Field Resistance to Melon Vine Decline in Wild Accessions of *Cucumis* spp. and in a Spanish Accession of *Cucumis melo*

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Melon vine decline is a complex disease with various associated pathogens (8). In south-eastern Spain, the two fungi *Acremonium cucurbitacearum* Alfaro-García, W. Gams *et* J. García-Jiménez and *Monosporascus cannonballus* Pollack *et* Uecker are considered the main causal agents of the disease, and mixed infections are frequent in this area (2).

Breeding melons for resistance or tolerance to vine decline is a difficult task. In field assays, the vine symptoms (yellowing, decay and finally plant collapse) are highly dependent on environmental factors causing water stress at the time of fruit maturity. Evaluation of root damage due to fungal infection is less influenced by environment and is a more precise indicator of resistance, and may be useful to identify resistant genotypes (3,4).

We conducted a field assay of 18 accessions of melon and wild related species (Table 1), all from the Genebank of the Center for Conservation and Breeding of Agricultural Biodiversity (COMAV). Sixteen plants per accession were arranged in a randomized complete block design with four replicates in each treatment and four plants per plot.

The assay was conducted in a field infested with *A. cucurbitacearum* and *M. cannonballus*, from which highly aggressive isolates of both fungi had been re-isolated from roots of collapsed plants in previous years. Plants were grown during the spring-summer season (planted in April, harvested in July-August). The plants were transplanted to the field at the three/four true-leaf stage.

The severity of vine decline in each plot was visually evaluated at the stage of full fruit size and fruit maturity. Several parameters were scored as follows: DR = Death rate (%), BW = Biomass weight (kg), NF = Number of fruits, FW = Fruit weight (kg). Root development and root disease severity were also scored in 2 to 6 roots per accession. RD = Root development (0 = reduced root development to 4 = vigorous, long and branched roots), RDS = Root disease severity (0 = healthy to 4 = extensively lesioned, with necrotic areas and rot roots, perithecia of *M. cannonballus*)(3,6). Root samples of the different accessions with vine decline symptoms were selected to check the presence of fungi through isolation on potato dextrose agar (PDA) plates.

The death rate varied from 0 to 100% (Table 1). The susceptible controls, cv. Amarillo Canario and Piel de Sapo, showed a mortality of 66.7 and 76.9% respectively, with a high RDS (in both cases of 4) and an intermediate RD (2 and 3). Although in previous field assays the mortality of these cultivars reached 100% (4), the lower fruit load per plant in the present assay probably contributed to plant survival. This effect has also been reported in previous studies, where the occurrence of plant collapse seems to be highly influenced by the length of growing cycle and the fruit load (7,8). The accession *C. melo* var. *agrestis* PAT 81, selected as partially resistant in previous field and greenhouse assays, showed a much lower death rate (15.4%), and had a more vigorous root system less affected by soilborne fungi (RDS=2 and RD=3). In root isolations the following fungi were detected: *M. cannonballus, Pythium* spp*, Fusarium* spp, *F. equiseti, F. oxysporum* and *F. solani***.** The lack of *A. cucurbitacearum* is not surprising since this fungus is often isolated at earlier plant developmental stages (2).

Some accessions (ECU-0085, ECU-0105 (*C. dipsaceus*), UPV-05118 (*C. ficifolius*) and CA-C-25 (*C. melo*)) displayed a low percentage of mortality, from 0 to 6.3%. These species were previously reported for their resistance to *Sphaerotheca fuliginea* and *Erysiphe cichoracearum* (6). However, there is no previous report of accessions of these wild species being resistant to collapse.

Other accessions exhibited partial tolerance with a DR intermediate between the tolerant control and the susceptible controls (UPV-08629 [*C. melo*], UPV-05114 [*C. zeyheri*], UPV-05124 [*C. myriocarpus*] y UPV-08594 [*C. africanus*]).

