C-bands in the amphiplasty in two interspecific F₁ hybrids of Crepis

BY HIROKO IKEDA-KOMATSU AND RYUSU TANAKA

Botanical Institute, Faculty of Science, Hiroshima University, Hiroshima 730

(Received March 3, 1983)

ABSTRACT

In the interspecific F₁ hybrids of Crepis, C-banding patterns under the condition of amphiplasty were studied. In each hybrid of C. capillaris x C. dioscoridis, C. capillaris x C. vesicaria and its reciprocal cross, C-banding patterns of individual chromosomes of the hybrids were similar to those of the parents, and were unchanged in the F₁ hybrids and in the condition of amphiplasty. This fact indicates that the differential and neutral amphiplasties do not give rise to the material change of chromosomes.

1. INTRODUCTION

Since the phenomenon "amphiplasty" was found by Navashin (1928, 1934) in hybrids of Crepis, this phenomenon has been often reported in plant hybrids as a morphological change in mitotic metaphase chromosomes (Avery 1930; Babcock and Emsweller 1936; Pierce 1936; Wilkinson 1941, 1944; Sherman 1946; Keep 1960, 1962; Doerschug et al. 1976). The amphiplasty is considered to occur by the change in the function or behavior of chromosome (e.g., Langridge et al. 1970; Wallace and Langridge 1971). In the present paper a C-banding analysis was dealt with the amphiplasty in the hybrids of Crepis.

2. MATERIALS AND METHODS

Three species of Crepis, C. capillaris, C. dioscoridis and C. vesicaria, were used in the present study.

Crepis capillaris (L.) Wallr. (2n=6) was supplied through the courtesy of Prof. Y. Shimizu of Tohoku University in 1974, and the inbreeding was repeated for three years in the experimental garden of Hiroshima University. C. dioscoridis L. (2n=8) was obtained from the University Botanical Garden, Uppsala, Sweden, and C. vesicaria L. ssp. taraxacifolia (Thuill.) Thell. (2n=8) from the Botanical Garden of Caen, France. We are indebted to the courtesy of the Hiroshima Botanical Garden for the supply of the latter two species.

The artificial crosses of C. capillaris x C. dioscoridis, C. capillaris x C. vesicaria and C. vesicaria x C. capillaris were made in a net room at the campus of Hiroshima University, respectively.
Aceto-orcein staining and C-banding technique were carried out according to the methods described by Tanaka and Komatsu (1977) for *dioscoridis*, *capillaris* and their F₁ hybrid, and by Komatsu and Tanaka (1978) for *vesicaria*, *capillaris* and their F₁ hybrid.

3. RESULTS

**Chromosomes of parental species**

*C. capillaris*, 2n = 6 (Fig. 1-A, B. Fig. 2-A, B): This species had three pairs of chromosomes. Pair 1 was a subterminal chromosome, and had two C-bands. One of them located in the terminal region and the other in the interstitial region of the short arm. Pair 2 was a satellite chromosome, and had a large secondary constriction (nucleolar constriction) in the distal region of the short arm. In this pair the C-bands appeared in the whole region of the satellite and the short arm, one large C-band in the proximal interstitial region and two small C-bands in the distal interstitial region of the long arm. Pair 3 was a subterminal chromosome, and had the C-bands in almost the whole region of the short arm, in the central interstitial region and the distal region of the long arm. A total of 20 C-bands were observed in the chromosomes of 2n complement. These observations were similar to those of the previous paper (Tanaka and Komatsu 1977).

*C. dioscoridis*, 2n = 8 (Fig. 1-C, D): This species had four pairs of chromosomes. Pair 1 was a submedian chromosome, and pair 2 and 3 were the subterminal ones. These three pairs had the C-band in the terminal region of the short arm, respectively. Pair 4 was a satellite chromosome, and had a large secondary constriction in the distal region of the short arm. In this pair the C-band appeared in the whole region of the satellite, and two small C-bands in the proximal interstitial region of the long arm. A total of 12 C-bands were found in the 2n chromosome complement.

