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Evaluation of Turkish melon accessions for resistance to *Fusarium* wilt, downy mildew, powdery mildew, *Cucumber mosaic virus* and *Zucchini yellow mosaic virus*

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Abstract

The aim of this study was to detect disease resistance in melon genetic resources collected from different regions (south-eastern Anatolia, middle Anatolia, Aegean, Marmara-Thrace and eastern Anatolia) of Turkey. A total of 85 melon and 15 snake melon genotypes were tested against *Fusarium* wilt (races 1 and 2), downy mildew and powdery mildew (race 3) as fungal diseases, and *Cucumber mosaic virus* (CMV) and *Zucchini yellow mosaic virus* (ZYMV) as virus diseases. In the case of *Fusarium* wilt race 1, eight genotypes were found resistant, 86 genotypes were susceptible and one genotype was segregating. Fifty-four percent of the genotypes were found to be resistant, 28% were susceptible and 18% were segregating for *Fusarium* wilt race 2. In the case of downy mildew, four genotypes ('Kav 28', 'Kav 71', 'Kav 237' and 'Kav 255') were resistant, while 78 genotypes were susceptible and 16 genotypes were segregating. Among all the genotypes tested, only two genotypes ('Kav 60' and 'Kav 277') were resistant to powdery mildew. While two genotypes ('Kav 281' and 'Ac 33') were found to be resistant to CMV, none of the genotypes were resistant to ZYMV.

Keywords: *Cucumis melo*, fungal diseases, virus, artificial inoculation

INTRODUCTION

Turkey is a rich country in terms of plant genetic resources, having about 163 families, 1225 genera and 9000 species in the flora, of which 3000 are endemic to Turkey. Therefore, the conservation and use of genetic material has a particular importance for Turkey (Özgen et al., 2000).

Melon (*Cucumis melo* L.) is a member of the family *Cucurbitaceae* and has a high level of morphological diversity (Kirkbride, 1993; Whitaker and Davis, 1962; Pitrat et al., 2000). Commercial production in Turkey is approximately 1.7 million tons (FAO, 2012), and the country is located in the secondary genetic diversity centre for melon (Pitrat et al., 2000). It has been reported that Turkey is rich in melon genetic resources, which are morphologically diverse, especially for fruit characters. Cukurova University Department of Horticulture has a melon genetic resources collection comprising more than 400 accessions, collected from different regions of Turkey and obtained from various countries in the world. Several studies have been conducted on morphological characterization of this melon germplasm (Solmaz et al., 2004; Sari and Solmaz, 2007). However, resistance to diseases and pests has not yet been investigated.

Diseases and pests are among the most important factors limiting melon production in Turkey. *Fusarium* wilt (Yucel et al., 1994), downy mildew (Koc, 1986), powdery mildew, *Zucchini yellow mosaic virus* (ZYMV) and *Cucumber mosaic virus* (CMV) (Yilmaz and Davis, 1984, 1985) cause significant problems in different melon-growing regions (Sari et al.,

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1994).

Fusarium wilt (*Fusarium oxysporum* f.sp. *melonis*) is a soil-borne fungal disease and one of the main problems in melon. In Turkey, the pathogen is already widespread in the Aegean, Mediterranean, eastern and south-eastern Anatolia regions and threatens production in all other areas (Zengin et al., 1975; Yildiz, 1977; Yucel et al., 1994; Kinay et al., 1995; Demir and Tezcan, 1995; Maden et al., 1998; Erzurum et al., 1999; Baran, 2000; Kurt et al., 2002). Use of resistant cultivars was found to be more effective in combination with chemical protection (Scherf and Mancab, 1986; Martyn and Gordon, 1996). Downy mildew (*Pseudoperonospora cubensis*) is another fungal disease causing problems in melon production areas (Lebeda et Cohen, 2011). *P. cubensis* isolates collected in various areas of Turkey were recently shown to exhibit weak genetic diversity but to be strongly distinct from Israeli isolates (Polat et al., 2014). In melon plants, the symptoms begin with necrotic lesions on old leaves, then spread to the whole plant and cause death. Powdery mildew is one of the first identified diseases, and *Podosphaera xanthii* and *Golovinomyces cichoracearum* are the main causal agents. CMV and ZYMV are serious virus diseases widely distributed in melon-growing areas of Turkey.