The accession CA-C-25 (*C. melo*) had a DR lower than the resistance source, PAT 81 exhibited a RDS of 2.83, similar to that of PAT 81 and a root disease severity of 2.83, slightly higher than that of PAT 81. This accession is also interesting because it has resistance to powdery mildew. It is possible that the high incidence of powdery mildew increased the death rate of *C. melo* var. *agrestis* PAT 81, while the accession CA-C-25 was not affected by the disease. CA-C-25 is a cultivated type, very similar to Galia melons. After some selection, it could be used directly in field, and also, it would be simple to incorporate its resistance in other types of melon. In any case it is necessary to check the tolerance to vine decline under artificial inoculation conditions

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Table 1. Analysis of variance for plant and fruit growth traits in *Cucumis* spp.accessions in a field test with high pressure from *A. cucurbitacearum* and *M. cannonballus.* Also, root growth and disease symptoms were evaluated.

Accessions	BW[z] (kg)	NF	FW(kg)	DR (%)	RD	RDS
					Mean	Mean
Cucumis dipsaceus (ECU-0085)	1.99[y] d	88.54 e	1.91 bc	0.00	3.75±0.50	0.75±0.50
C. dipsaceus (ECU-0105)	1.65 bcd	98.56 e	2.82 c	0.00	3.00±1.73	0.33±0.58
C. ficifolius (UPV-05118)	1.86 cd	40.00 bcd	0.82 ab	0.00	4.00±0.00	1.00±1.41
C. melo (CA-C-25)	0.86 ab	0.44 a	0.39 ab	6.25	2.83±0.75	2.83±1.47
C. melo var *agrestis* PAT 81	1.00 abc	8.58 ab	2.60 c	15.38	3.00±0.00	2.00±1.09
C. myriocarpus (UPV-05124)	0.98 abc	43.17 cd	0.30 ab	16.67	2.33±1.15	2.33±1.71
C. zeyheri (UPV-05114)	0.12 a	5.10 ab	0.12 a	20.00	1.00±0.00	2.75±0.95
C. africanus (UPV-08594)	0.07 a	3.46 a	0.07 a	33.33	1.00±0.00	4.00±0.00
C. melo (UPV-08629)	0.97 abc	4.40 ab	2.95 c	36.36	3.50±0.71	3.00±0.00
C. anguria var *longipes* (UPV-05125)	0.67 a	23.37 abc	0.52 ab	50.00	2.50±0.55	4.00±0.00
C. melo (C-C-30)	0.34 a	1.00 a	0.59 ab	66.67	2.00±0.00	4.00±0.00
C. melo (V-C-146)	0.41 a	1.13 a	1.10 ab	66.67	2.00±0.00	4.00±0.00
C. melo (Amarillo Canario)	0.49 a	0.31 a	0.16 a	66.67	2.00±0.00	4.00±0.00
C. melo (V-C-184)	0.27 a	0.31 a	0.14 a	71.43	-	4.00±0.00
C. anguria (UPV-05162)	0.35 a	65.37 de	0.28 a	75.00	3.00±0.00	3.50±0.71
C. melo (Piel de Sapo)	0.62 a	0.87 a	0.29 a	76.92	3.00±0.00	4.00±0.00
C. melo (C-C-34)	0.51 a	1.14 a	0.70 ab	80.00	3.00±0.00	4.00±0.00
C. anguria var *longipes* (UPV-05126)	0.18 a	28.92 abc	0.43 ab	100.00	1.00±0.00	4.00±0.00

		BW	NF	FW
P	Accessions	0.0001*	0.0000*	0.0000*
	Block	0.4072	0.0122*	0.0040*

[z]BW-Biomass weight, NF-number of fruits, FW-fruit weight,DR-death rate, RD- root development (0 = reduced root development, 4 = vigorous, branched roots), RDS-root disease severity (0 = healthy, 4 = extensive lesions, perithecia of *M. cannonballus*).

[y]Means followed by the same letter are not significantly different at the 5% level, Duncans mean comparison.