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THE GENUS ORNITHOGALUM L. (LILIACEAE). I.
ORNITHOGALUM KOCHII PARL.: MORPHOLOGICAL
AND CARYOTYPICAL ANALYSIS

Summary — *Ornithogalum kochii* Parl. from Gravina Petruscio (Puglie - Italy) is $2n = 16:6L + 6M + 2M^s + 2B$.

Ornithogalum tenuifolium Guss. from the same stand is $2n = 14:6L + 6M + 2M^s$.

Ornithogalum tenuifolium Guss. from Syracuse (Sicily) is a) $2n = 15:6L + 6M + 2M^s + 1B$; b) $2n = 14:6L + 6M + 2M^s$.

The four caryotypes are exactly alike, with the exception of B's presence.

Systematic rank of *Ornithogalum kochii* is discussed: this entity can't be considered as autonomous species. It is included in the «complex» of *Ornithogalum tenuifolium*, a well differentiated species from *O. umbellatum* L. to which was previously related.

Riassunto — *Ornithogalum kochii* Parl., proveniente da Gravina Petruscio (Puglie), ha la seguente formula cariotipica: $z = 2n = 16:6L + 6M + 2M^s + 2B$.

Ornithogalum tenuifolium Guss., raccolto nella stessa stazione pugliese, mostra la seguente formula: $z = 2n = 14:6L + 6M + 2M^s$.

Ornithogalum tenuifolium Guss., raccolto nei pressi di Siracusa, mostra due complementi cromosomici:

- a) $z = 2n = 15:6L + 6M + 2M^s + 1B$
- b) $z = 2n = 14:6L + 6M + 2M^s$.

I quattro cariotipi esaminati sono risultati identici, con l'eccezione della presenza di piccoli cromosomi metacentrici interpretati come accessori (B).

E' stato discusso il rango sistematico di *Ornithogalum kochii*: a nostro avviso quest'entità non può essere considerata una specie autonoma e deve ritenersi inclusa nel «complesso» di *O. tenuifolium*, una specie nettamente differenziata da *Ornithogalum umbellatum* L. alla quale in precedenza era stata riferita.

Sono in corso ulteriori indagini.

The systematic rank of *Ornithogalum kochii* Parl. is questionable. It was described as a species by PARLATORE [1852] and then

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considered a subspecies (MAIRE & WEILLER [1958]), a variety (FIORI [1923]) or a frail form of *Ornithogalum umbellatum* L. (NEILREICH [1958 b]). Previously it was considered a variety of *O. comosum* L. (FIORI [1896]) or synonymized to *O. tenuifolium* Guss. (BOISSIER [1884]) or to *O. umbellatum* L. var. *silvestre* Neilr. (FRITSCH [1909]).

The nomenclatural situation is also confused. The same specimens were named with three different specific epithets by three different authors; the geographical distribution is also uncertain and the valuation of phenetic characters lacks clarity (NEILREICH [1858 a], [1858 b]). Recent cytological (CULLEN & RATTER [1967]) and morphological studies (ZAHARIADI [1965]) have served to clarify the taxonomical position of several entities of the genus *Ornithogalum* L. but the case of *Ornithogalum kochii* Parl. was not dealt with.

The finding of a new stand of *O. kochii* Parl. in Italy offers an opportunity to re-examine its relationships with the closely related species *O. tenuifolium*.

MATERIAL AND METHODS

A single plant of *Ornithogalum kochii* Parl. was collected near Gravina Petruscio (Puglie - Italy) in May, 25, 1967, on calcareous soil of a degraded phrygana together with rare *Pinus halepensis*. Evidence occurred of karst phenomena and aeolian erosion. The plant is now in cultivation in the Botanic Garden of the University, Pisa. The morphological characters, which have remained constant during the three years of cultivation, correspond exactly to those referred by PARLATORE [1852] to *O. kochii*. A comparison with *typus* kept in the Herbarium Centrale Italicum (FI) has fully convinced us about its identity.

In the same Apulian stand, not far from *O. kochii*, and near Syracuse (Sicily), specimens of *O. tenuifolium* Guss. were found which showed a similar morphology to *O. kochii* as seen from the following comparation:

	<i>Ornithogalum kochii</i>	<i>Ornithogalum tenuifolium</i>
Bulb	globose and solitary	globose and solitary
Raceme	corymb	corymb
Pedicels	horizontal to ascending	horizontal to ascending

Bracts	largely twined round the pedicels; evident lengthwise green nerves	scarcely twined; no evident lengthwise green nerves
Capsule valves	elliptical-rectangular (Fig. 1, left)	elliptical-lengthened (Fig. 1, right)

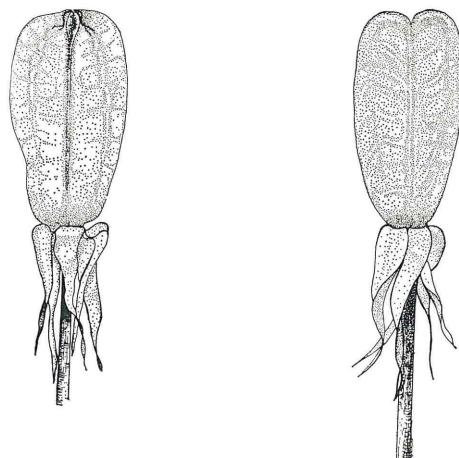


Fig. 1 - Capsule valves of *Ornithogalum kochii* Parl. (left) and *O. tenuifolium* Guss. (right).