The aim of this study was to evaluate the resistance of Turkish melon accessions to Fusarium wilt, downy mildew, powdery mildew, CMV and ZYMV.

MATERIALS AND METHODS

A total of 85 melon and 15 snake melon accessions was selected from the Cukurova University Department of Horticulture melon genetic resources collection and used as plant material. The origins and local names of the accessions are presented in Table 1.

Table 1. The origin, name and resistance of Turkish melon and snake melon accessions to Fusarium wilt, downy mildew, powdery mildew, CMV and ZYMV.

Genotype	Origin	Local name	Fusarium race 1	Fusarium race 2	Downy mildew	Powdery mildew	CMV
Kav 1	Diyarbakir	Asma kavunu	S	S	S	S	S
Kav 3	Mardin	Unknown	S	R	H	S	S
Kav 5	Sanliurfa	Unknown	S	R	S	S	S
Kav 8	Sanliurfa	Unknown	S	S	S	S	S
Kav 9	Gaziantep	Unknown	S	R	S	S	S
Kav 14	Sanliurfa	Unknown	S	R	S	S	S
Kav 19	Gaziantep	Unknown	S	S	S	S	S
Kav 23	NCTR	Yerli	S	S	S	S	S
Kav 26	Manisa	Kislik	S	H	S	S	S
Kav 27	Kutahya	Gonen	S	S	S	S	S
Kav 28	Manisa	Melemen	-	-	R	S	S
Kav 29	Manisa	Cengel Tatar	R	R	S	S	S
Kav 30	Konya	Cumra	S	S	S	S	S
Kav 33	Konya	Unknown	S	H	S	S	S
Kav 34	Konya	Unknown	S	R	H	S	S
Kav 36	Usak	Unknown	R	R	S	S	S
Kav 37	Istanbul	Unknown	S	S	H	S	S
Kav 38	Manisa	Dilim	S	H	S	S	S
Kav 39	Manisa	Lambada	S	S	H	S	S
Kav 40	Manisa	Dilim	S	R	H	S	S
Kav 42	Tekirdag	Unknown	S	S	S	S	S
Kav 43	Tekirdag	Unknown	S	R	H	S	S
Kav 44	Tekirdag	Unknown	S	S	H	S	S

Table 1. Continued.

Genotype	Origin	Local name	Fusarium race 1	Fusarium race 2	Downy mildew	Powdery mildew	CMV
Kav 45	Tekirdag	Suluklu	S	H	S	S	S
Kav 46	Usak	Unknown	S	R	S	S	S
Kav 48	Usak	Unknown	S	R	S	S	S
Kav 50	Manisa	Cavdan	S	R	S	S	S
Kav 52	Balıkesir	Acur	S	R	S	S	S
Kav 53	-	Unknown	S	H	S	S	S
Kav 54	Manisa	Siyah	S	S	S	S	S
Kav 56	Canakkale	Unknown	S	R	-	-	S
Kav 57	Adana	Unknown	R	S	H	S	S
Kav 59	-	Girnogi	S	H	S	S	S
Kav 60	NCTR	Yerli	S	S	H	R	S
Kav 61	Adiyaman	Bal	S	S	S	S	S
Kav 62	Adiyaman	Kelek bal	S	R	S	S	S
Kav 63	Sanliurfa	Unknown	S	S	S	S	-
Kav 64	Mardin	Semamok	S	R	S	S	S
Kav 65	Sanliurfa	Selengo	S	R	S	S	S
Kav 66	Sanliurfa	Yabani	S	S	S	S	S
Kav 67	Ankara	Unknown	S	S	S	S	S
Kav 70	-	Kuscular	S	R	S	S	S
Kav 71	-	Unknown	R	S	R	S	-
Kav 72	Sakarya	Unknown	S	H	H	S	S
Kav 73	Sanliurfa	Unknown	S	R	S	S	S
Kav 74	Sanliurfa	Unknown	S	S	H	S	S
Kav 79	Ankara	Unknown	S	S	H	S	S
Kav 82	Usak	Unknown	S	R	H	S	S
Kav 84	Manisa	Unknown	S	R	H	S	S
Kav 85	Nevsehir	Unknown	R	S	H	S	S
Kav 87	Nigde	Unknown	S	R	S	S	S
Kav 90	Elazig	Unknown	S	R	S	S	S
Kav 170	Antalya	Unknown	S	S	S	S	S
Kav 191	K.Maras	Unknown	-	-	S	S	S
Kav 213	Ankara	Tirtilli	S	R	S	S	S
Kav 214	Ankara	Altınbas	R	H	S	S	S
Kav 218	Ankara	Ipsala	S	H	S	S	S
Kav 221	Ankara	Kislik	S	R	S	S	S
Kav 226	Ankara	Altın	R	H	S	S	S
Kav 228	Ankara	U.Yuva	S	R	S	S	S
Kav 232	Ankara	Cikolata	S	H	S	S	S
Kav 234	Ankara	Ipsala	S	S	S	S	S
Kav 235	Ankara	Muhurlu	S	R	S	S	S
Kav 237	Ankara	Portakal	S	R	R	S	S
Kav 239	Ankara	Dilimli	S	R	S	S	S
Kav 242	Ankara	Muz	S	R	S	S	S
Kav 249	Ankara	Kirkagac	R	S	S	S	S
Kav 250	Ankara	Sememe	S	R	S	S	S
Kav 252	Ankara	Tepekoy	S	R	H	S	S
Kav 255	Konya	Kislik	S	R	R	-	S
Kav 265	Erzurum	Unknown	S	R	S	S	S

