

CYTOTAXONOMY OF SPANISH PLANTS.
III. DICOTYLEDONS: SALICACEAE - ROSACEAE

ÁSKELL LÖVE & EBBE KJELLQVIST

Institute of Arctic and Alpine Research, University of Colorado,
Boulder, Colorado 80302, U.S.A.

&

Agricultural Research and Introduction Centre, Izmir-Karsiyaka, Turkey

(Recibido el 10 de octubre de 1973)

Resumen. Se continúa con este tercer artículo una serie de trabajos sobre citotaxonomía de plantas españolas, procedentes de regiones montañosas del sur y centro del país. Se estudia el número cromosómico de 91 taxones de los cuales son nuevos, al parecer, o difieren de los conocidos previamente, los siguientes: *Willwebera montana* (L.) Löve & Löve subsp. *intricata* (Dufour) Löve & Löve, $2n = 28$; *Sabulina hybrida* (Vill.) Fourr., $2n = 138$; *Silene psammitis* Link, $2n = 24$; *Thalictrum speciosissimum* L., $2n = 28$; *Pulsatilla rubra* (Lam.) Delarbre subsp. *hispanica* Zimmermann, $2n = 32$; *Ranunculus granatensis* Boiss., $2n = 28$; *Ranunculus bulbosus* L. subsp. *adscendens* (Brot.) Neves, $2n = 16$; *Arabis parvula* Dufour, $2n = 32$; *Erophila praecox* (Stev.) DC., $2n = 36$; *Rapistrum rugosum* (L.) All. subsp. *orientale* (L.) Arcangeli, $2n = 16$; *Geum silvaticum* Pourret, $2n = 28$; *Potentilla reuteri* Boiss., $2n = 42$.

Se comenta la posición taxonómica de alguno de estos taxones, y se validan los nuevos taxones y combinaciones siguientes: *Willwebera* Löve & Löve; *Willwebera montana* (L.) Löve & Löve; *W. montana* subsp. *intricata* (Dufour) Löve & Löve; *Melandrium dioicum* (L.) Coss. & Germ. subsp. *divaricatum* (Reichenb.) Löve & Löve; *Pleconax conica* (L.) Löve & Kjellqvist; *P. conica* var. *sartori* (Boiss. & Heldr.) Löve & Kjellqvist; *P. conica* var. *subconica* (Friv.) Löve & Kjellqvist; *P. conica* subsp. *ammophila* (Boiss. & Heldr.) Löve & Kjellqvist; *P. conica* var. *carpathae* (Chowdhuri) Löve & Kjellqvist; *P. conica* subsp. *amphorina* (Pomel) Löve & Kjellqvist; *P. conica* subsp. *coniflora* (Nees) Löve & Kjellqvist; *P. conica* subsp. *conoidea* (L.) Löve & Kjellqvist; *P. conica* subsp. *lydia* (Boiss.) Löve & Kjellqvist, y *P. conica* subsp. *macrodonata* (Boiss.) Löve & Kjellqvist.

Summary. This is the third in a series of papers on the cytotaxonomy of Spanish plants, mainly from two mountain regions in the southern and central parts of the country. It reports the chromosome number of 91 taxa of dicotyledons, among which the following are new or deviate from earlier reports: *Willwebera montana* (L.) Löve & Löve subsp. *intricata* (Dufour) Löve & Löve, $2n = 28$; *Sabulina hybrida* (Vill.) Fourr., $2n = 138$; *Silene psammitis* Link, $2n = 24$; *Thalictrum speciosissimum* L., $2n = 28$; *Pulsatilla rubra* (Lam.) Delarbre subsp. *hispanica* Zimmermann, $2n = 32$; *Ranunculus granatensis* Boiss., $2n = 28$; *Ranunculus bulbosus* L. subsp. *adscendens* (Brot.) Neves, $2n = 16$; *Arabis parvula* Dufour, $2n = 32$; *Erophila praecox* (Stev.) DC., $2n = 36$; *Rapistrum rugosum* (L.) All. subsp. *orientale* (L.) Arcangeli, $2n = 16$; *Geum silvaticum* Pourret $2n = 28$; *Potentilla reuteri* Boiss., $2n = 42$.

