

CYTOTAXONOMIC INVESTIGATIONS IN SOME ANGIOSPERMS COLLECTED IN THE VALLEY OF AOSTA AND IN TRE NATIONAL PARK « GRAN PARADISO » *

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INTRODUCTION

Many Linnean species are very variable in cytological respect. For that reason cytogeographic studies are of great importance, both for plant-taxonomy and plant-geography. In order to fill some gaps in our knowledge of cytogeography, the authors decided to investigate a number of plants collected in the Valley of Aosta and the National Park « Gran Paradiso ». This material was collected by the first author during a botanical excursion with a group of students of the State University of Utrecht in the summer of 1966. The main objective of this excursion was to demonstrate the alpine flora of the National Park « Gran Paradiso » and to show the mediterranean influences on the composition of the flora of the warm and very dry valley of Aosta.

The material was collected at random, but special attention was paid to representatives of the genera *Symphytum*, *Sedum*, *Potentilla* and *Hieracium* (subgenus *Pilosella*).

The chromosome numbers together with notes on the taxonomy of the species are here presented.

MATERIAL AND METHODS

Living plants were collected as well as seed samples. The seeds were sown in the Botanical Garden of the State University of Utrecht.

Chromosome counts were made from roottips of potted plants. The tips were fixed in Karpechenko's fixative, embedded in paraffine, sectioned at 15 micron and stained according to Heidenhain's haematoxylin method. Specimens relating to this study are preserved in the herbarium of Utrecht.

* In memory of Professor Alberto Chiarugi on the tenth anniversary of his death.

RESULTS

The results of the chromosome counts are given in the following table. This table gives a survey of the species investigated, the source of the material, collection numbers and the chromosome numbers. Notes on some species (marked with an asterisk) have been added.

BORAGINACEAE

- 1.* *Lappula squarrosa* (Retz.) Dum.
coll. no.: G.5249 $2n=48$
origin: Valley of Aosta, roadside between La Salle and Morgex.
2. *Lithospermum arvense* L.
coll. no.: G.5238 $2n=28$
origin: Valley of Aosta, roadside near La Salle.
- 3.* *Lycopsis arvensis* L.
coll. no.: G.5294 $2n=48$
origin: Valley of Aosta, roadside near La Salle.
- 4.* *Symphytum officinale* L.
coll. no.: G.5463 and 5464 $2n=24+4B$
origin: In a moist meadow between La Sarre and Chateau de Sarre.

CAMPANULACEAE

5. *Jasione montana* L.
coll. no.: G.5597 $2n=12$
origin: Valley of Aosta, on a very dry and hot Sth.-exposed slope near Ville sur Nus, ± 1250 m.

CARYOPHYLLACEAE

6. *Agrostemma githago* L.
coll. no.: G.5560 $2n=48$
origin: Valley of Aosta, roadside near Nus, ± 800 m.
- 7.* *Cerastium arvense* L. subsp. *strictum* (Haenke) Gaudin
coll. no.: G.5621 $2n=36$
origin: National Park « Gran Paradiso ».
Between Rifugio Vittorio Sella and Valnontey.
- coll. no.: G.5639 $2n=36$
origin: National Park « Gran Paradiso ».
Near Rifugio Vittorio Sella, along a small footpath to Valnontey, ± 2500 m.

8. *Dianthus caryophyllus* L.
 coll. no.: G.5563 $2n=30$
 origin: Valley of Aosta, on a very dry and hot Sth.-
 exposed slope, ± 1200 m., between Nus and
 Ville sur Nus.
9. *Petrorhagia prolifera* (L.) P. Ball et Heywood
 coll. no.: G.5260 and G.5267 $2n=30$
 origin: Valley of Aosta, on the wall of Chateau de
 Sarre.
10. *Silene otites* (L.) Wibel
 coll. no.: G.5584 $2n=24$
 origin: Valley of Aosta. Ville sur Nus, ± 1500 m.
 coll. no.: G.5607 $2n=24$
 origin: Valley of Aosta, on a very dry and hot Sth.-
 exposed slope between Nus and Ville sur Nus,
 ± 1200 m.

