Samenvatting. **Evaluatie van middelen ter beheersing van witte vlieg in Europa**

Witte vlieg en door witte vlieg overgedragen virussen vormen een groot probleem in de Europese tomatenteelt. ENDURE's tomaten Case Study wilde bepalen waar en waarom witte vliegen een belangrijke beperking vormen, informatie verzamelen over witte vliegen en daardoor overgebrachte virussen, wilde vaststellen welke beheersinstrumenten beschikbaar zijn en de belangrijkste kennisleemten en onderzoeksprioriteiten vaststellen. Onderzoek door deelnemers aan de Case Study, een literatuurstudie en twee enquettes, uitgevoerd in verschillende Europese tomatenteeltgebieden, stelden de onderzoekers in staat deze doelstellingen te bereiken.

Twee soorten witte vlieg zijn een probleem in tomaten in Europa. *Bemisia tabaci* is wijdverspreid, terwijl *Trialeurodes vaporariorum* alomtegenwoordig is. Biotypes B en Q van *B. tabaci* zijn wijdverspreid en problematisch. Tomatengewassen zijn bijzonder gevoelig voor tomatengeelkrulbladvirus (TYLCD) en hoge niveaus van infectie van deze ziekte vallen samen met een hoge druk van *B. tabaci*. Anders dan bij andere tomatenziekten, hangt de betekenis van *B. tabaci* samen met de hoogteeaus van insecticidengebruik, waaruit blijkt dat er veel chemische middelen tegen dit insect worden ingezet.Resistentie tegen *B. tabaci* is al gerapporteerd voor bijna alle insecticiden.

Integrated pest management (IPM) op basis van biologische bestrijding (IPM-BC) wordt toegepast in alle onderzochte gebieden en wordt gezien als de strategie om minder insecticiden te gebruiken. Andere IPM componenten omvatten kasnetten en tomatenrassen die tolerant zijn tegen TYLCD. Bemonsteringstechnieken verschillen tussen regio's; beslissingen worden in het algemeen gebaseerd op de dichtheden van witte vlieg en worden niet gerelateerd aan bestrijdingsstrategieën of groeicycli.

IPM-BC is de aanbevolen strategie voor duurzame tomatenproductie in Europa. Er werden echter een aantal beperkingen voor verdere implementatie geïdentificeerd, zoals het ontbreken van biologische oplossingen voor bepaalde ziekten, de kosten van de biologische bestrijders, gering vertouwen bij telers, de kosten van technische advisering en lage schadedrempels. Onderzoeksprioriteiten ter versterking van IPM-BC worden voorgesteld.

Voor nadere informatie kunt u contact opnemen met:

Ben Vosman, PRI, Wageningen URn –Postbus 16 – 6700 AA Wageningen
Tel.: (+31) 317-480838 – Email: ben.vosman@wur.nl

Over ENDURE

ENDURE is het Europees Netwerk voor de Duurzame Toepassing van Gewasbeschermingsstrategieën. ENDURE is een 'Network of Excellence' (NoE) met twee hoofddoelstellingen: herstructurering van Europees onderzoek en ontwikkeling op het gebied van gewasbeschermingsmiddelen en het ontwikkelen van ENDURE tot wereldleider in de ontwikkeling en toepassing van duurzame bestrijdingsstrategieën door middel van:

> Opbouw van een blijvende onderzoeksgemeenschap op het gebied van gewasbescherming
> Eindgebruikers voorzien van een bredere reeks korte-termijn oplossingen
> Ontwikkeling van een holistische benadering van duurzame gewasbescherming
> Volgen van en informeren over veranderingen in het gewasbeschermingsbeleid.

Achttien organisaties in 10 Europese landen hebben zich voor vier jaar verbonden aan ENDURE (2007-2010), met financiële steun van het Zesde Kaderprogramma, prioriteit 5: Voedselkwaliteit en Veiligheid, van de Europese Commissie.

Website and ENDURE Information Centre

www.endure-network.eu

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Tomato Case Study – Guide Number 1

Evaluation of Tools to Manage Whiteflies in Europe

Judit Arnó, IRTA, Spain
Rosa Gabarra, IRTA, Spain
Montserrat Estopà, IRTA, Spain
Kevin Gorman, Rothamsted Research, UK
Michel Peterschmitt, CIRAD, France
Olivier Bonato, INRA, France
Ben Vosman, WUR, The Netherlands
Martin Hommes, Julius Kühn Institute, Germany
Ramon Albajes, Universitat de Lleida, Spain

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Evaluation of Tools to Manage Whiteflies in Europe

Controlling whiteflies and the viruses they transmit are a major challenge for European tomato producers

Tomatoes are the most widely grown vegetable in the world and in 2005 the European Union (EU) was the second largest producer (after China) with annual production of 17 million tonnes (FAOSTAT, 2007). In 2005, Europeans consumed 15 million tonnes of fresh tomatoes, 90% produced within the EU.

Data generated by the 2004 EU pesticide residues monitoring report showed that 1% of tomato samples exceeded the MRL (maximum residue limits). Pesticide biodegradation in soil is reported to be much slower than in the plant. Thus, when considering the whole food chain, the use of pesticides has a greater impact on the environment (farm) than on food (fork).

ENDURE's Tomato Case Study has examined European tomato production and the tools available for management of key pests with a special focus on *Bemisia tabaci* and the incidence of whitefly-transmitted viruses.