The taxonomy of several of the taxa is discussed briefly, and the following new taxa and combinations are validated: *Willwebera* Löve & Löve; *Willwebera montana* (L.) Löve & Löve; *W. montana* subsp. *intricata* (Dufour) Löve & Löve; *Melandrium dioicum* (L.) Coss. & Germ. subsp. *divaricatum* (Reichenb.) Löve & Löve; *Pleconax conica* (L.) Löve & Kjellqvist; *P. conica* var. *sartori* (Boiss. & Heldr.) Löve & Kjellqvist; *P. conica* var. *subconica* (Friv.) Löve & Kjellqvist; *P. conica* subsp. *ammophila* (Boiss. & Heldr.) Löve & Kjellqvist; *P. conica* var. *carpathae* (Chowdhuri) Löve & Kjellqvist; *P. conica* subsp. *amphorina* (Pomel) Löve & Kjellqvist; *P. conica* subsp. *coniflora* (Nees) Löve & Kjellqvist; *P. conica* subsp. *conoidea* (L.) Löve & Kjellqvist; *P. conica* subsp. *lydia* (Boiss.) Löve & Kjellqvist, and *P. conica* subsp. *macrodelta* (Boiss.) Löve & Kjellqvist.

This is the third paper in a series on the cytotaxonomy of Spanish plants, supported by NATO Science Grant No. 69. We refer to the introduction to the first paper (LÖVE & KJELLQVIST, 1972) for basic information on techniques and other primary considerations.

SALICACEAE

Salix elaeagnos Scop. subsp. *angustifolia* (Cariot) Rech. fil.

Voucher: Provincia de Jaén: Sierra de Cazorla, Vadillo; N. 0155. $2n = 38$.

This species of central and southern Europe is represented in its southwestern area by the subsp. *angustifolia* (RECHINGER, 1964). The chromosome number of this race, which is relatively frequent on borders of streams in the Sierra de Cazorla area, was found to be the diploid $2n = 38$, or the same as previously reported for Spanish plants by NEUMANN & POLATSCHKE (1972) and for the typical race, as *S. incana* L., inferred from a study of its hybrid with *S. hastata* L., by HAKANSSON (1955).

***Salix purpurea* L.**

Voucher: Provincia de Cuenca: Tragacete; N. 0403. $2n = 38$.

This common species is met with even at high altitudes in both the areas studied by us. Its chromosome number is a confirmation of several previous reports.

It is worth mentioning that a polysomatic layer was observed not far from the end of the root-tip; since it seemed to divide with about the same frequency as the normal diploid layer, perhaps such a phenomenon may be the cause of the reports of more than a single chromosome number for morphologically indistinguishable populations of *Salix*, as mentioned by ARGUS (1973).

MORACEAE

***Ficus carica* L.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Quesada; N. 0316. $2n = 26$.

A confirmation of the diploid chromosome number for this widespread southwest Asiatic and Mediterranean species.

URTICACEAE

***Urtica dioica* L.**

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0505.
 $2n = 52$.

Various authors have reported either $2n = 48$ or $2n = 52$ for populations of this widespread weed. We found only the latter in our material from Spain.

***Parietaria judaica* L.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Quesada; N. 0314. $2n = 26$.

A confirmation of previous reports for this southern and western European species. Because of confused nomenclature, it was reported from the area by

GALIANO & HEYWOOD (1960) as *P. erecta* Mert. & Koch, which is a frequently used synonym, as is *P. officinalis* L. (TOWNSEND, 1968; RAUSCHERT, 1973; BALL, 1964a).

POLYGONACEAE

Acetosella vulgaris (Koch) Fourr.

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0492.
 $2n = 42$.

