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Glossary

Mediterranean Partner Countries (MPC-12). Algeria, Cyprus, Egypt, Jordan, Israel, Lebanon, Malta, Morocco, Syria, the Gaza Strip and the West Bank, Tunisia and Turkey.

Whitefly species and biotypes

Bemisia tabaci is believed to be a species complex, with a number of recognized biotypes. *B. tabaci* has been reported from all continents except Antarctica. Over 900 host plants have been recorded for *B. tabaci* and it reportedly transmits 111 virus species. It is believed that *B. tabaci* has been spread throughout the world through the transport of plant products that were infested with whiteflies. Once established, *B. tabaci* quickly spreads and through its feeding habits and the transmission of the diseases it carries causes destruction to crops around the world. This species has been nominated as among 100 of the "World's Worst" invaders. (Global invasive species database, <http://www.issg.org/database/species/>).

Trialeurodes vaporariorum, is essentially tropical and subtropical. Introduced accidentally into Western Europe, it now constitutes a major pest in protected crops and may transmit viruses.

Main viruses species transmitted by *Bemisia tabaci*

TYLCV *Tomato yellow leaf curl virus* (*Tomato yellow leaf curl virus – Israel*) (Begomovirus). Insect vector: *B. tabaci*. Hosts: *Capsicum annuum*, *Lycopersicon esculentum*, *Phaseolus vulgaris*. Impact: Severe reduction of yield and heavy economic losses, mainly in tomato.

TYLCSV *Tomato yellow leaf curl Sardinia virus* (Begomovirus). Insect vector: *B. tabaci*. Hosts: *Lycopersicon esculentum*. Impact: Severe reduction of yield and heavy economic losses.

CYSDV *Cucurbit yellow stunting disorder virus* (Crinivirus). Insect vector: *B. tabaci*. Hosts: Cucumber and melon. Impact: High incidence and severe losses.

ToCV *Tomato chlorosis virus* (Crinivirus). Insect vector: *B. tabaci*. Hosts: Tomato. Impact: Yield reduction due to loss of photosynthetic area, reduced fruit growth and delayed ripening.

CVYV *Cucumber vein yellowing virus* (Ipomovirus). Insect vector: *B. tabaci*. Hosts: watermelon, cucumber. Impact: Considerable damage in Middle East and Spain

Summary

Main producers of fresh tomato in EU are Italy and Spain meanwhile US and Mexico are the major fresh tomato producers among the non-EU countries. The top of the world tomato exporters include first Spain and Mexico and to a lesser extent Italy and France. The EU mainly imports tomato from the Mediterranean Partner Countries (MPC-12) principally from Morocco.

Results from a bibliographic revision and a survey made in 9 different countries (6 EU and 3 MPC-12) have permitted to identify plant protection major constraints in the EU and MPC-12 tomato growing areas. Mixed populations of the whiteflies *Trialeurodes vaporariorum* and *Bemisia tabaci* are the key pest in most of the growing areas surveyed. Single infestations of *B. tabaci* are reported from some areas of Spain, Israel, Greece, Morocco and Turkey. The results of the survey indicate that biotype Q is the most widespread biotype alone (11 locations) or mixed with biotype B (4 locations). The main *Bemisia* transmitted viruses are TYLCV and TYLCSV in tomato, and CVYV and CYSDV in cucurbits crops. Those viruses are recorded from Mediterranean countries (UE and non UE countries) and in the Atlantic coast of Morocco, the Canary Islands and Reunion, where the most intensive fresh vegetables growing areas are concentrated.

The survey also indicates that insecticide whitefly control is used in all the countries. However, in many of the geographical areas biological control is used, specially in greenhouse crops. Nets to prevent *B. tabaci* populations are used in some areas with very intensive vegetable production as South of Spain, Sicily, Greece and Israel and, also in some areas with less intensive production, as the South of France. Other control methods applied, in a lesser extent, are cultural methods and plant genetic resistance to virus. In 19 of the surveyed geographical areas decision making on *Bemisia* control is based on thresholds and only in 6 areas decision making is based only on calendar treatments. Whitefly population sampling is done by counts of adults of both whitefly species on plants or on yellow traps.

1 Fresh tomato production in the World and in the EU

Fresh tomato production in EU and non-EU countries is presented in Figures 1 and 2. In the EU, Italy and Spain are the main producers, meanwhile US and Mexico are the major fresh tomato producers among the non-EU countries (MAPA 2004). The top of the world tomato exporters include first Spain and Mexico and to a lesser extent Italy and France. However, some important EU tomato producer countries as Italy and France are also major tomato importers (FAS/USDA 2004).