Table 1. Continued.

Genotype	Origin	Local name	Fusarium race 1	Fusarium race 2	Downy mildew	Powdery mildew	CMV
Kav 266	Erzurum	Unknown	S	S	S	S	S
Kav 267	Erzurum	Unknown	S	R	S	S	S
Kav 269	Erzurum	Unknown	S	S	S	S	S
Kav 273	Erzurum	Unknown	S	H	S	S	S
Kav 274	Erzurum	Unknown	S	H	S	S	S
Kav 277	Erzurum	Unknown	S	H	S	R	S
Kav 278	Erzurum	Unknown	S	H	S	S	S
Kav 279	Erzurum	Unknown	S	H	S	S	S
Kav 280	Erzurum	Unknown	S	R	S	S	S
Kav 281	Elazig	Sari	S	R	S	-	R
Kav 282	Elazig	Kis	S	R	S	S	S
Kav 284	Elazig	Malbora	H	H	S	S	S
Kav 286	Elazig	Muz	S	R	S	S	S
Kav 287	Elazig	Kislik beyaz	-	-	S	S	S
Ac 1	Ankara	Beyaz	S	R	S	S	S
Ac 3	Ankara	Siyah	-	-	-	-	-
Ac 5	Sanliurfa	Hitta	S	R	S	S	S
Ac 14	Mardin	Midyat 1	-	-	S	S	-
Ac 16	Adana	Adana	S	R	S	S	S
Ac 18	K.Maras	Diyarbakır 2	S	R	S	S	S
Ac 21	K.Maras	Urfa	S	R	S	S	S
Ac 31	AARI, Izmir	TR 40517	S	R	S	S	S
Ac 32	AARI, Izmir	TR 47782	S	R	S	S	S
Ac 33	AARI, Izmir	TR 47808	S	R	S	S	R
Ac 47	AARI, Izmir	TR 51559	S	R	S	S	S
Ac 51	Sanliurfa	Hitta	S	R	S	S	S
Ac 54	Siirt	Unknown	S	-	S	S	S
Ac 56	Nigde	Unknown	S	R	S	S	S
Ac 60	Sanliurfa	Tuylu	S	R	S	S	-

S, Susceptible, R, resistant, H, heterogeneous. -, No germination.

Fusarium wilt, downy mildew, powdery mildew, CMV and ZYMV tests were conducted at INRA, Avignon, France. All tests were performed using the protocol of Pitrat et al. (1991). Ten plants for fungal diseases and 15 plants for virus diseases were used.