This is the common hexaploid weed of fields in the lowland of central and northern Europe, which also has been spread to agricultural lands all over the world (LÖVE, 1943). It is rare in the Spanish fields, where the genus is represented by the diploid *A. angiocarpa* (Murb.) Á. Löve, but in the high mountains in the Iberian peninsula the hexaploid species is met with as a lowgrown race not very distinct from those of northern regions. In extreme cases this race is prostrate and small and very similar to the also hexaploid populations of the Atlas Mountains in North Africa, which have been given the name *Rumex atlanticus* Coss. that we regard as being synonymous only with *A. vulgaris*.

Rumex conglomeratus Murray

Voucher: Provincia de Jaén: Sierra de Cazorla, Quesada; N. 0320. $2n = 20$.

A confirmation of previous reports from elsewhere.

Rumex crispus L.

Voucher: Provincia de Cuenca: Tragacete; N. 0406. $2n = 60$.

A confirmation of numerous reports for this common dock.

Rumex obtusifolius L.

Voucher: Provincia de Cuenca: Tragacete; N. 0411. $2n = 20$.

A confirmation of previous reports. The material studied belongs to the subsp. *obtusifolius* which is the only race of the species occurring in this part of Europe.

Persicaria maculata (Rafin.) S. F. Gray

Voucher: Provincia de Cuenca: Tragacete; N. 0420. $2n = 44$.

A confirmation of previous results from elsewhere for this species, which is commonly placed as *Polygonum persicaria* L.

PORTULACACEAE

Montia fontana L. subsp. **amporitana** Sennen

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0537.
 $2n = 20$.

A confirmation of previous counts for various races of this species. For variations of this perhaps collective taxon we refer to the recent treatment by MOORE (1963).

ILLECEBRACEAE

Paronychia argentea Lam.

Voucher: Provincia de Jaén: Sierra de Cazorla, Quesada; N. 0333. $2n = 36$.

This is a confirmation of a previous report from the area around Aragon, by LORENZO-ANDREU & GARCÍA-SANZ (1950), whereas RODRIGUES (1953) and BLACKBURN & MORTON (1957) counted only $2n = 28$ from other Iberian localities. We are under the impression that the difference between these reports, and also numbers for other species of the genus which are multiples of basic numbers other than $x = 9$, may be apparent rather than real and caused by difficulties in getting clear metaphases of the small and usually crowded chromosomes typical of the group.

Spergula rubra (L.) D. Dietr.

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0575.
 $2n = 36$.

This is a confirmation of the tetraploid number, which has been most frequently reported for this species, although RATTER (1964a, 1964b) also observed higher and lower numbers in taxa so named.

***Spergula pentandra* L.**

Vouchers: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 055;
 Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0498.
 $2n = 18$.

This is a confirmation of a recent report from Portugal by FERNANDES & LEITAO (1971).

ALSINACEAE

***Arenaria serpyllifolia* L.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Guadalquivir, near Pantano del Tranco; N. 0232. $2n = 40$.

This is a confirmation of numerous reports of the tetraploid chromosome number of the type species of the genus *Arenaria* L., which in its strict sense has the basic number $x = 10$. The other European section *Grandiflorae* McNeill, which differs not only morphologically but also cytologically from the Linnaean genus in its strict sense by having the basic number $x = 11$, has recently been given a generic status under the name *Cernohorskyia* by LÖVE & LÖVE (1974a).

***Willwebera montana* (L.) Löve & Löve subsp. *intricata* (Dufour) Löve & Löve**

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0482.
 $2n = 28$.

