The transmission specificity and efficiency of tospoviruses

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Recent studies analyzing nucleocapsid protein gene have revealed the existence of a broad genetic diversity of tospoviruses. In Brazil, six tospoviruses have been reported in agricultural, horticultural and floral crops. The viruses *Tomato spotted wilt virus* (TSWV), *Tomato chlorotic spot virus* (TCSV), *Groundnut ringspot virus* (GRSV) and *Chrysanthemum stem necrosis virus* (CSNV) are well-known pathogens on tomato (de Ávila *et al.*, 1993, Bezzera *et al.*, 1999, Nagata *et al.*, 1998).

In the Federal District, Brazil, four potential thrips vector species, *Frankliniella occidentalis*, *F. schultzei*, *Thrips tabaci* and *T. palmi*, were used in a study to compare the efficiency by which they transmit these viruses (Nagata *et al*., 1999a). *F. occidentalis* and *T. palmi* are considered as recently introduced species in this country (Monteiro *et al.*, 1995a, b, 2000). *T. palmi,* which causes tremendous crop losses on green pepper, potato and cucurbits (Monteiro *et al.*, 2000), seems to be an important vector of tospoviruses in east and south Asian countries. In Europe and USA, *F. occidentalis* is considered to be the major vector of TSWV and *Impatiens necrotic spot virus* (INSV). In such diversity of tospoviruses and potential vector species, the elucidation of vector competence of tospoviruses in Brazil may be of great interest to provide a foundation to design effective management strategies.

The four above mentioned thrips species were tested for the efficiency by which the four tomato infecting tospoviruses are transmitted. After 16 h acquisition of virus by first instar larvae, the thrips were maintained on non-infected leaves till the adult stage, and the ability to transmit the virus was evaluated using leaf disk assay combined with ELISA (Wijkamp and Peters, 1993).

F. occidentalis transmitted all four tospoviruses with varying efficiency according to the virus species, from 18 % with GRSV to 71 % with CSNV. *F. schultzei* transmitted TCSV (70%), GRSV (93%) and CSNV (66%), but did not transmit the TSWV isolate. The recent explosion of GRSV epidemics in Brazil may be related to this high affinity of transmission between GRSV and *F. schultzei*. However, although the *T. tabaci* population used transmits *Iris yellow spot virus* to onion efficiently in Brazil (Nagata, *et al.,* 1999b), it did not transmit any tomato infecting tospovirus species in this study. Like *T. tabaci*, *T. palmi* also did not transmit any of these four tospoviruses. The results indicate that *F. occidentalis* and *F. schultzei* are the major tospovirus vectors in tomato crops, whereas *T. tabaci* and *T. palmi* probably do not play an important role in the spread of tospoviruses in this crop.

A discrepancy was observed between the specificity, the transmission, and the development of the infection in transmitters and non-transmitters. Not only those populations that transmitted the virus, but also *T. tabaci* and *T. palmi* were susceptible to infection by TSWV and CSNV, as shown by cocktail ELISA with an amplification step. An increase of the nucleocapsid protein could be demonstrated during the larval development in the two non-transmitter species. Since this increase followed an initial decrease of the virus titre after acquisition, we can conclude that TSWV and CSNV also replicate in these non-transmitting thrips species.

Circulative and propagative viruses like tospoviruses have to pass several tissues. These tissues may act as barriers, and thus finally determine vector competence (Hardy *et al.,* 1983; Hardy, 1988). For tospoviruses, these barriers may include a midgut infection, midgut escape, dissemination, salivary gland infection, and salivary gland escape barrier.

The results of this study show that the entry of and replication in the midgut do not determine, or regulate, transmission specificity. They suggest that no midgut infection barrier exists in these species, but that barriers are encountered in the dissemination of the virus from the midgut epithelium to other tissues, in particular to the salivary glands.

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