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Autor: Roti-Michelozzi, Guidetta / Riggio Bevilacqua, Letizia
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Biosystematic notes on the "Lathyrus sylvestris" complex in Italy

GUIDETTA ROTI-MICHELOZZI
&
LETIZIA RIGGIO BEVILACQUA

RÉSUMÉ

ROTI-MICHELOZZI, G. & L. RIGGIO BEVILACQUA (1990). Notes biosystématiques sur le complexe du "Lathyrus sylvestris" en Italie. *Candollea* 45: 599-608. En anglais, résumés français et anglais.

On présente ici une étude biosystématique des huit populations sauvages italiennes de *Lathyrus sylvestris* et *L. latifolius*, appartenant au groupement du *L. sylvestris*. Le polymorphisme morphologique et caryologique relevé parmi les échantillons de quatre populations du *L. latifolius* nous a fait proposer pour eux, au contraire de la classification actuelle, une séparation au niveau infraspécifique, avec le nom *L. latifolius* L. var. *angustifolius* Koch.

ABSTRACT

ROTI-MICHELOZZI, G. & L. RIGGIO BEVILACQUA (1990). Biosystematic notes on the "Lathyrus sylvestris" complex in Italy. *Candollea* 45: 599-608. In English, French and English abstracts.

A biosystematic investigation was carried out on eight Italian populations of the two entities *Lathyrus sylvestris* and *L. latifolius*, belonging to the *L. sylvestris* group. The morphological and karyological polymorphism, found in the specimens of four populations of *L. latifolius* supported, in contrast to what has been stated by contemporary taxonomists, their treatment at infraspecific level, as *L. latifolius* L. var. *angustifolius* Koch.

The *Lathyrus sylvestris* complex is a group of perennial *Lathyrus*, native to Europe and a few African countries around the Mediterranean (BALL, 1968). The complex includes (HEGI, 1924; HESS & al., 1970; GREUTER & al., 1989) *L. sylvestris* L., *L. latifolius* L. and *L. heterophyllus* L. The first two species are more frequent in Italy than the third (PIGNATTI, 1982) and they were the object of our investigation.

For a long time there has been a controversy about the taxonomic position and nomenclature of these entities. Some authors (LINNAEUS, 1753; BALL, 1968; PIGNATTI, 1982) believed that they were separate species, but did not group them in a complex. Others (FIORI, 1925) considered them at infraspecific level of a comprehensive species named "*L. silvester*". The epithet "*silvester*" was also used by HEGI (1924) and HESS & al. (1970), this time to indicate the complex grouping the three species. Finally GREUTER & al. (1989) corrected the epithet of the complex to "*sylvestris*". We agree with Greuter and co-workers in considering these entities related, but separate at specific level.

The present study was undertaken to ascertain if:

- a) the karyology of the Italian specimens may or may not confirm the taxonomic position given by the recent Flora authors for the members of this group;
- b) there can be some correlation between morphological and karyological diversification.

Material and methods

The material was collected from natural populations, and was also grown in the Genova Botanical Garden from seeds collected in the wild. Many specimens were observed, however in Table 1 only details concerning the localization and references of the material studied both from the morphological and karyological point of view are reported. Voucher specimens are preserved in the Genova Botanical herbarium (GE). The specimens investigated are illustrated in Fig. 1; moreover, following the methods used by LORENZ & GEMBARDT (1987) for the Gargano (Italy) Orchids, the outlines of the most critical features, drawn from fresh material of each entity, are presented in Fig. 2.

For karyotype analysis, data on somatic metaphase plates were raised from a minimum of five metaphase spreads belonging to root tips of different germinated seeds. Various pretreatments were used, but the best results were obtained keeping the root tips in a 0.2% aqueous solution of α -glucose at 0°C overnight. For the cytological methods see ROTI-MICHELOZZI (1986).

Entity	Locality	Voucher specimen
<i>Lathyrus sylvestris</i>	Aosta Province, Chabodey Livorno Province, Elba Island	Roti-Michelozzi 810810, 890814 Roti-Michelozzi 860615
<i>Lathyrus latifolius</i> var. <i>latifolius</i>	Genova Province, near Rapallo Firenze Province, near Gambassi	Roti-Michelozzi 870806, 870705 Roti-Michelozzi 870708
<i>Lathyrus latifolius</i> var. <i>angustifolius</i>	Savona Province, near Varazze Genova Province, near Zoagli Firenze Province, near Certaldo Palermo Province, Madonie Mounts	Roti-Michelozzi 870725 Roti-Michelozzi 870706 Roti-Michelozzi 870729, 890727 Roti-Michelozzi 890718

Table 1. — Source localities and voucher specimens of the material studied.