Although McNEILL (1962, 1963) greatly improved on the classification of the genera of *Alsinaeae* studied by him, he demonstrated a common timidity to draw conclusions deviating from the classical points of view even when observing fundamental differences between some of the taxa observed. Therefore, both the genera *Arenaria* and *Minuartia* as delimited by him continue to be unnatural assemblages which remain in need of a biologically based revision some of which could not be done at the time of his work because of lack of cytological information. One of the most distinct of the species which he included in *Arenaria*, following LINNAEUS (1755) and others, is *A. montana* L. which stands so far from all other species of the group in morphological characteristics that McNEILL (1962) placed it in a section

of its own, *Planosepalae*, unrelated to other groups and monotypic. It is also characterized by a karyotype somewhat different from the other sections, and, above all, by the basic number $x = 7$, which it shares with no other closely related taxon. It apparently has all the characteristics of a good genus: it is morphologically clearly distinct, forms an evolutionary line of its own as shown by its basic chromosome number, and has a complete crossability barrier towards its possible relatives as indicated by its karyotype and chromosome number (cf. LÖVE & LÖVE, 1974b) and the complete lack of hybrids, natural and artificial. Because of this distinction, we believe it is most appropriate to accept this section and species as a genus in its own right. For it we propose the name **Willwebera** Löve & Löve, gen. nov., based on *Arenaria* L. sectio *Planosepala* McNeill, in *Notes Roy. Bot. Gard. Edinb.* 24: 113 (1962). The genus is conspicuous by its mat-like or ascending growth form, large leaves and large sepals, which are never keeled but always obscurely nerved with at least a single median nerve and frequently with a couple of pairs of lateral nerves.

The type species of the new genus is **Willwebera montana** (L.) Löve & Löve, comb. nov., based on *Arenaria montana* L., *Cent. Pl.* 1: 12 (1755). Its typical race, subsp. *montana*, is common from northwest through central France to the Iberian peninsula, whereas in the southern part of Spain it is replaced by the rather distinct subsp. **intricata** (Dufour) Löve & Löve, comb. nov., based on *A. intricata* Dufour ex Ser. in DC., *Prodr.* 1: 410 (1824); *A. montana* L. subsp. *intricata* (Dufour) Pau.

It gives the authors a great pleasure to name this genus in honor of Professor William A. Weber, Curator of the Herbarium of the University Museum of the University of Colorado at Boulder, with whom they have been closely associated for a decade enjoying his stimulating company and deep knowledge of taxonomical and geographical botany.

The southern Spanish race differs from the typical subspecies by its larger and straggling stems; longer but narrower leaves; ovate, acute or subobtuse sepals without scarious margins, as contrasted to the typical race with its lanceolate to ovate, acute or subacute sepals with scarious margins; and the pedicels are glandular whereas the widespread taxon has eglandular pedicels.

The exact tetraploid number $2n = 28$ which we found in material of the subsp. *intricata* has previously been reported for subsp. *montana* by FAVARGER (1962), whereas BLACKBURN & MORTON (1957) counted only $2n = 20$ and FERNANDES & LEITAO (1971) observed $2n = 30$, perhaps

because of some mistake of identification or because of the possible occurrence of B-chromosomes.

***Sabulina hybrida* (Vill.) Fourr.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Pantano del Tranco; N. 0159.
 $2n = 138$.

All the subgenera of *Minuartia* as defined by McNEILL (1962) have previously been described as distinct genera and ought to be kept as such as long as there is not ample evidence for their closer biological relationship. Also, some of the sections and subsections which McNEILL (1962) accepts from MATTFELD (1922) and others, have been regarded as genera by able authors of the past, who judged their morphological characteristics differently and separated them to avoid to include heterogeneity in the genus. In some such cases recent cytological evidence strongly supports the latter philosophy, especially when widely distinct basic chromosome numbers and clear variation of the karyotype are met with.

One such group which MATTFELD (1922) and McNEILL (1962) accepted as a section only of the subgenus *Minuartia* had been named as the genus *Sabulina*, by REICHENBACH (1832), though only if restricted by typification, as a section, by *M. tenuifolia* (L.) Hiern that excludes the subgenus *Alsinarthus* also included in it by REICHENBACH (1832). Since it seems safe to conclude that its basic chromosome number is the derived $x = 23$, in addition to its annual habit and self pollination mechanism as contrasted to most other groups of the collective genus, we regard it as wise to retain it as a genus in its own right.