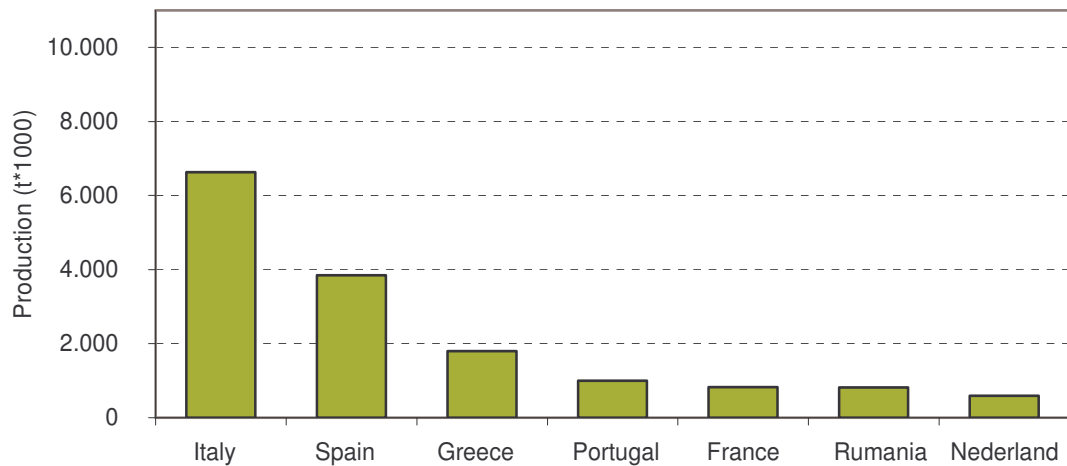


Figure 1: Fresh and chilled tomato production in the different EU countries in 2003 (MAPA 2004)

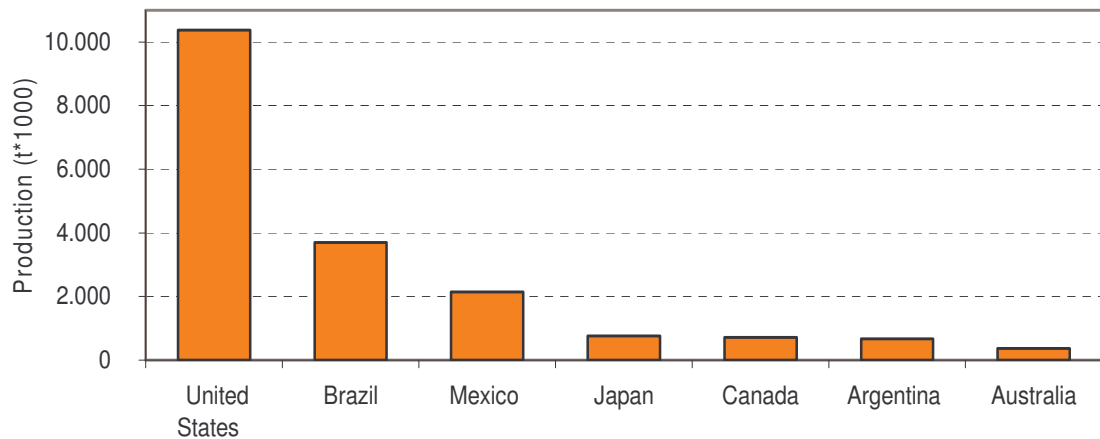


Figure 2: Fresh and chilled tomato production in the non-EU countries in 2003 (MAPA 2004).

The EU principally imports fruit and vegetables from the Mediterranean Partner Countries (MPC-12) and supplies them mainly with cereals and milk products. The MPC-12 supply practically all extra-EU imports of tomatoes and Morocco is the main exporter tomatoes to the EU, far ahead of Turkey and Israel. (Quefelec 2004).

2 Distribution of whitefly species

Figure 3 shows the distribution map of *Trialeurodes vaporariorum* and *Bemisia tabaci*, the only two whitefly species infesting tomato crops. Mixed infestations are common in most of the growing areas. Single populations of *T. vaporariorum* are common in northern locations of Europe (North of Germany, United Kingdom, and North of France) and in an area of Turkey where tomatoes are grown just in open field. Single infestations of *B. tabaci* are reported from Israel and some areas of Spain, Greece, Morocco and Turkey.