Results

Morphology, taxonomy and nomenclature

As said above, we agree with those authors who consider *L. sylvestris* and *L. latifolius* separate at specific level. BALL (1968), PIGNATTI (1982) and GREUTER & al. (1989) nevertheless, believe that *L. latifolius* comprises specimens all with large stipules and wide leaflets, as well as specimens, often mistaken for *L. sylvestris*, with only some large stipules but all with longer narrower leaflets; Ball, for instance, in his description of *L. latifolius*, reports: "very variable in leaflet shape, and sometimes divided, on this basis, into two species or subspecies, but there is little correlation between leaflet shape and other characters". Since the plants of *L. latifolius* "sensu stricto" (Fig. 1C, 2C) studied by us maintained, during several years of observation, the typical characters of this species, while the large majority of the Italian specimens of *L. latifolius* studied varied considerably in stipule and leaflet shape and measurements, it seemed more convenient to separate, at least at varietal level, the specimens with longer narrower leaflets from the other ones. It must be also noted that:

- a) the specimens of this group showed all their differential characters only when in flower or in fruit;



Fig. 1. — A, *Lathyrus sylvestris* L., habit; B, *Lathyrus latifolius* L. var. *angustifolius* Koch, leaf; C, *Lathyrus latifolius* L. var. *latifolius*, habit.

