The vector capability of *Thrips tabaci*

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Abstract: A severe epidemic of TSWV was observed in tobacco plantations in North East Hungary in 1996. The TSWV infections occurred in different proportions, mostly 5 – 15% in this region, even in the last years. Among the known vectors only *Thrips tabaci* occurs here. Further investigations are required to clarify the role of *T. tabaci* populations propagating by arrhenotoky on different plant species e.g. on onion, and the relationships between the host ranges of *T. tabaci* and TSWV.

Introduction

The presence of tomato spotted wilt virus (TSWV) has been known for many decades in Central and East Europe and the Balkan peninsula (Razvyazkina 1953, Ivantcheva – Gabrovska 1959, Todorovski 1969, Gajos 1972, Zawirska et al. 1983). Its sporadic appearance was observed in tobacco in Hungary in 1972 (Ligeti and Nagy 1972). Twenty years later, in the early 1990s, it caused severe yield losses in North East Hungary (Nagy 1993). At about the same time TSWV epidemics occurred in green pepper, tomato, cucumber (Gáborjányi et al. 1955) and chrysanthemum cultures (E. Tóth, Budapest, personal communication). The sudden spread of this virus in forced vegetable cultures was connected undoubtedly with the introduction and abundance of western flower thrips, *Frankliniella occidentalis* (Jenser and Tasnádi 1989, Jenser 1995). However, in the tobacco fields of North East Hungary the only TSWV vector we have found is *Thrips tabaci*, so an explanation of the recent Tospovirus outbreaks in these fields was needed.

T. tabaci is a cosmopolitan species and known as a pest all over the world, but its reproduction, host range and vector capability are problematic. The TSWV epidemics in the tobacco fields of Hungary provided the possibility of studying the vector capability of this thrips under Hungarian climatic conditions.

Materials and methods

The strains of TSWV occurring on tobacco, green pepper, tomato, potato and chrysanthemum were identified by DAS-ELISA test.

T. tabaci was collected separately from weeds, mainly chickweed (*Stellaria media*), around the nurseries, also in different biotopes from onion and cabbage. It was then reared on bean pods under laboratory conditions.

The transmission capability of *T. tabaci* was examined by transferring specimens to indicator plants, mainly *Nicotiana benthamiana*.

The occurrence of males was studied by investigating 1400 microcopic slides of *T. tabaci* in the collection of the Systematic Entomology Laboratory of USDA in Beltsville.

Results

Isolates collected from tobacco, tomato, green pepper, chrysanthemum and from different weed species in tobacco fields and in the surroundings of TSWV-infected cultivated plants, produced high values in DAS-ELISA using polyclonal antisera against TSWV BR-01 serotype.

T. tabaci specimens collected from infected tobacco plants, as well as from weeds around TSWV infected the tobacco fields, transferred the virus to the indicator plants.

TSWV was detected individually in *T. tabaci* females collected from tobacco (*Nicotiana tabacum*) and gallant soldier (*Galinsoga parviflora*) in autumn as well as from chickweed (*Stellaria media*) and alfalfa (*Medicago sativa*) in spring.

According to our recent investigations, populations propagating by arrhenotoky occurred regularly on tobacco, but such populations were also found on onion (Pénzes 1994) as well as on different plant species e.g.

Datura stramonium and *Galinsoga parviflora.* Populations originated from tobacco as well as from onion were reared for several generations on bean pods under laboratory conditions.

The only males of *T. tabaci* in the collections at the USDA Systematic Entomology Laboratory in Beltsville are from onion imported from Italy and France, not a single male coming from North America.

Discussion

T. tabaci was the first known vector of TSWV (Pittman 1927) and this record was confirmed by many further experiments (Smith 1932, Linford 1932, Razvyazkina 1953, Ivantcheva - Gabrovska 1959, Sakimura 1961, 1963, Lemmetty and Lindqvist 1993). However, various authors, mainly in North America, have questioned the vector capability of *T. tabaci*; in some places the species is apparently not able to transmit TSWV (Paliwal 1974, 1976); in North Carolina (Eckel et al. 1996), and in Georgia (McPherson et al. 1999), the species does not occur among the potential vectors. In contrast, in California the species proved to be an efficient vector (Sakimura 1961).

There are some explanations of the possible causes regarding its vector capability. The transmission capacity of *T. tabaci* depends on the isolates of TSWV. Consequently where the isolates of this virus changed (German et al. 1992), or the virulent isolates are not present (Paliwal 1974), *T. tabaci* is not an effective vector. We are aware of only one strain in Hungary, and there is no information about other isolate or isolates having occurred formerly. Presumably this strain had been present and was transmitted by *T. tabaci* in Central and East Europe. The former tobacco varieties cultivated in Hungary were less susceptible to TSWV than the recent ones, e.g. cv. Burley which over the years were changed (I. Nagy , Debrecen, Hungary, personal communication).

The different vector capability could be explained by the statement of Zawirska (1976), that *T. tabaci* comprises two "types" from among which the populations of *T. tabaci tabaci* living on tobacco (*Nicotiana tabacum*) from time to time on gallant soldier (*Galinsoga parviflora*) and on potato (*Solanum tuberosum*) and out of the vegetation period on different weed species, propagate by arrhenotoky and are capable to transmit TSWV. However the populations of *T. tabaci communis* living on different plant species, mainly on onion, propagate by parthenogenesis and their specimens are not virus vectors. The experiments of Wijkamp and co-workers (1995), carried out by parthenogenetic populations reared on leek as well as by arrhenotokous population reared on bean pods, confirmed the statement of Zawirska (1976). According to the available information in North America in the *T. tabaci* populations males very rarely are present, their populations do not live on tobacco, while it is a well known pest of onion. In all probability this is one of the explanations for the variability or missing vector capability of *T. tabaci* populations.

In Europe the occurrence of *T. tabaci* populations propagating by arrhenotoky or parthenogenesis is different in many respects from those observed by Zawirska (1976) in Poland. We have found arrhenotokous *T. tabaci* populations, which contradicted our former statement (Jenser and Gáborjányi 1998) besides on onion, on tobacco (*Nicotiana tabacum*) as well as on potato (*Solanum tuberosum*), on thorn-apple (*Datura stramonium)* and on gallant soldier (*Galinsoga parviflora*) throughout the vegetation period.

Populations with males occur in the eastern Mediterranean region on onion (Mound 1970 cit. Lewis 1973). Studying the *T. tabaci* specimens in the collection of Systematic Entomology Laboratory of USDA in Beltsville I have found males occurring on onion in South and West Europe, too. *T. tabaci* populations with males could be reared on bean pods as it was experienced by Wijkamp and co-workers (1995) as well as by us. On the other hand in England the males of *T. tabaci* may appear locally out of doors, but never in the artificial sub-tropical climate of glasshouses where reproduction is always parthenogenetic (Morison, 1957 cit. Lewis 1973).

According to available data TSWV could be transmitted by *T. tabaci* populations with males. At the same time the occurrence of the males is more frequent than it was observed by Zawirska in Poland, and it does not depend only on the host plant. It requires further investigations to make it clear whether the populations having males but propagating on onion are able to transmit this virus.

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