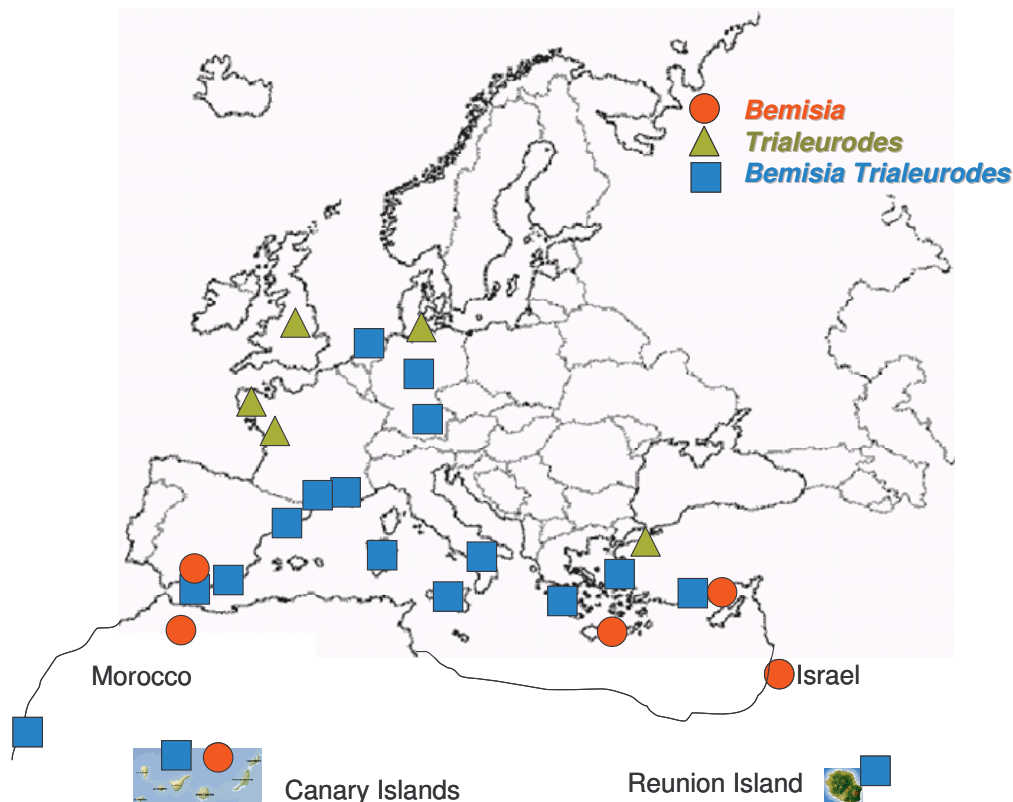


Figure 3: Distribution of whitefly species in tomato growing areas in Europe and Mediterranean partner countries. Results from a survey conducted by UdL-IRTA in 9 countries (numbers in brackets indicate the number of questionnaires from each area): France (5), Germany (4); Greece (2), Israel (2), Italy (3), Morocco (2), The Netherlands (3), Spain (8) and Turkey (5). From UK an answer reporting no presence of *B. tabaci* was received.

3 Distribution of *Bemisia tabaci* biotypes

Several biotypes of *B. tabaci* have been described in EU and MPC-12 countries. Figure 4 shows the results of our survey which indicates that biotype Q is the most widespread biotype on its own (11 locations) or mixed with biotype B (4 locations). Single infestations of biotype B are present in 6 locations. In the scientific literature it is reported that Q was the most abundant *B. tabaci* biotype in many European countries: France (Dalmon et al. 2006), Italy (Simon et al. 2003), Spain (Rua et al. 2006), Greece (Tsagkarakou et al. 2007) and Croatia (Zanic et al. 2005). Biotype B was present in France (Dalmon et al. 2006), in Spain and Portugal (Moya et al. 2001). Other biotypes reported in Europe are biotype S which has been identified only on *Ipomoea indica* in Spain (Malaga) (Rua et al. 2006) and biotype T, identified only on *Euphorbia characias* in Southern Italy and Sicily (Simon et al. 2003).

Bemisia tabaci Q biotype is described to be more resistant to neonicotinoids, IGRs (as pyriproxifen), piretroids, etc. than the B-type. This last biotype is known to survive better than Q-type under untreated conditions (Horowitz et al. 2005, Pascual 2006). Therefore intensive chemical control may produce biotype selection and would produce a greater survival of *B. tabaci* biotype Q.