All genotypes were tested for *F. oxysporum* races 1 and 2. 'Charentais Fom-1' (susceptible to race 1 and resistant to race 2) and 'Charentais Fom-2' (resistant to race 1, susceptible to race 2) were used as controls. Inoculation was done by a root dipping method. Spores of downy mildew were produced on the susceptible line 'Védrantais' and used to inoculate five leaf discs per accession. 'Védrantais' was used as a susceptible control and 'PI 124112' and 'MR1' as resistant controls. For powdery mildew screening, a strain of race 3 of *P. xanthii* was used and increased on bottle gourd (*Lagenaria*) cotyledons. Five leaf discs of each accession were inoculated. The susceptible controls were 'Védrantais' and 'PMR 45', and 'RIL 56' ('Védrantais' × 'PI 124112') as a resistant control (Perchepied et al., 2005). CMV and ZYMV were tested as virus diseases. 'Védrantais' was the susceptible control for both viruses, while the resistant controls were 'Virgos' for CMV and 'PI 414723' for ZYMV.

RESULTS AND DISCUSSION

A core collection of 100 melon and snake melon genotypes collected from different regions of Turkey (middle Anatolia, Aegean, Mediterranean, eastern Anatolia, south-eastern

Anatolia and Marmara-Thrace) and obtained from the National Gene Bank of Turkey (AARI) was tested for Fusarium wilt, downy mildew, powdery mildew, CMV and ZYMV at INRA, Avignon, France. The results are presented in Table 1.

In the case of Fusarium wilt race 1, 8 accessions ('Kav 29', 'Kav 36', 'Kav 57', 'Kav 71', 'Kav 85', 'Kav 214', 'Kav 226' and 'Kav 249') were found to be resistant, while the others were susceptible. Segregation was observed only in 'Kav 284'. It is worth noting that the geographical origins of the resistant genotypes were not the same. Moreover, the wild genotype 'Kav 71', belonging to *C. melo* group *agrestis*, was identified as resistant, while the other wild genotype 'Kav 73' was found to be susceptible. Regarding Fusarium wilt race 2, 51 accessions were resistant and 26 were susceptible, while 17 genotypes showed segregation. As for race 1, geographical origins were not correlated with resistance/susceptibility. While *C. melo* group *agrestis* genotypes ('Kav 63' and 'Kav 71') were identified as susceptible, *C. melo* group *dudaim* genotypes ('Kav 64' and 'Kav 250') were found to be resistant.

F. oxysporum f. sp. *melonis* is an economically destructive soil-borne disease agent, and four races (0, 1, 2 and 1-2) have been defined (Risser et al., 1976; Pitrat et al., 1991). The most widespread races are 0 and 1 in Turkey (Sari et al., 1994), race 1-2 were observed in the Aegean region (Yildiz, 1977) and in the east Mediterranean region (Yucel et al., 1994); however, all four races were detected in middle Anatolia (Erzurum et al., 1999). Our results are in agreement with the report of Sensoy et al. (2007), who tested 79 melon accessions with fusarium wilt race 1 and found only seven resistant genotypes, three genotypes as heterogeneous and the rest as susceptible. In another study performed by Pitrat et al. (1996), 271 melon genotypes from around the world were tested for *F. oxysporum* f.sp. *melonis* race 1, 2 and 1-2 with 20% of the genotypes found to be susceptible to all three races. In their study of 271 accessions, resistance to race 2 was 14.7% (22.4% including the heterogeneous accessions) and 13.8% for race 1 (22% including the heterogeneous accessions), while only 3% were found to be resistant to race 1-2.

Regarding downy mildew, four genotypes ('Kav 28', 'Kav 71', 'Kav 237' and 'Kav 255') were observed as resistant, 16 were heterogeneous and the other genotypes were susceptible. The four genotypes constitute new sources of resistance to downy mildew, which have so far been found mainly in Indian accessions, such as 'PI 124112' and 'MR1' (Thomas and Jourdain, 1992; Dhillon et al., 2007).

Powdery mildew (*P. xanthii*) is one of the first determined fungal diseases of melon (Pitrat et al., 1998), which is damaging both in open fields and under greenhouse conditions. Among the Turkish melon and snake melon genotypes, only 'Kav 60' and 'Kav 277' (which were collected from the North Cyprus Turkish Republic and Erzurum, respectively) were observed as resistant to race 3. As for downy mildew, most known resistances to powdery mildew originate from India (Pitrat et al., 1996), and so our work may have identified valuable new sources of resistance to this disease.