The taxonomy of several of the taxa of the genus *Sabulina* is rather confused, as shown by McNEILL (1962, 1963). So have also been reports on the cytology of the species involved, probably mainly because seeds from plants collected without sufficient care have been used. Our plants, determined by aid of the keys and descriptions by McNEILL (1963) and HALLIDAY (1964), seem to belong to the subsp. *hybrida*, although according to FRIEDRICH (1962) they would belong to his subsp. *vallantiana* (DC.) Friedr. for which FAVARGER (1962, 1967) reported $2n = 46$, from the area that according to FRIEDRICH (l. c.) is occupied only by his subsp. *hybrida*. The fact that both McNEILL (l. c.) and HALLIDAY (l. c.) regard these taxa to be synonymous does not decrease the confusion, whereas the occurrence of both the diploid and hexaploid chromosome numbers within the complex may show a possible way to the solution of the problem.

According to FAVARGER (1962), the very closely related species *S. mesogitana* (Boiss.) Hand.-Mazz. has $2n = 22$ chromosomes only, whereas LÖVE & LÖVE (unpubl.) found material from a couple of localities in the eastern Mediterranean to have $2n = 46$. Likewise, LÖVE & LÖVE (unpubl.) determined the number $2n = 46$ on material of the species *S. mediterranea* (Ledeb.) K. Maly from the coasts of the northern Adriatic Sea, although BLACKBURN & MORTON (1957) had reported $2n = 20$ and FAVARGER (1962) found $2n = 24$. Therefore, we feel safe to conclude that the genus *Sabulina* is characterized by the secondary polyploid basic number $x = 23$ only, and that other reports must have been based on some mistakes in the classification of the material investigated.

***Stellaria alsine* Grimm**

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0541
 $2n = 24$.

This is a confirmation of previous reports from elsewhere.

***Alsine pallida* Dum.**

Vouchers: Provincia de Jaén: Sierra de Cazorla, Laguna de Valdeazores and Nava de San Pedro; N. 032 and N. 0290. $2n = 22$.

In order to avoid heterogeneity in the genus *Stellaria*, we believe in accepting the genus *Alsine* in its strict and original sense as typified by the species *A. media* L. and including only the closest relatives of that taxon. The species *A. pallida* is often regarded only as the var. *apetala* Gaudin of *Stellaria media*, although its morphology and cytology clearly support its specific status. The chromosome number here reported is a confirmation of several previous observations; the deviating number, $2n = 24$, recently reported by FERNANDES & LEITAO (1971), is perhaps an indication of the occurrence of B-chromosomes, although we have not seen such deviations in our material.

***Dichodon cerastoides* (L.) Reichenb.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Valley of Rio Borosa, N. 069A.
 $2n = 38$.

Cytological evidence in form of a distinct basic number and chromosome

morphology strongly supports the separation of the species *D. cerastoides* and its relatives from the genera *Cerastium* and *Stellaria*, as proposed by REICHENBACH (1841, cf. IKONNIKOV, 1973) and more recently by BOIVIN (1966) on purely morphological grounds. The species *D. cerastoides* (or *Cerastium cerastoides* (L.) Britton) is not included from this area by GALIANO & HEYWOOD (1960), and we collected it only in this single locality, where it grew together with *Cerastium glomeratum* Thuill., probably as a waif. The chromosome number is a confirmation of numerous reports from other regions.

***Cerastium boissieri* Gren.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0283.
 $2n = 72$.

This is a confirmation of previous reports from elsewhere.

***Cerastium brachypetalum* Pers. subsp. *tauricum* (Sprengel) Murb.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Valley of Rio Borosa; N. 071.
 $2n = 90$.

This is a confirmation of previous reports for this and some other races of this variable species in its strict sense.

***Cerastium glomeratum* Thuill.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Valley of Rio Borosa; N. 069.
 $2n = 72$.

This is a confirmation of numerous previous reports. Our material seems to be referable to the var. *corollinum* (Fenzl) Rouy & Fouc., although that variety may be of only a small taxonomical significance.