The following chromosome numbers were found in Feulgen stained c-metaphase root-tip mitoses:

- 1 - *Ornithogalum kochii* Parl. (Gravina Petruscio): $2n = 16$ (Fig. 2)
- 2 - *Ornithogalum tenuifolium* Guss. (Gravina Petruscio): $2n = 14$ (Fig. 3)
- 3 - *Ornithogalum tenuifolium* Guss. (Syracuse): $2n = 14$ (Fig. 4)
- 4 - *Ornithogalum tenuifolium* Guss. (Syracuse): $2n = 15$ (Fig. 5)

The analysis of the idiograms drawn from the 14-15-16 chromosomes caryotypes shows 7 identical pairs in all the taxa examined. The only difference consists in the presence of 1 (*O. tenuifolium*) or 2 (*O. kochii*) metacentric chromosomes, the smallest members of the complement.

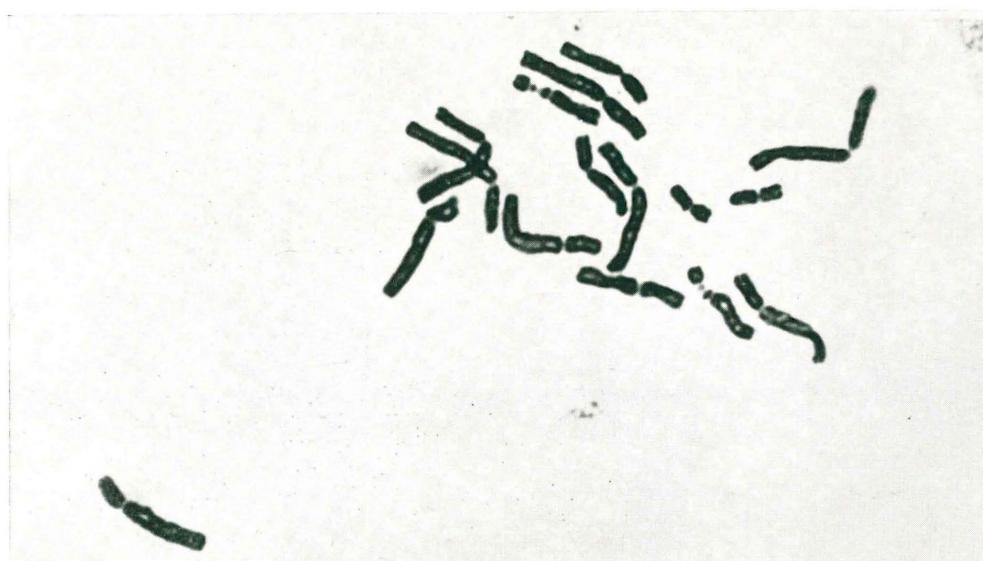


Fig. 2 - *Ornithogalum kochii* Parl. from Gravina Petruscio (Puglie), $2n = 16$ (x 1350).
Arrows indicate B chromosomes.



Fig. 3 - *Ornithogalum tenuifolium* Guss. from Gravina Petruscio (Puglie), $2n = 14$ (x 1350).

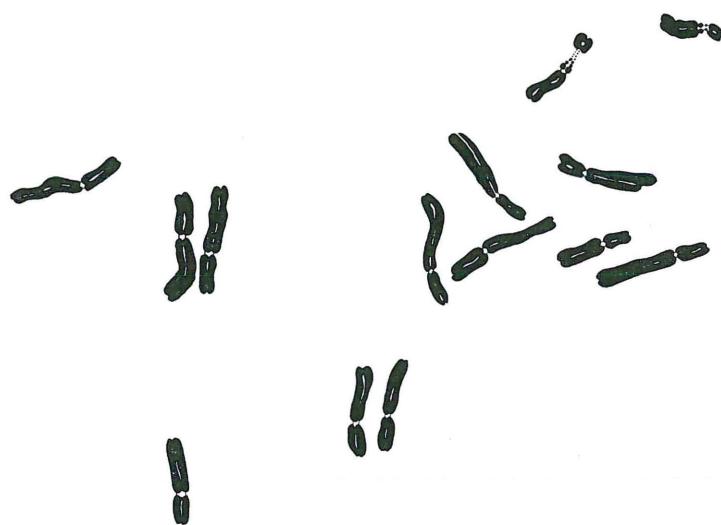


Fig. 4 - *Ornithogalum tenuifolium* Guss. from Syracuse (Sicily), $2n = 14$ (x 1350).



