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Influence of styles development on longevity of carnation cut flowers. (1).

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Introduction

A cut flower may either start immediately senescence or continue its development and start later senescence. The metabolic pattern which develops after removal of the flower from the parent plant depends on many factors, but it seems to be heavily affected by the stage of development of the reproductive apparatus at the time of picking. The main function of the floral organs is to perform pollination and to accomplish fertilization of the gametophyte, thus giving rise to a new zygote. Once this is achieved a very rapid wilting process occurs.

On the basis of this concept we investigated what kind of relationship exists between petal wilting and development of reproductive apparatus in carnation cut flowers.

Materials and methods

One hundred flowers of cultivars with different longevity: 'Astor', short keeping, and 'Alice', long keeping, were harvested from a commercial

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farm (located in Sanremo) and immediately dispatched to the laboratory (150 kms apart) on early June.

The vase life was measured during fall on November 17th and during spring on March 7th. It ranged from 4.9 days ('Astor') to 12.8 ('Alice') during fall and from 8.9 ('Astor') to 15.2 ('Alice') during spring.

They were chosen on the basis of their vase life and because of the availability of petal hystochemical data which have been reported elsewhere (*Jona et al.*, 1980). The flowers were cut at the commercial stage of maturity (first stage of figures 1 and 2) and trimmed to 40 cm. On the following day the flowers were singularly placed into test tubes filled with distilled water under continuous fluorescent light (1200 lux) for longevity determination. The relative humidity ranged from 40% to 60% and temperature was 22° ± 1°C.

Just after trimming, flowers were dipped half an hour in $AgNO_3$ (1000 ppm), in order to prevent microbial interference with the style influence on whorl life (*Mayak et al.*, 1977). Daily observations were performed and the flowers were discarded when the first wilting symptoms were evident.

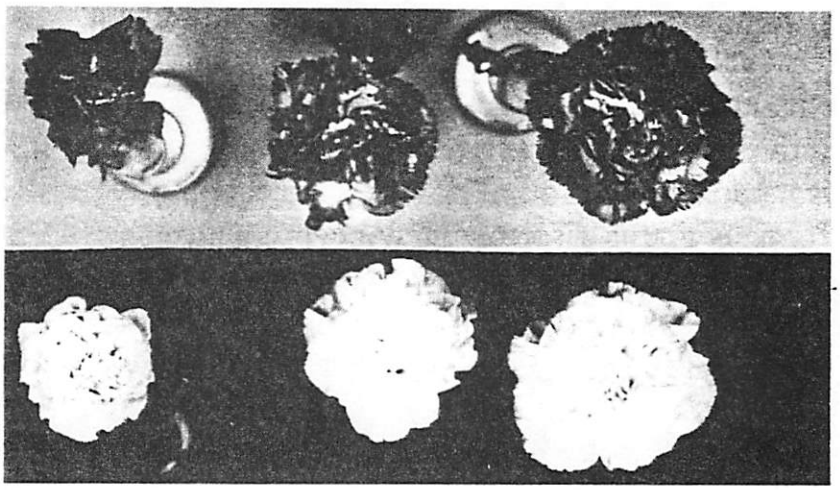

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Fig. 1 - Size of 'Astor' flowers at various stages of development. From left to right: flower diameter 3 ÷ 4 mm; 5.5 ÷ 6.0; 6 ÷ 7.
Dimensione dei fiori della cv. "Astor" a vari stadi di sviluppo. Da sinistra a destra: diametro del fiore 3-4; 5,5-6; 6-7 mm.

Fig. 2 - Size of 'Alice' flowers at various stages of development. From left to right: flower diameter 3 ÷ 4 mm; 5.5 ÷ 6.0; 6 ÷ 7.
Dimensione dei fiori della cv. "Alice" a vari stadi di sviluppo. Da sinistra a destra: diametro del fiore 3-4; 5,5-6; 6-7 mm.

Within the two populations, flowers at 3 different stages of development were chosen for analysis (see fig. 1 and 2).

Maturity of styles was selectd as a critical parameter of full gametic maturity of the flower. Styles maturity was identified by direct observation of their tips: they roll backword protruding stigmatic papillae whose appearance is turgid and exudating when they reach maturity. These data were recorded together with the wilting dates of each flower.