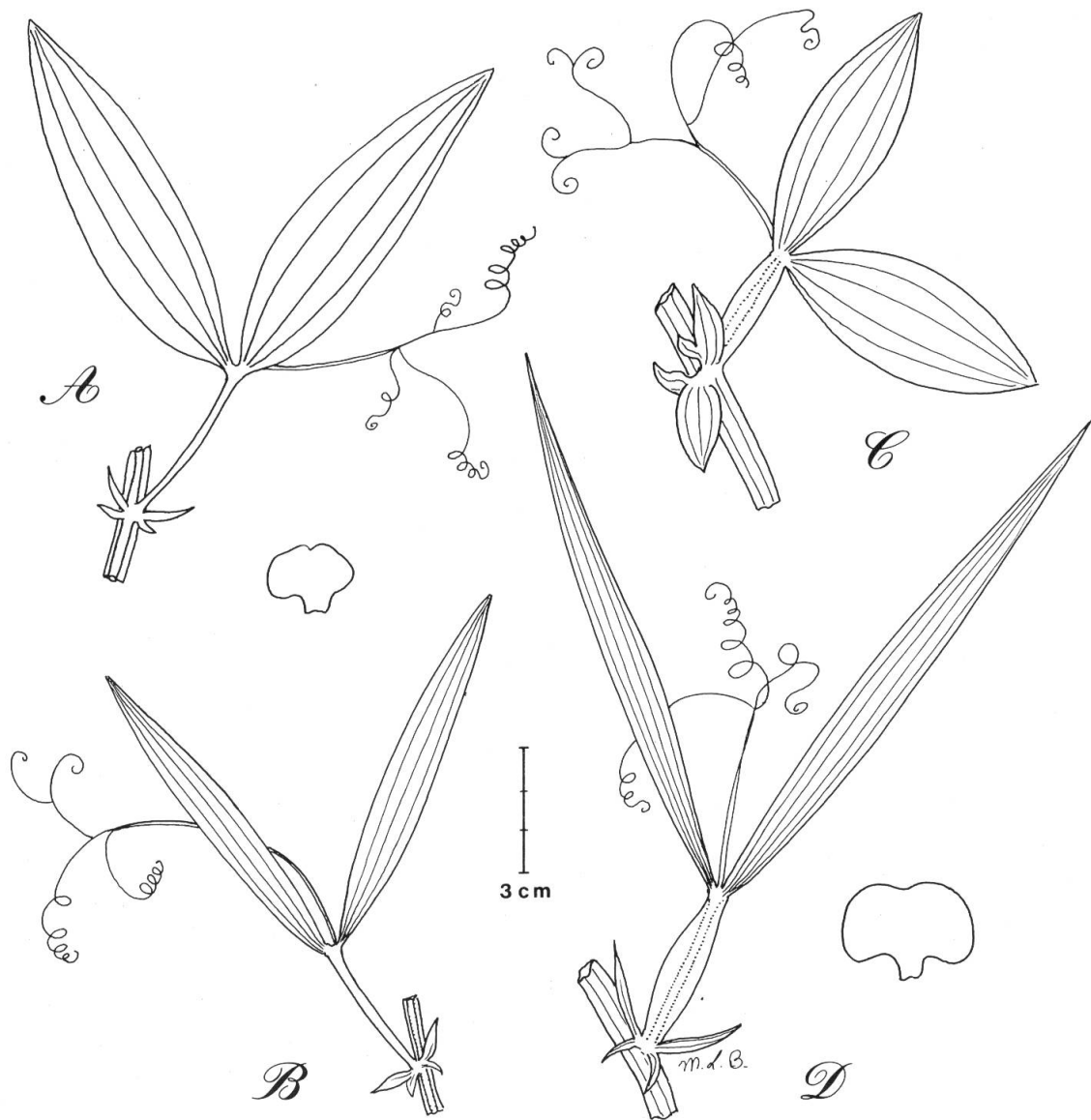


Fig. 2. — Leaflet rib number and outline of leaves and standards.
A, B, *Lathyrus sylvestris* L.; **C**, *Lathyrus latifolius* L. var. *latifolius*; **D**, *Lathyrus latifolius* L. var. *angustifolius* Koch.

- b) some features, not described by Ball, seemed correlated to the leaflet shape: for instance the petiole's width, or the leaflet's prominent rib number;
- c) other characters, on the contrary, such as the seed's more or less "tuberculate" or "mounded" surface (terminology according to LERSTEN & GUNN, 1982), emphasized by some authors (GISMONDI, 1950), seemed uncorrelated to the above mentioned characters.

As for the nomenclature of the infraspecific entities of *L. latifolius*, many names have been proposed for the variety illustrated in Fig. 1B and 2D, but the first name with which this variety was recognized was *L. latifolius* L. var. "*angustifolia*" Koch (KOCH, 1843). According to GREUTER & al. (1988), the epithet "*angustifolia*" must be conserved, but properly written in latin "*angustifolius*".

It seemed therefore advisable to classify the specimens studied as one or the other species, or even as one or the other variety, depending on the amount of the differential and correlated characters, as shown in Table 2.

	<i>Lathyrus sylvestris</i>	<i>Lathyrus latifolius</i> var. <i>latifolius</i>	<i>Lathyrus latifolius</i> var. <i>angustifolius</i>
Stipules	10-30 × 0.5-3 mm	25-60 × 5-11 mm	10-60 × 2-8 mm
Petiole	15-25 times longer its width	at most 6 times longer its width	at most 6 times longer its width
Leaflets	45-100 × 3-20 mm	65-90 × 20-40 mm	60-130 × 6-12 mm
Prom. leafl. ribs	3	4-6	3-4
Standard area	2-2.5 cm ²	3.5-6 cm ²	3.5-6 cm ²
Legume	about 50 × 7-10 mm	70-90 × 5-6 mm	70-90 × 5-6 mm
Seed hilum	More than 1/3 of circumference	1/4 of circumference	little less than 1/3 of circumference

Table 2. — Main morphological differences among the studied entities of the *Lathyrus sylvestris* group.

Karyology

Lathyrus sylvestris L.

This species is found almost throughout the whole of Europe. The chromosome number $2n = 2x = 14$, confirmed by our investigation, was reported by SENN (1938), BRUNSBURG (1965), LAVANIA & SHARMA (1980) and NARAYAN (1982), for cultivated material, by HINDAKOVA & CINCURA (1967), DVORAK & DADAKOVA (1975), FERNANDES & SANTOS (1975) and ROMANO & al. (1987) for wild material, but only the Czechoslovakian and Indian authors provided an idiogram.

Entity	Population	Karyotypic formula (LEVAN & al., 1964)	Whole complement length (μm)	Total index of symmetry (LADIZINSKY, 1978)
<i>Lathyrus sylvestris</i>	Chabodey Elba Island	2m + 2sm ^s + 10sm	101.22	0.56
		2m + 2sm ^s + 2m + 2sm + 4m + 2sm	95.08	0.58
<i>Lathyrus latifolius</i> var. <i>latifolius</i>	Near Rapallo Near Gambassi	2m + 2sm ^s + 4sm + 4m + 2sm	96.22	0.60
		2m + 6sm + 4m + 2sm	89.90	0.59
<i>Lathyrus latifolius</i> var. <i>angustifolius</i>	Near Varazze	2sm ^s + 2m + 4sm + 2m + 2sm + 2m	98.36	0.60
	Near Zoagli	2m + 4sm + 2sm ^s + 4sm + 2m	84.84	0.61
	Near Certaldo	2m + 4sm + 2sm ^s + 2sm + 4m	91.70	0.57
	Madonie Mounts	4m + 2sm ^s + 6m + 2M	98.94	0.60

Table 3. — Karyotypic formulae, whole complement lengths and total karyotype indexes of symmetry of the studied populations.