CMV was the first viral disease identified in cucurbits (Doolittle, 1916; Jagger, 1916), and has the widest host range of any plant virus, including more than 1200 species in over 100 families. In this study, two genotypes ('Kav 281' and 'Ac 33') were determined as resistant, while the others were susceptible. This is an interesting result as, to date, high levels of resistance to CMV have mainly been reported only in melons from the Far East (Dogimont, 2011). Gómez-Guillamón et al. (1998) evaluated landraces and wild varieties and reported that none of them were resistant to CMV. Among 36 snapmelon landraces (*C. melo* var. *momordica*) collected in India, a single one was found resistant to CMV (Dhillon et al., 2007).

ZYMV is an important pathogen in cucurbit-growing regions throughout the world (Antignus et al., 1989; Lecoq and Desbiez, 2012). In our collection, all the genotypes were found to be susceptible to ZYMV. This result is consistent with the fact that resistance to ZYMV is found with a very low frequency in melon, such as the study of more than 500 accessions by Pitrat et al. (1996), in which only a single accession, 'PI 414723', showed resistance.

CONCLUSIONS

In this study, we tested 85 melon and 15 snake melon accessions for Fusarium wilt, downy mildew, powdery mildew, CMV and ZYMV. Although these accessions represent only a small proportion of Turkish melon germplasm, potential new sources of resistance have been identified. This valuable genetic material must be conserved for the future, and more emphasis given to using these resistant genotypes in future breeding studies.

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Literature cited

- Antignus, Y., Raccach, B., Gal-On, A., and Cohen, S. (1989). Biological and serological characterization of zucchini yellow mosaic virus and watermelon mosaic virus-2 isolates in Israel. *Phytoparasitica* 17 (4), 289–298 <http://dx.doi.org/10.1007/BF02980758>.
- Baran, B. (2000). Guneysdogu Anadolu bolgesi kavun ekim alanlarinda solgunluk hastaligi etmeni "*Fusarium oxysporum* f.sp. *melonis* (Leach and Currence)" in yayginligi ve bu etmene karsi bazi kavun cesitlerinin tepkileri. YYÜ Fen Bil. Ens. Yuksek Lisans Tezi (Van), pp.29.
- Demir, S., and Tezcan, H. (1995). Van ili kavunlarinda toprak kaynakli funguslarin neden oldugu kurumalar uzerinde arastirmalar. Paper presented at: VII Türkiye Fitopatoloji Kongresi (Adana, Turkey), pp.204–207.
- Dhillon, N.P.S., Ranjana, R., Singh, K., Eduardo, I., Monforte, A.J., Pitrat, M., Dhillon, N.K., and Singh, P.P. (2007). Diversity among landraces of Indian snapmelon (*Cucumis melo* var. *momordica*). *Genet. Resour. Crop Evol.* 54 (6), 1267–1283 <http://dx.doi.org/10.1007/s10722-006-9108-2>.
- Dogimont, C. (2011). 2011. Gene list for melon. *Rep. Cucurbit Genet. Coop.* 33/34, 104–113.
- Doolittle, S.P. (1916). A new infectious mosaic disease of cucumber. *Phytopathology* 6, 145–147.
- Erzurum, K., Taner, Y., Secer, E., Yanmaz, R., and Maden, S. (1999). Occurrence of races of *Fusarium oxysporum* f.sp. *melonis* causing wilt on melon in Central Anatolia. *J. Turk. Phytopathol.* 28, 87–97.
- FAO. (2012). <http://faostat.fao.org>.
- Gómez-Guillamón, M.L., Moriones, E., Luís-Arteaga, M., Alvarez, J.M., Torés, J.A., López-Sesé, A.I., Cánovas, I., Sánchez, F., and Camero, R. (1998). Morphological and disease resistances evaluation in *Cucumis melo* and its wild relatives. In *Cucurbitaceae '98 Evaluation and Enhancement of Cucurbits Germplasm*, J.D. McCreight, ed. (Alexandria, VA, USA: ASHS Press), p.53–61.
- Jagger, I.C. (1916). Experiments with the cucumber mosaic disease. *Phytopathology* 6, 148–151.
- Kinay, P., Yıldız, M., and Buanoglu, M. (1995). Ege Bolgesinde kavun kurumalari ve patojenik mikrofloranin sulamayla iliskisi. Paper presented at: VII Türkiye Fitopatoloji Kongresi (Adana, Turkey), p.191–194.
- Kirkbride, J.H. (1993). *Biosystematic Monograph of the Genus Cucumis (Cucurbitaceae)* (Boone, NC, USA: Parkway Publishers).
- Koc, K. (1986). Sebze Hastalıkları. C.Ü. Ziraat Fakültesi, Ders Notu Yay., No. 136 (Adana, Turkey).
- Kurt, S., Baran, B., Sari, N., and Yetisir, H. (2002). Physiologic races of *Fusarium oxysporum* f.sp. *melonis* in the Southeastern Anatolia region of Turkey and varietal reactions to races of the pathogen. *Phytoparasitica* 30 (4), 395–402 <http://dx.doi.org/10.1007/BF02979687>.
- Lebeda, A., and Cohen, Y. (2011). Cucurbit downy mildew (*Pseudoperonospora cubensis*) - biology, ecology, epidemiology, host-pathogen interaction and control. *Eur. J. Plant Pathol.* 129 (2), 157–192 <http://dx.doi.org/10.1007/s10658-010-9658-1>.
- Lecoq, H., and Desbiez, C. (2012). Viruses of cucurbit crops in the Mediterranean region: an ever-changing picture. In *Viruses and Virus Diseases of Vegetables in the Mediterranean Basin*, G. Loebenstein and H. Lecoq, eds. (Amsterdam, Netherlands: Elsevier). p.67–126.
- Maden, S., Erzurum, K., Yanmaz, R. and Taner, K.Y. (1998). Orta Anadolu bolgesinde kavun solgunluk etmeni *Fusarium oxysporum* f.sp. *melonis*'in irklarinin belirlenmesi. TUBITAK/TOGTAG/1585 No'lu Proje Kesin Raporu, pp.14.