***Bemisia tabaci* (whitefly) and symptoms of tomato yellow leaf curl disease (TYLCD).**

Key pests

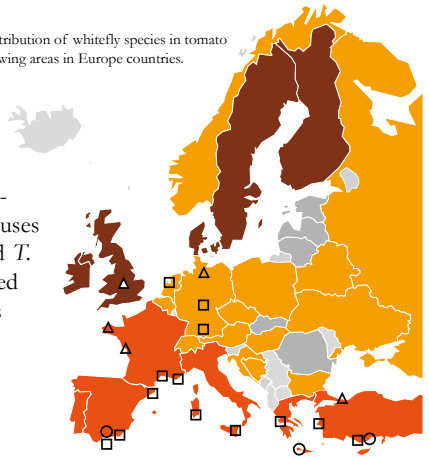
The relative economic importance of individual pest species in different areas of Europe varies according to local cultivation practices, the environment and cropping cycles. Two whitefly species are key pests: *Bemisia tabaci,* widely distributed around the Mediterranean basin, and *Trialeurodes vaporariorum,* ubiquitous but predominant in northern locations (see map). At least four biotypes of *B. tabaci* are currently present in Europe. The two most widespread and problematical for agriculture are biotypes B and Q, which are known to coexist in some areas but do not seem to interbreed.

Other insect pests ranked as important in at least some areas are: *Helicoverpa armigera* (during summer), leaf miners (mainly in long growing cycles) and *Frankliniella occidentalis*. The russet mite *Aculops lycopersici* is an increasingly harmful pest around the Mediterranean.

Whitefly-vectored viruses

Bemisia tabaci causes severe losses due to the transmission of tomato yellow leaf curl disease (TYLCD) and there is a high incidence of the viruses responsible for TYLCD when *B. tabaci* pressure is high. A less significant group of whitefly-transmitted viruses is the tomato chlorosis virus (ToCV), transmitted by *B. tabaci,* and *T. vaporariorum,* and tomato infectious chlorosis virus (TICV) transmitted by *T. vaporariorum*. In these cases, no strict correlation between virus importance and insect vector prevalence is observed.

Distribution of whitefly species in tomato growing areas in Europe countries.



In colours: = outdoor and protected crops, = primarily protected crops, = absent or non-persistent, = absent or non persistent (protected zone), = no information.

In symbols: ○ = *B. tabaci*, △ = *T. vaporariorum* and □ = mixed populations of *B. tabaci* and *T. vaporariorum*. (Data from ENDURE questionnaires).

Whitefly control strategies

Of the integrated pest management (IPM) strategies identified, IPM based on insecticide application (IPM-Insecticide) was used in 70% of the surveyed area, IPM based on biological control (IPM-BC) in 25% and chemical control only in 5%. The number of insecticide applications per month is higher in IPM-Insecticide than in IPM-BC.

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Not only insecticide applications but active ingredients (a.i.) are also saved using IPM strategies: IPM-Insecticide uses 18% less a.i./application than the chemical strategy and 17% more a.i./application than IPM-BC. *Bemisia tabaci* is one of the principal insect pests driving insecticide use, primarily due to the threat of TYLCD and the resulting low tolerance thresholds it imposes.

Insecticide resistance has been reported for both whiteflies, especially for *B. tabaci,* to all the pesticide compounds used: organophosphate, pyrethroid, carbamate and neonicotinoid, and the specific insect growth regulators pymetrozine and pyridaben. Therefore, IPM-BC is the recommended control strategy for more sustainable tomato production.

Sampling techniques for population follow-up and decision making do not depend on control strategies and differ between regions. Decisions are generally based upon whitefly densities and whitefly species are always identified.

Other control tools

An additional component of IPM strategies is the use of nets in vents and double-door systems to reduce the entry of *B. tabaci* into greenhouses, however compensations have to be made for the reduced ventilation this entails. The use of tomato varieties tolerant to TYLCD is useful in reducing economic impacts, but these varieties need additional protection from virus-transmitting insects during the first month after planting because they show reduced susceptibility to the virus rather than resistance. At present, there are no tomato varieties resistant to whiteflies. However, strong resistance is present in wild relatives and this might be introduced by breeding.

Biological controls

IPM-BC of whiteflies in tomatoes is mainly based on inoculative releases of the polyphagous predators *Macrolophus caliginosus* and *Nesidiocoris tenuis*, and the parasitoids *Eretmocerus mundus* and *Encarsia formosa*. *Eretmocerus mundus* is used in areas with high *B. tabaci* populations and *Encarsia formosa* is used, principally, for *T. vaporariorum* control. Rates of natural enemies are very variable depending on the area and crop cycle. In northern Spain, a programme based on the conservation of native populations of *Macrolophus* is also used. The fact that *N. tenuis* can cause damage to tomato plants when prey is scarce probably results in lower recommended release rates.

Factors limiting IPM uptake

Factors limiting IPM uptake include lack of biological solutions for some pests, costs of beneficials, low farmer confidence, increase costs of technical advice and low pest injury thresholds. To overcome these, research needs to be conducted on the emergence and invasion of new whitefly-transmitted viruses, on the relevance of *B. tabaci* biotypes regarding insecticide resistance, on the biochemistry and genetics of plant resistance towards whitefly, on economic thresholds and whitefly sampling techniques for decision making and on native whitefly natural enemies and other natural biological agents for tomato pest control. Efficient training of farmers and advisors will help to improve knowledge on IPM-BC strategies and boost end-user confidence in this method.

Natural enemies (from top to bottom): *Macrolophus caliginosus*, *Nesidiocoris tenuis*, *Encarsia formosa* and *Eretmocerus mundus*.