Yellow Vein Clearing of Lemons in Turkey

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ABSTRACT. Lemon production is an ancient and important sector of Turkish agriculture. In 2005, there were 6.6 million lemon trees in Turkey and 18,78% of them were in the Çukurova region. Interdonata and Kütdiken lemon varieties on sour orange rootstock in field were observed yellow vein clearing (YVC) symptoms in Çukurova region in 2000. Yellow vein clearing symptoms appear with yellow flecks at varying length on lateral veins. This symptom is combined with leaf crinkling and warping of young leaves. Field symptoms are very clear during spring and autumn flushes, and the symptoms remain visible on mature leaves. Graft transmission studies showed that YVC was transmissible to sour orange, Interdonata, Kütdiken, Italian and Lamas lemon varieties. However, sevaral sweet oranges (Madam Vinous, Pineapple, Navelina, Washington navel, Valencia), mandarins (satsuma, Clementine, Fremont, Nova, Parsons's Special, Kara), grapefruits (Star Ruby, Rio Red, Marsh seedless, Duncan), Tahiti lime and rough lemon did not develop any YVC symptoms.

Lemon production is an ancient and important sector in Turkish agriculture. In 2007, Turkey lemon production was 651.767 tons and 18.78 % of this in the Çukurova region (1). Interdonato and Kutdiken lemon varieties on sour orange rootstock were observed with yellow vein clearing (YVC) symptoms in this region in 2000 (6). YVC symptoms was first reported in Pakistan (2, 3), and were later associated with filamentous virus particles (4).

The leaves of lemon trees infected with YVC in Çukurova region showed vein clearing which appeared with yellow flecks at varying length on lateral veins. This symptom was combined with leaf crinkling and warping of young leaves (Fig. 1). Vein clearing symptoms, with a water-soaked appearance, were seen on the adaxial veins underside of the leaves. Field symptoms are excellent during the spring and autumn flushes, as well as during the flushing periods in summer. The symptoms are constantly present on mature leaves.

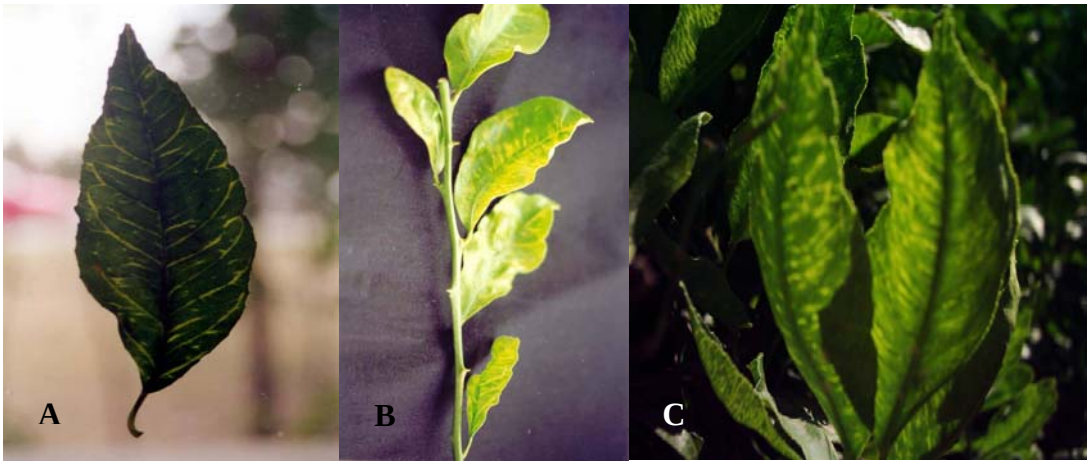

Fig.1. Different leaf symptoms of YVC on Kutdiken lemon : A - yellow vein clearing , B - chlorotic lesions, C - yellow vein clearing with leaf deformation.

Fig.2. Sour orange leaf with YVC symptoms (A), and Kutdiken lemon inoculated with YVC.

Graft transmissible studies showed that YVC was transmissible to sour orange, and Interdonato, Kutdiken, Italian and Lamas lemon varieties (Fig. 2). However, Madam Vinous, Pineapple, Navelina, Washington navel, Valencia oranges, satsuma, Clementine, Fremont, Nova, Parson's Special, Kara mandarin varieties, Star Ruby, Rio Red, Marsh Seedless, Duncan grapefruits, Tahiti lime and rough lemon did not shown any YVC symptoms. The YVC was compared with *Citrus psorosis virus* (CPsV), *Citrus variegation virus* (CVV) and Citrus Chlorotic Dwarf Disease (CCD). CPsV induced symptoms on sour orange, lemon, mandarin, orange and grapefruit varieties, but YVC symptoms only appear on sour orange and lemon varieties. The DAS-ELISA results for CVV on YVC infected lemon and sour orange varieties were negative. The symptoms of YVC are very similar to CCDV, which is transmitted by whitefly, *Parabemisia myricae* (Kuwana) (5). However, CCDV-infected mandarin, orange and grapefruit seedlings showed symptoms on leaves, but YVC did not. YVC was transmitted mechanically by slash inoculation from citrus to citrus. The disease may be insect transmitted, but further investigations are necessary to confirm this.

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