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Screening of Turkish Melon Accessions for Resistance to ZYMV, WMV and CMV

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Abstract

In the Çukurova University Department of Horticulture more than 350 melon accessions were collected from different ecological parts of Turkey which is located on the secondary genetic diversification center of this crop, and their characterization studies are near completion. Furthermore, evaluation studies of these materials have started. In the present study 67 melon accessions, sampled from this germplasm, were tested for resistance to zucchini yellow mosaic virus (ZYMV), *Cucumber* mosaic virus (CMV) and watermelon mosaic virus (WMV). After resistance tests made by mechanical inoculation, four accessions ('CU 100', 'CU 287', 'CU 305' and 'CU 328') were found resistant to ZYMV and three accessions ('CU 305', 'C 264', and 'C 276') to WMV. No resistant genotype was found to CMV.

Keywords: *Cucumis melo*, melon, germplasm, virus, resistance

Introduction

Melons have much importance, in human nutrition and for economic values, being represented in the world with 27 million tones on 1.2 million ha area yearly production. Turkey is a leading producer of melon, being on the second place among the world producer countries, with about the 1.8 million tones production, realized on 115 thousand ha area (Anonymous, 2005). Cultivated melon (85%) consists of inodorous melon group (Kirkagac, Hasanbey, Yuva etc.) and the rest (15%) is composed by reticulatus and cantalupensis types (ie. Ananas, Galia etc.) in Turkey (Abak, 2001).

Viral diseases cause important economic losses throughout the world. More than 35 viruses have been isolated from cucurbits (Provvidenti, 1996). These viruses constitute complex and dynamically changing problems as described by Nameth *et al.* (1986). Most commercial melon varieties are susceptible to the viral pathogens. Potyviruses form the largest and the most economically significant group of plant viruses (Riechmann *et al.*, 1992). Severe losses in melon production areas are due to potyvirus infection, including watermelon mosaic virus (WMV), zucchini yellow mosaic virus (ZYMV) and papaya ringspot virus (PRSV) (Davis and Mizuki, 1987; Provvidenti and Gonsalves, 1984). Infected melon plants may show vine decline, reduced or absent yield and fruit quality defects.

Virus infections caused by nonpersistently transmitted viruses are difficult to prevent by insecticide application (Raccah, 1986), which is the most frequent measure used by growers. Therefore, incorporation of genetic resistance in the host plant is a valuable alternative. Commercial melons carrying resistance to cucumber mosaic virus (CMV) and PRSV are available (Lecoq *et al.*, 1998). However, resistant cultivars to ZYMV or WMV are not commercially available (Danin-Poleg *et al.*, 2000; Pitrat and Lecoq, 1984; Gilbert *et al.*, 1994; Gray *et al.*, 1988).

Melon is a diploid species of African origin and Turkey is not a center of origin of this crop. Hence, there are no wild types or forms of genera such as *Cucumis, Cucurbita, Citrullus, Lagenaria* etc. However, Anatolia peninsula is situated on the second genetic diversification center for these plants (Robinson and Decker-Walters, 1997; Pitrat *et al.*, 1999) and a rich genetic diversity of melon, watermelon, snake cucumber, squash and pumpkin found in that area (Harlan, 1951; Kucuk *et al.*, 2002). In the Ministry of Agriculture and Rural Affairs, a special service was established in 1964 for plant genetic resources and a national framework was implemented. The Aegean Agricultural Research Institute (AARI) has taken responsibility of projects of this kind. About 1600 cucurbit accessions (350 melons) have been collected within this institute. On the other hand, nearly 400 melon accessions were collected from different ecological parts of Turkey by the University of Çukurova, Department of Horticulture, and their characterization studies are near completion. Furthermore, evaluation studies of these materials have started, searching for the resistance to diseases: *Fusarium oxysporum* f.

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sp. *melonis*, *Pseudomonas viridiflava* and some viruses. The objective of the present work was to search for novel sources of resistance to ZYMV, CMV and WMV, in Turkish *C. melo* germ plasm collection, and to use this resistance sources in further breeding studies.

