High density of Type I trichomes related to tolerance to *Aphis gossypii* in primitive melon accessions

E. Sarria, A.I. López Sesé and M.L. Gomez-Guillamón*
Experimental Station 'La Mayora', 29750-Algarrobo, Málaga-Spain
**Corresponding author*: guillamon@eelm.csic.es

Aphis gossypii Glover causes considerable direct and indirect damages to many crops and is considered a serious pest in melon, *Cucumis melo* L. Growing resistant or tolerant genotypes is the most effective and environmentally safe control strategy. The presence of glandular trichomes, because of the substances they produce and store, has been related to the rejection of plants as hosts by insects and spider-mites in several plant species (9, 10, 11). The presence of glandular trichomes in melons was first described by Gómez-Guillamón et al. (2006) according to the classification made by Kolb and Müller (2004) and the relation of Type I glandular trichomes to non-preference of plants by *A. gossypii* is under study.

In this work, the density of glandular trichomes (Type I) and the tolerance against Type I trichomes were counted on the second leaf from the plant apex in the area circumscribed to secondary veins. Two leaf disks (27 mm^2 area) per plant were immersed in absolute ethanol and heated to 80 ºC for three minutes. Then, samples were stained by their immersion in a 0.05 % toluidine blue O solution during 5 min (7).
A. gossypii infestation have been evaluated in several melon genotypes: four of them carried the gene *Vat*, three were aphid susceptible, and the behavior against *A. gossypii* of two more accessions was unknown (Table 1). The relationship between this trait and the tolerance against *A. gossypii* is discussed.

Aphid tolerance was tested in all genotypes. Twenty plants per genotype were infested with 10 aphids per plant, following Ivanoff (1945). Aphids were reared on plants of 'ANC-57'(Spanish melon accession) and adult aphids recently emerged were used in the experiments. Plants and aphid colonies were maintained in a growth chamber at 25ºC (day) and 20ºC (night) with a 16:8 hours (L:D) photoperiod.

Trichome density numbers were log-transformed before the statistical analyses that were made through one-way ANOVA ($P < 0.05$) and post hoc comparisons were done by Tukey b test.

A high density of glandular trichomes was found in the wild accessions carrying the *Vat* gene ('TGR-1551', 'PI 414723', and 'PI 161375') while a significantly lower density was observed in the three aphid susceptible accessions (Table 1); therefore the high density of these trichomes seems to be related to tolerance against *A. gossypii*. The results for genotypes 'Nagata kin Makuwa' and 'Ananas', whose response against *A. gossypii* was unknown supported this relationship; 'Nagata kin Makuwa' showed resistance to aphids and also had a high density of Type I trichomes; 'Ananas', with a low density of these trichomes, showed an aphid susceptible response (Table 1). Thus, the high density of Type I trichomes could be used as a morphological marker to select for aphid resistance when screening melon landraces or primitive accessions. 'AR 5', showed a glandular trichomes density similar to that observed in susceptible genotypes in spite of its tolerance to *A. gossypii*. Since this genotype is a bred line, we could assume that a

high density of glandular trichomes could be related to undesirable melon characters lost in the breeding program. The evaluation of the effect of these trichomes and related substances in the host selection by aphids should be encouraged, since this character could be an additional resistance factor in the aphid tolerance controlled by the *Vat* gene, and they should be taken into account in melon breeding.

Acknowledgements: The authors thank the valuable collaboration of R. Tobar. This work has been partially financed by the CICYT Research Project: AGL2005-03850-C02-01.

Literature Cited

1. Bohn G. W., A.N. Kishaba and H.H. Toba. 1972. Mechanisms of resistance to melon aphid in a muskmelon line. Hortscience 7:281-282.
2. Garzo, E., C. Soria, M. L. Gómez-Guillamón, and A. Fereres. 2002. Feeding behavior of Aphis gossypii on resistant accessions of different melon genotypes (Cucumis melo). Phytoparasitica. 30(2):129-140.
3. Gómez-Guillamón ML, Heredia A, Sarria E, 2006. Epicuticular wax morphology and trichome types in relation to host plant selection by aphis gossypii in melons. In Proceedings of Cucurbitaceae 2006, 17-21 September 2006. Asheville, North Carolina, USA. pp.108-115.
4. Ivanoff, S. S. 1945. A seedling method for testing aphid resistance and its application to breeding and inheritance studies in cucurbits and other plants. Journal of Heredity 36:357-361.
5. Kolb, D. and M. Müller. 2004. Light, conventional and environmental scanning electron microscopy of the trichomes of Cucurbita pepo sbsp. pepo var. styriaca and histochemistry of glandular secretory products. Ann. Bot. 94:515-526.
6. McCreight J. D., Kishaba, A. N., Bohn G. W., 1984. AR Hale's Best Jumbo, AR 5, and AR Topmark: melon aphid-resistant muskmelon breeding lines. HortScienc 19: 309-310.
7. O'Brien, T. P., N. Feder, and M. McCully. 1964. Polychromatic staining of plant cell walls by toluidine blue. Protoplasma. 59:367-373.
8. Pitrat, M., and H. Lecoq. 1980. Inheritance of resistance to cucumber mosaic virus by Aphis gossypii in Cucumis melo. Phtytopathology. 70:958-961.
9. Renwick, J. A. A. 1983. Nonpreference mechanisms: plant characteristics influencing insect behaviour, p. 199–213. In: P. E. Hedin (ed.). Plant resistance to insects. American Chemical Society, Washington, DC.
10. Simmons, A. T., G. M. Gurr, D. McGrath, H. I. Nicol, and P. M. Martin. 2003. Trichomes of Lycopersicon spp. and their effect on Myzus persicae (Sulzer) (Hemiptera: Aphididae). Austral. J. Entomol. 42:373-378.
11. Wagner, G. J., E. Wang, and R.W. Shepherd. 2004. New approaches for studying and exploiting an old protuberance, the plant trichome. Ann. Bot. 93:3-11.

Table 1. Evaluation of melon genotypes for aphid infestation and glandular trichomes (Type I) density.

Genotype	Behavior against *A. gossypii*		Type I trichomes · cm^{-2} (mean ± SE)	Plants showing curled leaves (%)
'Nagata kin Makuwa'	U	-	320 a[z] ± 65	0
PI 161375	R	Pitrat and Lecoq, 1980	318 a ± 40	0
TGR-1551	R	Garzo et al., 2002	263 ab ± 44	0
PI 414723	R	Bohn et al., 1972	216 b ± 75	0
'AR 5'	R	McCreight et al., 1984	90 c ± 33	0
'Hale's Best Jumbo'	S	McCreight et al., 1984	69 cd ± 16	100
'Doublon'	S	Pitrat and Lecoq, 1980	61 cde ± 15	100
'Bola de Oro'	S	Soria et al., 2000	43 de ± 13	100
'Ananas'	U	-	41 e ± 20	100

U: unknown; R: resistant; S: susceptible; [z]significant differences through Tukey b test.