- Martyn, R.D., and Gordon, T.R. (1996). Fusarium wilt of melon. In Compendium of Cucurbit Diseases, T.A. Zitter, D.L. Hopkins, and C.D. Thomas, eds. (St. Paul, MN, USA: American Phytopathological Society), p.14–15.
- Özgen, M., Adak, M.S., Soylemezoglu, G., and Ulukan, H. (2000). Bitkisel gen kaynaklarının korunma ve kullanımında yeni yaklaşımlar. Paper presented at: V. Türkiye Ziraat Mühendisliği Teknik Kongresi (Ankara, Turkey).
- Perchepped, L., Bardin, M., Dogimont, C., and Pitrat, M. (2005). Relationship between Loci conferring downy mildew and powdery mildew resistance in melon assessed by quantitative trait Loci mapping. *Phytopathology* 95 (5), 556–565 <http://dx.doi.org/10.1094/PHYTO-95-0556>. PubMed
- Pitrat, M., Risser, G., Epinat, C., Ferriere, C., Ricard, M., Olivier, C., Ruffinato, A., Lecoq, H., Blancard, D., Bertnard, F., et al. (1991). Techniques d'inoculation artificielle du melon avec différents agents pathogènes pour la sélection de variétés résistantes. INRA Domaine Saint Maurice BP 94, 84143.
- Pitrat, M., Risser, G., Bertrand, F., Blancard, D., and Lecoq, H. (1996). Evaluation of a melon collection for disease resistances. Paper presented at: VIth Eucarpia Meeting on Cucurbit Genetics and Breeding (Malaga, Spain).
- Pitrat, M., Dogimont, C., and Bardin, M. (1998). Resistance to fungal diseases of foliage in melon. In Cucurbitaceae '98, Evaluation and Enhancement of Cucurbit Germplasm, J.D. McCreight, ed. (Alexandria, VA, USA: ASHS Press), p.167–173.
- Pitrat, M., Hanelt, P., and Hammer, K. (2000). Some comments on infraspecific classification of cultivars of melon. *Acta Hort.* 510, 29–36 <http://dx.doi.org/10.17660/ActaHortic.2000.510.4>.
- Polat, İ., Baysal, Ö., Mercati, F., Kitner, M., Cohen, Y., Lebeda, A., and Carimi, F. (2014). Characterization of *Pseudoperonospora cubensis* isolates from Europe and Asia using ISSR and SRAP molecular markers. *Eur. J. Plant Pathol.* 139 (3), 641–653 <http://dx.doi.org/10.1007/s10658-014-0420-y>.
- Risser, G., Banihashemi, Z., and Davis, D.W. (1976). A proposed nomenclature of *Fusarium oxysporum* f. sp. *melonis* races and resistance genes in *Cucumis melo*. *Phytopathology* 66 (9), 1105–1106 <http://dx.doi.org/10.1094/Phyto-66-1105>.
- Sari, N., and Solmaz, I. (2007). Fruit characterization of some Turkish melon genotypes. *Acta Hort.* 731, 103–109 <http://dx.doi.org/10.17660/ActaHortic.2007.731.14>.