COMPOSITAE

- 11.* *Achillea setacea* Waldst. et Kit.
 coll. no.: G.5583 $2n=18$
 origin: Valley of Aosta, near Ville sur Nus, roadside,
 ± 1450 m.
 coll. no.: G.5610 $2n=18$
 origin: Valley of Aosta, on a hot Sth.-exposed slope
 near Ville sur Nus, ± 1400 m.
- 12.* *Centaurea nervosa* Willd.
 coll. no.: G.5660 $2n=22$
 origin: National Park « Gran Paradiso ».
 Valnontey, in a meadow, ± 1000 m.
13. *Centaurea nigra* L.
 coll. no.: G.5282 $2n=44$
 origin: Valley of Aosta, in a meadow along the road
 Aosta - Sarre.
14. *Chrysanthemum ircutianum* Turcz.
 coll. no.: G.5242 $2n=36$
 origin: Valley of Aosta, between La Salle and Morgex,
 along the river Dora Baltea.
15. *Chrysanthemum montanum* All.
 coll. no.: G.5651 $2n=54$
 origin: National Park « Gran Paradiso ».

- Between Valnontey and Rifugio Vittorio Sella,
± 2000 m.
- 16.* *Hieracium amplexicaule* L.
coll. no.: G.5598 2n = 27
origin: Valley of Aosta, on a very hot and dry Sth.-
exposed slope near Ville sur Nus.
- 17.* *Hieracium peleterianum* Mérat.
coll. no.: G.5562 2n = 18
origin: Valley of Aosta, near Chateau Nus, ± 1200 m.
coll. no.: G.5626 and G.5638 2n = 18
origin: National Park « Gran Paradiso ».
Between Rifugio Vittorio Sella and Valnontey,
± 2200 m.
coll. no.: G.5655 2n = 18
origin: National Park « Gran Paradiso ».
Near Valnontey, ± 1800 m.
- 18.* *Hieracium pilosella* L.
coll. no.: G.5480 and G.5481 2n = 18
origin: Valley of Aosta, near Ville sur Nus.
On a dry Sth.-exposed slope, ± 1400 m.
coll. no.: G.5586 2n = 36
origin: Valley of Aosta, Villa sur Nus, ± 1500 m.
coll. no.: G.5525 2n = 45
origin: National Park « Gran Paradiso ».
Near Rifugio Vittorio Sella.
coll. no.: G.5619 2n = 45
origin: Between Rifugio Vittorio Sella and Valnontey,
± 2200 m.
coll. no.: G.5636 2n = 54
origin: National Park « Gran Paradiso ».
Between Rifugio Vittorio Sella and Valnontey,
± 2200 m.
19. *Lactuca serriola* L.
coll. no.: G.5299 2n = 18
origin: Valley of Aosta, roadside near Sarre.
20. *Lactuca virosa* L.
coll. no.: G.5600 2n = 18
origin: Valley of Aosta, between Nus and Ville sur Nus.
21. *Silybum marianum* (L.) Gaertn.
coll. no.: G.5296 2n = 34
origin: Valley of Aosta, roadside near Sarre.

22. *Tragopogon dubium* Scop.
 coll. no.: G.5640 $2n=12$
 origin: National Park « Gran Paradiso ».
 Between Rifugio Vittorio Sella and Valnontey,
 ± 2200 m.
23. *Tragopogon pratensis* L.
 coll. no.: G.5572 $2n=12$
 origin: Valley of Aosta, roadside near Nus, ± 800 m.

CRASSULACEAE

24. *Sedum album* L.
 coll. no.: G.5462 and G.5465 $2n=68$
 origin: Valley of Aosta, on the wall of Chateau de Sarre.
25. *Sedum alpestre* Vill.
 coll. no.: G.5487 $2n=16$
 origin: National Park « Gran Paradiso ».
 Near Rifugio Vittorio Sella, ± 2500 m.
- 26.* *Sedum ochroleucum* Chaix in Vill.
 coll. no.: G.5468 $2n=34$
 origin: Valley of Aosta, near Nus, ± 600 m.
 coll. no.: G.5472 $2n=34$
 origin: Valley of Aosta, between Chateau de Nus and
 Ville sur Nus.
 coll. no.: G.5507 $2n=34$
 origin: National Park « Gran Paradiso ».
 Between Rifugio Vittorio Sella and Valnontey,
 coll. no.: G.5532 $2n=34$
 origin: National Park « Gran Paradiso ».
 Near Valnontey.
 coll. no.: G.5508 and G.5510 $2n=51$
 origin: National Park « Gran Paradiso ».
 Between Rifugio Vittorio Sella and Valnontey,
 ± 2200 m.