Fig. 5 - *Ornithogalum tenuifolium* Guss. from Syracuse (Sicily), $2n = 15$ (x 1350),
Arrow indicates 1 B's.

DISCUSSION

The occurrence of aneuploidy (DYER & Coll. [1970]) or — generally — dispoloidy, supernumerary or accessory chromosomes is well-known in the caryology of the genus *Ornithogalum* (NEVES [1952], MESQUITA [1964], CULLEN & RATTER [1967], CZAPIK [1968]).

On the basis of data reported by BATTAGLIA [1964] and JOHN & LEWIS [1968], we are of the opinion that the smallest metacentric chromosomes in the caryotype of *O. kochii* are B's. It is well known

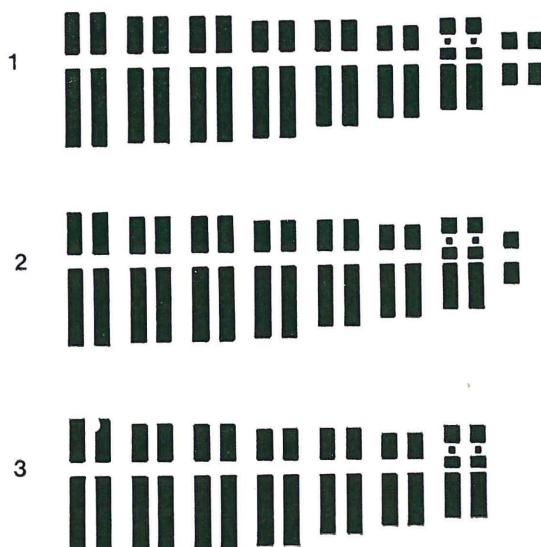


Fig. 6 - Idiograms: 1. *Ornithogalum kochii* Parl., $2n = 16$; 6L + 6M + 2Ms + 2B
2. *Ornithogalum tenuifolium* Guss., $2n = 15$; 6L + 6M + 2Ms + 1B
3. *Ornithogalum tenuifolium* Guss., $2n = 14$; 6L + 6M + 2Ms

that the presence or absence of accessory chromosomes does not necessarily entail appreciable phenotypic change (BATTAGLIA & GUANTI [1966], [1968]; FROST [1969]), though physiological or behavioural differences can be produced (VOSA [1966], SMITH [1968]).

The presence of 2 B's in *O. kochii* may be the genetical background for some somatic differences (see, i.e., bracts or valves of the capsule): it may be possible to test this by the analysis of amphimixical progeny and the possible segregation of cytotypes with B's.

Contrary to VOSA's data [1966] on *Allium porrum*, seed germination in *Ornithogalum kochii* and *O. tenuifolium* (with or without B's) occurs contemporaneously.

The presence of different caryotypes in the same stand of Syracuse may prove that also *O. kochii* from Gravina Petruscio is merely *O. tenuifolium* with 2 B's. That is *O. kochii* is a particular cytotype of *O. tenuifolium* (Fig. 6) like other biotypes previously described for the same species by other authors (CHIAPPINI [1968]).

From a systematic point of view we can't come to a final conclusion till the presence of B's (and generally the caryotypical infraspecific variability) in relation to the choice of precise taxonomical ranks will have been discussed. If the B's presence in a species should signify the use of *varietas* as taxon, a role of accessory chromosomes in differentiation of the species itself should be admitted; but it is not generalizable. According to us, caution in hypothesizing the origin and differentiation of a species or its section (SMITH [1968]) on the basis of B's presence in a population, is recommended. In fact all phenomena at various systematic levels causing a caryotype rearrangement could be the cause of B-chromosomes formation (BATTAGLIA [1964]), independently from problems of speciation.

CONCLUSION

The chromosome complement of a single plant of *Ornithogalum kochii* has the following idiogrammatic formula:

$$z = 2n = 16: 6L + 6M + 2M^s + 2B.$$

Two different caryotypes have been found in *Ornithogalum tenuifolium*:

- a) $z = 2n = 15: 6L + 6M + 2M^s + 1B$
- b) $z = 2n = 14: 6L + 6M + 2M^s.$

Satellites are always intercalary. B's are euchromatic. This research rejects the specific rank for *O. kochii* this being a cytotype of *O. tenuifolium* Guss.

The results of a cytogenetic study now in course, the meiotic behaviour, biochemical and structural nature of B's may prove the role of *O. kochii* in the variability and differentiation of *O. tenuifolium*.

A final consideration: the seeds of *O. tenuifolium* regularly germinate without vernalization on contrary to those of *O. umbellatum* that are supported by it.

Lastly *O. umbellatum* has a monoploid number $n = 9$, while *O. tenuifolium* has $n = 7$. According to us, these considerations exclude the reference of *O. tenuifolium* to the « complex » of *O. umbellatum*, as previous authors supposed.

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