*C. vesicaria* ssp. *taraxacifolia*, 2n = 8 (Fig. 2-C, D): This species had four pairs of chromosomes. Pair 1 was a submedian chromosome, and pair 2 and 3 were the subterminal ones. These three pairs had the C-band in the proximal region of both arms, respectively. Pair 4 was a satellite chromosome, and had a large secondary constriction in the distal region of the short arm. In this pair the C-bands appeared in the whole region of the satellite and the short arm, and the other one in the proximal interstitial region of the long arm. The C-band in the proximal interstitial region was smaller than that in the proximal interstitial region of the long arm in the satellite chromosome of *capillaris*. A total of 12 C-bands were found in the 2n chromosome complement. These results were almost similar to those of the previous paper (Komatsu and Tanaka 1978).

**Chromosomes of interspecific F₁ hybrids**

F₁ hybrid of *C. capillaris* × *C. dioscoridis* (Fig. 1-E, F): Chromosome number
of this hybrid was $2n=7$. In the $2n=7$ complement each of the three chromosomes of *capillaris* and that of the four chromosomes of *dioscoridis* were identified morphologically. The *capillaris*-chromosomes were shorter than those of the parental chromosomes, and *dioscoridis*-chromosomes were longer
than the parental chromosomes. This is considered to be the neutral amphiplasty (cf. Navashin 1934). In addition, the secondary constriction was observed only in the 2nd chromosome of *capillaris* and never in the 4th chromosome of *dioscoridis* in the 30 metaphase plates of the hybrids studied. This is considered to be the differential amphiplasty (cf. Navashin 1934).

C-banding patterns of each chromosome in the hybrid were observed to be similar to those of the parental species, that is, the three *capillaris*-chromo-
C-bands in amphiplasty of Crepis

Somes showed 10 C-bands as described above, and the four dioscoridis-chromosomes showed 6 C-bands. In the 4th chromosome of dioscoridis the C-band was observed on the region which corresponded to the satellite in the short arm, and two small C-bands on the proximal interstitial region of the long arm. The size of C-band corresponding to the satellite was found to be the same as that of the satellite in the parental clones.

F1 hybrid of C. capillaris × C. vesicaria ssp. taraxacifolia (Fig. 2-E, F) and their reciprocal F1 hybrid (Fig. 2-G, H): The chromosome number of this F1 hybrid was 2n = 7. In the 2n = 7 complement each of the three chromosomes of capillaris and that of the four chromosomes of vesicaria were identified morphologically. The capillaris-chromosomes were longer than those of the parental chromosomes, and vesicaria-chromosomes were shorter than the parental chromosomes. This is the neutral amphiplasty. In addition, the secondary constriction was observed only in the 2nd chromosome of capillaris and never in the 4th chromosome of vesicaria in the 50 metaphase plates of the hybrids studied. This is the differential amphiplasty.

C-banding patterns were similar to those of the parental species, that is, the three capillaris-chromosomes showed 10 C-bands, and the vesicaria-chromosomes showed 6 C-bands as described above. In the 4th chromosomes of vesicaria two C-bands were observed adjacent to each other in the short arm, one in the terminal region which corresponded in size to the satellite in the parental clones and the other one in the proximal region of the short arm. Another C-band was observed in the proximal interstitial region of the long arm. The size of the terminal C-band corresponded to the satellite was also found to be the same as that of the satellite in the parental clones.

In the case of the reciprocal hybrid, vesicaria × capillaris both neutral and differential amphiplasties were also observed in the chromosomes (Fig. 2-G). C-banding patterns of this hybrid were similar to those of capillaris × vesicaria (Fig. 2-H). The amphiplastic changes in the chromosomes of this hybrid were found to occur in the same direction as the hybrid of capillaris × vesicaria, and thus being independent of any maternal effect.

It was found that C-banding patterns occurred constantly even under the differential and neutral amphiplasties.

4. DISCUSSION

Wallace and Langridge (1971) and Doerschug et al. (1976) have proposed that the differential amphiplasty is caused by the disappearance of the secondary constriction (nucleolus organizing region) due to the inactivation of the nucleolar organizer, while Langridge et al. (1970) have proposed that the neutral amphiplasty is caused by the difference of duration of chromosome condensation between the parental species. These authors regard the amphiplasty as the functional change of chromosomes.
In the present study it was found that C-banding patterns were constant in the hybrid without altering by amphiplasty. According to the results from cytochemical analysis, C-bands are considered to stain the material segmentation of chromosomes. The differential and neutral amphiplasties, therefore, can be regarded as not leading the material change in both the nucleolus organizing region and the other C-banded regions of the chromosomes. This fact supports the papers above mentioned that the amphiplasty is due to the functional change of chromosomes.

REFERENCES