Cytological Identification of the Genomes in Pentaploid

*Allium neapolitanum* Using Giemsa C-Banding

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(Received April 18, 1980)

**Key Words:** Liliaceae, *Allium neapolitanum.* — Karyology, Giemsa C-banding, homoeologous chromosomes, karyotype, plant systematics, polyploidy.

**Abstract:** Two homoeologous sets of chromosomes in pentaploid *Allium neapolitanum* Cyr. (Liliaceae) are recognizable by their C-bands. The banding pattern is the same for one Californian and five Yugoslavian populations, suggesting a common chromosomal origin. Predominant meiotic association of identically banded homologues indicates a genomic formula of AAAABB, confirms an allopolyploid origin, and argues against genetically controlled pairing.

Recent investigations demonstrate an increasing effectiveness of Giemsa C-banding in resolving systematic relationships among plants. Differences in banding patterns among otherwise karyologically similar taxa of *Anacyclus* allowed systematic and evolutionary interpretations which corresponded to conclusions from morphological and phytochemical studies (Schweizer & Ehrendorfer 1976, Ehrendorfer & al. 1977). The geographic distribution of C-band polymorphism in *Gibasis* led to recognition of regional morphological variants which previously were erroneously thought to represent different ploidy levels (Kenton 1978). Generally divergent interspecific banding patterns in *Scilla* supported taxonomic groupings based on morphology; in addition, variation of intraspecific banding patterns in that genus allowed a parallel to be drawn between degrees of chromosomal and environmental stability (Greilhuber & Špeta 1976, 1977, 1978). In *Allium*, karyosystematic investigations utilizing Giemsa C-banding or fluorescence banding indicate generally similar patterns for closely related species and often divergent patterns for more distantly related groups.
(El-Gadi & Elkington 1975, Badr & Elkington 1977, Vosa 1971, 1976a, 1976b). Although considerable intraspecific polymorphism was sometimes observed, no investigations in Allium compare bands from a relatively large populational sample.

Giemsa C-banding can be used to investigate the genomic relationships of polyploids (Gill & Kimber 1974). In Allium, only one such study has been reported. Ploidy level aside, a more or less monomorphic, diploid, C-banded karyotype of A. caeruleum differed from a monomorphic triploid mostly in having additional, terminal bands in two sets of homologues (Hussain & Elkington 1978). An autotriploid derivation from the diploid was suggested on the basis of karyotypic similarity. However, chromosomal homology was established largely on the basis of length measurements, a somewhat unreliable criterion (Bothmer 1970, Bentzer & al. 1971), and infrequent quadrivalent meiotic associations in the triploid remain unexplained. Both of these considerations could be clarified by identifying chromosomes associated during meiosis; such identification was accomplished in diploid A. flavum by C-banding of meiotic cells (Loidl 1979).

The present study was undertaken to determine and compare the genomic constitution of several populations of pentaploid A. neapolitanum Cyr. C-bands of mitotic chromosomes have been used to establish chromosomal identities, and the frequency of meiotic association among these identifiable chromosomes has been used to indicate relative homology.

**Materials and Methods**

Plants were collected from five geographically separate Yugoslavian localities (Fig. 1) and bulbs were obtained from Davis, California, U.S.A. In all cases, plants were growing without cultivation in more or less disturbed habitats. Voucher specimens with more exact location descriptions are deposited at the herbarium L J U.

The C-banding procedure utilized is that of Vosa (1973) with the following modifications. Root tips and anthers were treated in 5% pectinase for about 2 hr at room temperature, then hydrolyzed in 1 N HCl for 30-60 min at room temperature. After rinsing in distilled water, the material was teased apart on a cover glass, inverted onto an albumenized slide, and squashed. Unstained slides were scanned using phase contrast, and clear figures were photographed and their coordinates recorded. Photographing unstained cells allowed length measurements of mitotic chromosomes to be made and also allowed interpretation of chromosomal configurations which were sometimes obscured by the C-banding procedure. The cover glass was removed using liquid CO2, leaving the material to be C-banded on the slide. Five to ten plants per population and two to ten cells per plant were analyzed. Meiotic chromosomes were analyzed only in plants from the island Mali Lošinj, Croatia, Yugoslavia.