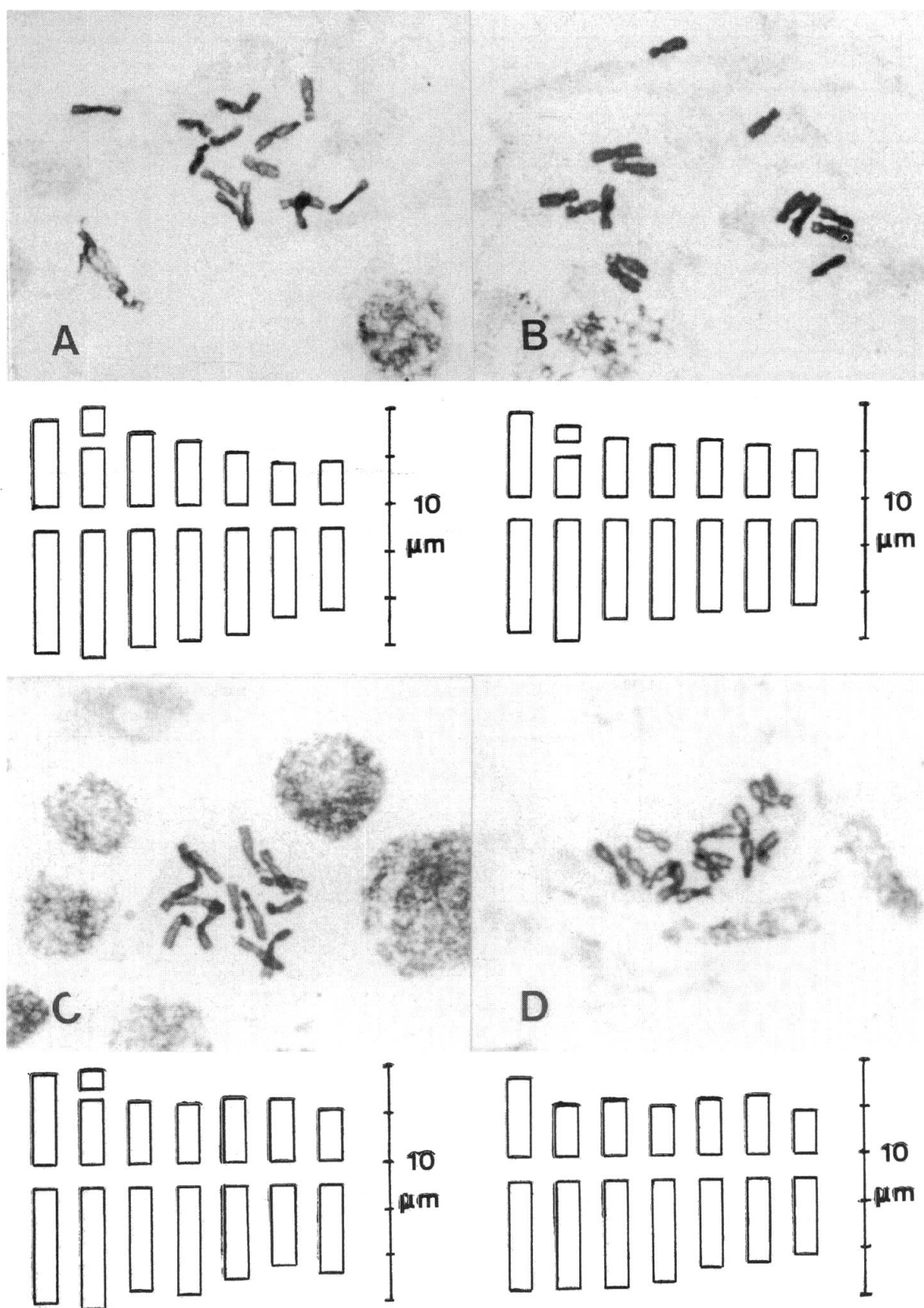


Fig. 3. — Metaphase plates and idiograms of: **A, B**, *Lathyrus sylvestris* L. **A**, Aosta valley population; **B**, Elba Island populations; **C, D**, *Lathyrus latifolius* L. var. *latifolius*; populations from: **C**, Rapallo; **D**, Gambassi.