CRUCIFERAE

- 27.* *Alyssum alyssoides* (L.) L.
 coll. no.: G.5652 $2n=24$
 origin: National Park « Gran Paradiso ».
 Near Valnontey, ± 1600 m.

28. *Isatis tinctoria* L.
 coll. no.: G.5271 2n=28
 origin: Valley of Aosta, Chateau de Sarre.

GERANIACEAE

29. *Erodium moschatum* (L.) 1-Herit. in Aiton.
 coll. no.: G.5548 2n=20
 origin: Valley of Aosta, near Nus, ± 600 m.

GRAMINEAE

30. *Bromus sterilis* L.
 coll. no.: G.5284 2n=14
 origin: Valley of Aosta, roadside between Aosta and Sarre.
31. *Melica ciliata* L.
 coll. no.: G.5269 2n=18
 origin: Valley of Aosta, on the wall of Chateau de Sarre.

HYPERICACEAE

32. *Hypericum perforatum* L.
 coll. no.: G.5241 2n=32
 origin: Valley of Aosta, near La Salle, ± 900 m.
 Dry river bed of the Dora Baltea.

LABIATAE

33. *Salvia pratensis* L.
 coll. no.: G.5265 2n=18
 origin: Valley of Aosta, near Chateau de Sarre.

LEGUMINOSAE

34. *Lotus alpinus* (DC.) Schleicher ex Ramond
 coll. no.: G.5634 2n=12
 origin: National Park « Gran Paradiso ».
 Between Rifugio Vittorio Sella and Valnontey,
 ± 2250 m.
35. *Lotus corniculatus* L.
 coll. no.: G.5285 2n=24

- origin: Valley of Aosta, roadside between Sarre and Aosta.
 coll. no.: G.5543 $2n=24$
 origin: Valley of Aosta, meadow near Nus, ± 600 m.
 coll. no.: G.5568 $2n=24$
 origin: Valley of Aosta, between Nus and Ville sur Nus. In a meadow, ± 900 m.
 coll. no.: G.5595 $2n=24$
 origin: Valley of Aosta, between Nus and Chateau de Nus, ± 800 m.
 coll. no.: G.5611 $2n=24$
 origin: Valley of Aosta, between Nus and Ville sur Nus, in a meadow, ± 1200 m.
36. *Medicago sativa* L.
 coll. no.: G.5266 $2n=32$
 origin: Valley of Aosta, near Chateau de Sarre.
- 37.* *Ononis repens* L.
 coll. no.: G.5601 $2n=60$
 origin: Valley of Aosta, in a meadow near Nus, ± 900 m.
- 38.* *Ononis spinosa* L.
 coll. no.: G.5291 $2n=30$
 origin: Valley of Aosta, roadside near Sarre.
39. *Vicia cracca* L.
 coll. no.: G.5243 $2n=28$
 origin: Valley of Aosta, near La Salle, ± 900 m.
 Along the river Dora Baltea.

LILIACEAE

40. *Allium oleraceum* L.
 coll. no.: G.5533 $2n=40$
 origin: Valley of Aosta, roadside near Sarre.
41. *Asparagus officinalis* L.
 coll. no.: G.5569 $2n=20$
 origin: Valley of Aosta, between Nus and Ville sur Nus.
 Roadside, ± 900 m.

MALVACEAE

42. *Malva neglecta* Wallr.
 coll. no.: G.5289 $2n=42$

origin: Valley of Aosta, in a meadow along the road
Aosta - Sarre.

PAPAVERACEAE

43. *Chelidonium majus* L.
coll. no.: G.5235 $2n=12$
origin: Valley of Aosta, near La Salle, ± 900 m.
Along the river Dora Baltea.

PLANTAGINACEAE

44. *Plantago lanceolata* L.
coll. no.: G.5274 $2n=12$
origin: Valley of Aosta, near Chateau de Sarre.

PRIMULACEAE

- 45.* *Samolus valerandi* L.
coll. no.: G.5587 and G.5591 $2n=26$
origin: Valley of Aosta, on a very wet rock by a small
mountain stream, near Nus, ± 800 m.