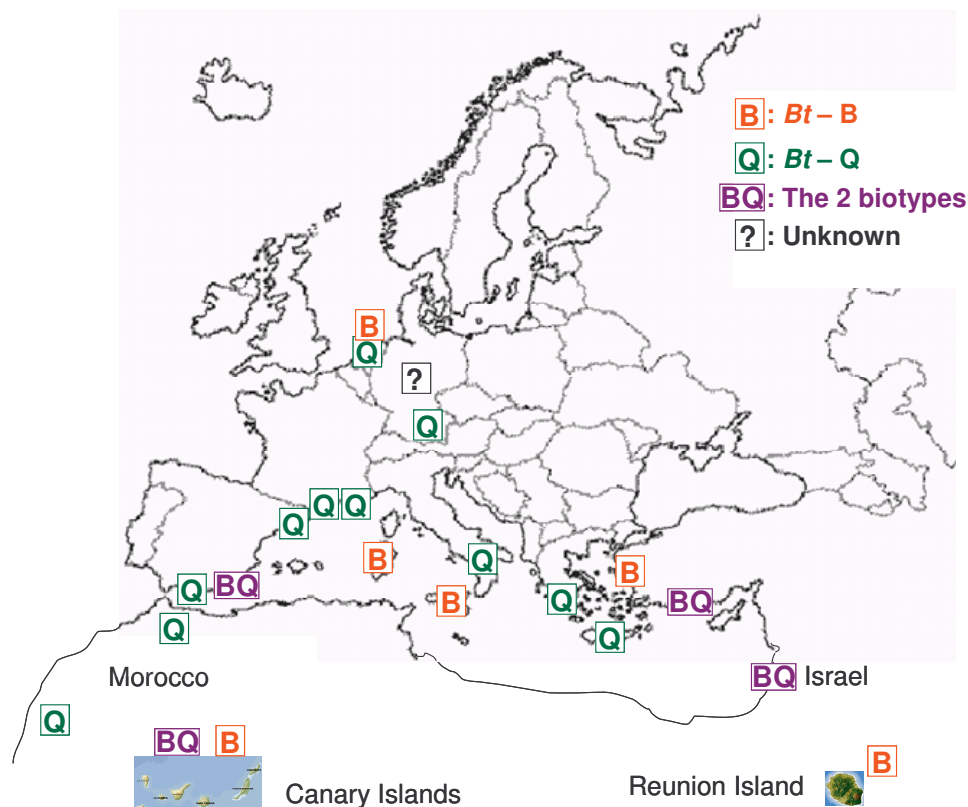


Figure 4: Distribution of whitefly species in tomato growing areas in Europe and Mediterranean partner countries. Results from a survey conducted by UdL-IRTA in 9 countries (numbers in brackets indicate the number of questionnaires from each area): France (5), Germany (4); Greece (2), Israel (2), Italy (3), Morocco (2), The Netherlands (3), Spain (8) and Turkey (5).

4 *Bemisia* transmitted viruses

Figures 5, 6 and 7 summarize the geographical distribution of the main *Bemisia* transmitted viruses in tomato and cucurbits. Data in the figures compile information on the literature and from the survey conducted by UdL-IRTA in 9 countries.

Tomato yellow leaf curl virus (TYLCV) and tomato yellow leaf curl sardinia virus (TYLCSV)

TYLCV and TYLCSV, which produce a severe reduction of yield, mainly in tomato crops, are the most widespread *Bemisia* transmitted viruses in Europe and MPC-12 countries. According to our survey, TYLCV also produces damage to bean crops in some areas of Greece, to peppers in Reunion and to ornamentals in Israel and mainland Italy.



Figure 5. Geographical distribution of TYLCV and TYLCSV in the EU-countries and the Mediterranean Basin.

4.2. Tomato chlorosis virus (ToCV)

This *Bemisia* transmitted virus is present in several countries around the Mediterranean Basin (Figure 6). It produces yield reduction due to loss of photosynthetic area, reduced fruit growth and delayed ripening.