- Sari, N., Pitrat, M., Abak, K. and Yucel, S. (1994). Türkiye'de yaygın olarak yetistirilen karpuz ve kavun cesitlerinin bazı fungal hastalıklara ve virüslere karşı reaksiyonları. Ç.U. Ziraat Fakültesi, 25. Kuruluş Yılı Özel Sayısı, p.37–50.
- Scherf, A.F., and Mancab, A. (1986). *Vegetable Diseases and Their Control*, 2nd edn (New York, NY, USA: Wiley-Interscience).
- Sensoy, S., Demir, S., Buyukalaca, S., and Abak, K. (2007). Response of Turkish melon genotypes to *Fusarium oxysporum* f. sp. Race 1 determined by inoculation tests and RAPD Markers. *Eur. J. Hort. Sci.* 72, 220–227.
- Solmaz, I., Aras, V., Unlu, H., and Sari, N. (2004). Characterization of snake melon (*Cucumis melo* var. *flexuosus*) genotypes which are collected from the different regions of Turkey. Paper presented at: Turkey 5th National Vegetable Production Symposium (Canakkale, Turkey: Canakkale Onsekiz Mart University, Faculty of Agriculture).
- Thomas, C.E., and Jourdain, E.L. (1992). Evaluation of melon germplasm for resistance to downy mildew. *HortScience* 27, 434–436.
- Whitaker, T.W., and Davis, G.N. (1962). *Cucurbits: Botany, Cultivation and Utilization* (New York, NY, USA: Interscience).
- Yildiz, M. (1977). Ege bölgesinde kavun solgunluk etmeninin patojenitesi, ırkları ve yerel cesitlerin dayanıklılığının saptanması üzerinde araştırmalar. E.U. Ziraat Fakültesi Bitki Koruma Bolumu, Docentlik Tezi, pp.112.
- Yilmaz, M.A., and Davis, R.F. (1984). Purification and particule morphology of TMV, CMV and ZYMV isolated from various cultivated crops grown along the Mediterranean coast of Turkey. *J. Turk. Phytopathol.* 13, 29–38.
- Yilmaz, M.A., and Davis, R.F. (1985). Identification of viruses infecting vegetable crops along the Mediterranean Sea coast in Turkey. *J. Turk. Phytopathol.* 14, 1–8.
- Yucel, S., Pala, H., Sari, N., and Abak, K. (1994). Determination of *Fusarium oxysporum* f.sp. *melonis* races in the east Mediterranean region of Turkey and response of some melon genotypes to the disease. Paper presented at: 9th Congress of the Mediterranean Phytopathological Union, (Kusadası-Aydın, Turkey).
- Zengin, H., Yildirim, G. and Gulsoy, E. (1975). Marmara bölgesinde kavunda *Fusarium oxysporum* f.sp.*melonis*, karpuzda *Fusarium oxysporum* f.sp. *niveum* solgunluk etmeni ve kimyasal savaş olanakları üzerinde araştırmalar. Erenköy Böl. Zir. Muc. Arast. Enst. E-108-829 No'lu Proje Nihai Raporu.