ROSACEAE

- 46.* *Potentilla argentea* L.
coll. no.: G.5632 $2n=14$
origin: National Park « Gran Paradiso ».
Between Rifugio Vittorio Sella and Valnontey,
 ± 1200 m.
coll. no.: G.5656 $2n=14$
origin: National Park « Gran Paradiso ».
Valnontey, roadside, ± 1650 m.
coll. no.: G.5574, G.5575 and G.5578 $2n=42$
origin: Valley of Aosta, Ville sur Nus, ± 1400 m.
On a very dry Sth.-exposed slope.
coll. no.: G.5585 $2n=42$
origin: Valley of Aosta, near Ville sur Nus, ± 1500 m.
On a wall.
47. *Potentilla crantzii* (Crantz) G. Beck ex Fritsch
coll. no.: G.5492 $2n=28$
origin: National Park « Gran Paradiso ».

- Col de Lausson, ± 2900 m.
 coll. no.: G.5524 $2n=28$
 origin: National Park « Gran Paradiso ».
 Rifugio Vittorio Sella, ± 2540 m.
 coll. no.: G.5628 $2n=42$
 origin: National Park « Gran Paradiso ».
 In a meadow, between Rifugio Vittorio Sella
 and Valnontey, ± 2200 m.
48. *Potentilla reptans* L.
 coll. no.: G.5295 $2n=28$
 origin: Valley of Aosta, roadside near Sarre.

SCROPHULARIACEAE

49. *Linaria vulgaris* Miller
 coll. no.: G.5557 $2n=12$
 origin: Valley of Aosta, near Nus, roadside, ± 600 m.
50. *Veronica persica* Poiret
 coll. no.: G.5237 $2n=28$
 origin: Valley of Aosta, near Morgex, ± 900 m.
 In a dry river-bed of the Dora Baltea.

UMBELLIFERAE

51. *Daucus carota* L.
 coll. no.: G.5283 $2n=18$
 origin: Valley of Aosta, Chateau de Sarre, in a meadow.
52. *Pastinaca sativa* L.
 coll. no.: G.5264 $2n=22$
 origin: Valley of Aosta, near Chateau de Sarre.

VALERIANACEAE

53. *Kentranthus ruber* (L.) DC.
 coll. no.: G.5259 $2n=32$
 origin: Valley of Aosta, on the wall of Chateau de
 Sarre.

NOTES ON SOME SPECIES

1.* *Lappula squarrosa* (Retz.) Dum.

This species was counted by LÖVE and LÖVE (1956) and by MULLIGAN (1957). They published their results under the synonyms *Lappula myosotis*

Moench and *Lappula echinata* Gilib., respectively. In both cases the chromosome number turned out to be $2n=48$. The present authors could confirm these results. Besides *Lappula squarrosa* two other species of this genus were studied previously: *Lappula deflexa* (Wg.) Garcke: $2n=24$ (KNABEN and ENGELSKJÖN 1967) and *Lappula heteracantha* Ledeb.: $2n=48$ (BAKSAY 1956).

These results indicate that the most probable basic number of this genus is $x=12$.

3.* *Lycopsis arvensis* L.

Previous results obtained on this species demonstrate that the exact chromosome number could not be determined with certainty: $2n=ca. 48$ (LÖVE and LÖVE 1956); $2n=ca. 54$ (SVENSSON 1925). The present investigation showed without any doubt that the plants of the valley of Aosta have $2n=48$.

4.* *Symphytum officinale* L.

Symphytum officinale L. is a very variable species (GADELLA and KLIPHUIS 1967, 1969; GADELLA, KLIPHUIS and KRAMER 1970, in press; TUTIN 1956; WADE 1958).

Three cytotypes are known. ($2n=24$, $2n=40$ and $2n=48$).

In the Netherlands diploids ($2n=24$) seem to have a restricted distribution. Hitherto only two small populations in a small area (osier bed) were found (GADELLA and KLIPHUIS 1967).

This cytotype is also known from Eastern Germany (near Gotha) and Hungary (near Dabas).

In the present study, plants with $2n=24$ chromosomes have been reported from the Valley of Aosta.

Dutch and Italian material investigated showed in the diploids the occurrence of B chromosomes. In the diploid plants from Germany and Hungary these additional chromosomes were never met with.

Many populations in Western Germany, the Netherlands, Austria (Burgenland) and the North of Yugoslavia consist entirely of tetraploid plants. It seems to be the most common type in Europe. In the Netherlands it occurs frequently on dikes and along roads.

Plant with $2n=40$ chromosomes were found in the Netherlands only. They are very common in very moist places on low moor peat.

