Fig. 1) is harvested for use in cooking to enhance flavour of various dishes and it is also considered to have medicinal properties.

In early September 2007 crops of *T. cordata* in Nam Dan District, Nghe An province, were severely affected by a disease referred to as 'quick death' by local farmers. There was 100% loss of plants in the majority of crops by late October. The onset of the disease followed prolonged wet weather and flooding. An *ad hoc* survey revealed that a stem and root rot disease was the apparent cause of plant death. Initially, the leaves of a diseased vine become bright yellow before wilting and dropping to the ground (Fig. 2). The entire vine is gradually affected and usually dies within a few weeks (Fig. 3). Necrosis of the roots and the underground stems (Fig. 4) is obvious when the roots are removed, washed and sectioned longitudinally.

Sections, 3 cm long, of diseased underground stems were collected on an *ad hoc* basis from five diseased plants from one crop in each of two communes, Nam Xuan and Hung Tien. The diseased underground stems were part of the new growth. The sections were washed thoroughly in tap water, surface sterilised by dipping in 70% ethanol, rinsed in sterile water and then damp-dried on sterile paper tissues. Small segments (~$2 \times 2 \times 2$ mm) were aseptically cut from the

Fig. 1. Inflorescence of *Telosma cordata* vine from Nam Dan district, Nghe An, Vietnam.

Fig. 2. Leaf yellowing and wilting of *Telosma cordata*, early symptoms of stem and root rot caused by *Phytophthora palmivora*.

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Fig. 3. Crop of *Telosma cordata* severely affected by stem and root rot caused by *Phytophthora palmivora*.

Fig. 4. Longitudinal section of an underground stem of *Telosma cordata* showing progressive necrosis caused by *Phytophthora palmivora*.

central part of the stem section at the margin of symptomless and diseased tissue. Segments were plated on either water agar (WA) or Phytophthora selective medium (PSM) (Burgess *et al*. 2008). The PSM plates were placed in the dark for 2–3 days at 25°C, whereas the WA plates were placed under 12 : 12 h dark : ultraviolet and fluorescent light at 25°C. Colonies of *Phytophthora* developed from all segments on both media. The colonies were subcultured to PSM and purified by hyphal tipping (Burgess *et al*. 2008), and finally grown on potato carrot agar (PCA) under light as above, for morphological identification based on the descriptions in Erwin and Ribeiro (1996). All colonies developed abundant sporangia typical of *P. palmivora*. One culture (isolate NA3) was selected for

Fig. 5. *Telosma cordata* vines planted in basket-mounds to enhance drainage of the soil in the root zone.

pathogenicity testing and a subculture was deposited in the culture collection at the National Institute of Medicinal Materials, Hanoi, as IMM035.

The pathogenicity of NA3 was tested using stem inoculation and soil inoculation methods. Aboveground stem sections from a symptomless *T. cordata* plant were used to establish well rooted young vines in an artificial soil mix consisting of 1 : 1 (v/v) sand and sterilised rice hulls. The stem sections were coiled several times in the soil mix at a depth of 10 cm in 20 cm pots. The vines were grown for two months to a height of 30–40 cm and trellised.

The stem inoculation method involved placing a small block (~5 mm × 5 mm) of agar from a colony of NA3 grown on PCA in a small cut in the stem of each of two vines, near the soil surface. A strip of Parafilm® was wrapped around the site of inoculation. Two similar vines were used as controls. Typical symptoms of stem rot developed in both inoculated plants after 5 days, namely stem browning and leaf yellowing. *Phytophthora palmivora* was reisolated from tissues 5 cm from the site of inoculation, using the technique described above. The control plants remained symptomless.

Inoculum for the soil inoculation technique was prepared by growing NA3 in a medium consisting of sterilised moist millet seed and rice hulls, 1 : 1 (v/v), in bottles under light at 25°C for 7 days. The millet seed was immersed in water for 12 h at 5°C before use. The medium was autoclaved twice and inoculated using three 1 cm squares from a colony of NA3 on PCA in each bottle. The soil around each of five vines was inoculated by incorporating 100 mL of inoculum into the top 10 cm of the soil mix, above the original rooted coiled stem sections. There were

five control vines. Typical symptoms of leaf yellowing developed gradually in inoculated vines after 5 days, and leaves began to drop after 10 days. The stems from the diseased vines were removed and severe stem rot was observed. *P. palmivora* was reisolated from all five inoculated vines. The control vines did not develop symptoms. Koch's Postulates were fulfilled using both inoculation techniques.

It was not possible to establish a formal field trial to evaluate control measures as the incidence of disease in farmers' fields was too high to permit a properly designed trial. However, a farmer demonstration trial was implemented using metalaxyl either as a spray or a drench. Some vines were untreated. The results suggest that both treatments reduced the incidence of vine deaths and supports the supposition that an oomycete is the major cause of the disease.

Phytophthora palmivora was isolated from durian root rot from the central province of Quang Nam in 1999 (H. L. Dang and F. Benyon, pers. comm.), and from papaya in 2006 (T. M. Luong, pers. comm.). Papaya trees are grown in gardens in Nghe An and seedlings can be imported from other areas. It is possible that the fungus has been introduced into the affected commune on papaya seedlings in recent years. The unusually heavy rain and flooding which occurred in September and October would have provided ideal conditions for the proliferation and dispersal of *P. palmivora*. Lengthy periods of saturated or near-saturated soil enhances the formation of sporangia and zoospores and severe disease development of Phytophthora root rots (Duniway 1979).

An integrated disease management strategy has been developed in consultation with farmers. Good drainage, the use of pathogen-free cuttings, rotation where feasible and drenching with metalaxyl are key elements of this strategy. It is planned to evaluate the efficacy of a wider range of fungicides. Mounds were shown to reduce severity of Phytophthora root rot of papaya in northern Queensland (Vawdrey *et al*. 2004). The practicality of using basket-mounds (Fig. 5) to reduce Phytophthora stem and root rot in *T. cordata* is being assessed in a cooperative study with farmers.

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