Materials and methods

In the study 65 melon accessions including inodorous, reticulatus and cantalopensis groups ('CU04', 'CU16', 'CU34', 'CU51', 'CU67', 'CU99', 'CU100', 'CU104', 'CU172', 'CU177', 'CU179', 'CU180', 'CU190', 'CU193', 'CU196', 'CU199', 'CU203', 'CU204', 'CU206', 'CU227', 'CU230', 'CU233', 'CU235', 'CU236', 'CU239', 'CU241', 'CU243', 'CU245', 'CU252', 'CU256', 'CU265', 'CU272', 'CU287', 'CU297', 'CU306', 'CU307', 'CU308', 'CU315', 'CU316', 'CU319', 'CU320', 'CU328', 'CU329', 'CU331', 'CU334', 'CU335', 'CU336', 'CU337', 'CU338', 'CU340', 'CU341', 'CU342', 'CU343', 'CU344', 'CU345', 'C157', 'C264', 'C276', 'C285', 'C824', 'Cum334', 'Çesme', 'Kırkagaç', 'Negro' and 'PMR45') and two wild relatives ('CU305', 'CU332') were evaluated for resistance to CMV, ZYMV and WMV. Thirteen accessions were provided from INRA-Montfavet, and eigth from Spain SIA-DGA and La Mayora-C.S.I.C. Screening tests were carried out at University of Çukurova and Adana Regional Plant Protection Research Institute. Virus isolates ZYMV- 'CU0190', CMV- 'CU0172' from Çukurova University and WMV-ZM from Izmir Plant Protection Research Institute were used for the study. All virus isolates were propagated by mechanically inoculation onto the susceptible melon plants, and then tested by ELISA method for confirmation before using in trials. Plants were growth in 4 cm diametered multi cellular trays. Virus isolates were mechanically inoculated to the cotyledons at the first true leaf stage of the plant by rubbing Carborundum-dusted with extracts from 1 g of infected plant material prepared in 0.02 M phosphate buffer and containing 0.1% 2-mercaptoethanol (pH:7.0) and added activated carbon. After inoculation cotyledons were washed using tap water. Plants were left to grow in 16 h light 8 h dark at 25 °C temperature conditions. Presence or absence of virus symptoms was scored for each test plant 3 weeks after inoculation. The accessions, developed visual symptom, were recorded as susceptible and symptomless plants resistant. Then symptomless plants were controlled by ELISA test to confirm resistance.

Results and discussion

In this work, forty six melon accessions representative of various geographical regions of Turkey, thirteen from France and eigth from Spain were screened for resistance to CMV, WMV, and ZYMV, especially for other than known mechanisms of resistance to these diseases, to evaluate our melon germplasm. Results of the resistance tests are summarized in Tab. 1.

Tab. 1. Results of mechanical inoculation of *C. melo* and wild relatives tested with CMV, WMV and ZYMV

Number of *C. melo* / number of wild relative			
Virus Tested	Susceptible	Resitant	Total
CMV*	65 / 2	0 / 0	65 / 2
WMV	63 / 1	2 / 1	65 / 2
ZYMV	62 / 1	3 / 1	65 / 2

*After CMV test 29 accessions were found to be susceptible and 38 accessions did not produced clear symptoms. Therefore all genotypes tested by ELISA and all gave positive reaction.

The results show that there was no resistance to CMV in tested accessions. Among 67 accessions, 'CU305'- a wild relative of melon (*C. melo* var. *agrestis*) collected from Adana, was found to be resistant to both ZYMV and WMV. 'CU100' (collected from Turkmenistan), 'CU287' (collected from eastern Anatolia) and 'CU328' (collected from central Anatolia) were also observed resistant to ZYMV. Accessions 'C264' and 'C276' (both obtained from Spain) showed resistance to WMV, together with the 'CU305'. The type or heritability manner of the resistance of these accessions was not tried in the study. As seen in Tab. 1, the virus resistance source is very limited in the melon cultivars. There is no resistance in the commercial varieties, but some melon lines have good resistance to viruses. The Indian accession PI 414723 (McCreight *et al.*, 1992) possesses multiple disease and pest resistances. Anagnostou *et al.* (2000) identified that a breeding line derived from PI 414723 has multiple resistance to WMV, ZYMV, PRSV and powdery mildew. Its resistance to WMV is governed by a single dominant gene WMV. Pitrat and Lecoq (1984) identified a single dominant gene, ZYM, in the same accession PI 414723 for resistance to ZYMV. Another melon accession- PI 161375, confers heterogeneous resistance to CMV (Diaz *et al.*, 2003). This accession confers a complete resistance to M-373 and some plants gave symptoms when inoculated by B-20.2 and M-6 strains of CMV.

For the further studies, the rest of our melon germplasm will be evaluated for virus and other diseases, and the mechanisms of virus resistances will also be studied.

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