CARYOPHYLLACEAE

***Silene muscipula* L.**

Voucher: Provincia de Jaén: Sierra de Cazorla, roadsides between Cazorla and Peal de Becerro; N. 0354. $2n = 24$.

This is a confirmation of a single previous report by BLACKBURN (1928) for this western Mediterranean species.

Silene psammitis Link

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0244.
 $2n = 24$.

This seems to be the first report for this Iberian endemic species.

Silene nocturna L.

Voucher: Provincia de Jaén: Sierra de Cazorla, roadsides between Cazorla and Peal de Becerro; N. 0362. $2n = 24$.

This confirms previous reports for this Mediterranean species.

Silene gallica L.

Voucher: Provincia de Málaga: about 4 km west of Málaga, in crevices in a rock close to the sea; N. 013. $2n = 24$.

This is a confirmation of several previous reports for this weedy species.

Silene colorata Poiret

Vouchers: Provincia de Jaén: Sierra de Cazorla, Pantano del Tranco; N. 0161. Sierra de Cazorla, Nava de San Pedro; N. 0244. Sierra de Cazorla, Vadillo; N. 0392. $2n = 24$.

This is a confirmation of two previous reports from the western and eastern Mediterranean region. The plants from Vadillo are referable to the var. *pubicalicyna* Fenzl, which is of a doubtful taxonomical value.

Pleconax conica (L.) Löve & Kjellqvist

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0243.
 $2n = 20$.

This is a confirmation of earlier reports, although some authors have mistakenly reported $2n = 24$ chromosomes. LÖVE & KJELLQVIST (1972) discuss in detail the reasons for the revival of this biologically and morphologically distinct genus and review its variations. However, in selecting for

it the generic name *Conosilene* Fourr. (1868), they overlooked the availability of the older and validly published generic name *Pleconax* Rafin., described by RAFINESQUE (1840), renaming as *P. striata* Rafin. the type species *Silene conica* L. (cf. MERRILL, 1949; PENNELL, 1921). The single species name accepted by RAFINESQUE (1840) for this genus must be regarded as a superfluous name, though the Linnaean epithet does not seem to have been transferred to this genus. Therefore, we hereby validate the combination ***Pleconax conica*** (L.) Löve & Kjellqvist, comb. nov. (based on *Silene conica* L., *Sp. Pl.*: 418, 1753), for the plant cytologically studied by us from the Sierra de Cazorla. It is, in our view, the only species of the genus, and includes the following subspecies and varieties: subsp. *conica*, with var. *conica*, var. **sartori** (Boiss. & Heldr.) Löve & Kjellqvist, comb. nov. (based on *Silene sartori* Boissier & Heldreich, in Boissier, *Diagn. Pl. Orient. Nov.* 3(1): 53, 1856), and var. **subconica** (Friw.) Löve & Kjellqvist, comb. nov. (based on *Silene subconica* Friwaldszky, *Flora*, 18: 334, 1835); subsp. **ammophila** (Boiss. & Heldr.) Löve & Kjellqvist, comb. nov. (based on *Silene ammophila* Boissier & Heldreich, in Boissier, *Diagn. Pl. Orient. Nov.*, 2(8): 82, 1849), with the var. *ammophila* and var. **carpathae** (Chowdhuri) Löve & Kjellqvist, comb. nov. (based on *Silene ammophila* subsp. *carpathae* Chowdhuri, *Notes Roy. Bot. Gard. Edinb.*, 22: 278, 1957); subsp. **amphorina** (Pomel) Löve & Kjellqvist, comb. nov. (based on *Silene amphorina* Pomel, *Nouv. Mat. Atl.*: 330, 1860); subsp. **coniflora** (Nees) Löve & Kjellqvist, comb. nov. (based on *Silene coniflora* Nees von Esenbeck ex Otth, in DC., *Prodr.*, 1: 331, 1824); subsp. **conoidea** (L.) Löve & Kjellqvist, comb. nov. (based on *Silene conoidea* L., *Sp. Pl.*: 418, 1753); subsp. **lydia** (Boiss.) Löve & Kjellqvist, comb. nov. (based on *Silene lydia* Boissier, *Diagn. Pl. Orient. Nov.*, 1(1): 37, 1843); and subsp. **macrodonata** (Boiss.) Löve & Kjellqvist, comb. nov. (based on *Silene macrodonata* Boissier, *Diagn. Pl. Orient. Nov.*, 1(1): 37, 1843). Of these taxa, only *P. conica* subsp. *conica* var. *conica* and subsp. *conoidea* are known to occur in Spain.