BUCKNALL (1913) treats in his revision of the genus *Symphytum* the species. *Symphytum uliginosum* Kern. The Dutch material with $2n=40$

chromosomes closely matches BUCKNALL's description. According to BUCKNALL (*l.c.*) this species occurs in Hungary and the South of Russia.

It is a remarkable fact that, as far as is known, all diploid plants are white flowered. Tetraploids have also purple and red flowers. White flowered tetraploids and white flowered diploids are morphologically indistinguishable. The $2n=40$ type is nearly always purple flowered. Morphologically this type is somewhat different from the $2n=48$ type.

Crossing experiments showed that the diploids are reproductively isolated from the $2n=40$ type and to a very large extent also from the tetraploid plants. Only twice a triploid hybrid could be produced after many unsuccessful attempts. The $2n=40$ type is capable of exchanging genes with the tetraploid ($2n=48$). Their hybrids ($2n=44$) are fully fertile (GADELLA and KLIPHUIS 1969).

7.* *Cerastium arvense* L. subspecies *strictum* (Haenke) Gaudin

The plants originating from the National Park « Gran Paradiso » have the chromosome number $2n=36$.

The habit of these plants differs considerably from that of the Dutch plants of the same species, which belong to the subspecies *arvense* ($2n=72$). Plants of this subspecies are larger, loosely matted and have non flowering shoots which are nearly as long as the flowering stems. The Italian plants, belonging to the subspecies *strictum*, retained their characteristics in the experimental garden of the University of Utrecht.

11.* *Achillea setacea* Waldst. et Kit.

This species is sometimes regarded as variety of *Achillea millefolium* L.: *Achillea millefolium* L. var. *setacea* Koch. In Hegi, *Illustrierte Flora von Mittel Europa* VI, 2 page 573-574, 1929, *Achillea setacea* is treated as a separate species, but the following note is added to the description: « *Achillea setacea* ist jedenfalls nur eine xerophile Rasse von *Achillea millefolium*, die besser den Rang einer Unterart verdient ».

The chromosome number, $2n=18$, however, differs from that of *Achillea millefolium* ($2n=54$).

Besides morphological differences, there is also a cytological one. This supports the view that the different forms are not conspecific.

12.* *Centaurea nervosa* Willd.

The plants studied largely match the description of *Centaurea nervosa* (cf. Hegi, *Illustrierte Flora von Mittel-Europa* VI. 2: 956-958, 1929). The

leaves and the involucre scales agree with *Centaurea nervosa*, but the plants differ from this species in having more flowerheads per stem, a character of the related species *Centaurea phrygia* L. The specimens studied may possibly be hybrids. Both species have the chromosome number $2n=22$ (PODDUBNAJA-ARNOLDI 1931; FAVARGER 1953). In the present authors' opinion the whole complex *Centaurea phrygia/Centaurea nervosa* would be extremely suitable for further cytotaxonomic investigations.

16.* *Hieracium amplexicaule* L.

The chromosome number of this species turned out to be $2n=27$. Previously, GADELLA and KLIPHUIS (1968) published the number $2n=36$, for material found in the Netherlands.

POLATSCHEK (in litt.), however, drew our attention to the fact that the Dutch material did not belong to *Hieracium amplexicaule*, but to *Hieracium pulmonarioides* Vill. The material was identified by us with the aid of the Schoolflora van Nederland by HEUKELS and VAN OOSTSTROOM (1962). According to this Flora our material belongs to *Hieracium amplexicaule*. ZAHN (1921) distinguished two grexes in the species *Hieracium amplexicaule* L.: grex *Hieracium amplexicaule* (L.) Zahn and grex *Hieracium pulmonarioides* (Vill.) Zahn. The Dutch material completely agrees with the description of the grex *pulmonarioides*, the Italian with the grex *amplexicaule*.

Studies in reproduction biology are necessary to obtain a better insight in the mode of reproduction (sexually or agamosperously). It seems likely that the triploid type reproduced agamosperously.

17*, 18.* *Hieracium pilosella* L. and *Hieracium peleterianum* Mérat.

Both species belong to the subgenus *Pilosella*, section *Pilosellina*, (rosette-bearing, one flower-head per scape). The basic number in the genus *Hieracium* is $X=9$. Polyploidy is common in the section *Pilosellina*: $2n=18, 27, 36, 45, 54$ and 63 , (TURESSON and TURESSON 1960; GADELLA and KLIPHUIS 1968 *b, c*; SKALINSKA 1967).