Results

In flowers of stages 1 and 2, styles are short and hidden within the petals; in stage 3 style tips start to appear above the petals. After this stage while the flower opens and expands itself, styles continue their development by elongation (figs. 3 & 4 - 6 & 7) followed by rolling the tips backword, thus exposing stigmatic papillae, which were folded inside along the whole length of style (figs. 5, 8, 9 and 10). Upon maturity, which gradually proceeds upward to the tips, the styles become turgid and exudating (figs. 9 and 10). In the cv. 'Alice' this late process is less evident and less exudation was observed. In cv. 'Astor', maturity is more conspicuous: exudation is larger than in 'Alice', the stigmatic papillae protrude more from the style body, the whole style turns pink from the original white. Finally in the middle of the style a bundle of stigmatic protrusions forms a crest-like structure which in this cultivar becomes evident upon maturity (fig. 9).

Table 1 reports longevity and the span of time between flower harvesting and style extrusion and between style extrusion and wilting of flowers. Once styles have reached maturity, the lenght of the time required to reach wilting stage is constant: 3.5-4.0 days, regardless of the cultivar and the stage of harvesting (table 1). The variable element is the time required for the extrusion of the style above the petals. This requires, obviously, a longer time in the flowers cut at an earlier stage, but is also longer in 'Alice', the long lived cultivar.

It should be recalled that (*Nichols*, 1977) relatively little ethylene is produced from any floral tissue up to a moment close to the irreversible petal wilting. Furthemore, it was found (*Nichols*, 1977) that approximately 40-50% of the carnation ethylene could be accounted for by the styles. This may indicate that the difference in longevity of different cultivar is due to different speed in style development, which, in turn, is related to a different time of ethylene surge.

The above reported results point the existence of a possible relationship between style maturity and longevity. Further experiments are required in order to gain confidence in the validity of this idea as a general concept.

