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## Transmission of *Xanthomonas* *vasicola* pv. *musacearum* to banana and enset through garden tools in Ethiopia

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### Abstract

*Xanthomonas* wilt caused by *Xanthomonas vasicola* pv. *musacearum* (*Xvm*) has been an important constraint to enset (*Ensete ventricosum*) production in Ethiopia for over 50 years. Bananas grown alongside enset have also been attacked by *Xvm*. Since 2001 the disease has spread beyond Ethiopia to other regions in east and central Africa, where it is threatening food and income security of banana farmers. It was postulated that *Xanthomonas* wilt has a similar epidemiology to that of other banana bacterial wilts, e.g. Moko, Bugtok, and banana blood disease which are transmitted by insect vectors and gardening tools. Earlier research in Uganda confirmed the role of insect vectors in spreading the disease through the male

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inflorescence of banana plants. Applying this knowledge, through de-budding, has been effective in preventing disease transmission by insect vectors. However, the role of contaminated gardening tools in the transmission of *Xanthomonas* wilt has not been conclusively investigated. In some areas, it has been observed that disease transmission continues to occur even when de-budding has been done, which suggests that other factors, e.g. tools play a role in pathogen transmission. In Ethiopia, as elsewhere in developing countries, resource poor farmers have few garden tools which they use regularly across their entire farm. Farmers are also likely to borrow tools from each other for use in their farms, and since they do not practice disinfection, this practice could accelerate the spread of pathogens. A study to determine the role of gardening tools in the transmission of *Xanthomonas* wilt was carried out in Ethiopia using Enset sp. and banana cultivar 'Pisang Awak' (*Musa* ABB group) plants. Experiments on enset were done in a greenhouse at the Southern Agricultural Research Institute (SARI) at Awassa, while trials on 'Pisang Awak' were carried out in the field in Amaro district. Using a contaminated knife the following treatments were carried out on enset: Cut green leaves (T1); cut broken green leaves (*i.e.* break the leaf petiole and cut off the leaf on the leaf lamina side at the point of breakage) (T2); cut dry leaves (T3); making a cut in the pseudostem (T4); cut roots (T5); and a control per treatment, using a clean machete. Each treatment was applied on 24 enset plants and replicated three times. In the field trials, treatments on 'Pisang Awak' comprised of T1, T2 and T3 (each with 45 plants over three replications), T4 and T5 (with 10 plants each over two replications) and de-suckering (T6) (10 plants over two replications). As a control T1-T6 were done with a clean machete on a similar number of plants. De-

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budding was done on 45 'Pisang Awak' plants by cutting off the male bud with a contaminated machete (T7) and by breaking off the male bud with a forked stick (T8) (45 plants - control). In addition, bacterial ooze was smeared on 10 fresh (T9) and 10 dry (T10) flower scars and 10 fresh (T11) and 10 dry (T12) bract scars on the male inflorescences. All treatments were observed over a period of 120 days. Results indicated that all plants (100%) of enset and banana that were cut in the pseudostem with a contaminated machete (T4), and all banana plants (100%) that were de-budded with a contaminated machete (T7) got infected. Similarly, T1 and T2 resulted in a high disease transmission of 67 and 62%, respectively on banana, and 58 and 54% respectively on enset. High transmission rates of 90% were also obtained for T6 on banana. On the other hand, cutting roots (T5) with a contaminated machete resulted in low transmission levels of 20% on bananas and 25% on enset, suggesting that infection through tools occurs mainly above ground. No infection was observed on the controls and where dry leaves were cut. These results demonstrate that in addition to insect vectors, contaminated gardening tools also play a major role in transmitting *Xanthomonas* wilt. Furthermore, whereas insect vector transmission of *Xvm* is possible only on flowering plants, contaminated tools can transmit the pathogen during both the vegetative and flowering phases of plant growth. These findings reinforce the need for rigorous tool disinfection either through flaming in fire or using disinfectants. Removing suckers and leaves in highly infected fields should be avoided, while de-budding should be carried out using a forked stick.