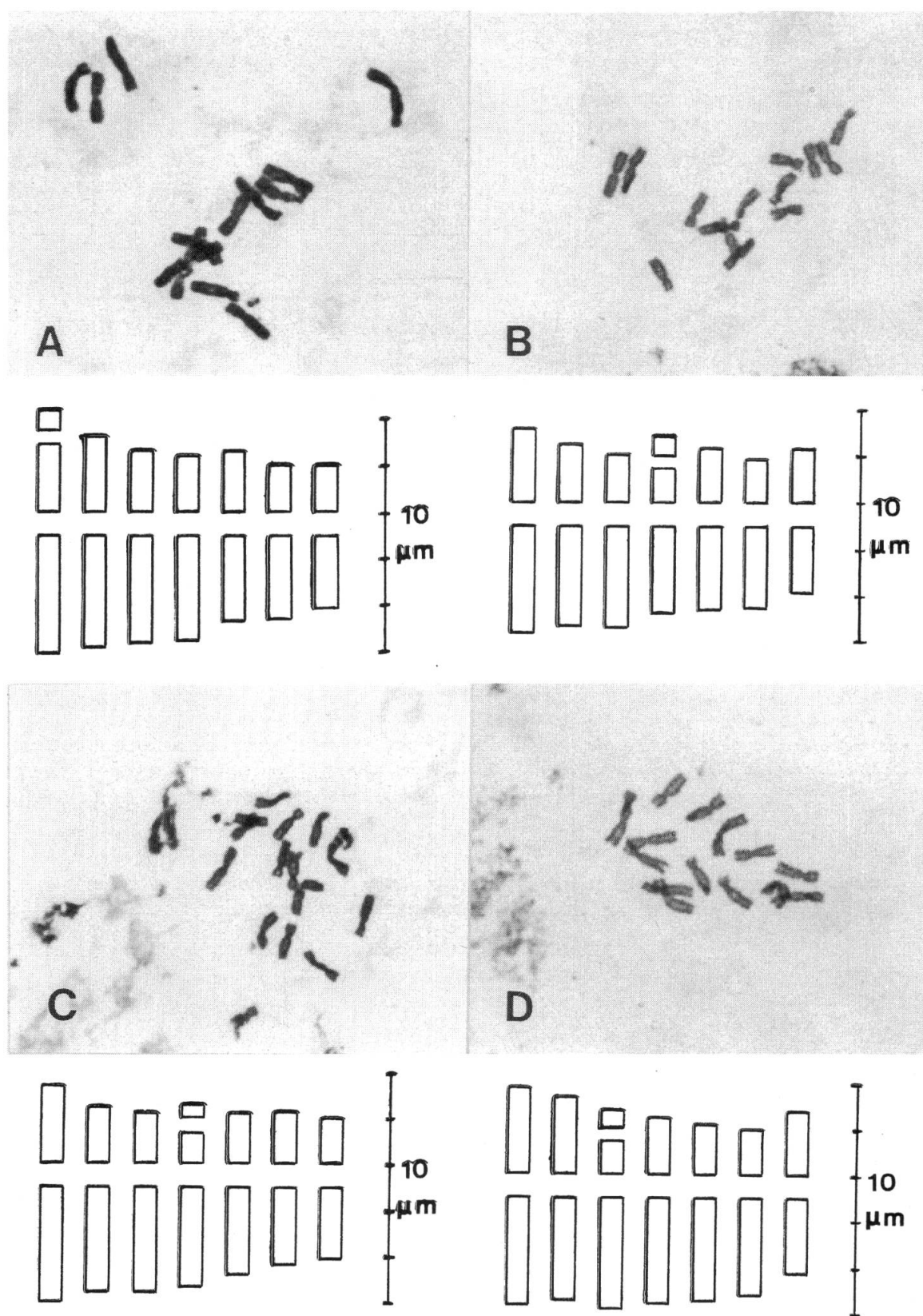


Fig. 4. — Metaphase plates and idiograms of *Lathyrus latifolius* L. var. *angustifolius* Koch; populations from: A, Varazze; B, Zoagli; C, Certaldo; D, Madonie Mounts.