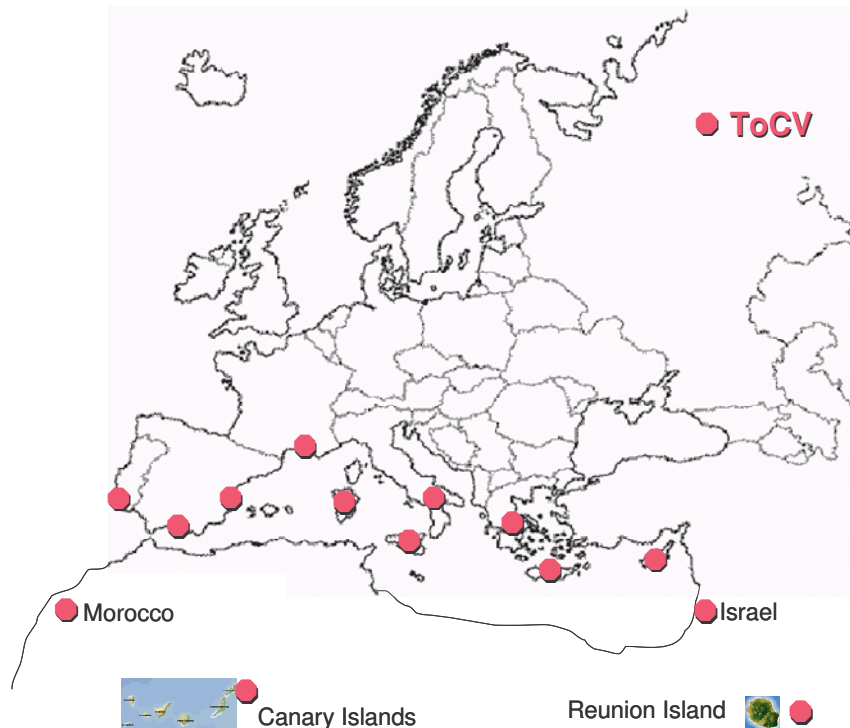


Figure 6. Geographical distribution of ToCV in the EU-countries and the Mediterranean Basin.

4.3. Viruses affecting cucurbits

Cucurbits are also severely affected by *Bemisia* transmitted viruses such as cucumber vein yellowing virus (CVYV) and cucurbit yellow stunting disorder virus (CYSDV). They are present in some countries along the Mediterranean and in the Atlantic coast of Morocco and the Canary Islands (Figure 7). At the present, watermelon chlorotic stunt virus (WmCSV) and squash leaf curl virus (SLCV) are present only in Israel.

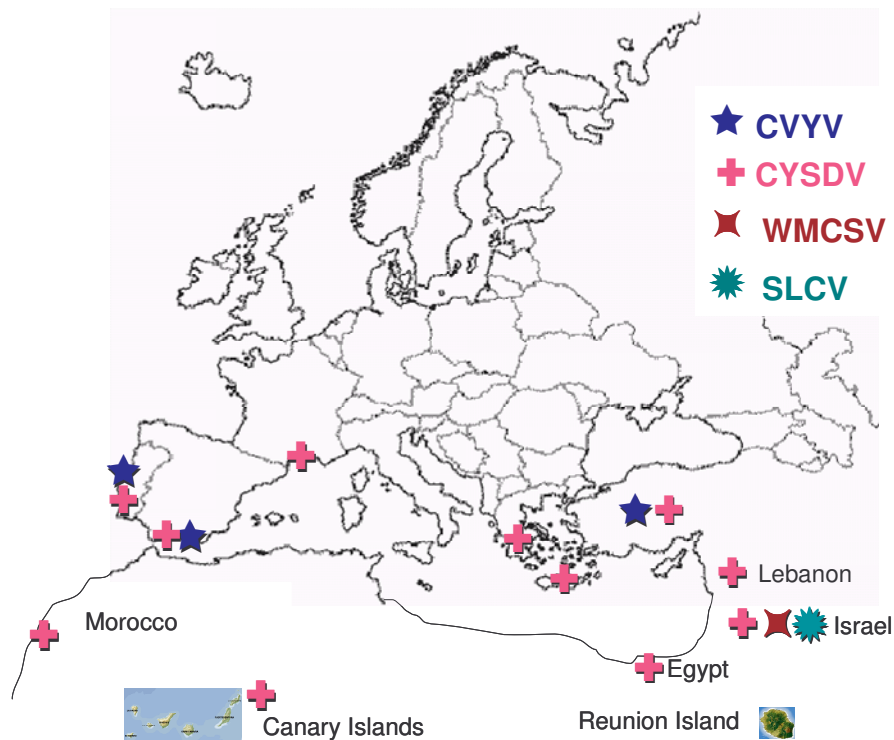


Figure 7. Geographical distribution of *Bemisia* transmitted viruses in cucurbits in the EU-countries and the Mediterranean Basin.

5 Whitefly control methods and decision tools

Insecticide whitefly control is used in all the surveyed countries. However, biological control is increasingly being used in the majority of the geographical areas, specially in greenhouse crops. Nets to reduce *B. tabaci* populations are extensively used in some areas with very intensive vegetable production as South of Spain, Sicily, Greece and Israel and, also, in some areas with less intensive production, as South of France. Other control methods applied, in a lesser extent, are cultural methods and plant genetic resistance to virus (Results from the survey conducted in nine tomato producer countries).

In 19 of the surveyed geographical areas decision making on *Bemisia* control is based on thresholds and only in 6 areas decision making is based only on calendar treatments. Frequently, whitefly population sampling is done by counts of adults of both whitefly species on plants or on yellow traps.

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