In *Hieracium pilosella* the numbers $2n=36, 45, 54$ and 63 were counted in Sweden (the $2n=45$ type has the most extended distribution in Sweden according to TURESSON and TURESSON (*l.c.*)). In the Netherlands the tetraploid type is abundant, the pentaploids are far less common. In Austria tetraploids, pentaploids and hexaploids were found repeatedly in Burgenland and Steiermark (GADELLA, KLIPHUIS and KRAMER 1970, in press). In Poland the pentaploid was found frequently, the hexaploid occasionally in the Tatra mountains (900-1700 m.).

These results show that in spite of extensive investigations in various parts of Europe never diploid plants of *Hieracium pilosella* were found.

Therefore, the authors were rather surprised to find diploid plants near Aosta. These plants have been concisely diagnosed and there can be no doubt with regard to their assignment to *Hieracium pilosella*. This opinion was confirmed by Prof. Dr. J. L. VAN SOEST, a *Hieracium*-specialist, Rijks-herbarium of Leyden.

The diploid plants belong to the very large and polymorphic group *Hieracium eu-pilosella*, characterized by the non-floccose upperside of the leaves. The tetraploid plants belong to the same group. The higher polyploids, from Italy, however, are characterized by grey leaves, floccose on upperside as well as underside and by very long runners. Also the scape is much longer than in the diploids. Both pentaploids and hexaploids ($2n=45$ and $2n=54$ respectively) from Italy undoubtedly belong to the group *Hieracium incanum* (DC.) Zahn (cf. Hegi, *Illustrierte Flora von Mittel-Europa*, VI, 2, p. 1198-1202, 1929). The members of this group have a different geographic distribution and are mainly confined to mountainous areas. They usually occur at higher altitudes (900-2500 m., exceptionally descending to ± 450 m.).

The other diploid plants belong to the species *Hieracium peleterianum* Mérat. In Sweden also polyploids were found (TURESSON and TURESSON, l.c.), but in the Netherlands only diploids were met with (GADELLA and KLIPHUIS 1968b). Once two plants with the number $2n=27$ were found on the Isle of Terschelling, province of Friesland, but these plants are probably hybrids between *Hieracium pilosella* ($2n=36$) and *Hieracium peleterianum* ($2n=18$).

A study of the reproduction biology of some Dutch plants revealed the fact that tetraploids reproduce sexually, pentaploids agamosperously. The pentaploid and hexaploid types from Italy have not yet been subjected to such investigations.

26.* *Sedum ochroleucum* Chaix subsp. *montanum* (Song. et Perr.) D.A. Webb.

The *reflexum*-group of the section *Sedum* of the genus *Sedum* is represented in Europe by the following species: *Sedum sediforme* (Jacq.) Pau, *Sedum ochroleucum* Chaix in Vill., *Sedum reflexum* L., *Sedum forsterianum* Sm. in Sowerby, *Sedum tenuifolium* (Sibth. et Sm.) Strobl, *Sedum pruinaatum* Link ex Brot.

The taxonomy of the group is not yet clearly understood. One of the reasons responsible for this situation is perhaps the scarcity of well preserved herbarium specimens.

For that reason the authors decided to study living plants of all species of this group, both from the morphological and cytological point of view.

Flowering and fruiting stems as well as non flowering shoots were preserved in a solution of 70% alcohol. Many living plants were collected in various parts of Europe and cultivated in the Botanical Garden of Utrecht.

Cytological studies showed that two basic numbers are present in the *reflexum* group: $X=16$ and $X=17$. *Sedum ochroleucum* fits in with the $X=17$ series. In *Sedum ochroleucum* diploids and triploids were found near Valnontey in Italy, with $2n=34$ and $2n=51$ chromosomes respectively.

Tetraploid plants ($2n=68$) have been found in various parts of Yugoslavia, but these plants belong to the subspecies *ochroleucum*, whereas the diploid and triploid plants of the West Alps belong to the subspecies *montanum*.

The differences, which are retained in cultivation, are:

subspecies *ochroleucum*: petals 7-10 mm., erect, creamy-coloured. Plant early flowering (second half of June); $2n=34$.

subspecies *montanum*: petals 7-8 mm., patent, dark yellow. Plant late flowering (from the first week of July onwards); $2n=68$.