The two Italian populations were found in very different habitats, one in the Aosta Valley, at about 1100 m above sea level, in a forest of *Abies*, *Picea* and *Larix*, while the other grew in an unusual environment for this species, in the Elba Island (Toscana), among a typical Mediterranean flora. The karyotypes of both the Italian populations were similar (Fig. 3A, B), though the karyotypic formulae (LEVAN & al., 1964), whole complement lengths and total indexes of symmetry varied slightly (Table 3); however the position and feature of the satellited chromosomes were the same in both populations, and were also in agreement with those revealed in the idiogram drawn by HINDAKOVA & CINCURA (1967) for a wild Czechoslovakian specimen. Instead, in the idiogram drawn by LAVANIA & SHARMA (1980), for cultivated material, these marker chromosomes were in first position.

***Lathyrus latifolius* L. (sensu lato)**

This species also is a pan-european one; the majority of the authors consider it, however, a more southern element than *L. sylvestris*. Both the varieties recognized by us were provided with the chromosome number $2n = 2x = 14$, concurring with previous records (SENN, 1938; BRUNSBERG, 1965; D'AMATO & al., 1978, for cultivated material; HINDAKOVA & CINCURA, 1967; FERNANDES & SANTOS, 1971; COLOMBO & al., 1978; NATARAJAN, 1978, for wild material). These data confirm that the chromosome number $2n = 14$ is the most frequent in the whole genus *Lathyrus*.

Lathyrus latifolius* L. var. *latifolius

The two Italian populations investigated, though showing slightly different whole complement lengths and total indexes of symmetry, had the same number of metacentric and submetacentric chromosomes, exactly in the same order (fig. 3C, D, Tab. 3). The karyological difference between the specimens studied was the presence, in the Ligurian population, of a satellited couple of chromosomes, in second position, and the absence of these nucleolar chromosomes, in the Tuscan population. A couple of satellited chromosomes, similarly in second position, was also recorded by HINDAKOVA & CINCURA (1967) in czech wild material. Instead these marker chromosomes were noticed in fourth position by D'AMATO & al. (1978), in cultivated material.

***Lathyrus latifolius* L. var. *angustifolius* Koch**

In the four wild Italian populations of this entity the chromosome morphology varied considerably, as well as the whole complement length and total index of symmetry (Fig. 4A, B, C, D, Tab. 3). In particular the nucleolar organizing chromosomes were sometimes in first position (in the Savona province population), sometimes in third position (in the specimen grown from seeds collected in Sicily), or more often in fourth position (in the other Ligurian and in the Tuscan population).

Discussion

Chromosome number and chromosome size

As it has been noticed by various authors, the chromosome number, in the genus *Lathyrus*, is very uniform. In fact, according to SENN (1938), only one species, among 42, investigated by him, exhibits a chromosome number different to $2n = 14$. Also LAVANIA & SHARMA (1980) as well as NARAYAN (1982) agree about this statement; only GOLDBLATT (1981) mentions three species among 41 with chromosome number sometimes or always completely different from $2n = 14$ (*L. pratensis*, $2n = 14, 28$; *L. sepium*, $2n = 28$; *L. palustris*, $2n = 42$).

The chromosome sizes, on the contrary, may greatly vary in different *Lathyrus* species (NARAYAN & REES, 1976; NARAYAN, 1982; REES, 1984). In the case of the Italian specimens of the *L. sylvestris* group, however, the chromosome sizes were rather uniform.

Chromosome morphology

The karyotypes of the investigated specimens were, in agreement with what noted by REES & NARAYAN (1989) in other *Lathyrus* species, rather symmetrical both for arm ratio and relatively small difference in length between the longest and shortest chromosome.

Concluding remarks

According to some authors (BRANDHAM, 1971; TZANOUDAKIS, 1983) karyotypes of different species may show a diversification due to the different position of the satellited chromosomes. Therefore, considering that in both wild *L. sylvestris* and *L. latifolius* var. *latifolius*, well separated from each other by external morphological features, the position and morphology of the nucleolar chromosomes were stable, even in specimens collected in very different habitats, the variability in their position, in *L. latifolius* var. *angustifolius* wild Italian specimens, seemed significant. This karyotype variability could be correlated to their phenotypic polymorphism and therefore justify, in contrast to the taxonomic arrangement given by the recent Flora authors, their separation at varietal level from the specimens of *L. latifolius* var. *latifolius*. Moreover, as *L. latifolius* var. *angustifolius* is very common and distributed throughout Italy, probably its chromosome variability also reflects its geographical and ecological differentiation.

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