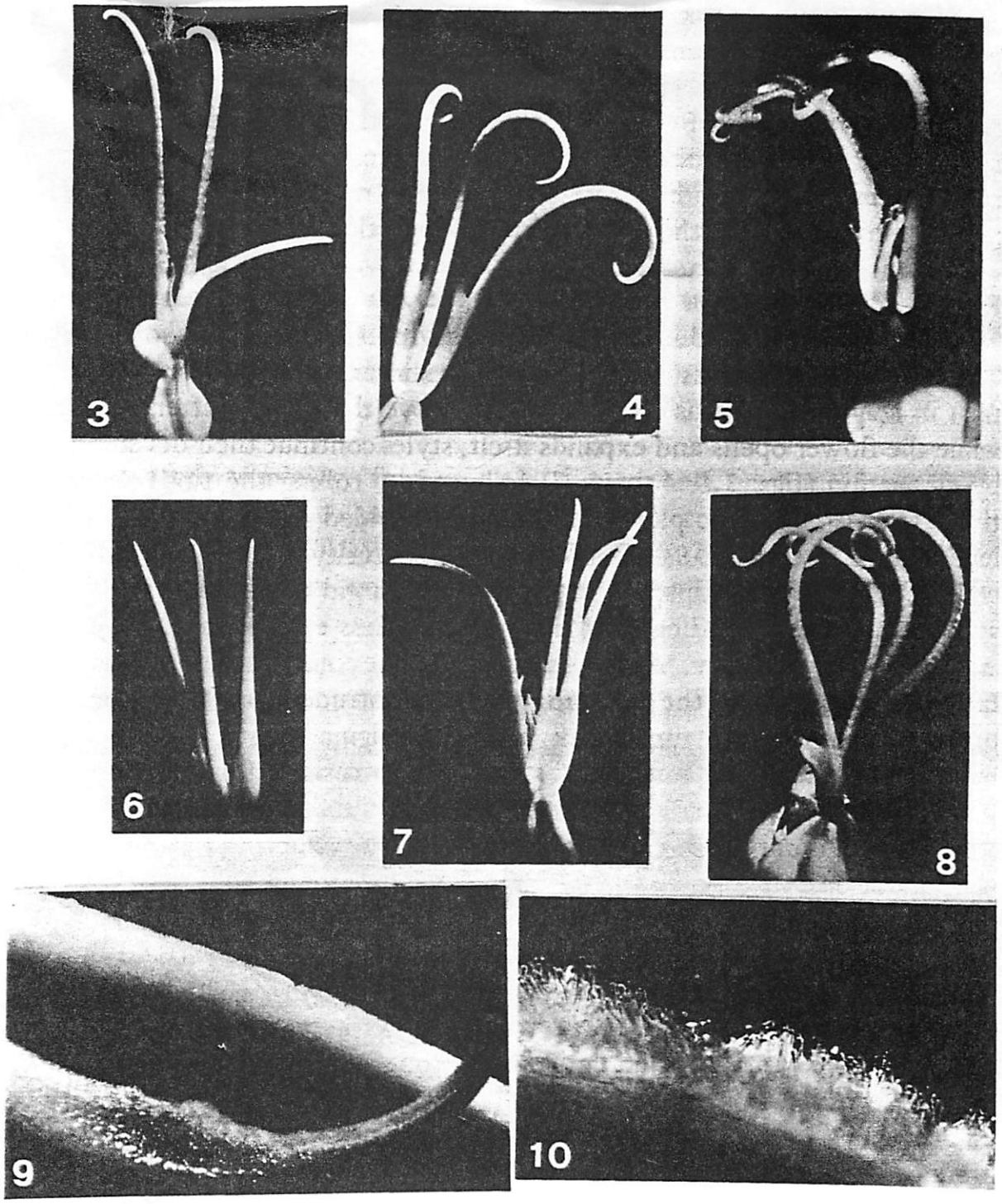

Fig. 3-4-5 - Pistils of cv. 'Astor' at various stages of development. The growth of the ovary is well evident and is paralleled by the rolling of the styles tips. In the third stage the extrusion of papillae from ventral side of the style is well evident, while the tips appear to be already overripe (2.25 x). The avarage length of the style is about 3 cm.

Pistilli della cv. "Astor" a vari stadi di sviluppo. L'accrescimento dell'ovario è ben evidente e procede con l'arrotolamento degli apici degli stili. Nel terzo stadio la fuoriuscita delle papille dal lato ventrale dello stilo è ben evidente, mentre gli apici appaiono già sovramaturi (2,25 x). La lunghezza media dello stilo è di circa 3 cm.

Table 1 - Correlation of style development and longevity of two carnation cultivars. Correlation coefficients (r) were calculated 1) between average lag for two styles extrusion and longevity; 2) between average span from two styles extrusion to wilting of flower and longevity.
Correlazione tra lo sviluppo dello stilo e la conservazione di due cultivars di garofano. I coefficienti di correlazione (r) furono calcolati: 1) tra l'intervallo di tempo intercorrente tra la raccolta e l'estrusione di due stili e la longevità; 2) tra il tempo dell'estrusione di due stili fino all'avvizzimento del fiore e la longevità.

Cultivar and stage	Average lag from harvesting and two styles extrusion (days)	Average span from styles extrusion to wilting of flower (days)	Longevity (days)
'Astor'			
1	3.55 B (x)	3.43 A	6.94 B
2	2.01 A	3.46 A	5.47 AB
3	1.25 A	3.68 A	4.93 A
'Alice'			
1	6.70 C	3.60 A	10.30 C
2	6.76 C	3.98 A	10.56 C
3	5.62 C	3.62 A	9.24 C
Correlation coefficient	r = 0.83 +	r = 0.60 n.s.	

+= significant at P = 0.05
n.s. = not significant
(x) = Values of the same column followed by the same letter are not significantly different (Duncan Multiple Range Test, P = 0.01)

Fig. 6-7-8 - The same as figs. 2-3-4 in cv. 'Alice'. Note the smaller size of the stylar papillae (2.25 x).
Come nelle figure 2-3-4 nel caso della cv. "Alice". Notare la minore dimensione della papille stilari (2,25 x).

Fig. 9 - Higher magnification of styles of the two cultivars: above 'Alice', low 'Astor' (4,5 x).
Maggiore ingrandimento degli stili delle due cvs: sopra "Alice", sotto "Astor" (4,5 x).

Fig. 10 - Stylar papillae of 'Alice (9.0 x).
Papille stilari della cv. "Alice" (9,0 x).

Summary

It is known that carnation petals fade following pollination and fertilization of the gametophyte. Therefore the relationship between the development of reproductive apparatus and wilting was investigated. Two cultivars 'Astor', short keeping, and 'Alice', long keeping, were thoroughly investigated. It clearly appeared that vase life is longer in the cultivar whose initial stylar development is slower. Once the style has reached maturity, thus protruding stigmatic papillae, the flower wilts within 3. 5 ÷ 4 days.

Riassunto

Influenza dello sviluppo degli stili sulla durata del fiore reciso di garofano.

Per il presente studio sono state impiegate due cultivars di garofano 'Astor' e 'Alice' caratterizzate rispettivamente da breve e lunga durata in vaso. Si è ricercata l'eventuale relazione esistente tra l'avvizzimento del fiore e lo sviluppo dell'apparato riproduttivo, essendo noto che i petali di garofano appassiscono in seguito all'impollinazione e alla fertilizzazione del gametofito.

Dai risultati ottenuti è apparso chiaro che la durata del fiore è maggiore nella cultivar il cui sviluppo iniziale dello stilo è più lento: quando lo stilo ha raggiunto la maturità, il fiore avvizzisce in 3, 5 ÷ 4 giorni, indipendentemente dalla cultivar.

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