Webb (in *Flora Europaea* I, p. 358-359, 1964) is of the opinion that the two taxa are conspecific and treats them as subspecies. Huber (in *Hegi, Illustrierte Flora von Mittel-Europa* IV, 2a, p. 88-89, 1963) treats them as distinct species: *Sedum montanum* Perr. et Song and *Sedum ochroleucum* Chaix in Vill.

The cytological differences seem to support Huber's opinion, but according to Webb intermediate forms occur in Yugoslavia.

It is the intention of the authors to carry out some crossing experiments between the two subspecies. These crossing experiments, however, are hampered by the differences in flowering period. The results of these planned experiments possibly give valuable indication with regard to the taxonomic position of the diploid and tetraploid plants. Moreover, continued cytological research is necessary before we can arrive at more definite conclusions concerning the taxonomic rank of the two forms.

27.* *Alyssum alyssoides* (L.) L.

The basic number of the genus *Alyssum* is $X=8$.

MANTON (1932), BÖCHER and LARSEN (1958) and MULLIGAN (1964) found $2n=32$ for this species, whereas the present authors counted $2n=24$.

37*, 38.* *Ononis spinosa* L. and *Ononis repens* L.

In these species the numbers $2n=30$ and $2n=30, 60$ were found re-

spectively. Previous results obtained on these species are: $2n=30$ (LARSEN 1956; TSCHETCHOW 1933) and $2n=32$ (MORISSET 1964; MORTON 1956; TSCHETCHOW 1933) for *Ononis spinosa* and $2n=30$ (LARSEN 1956), $2n=32$ (REESE 1952), $2n=60$ (LARSEN 1956) and $2n=64$ (MORISSET 1964; MORTON 1956) for *Ononis repens*.

In Flora Europaea II p. 147, 1968, R.B. Ivemy-Cook expresses the opinion that the numbers $2n=32$ and $2n=64$ may be due to incorrect interpretation of the chromosome number. Generally one pair of chromosomes possesses a long constriction so that it frequently appears to be two pairs.

GADELLA and KLIPHUIS 1966 and 1968 published the numbers $2n=32$ and $2n=30$ for *Ononis spinosa*. A reinvestigation clearly showed that the long constriction in one pair of the chromosomes in the $2n=32$ type was present. Therefore the chromosome number $2n=32$ must be regarded as incorrect. The correct number is: $2n=30$.

45.* *Samolus valerandi* L.

This species is characterized by three chromosome numbers: $2n=24$ (Schleswig-Holstein, WULFF 1937; Canary Islands, LARSEN 1960), $2n=26$ (Roumania, TARNAVSCHI 1948; Portugal, RODRIGUES 1953; Italy, MORI 1957; The Netherlands, GADELLA and KLIPHUIS 1968), $2n=36$ (Roumania, TARNAVSCHI 1948; France, LÉVÊQUE and GORENFLOT 1969).

LÉVÊQUE and GORENFLOT (1969) remark that all investigated plants are collected near the sea coast. Therefore it is interesting to note that the plants from Aosta clearly show $2n=26$, a number which was also found in all Dutch plants sampled near the coast of the North Sea.

46.* *Potentilla argentea* L.

This species was subjected to numerous cytological investigations (for references see LÖVE and LÖVE 1961).

In the Valley of Aosta and the National Park « Gran Paradiso », diploids ($2n=14$) and hexaploids ($2n=42$) were found. The diploids are prostrate or procumbent plants, the hexaploids erect. These plants retained their characteristics in cultivation.

Ball, Pawlowski and Walters (Flora Europaea II, p. 41, 1968) divide the *Potentilla argentea* group into three species. The diploid plants are assigned to *Potentilla argentea* L., the hexaploid plants to *Potentilla neglecta* Baumg., whereas a third species, *Potentilla calabra* Ten., occurring in the Balcan Peninsula, was not yet subjected to cytological investigation.

A close comparison of the characters of the Italian diploid and hexa-

ploid plants made clear that the species *Potentilla neglecta* and *Potentilla argentea* show intergradation. The specimens examined have the same number of teeth at the margin of the leaflets, whereas the lobes may be acute in both diploid and hexaploid plants. Only the procumbent or ascending habit of the diploid and the erect habit of the hexaploid are distinctive.

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SUMMARY

The chromosome number of 53 species of Angiosperms, occurring in the Valley of Aosta and in the National Park « Gran Paradiso » was determined. Some notes on the taxonomy of some species are presented in this paper.