Melandrium dioicum (L.) Coss. & Germ. subsp. **divaricatum** (Reichenb.)
Löve & Löve

Voucher: Provincia de Jaén: Sierra de Cazorla, El Chorro; N. 0376. $2n = 24$.

Although this is a confirmation of numerous previous reports for this taxon, it seems to be the first observation made on apparently wild material from the area where it is native. It is closely related to the more northern subsp. *dioicum*, the taxon of open fields characterized by white flowers, but

differs from it in several characters and also in geographical distribution, since the present subspecies is distinctly Mediterranean. Although the taxon was given its subspecific name by LÖVE & LÖVE (1961), this was done without a formal transfer. Therefore, we wish to add the necessary references: *Melandrium dioicum* (L.) Coss. & Germ. subsp. *divaricatum* (Reichenb.) Löve & Löve, comb. nov., based on *Lychnis divaricata* Reichenb., *Pl. Crit.*, 4: 3 (1826); *Melandrium album* (Miller) Garcke subsp. *divaricatum* (Reichenb.) Le Grand. The complete interfertility within the taxa of this dioecious group of taxa has been thoroughly proven by aid of numerous experiments (cf. D. LÖVE, 1944).

PAEONIACEAE

***Paeonia officinalis* L. subsp. *humilis* (Retz.) Cullen & Heywood**

Voucher: Provincia de Jaén: Sierra de Cazorla, Pico Cabañas, limestone ravine; N. 08. $2n = 20$.

This is a confirmation of many previous reports for the species and of a couple of earlier reports of the chromosome number of this southwest European race.

HELLEBORACEAE

***Helleborus foetidus* L.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Pico Cabañas; N. 0116. $2n = 32$.

This confirms several earlier reports from elsewhere.

***Trollius europaeus* L.**

Voucher: Provincia de Cuenca: 30 km. from Tragacete on the road towards Cañete; N. 0474. $2n = 16$.

This is a confirmation of numerous reports from many countries.

***Aconitum lamarckii* Reichenb.**

Voucher: Provincia de Teruel: Sierra de Albarracín, Cerro de San Felipe;
N. 0443. $2n = 16$.

This is a confirmation of two earlier reports from the Alps.

THALICTRACEAE

***Aquilegia vulgaris* L.**

Voucher: Provincia de Cuenca: 30 km. from Tragacete on the road towards
Cañete; N. 0473. $2n = 14$.

A confirmation of earlier reports from elsewhere.

***Thalictrum speciosissimum* L.**

Vouchers: Provincia de Jaén: Sierra de Cazorla, Vadillo and Guadahornillos;
N. 048 and N. 0101. $2n = 28$.

This is the first report of the chromosome number of this Iberian taxon, which frequently has been included in the species *T. flavum* L. as its subsp. *glaucum* (Desf.) Batt. and is so named by HEYWOOD (1961) and by TUTIN (1964b). Since *T. flavum* s. str. is characterized by the dodecaploid chromosome number $2n = 84$, as shown by numerous authors, there can be no doubt that these two taxa are not conspecific and that the Iberian plant ought to be retained as species as originally proposed.

RANUNCULACEAE

***Anemone palmata* L.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0251.
 $2n = 16$.

A confirmation of the diploid number for this southwest European species, previously reported from cultivated material only. The report of the tetraploid number, by LANGLET (1932), has certainly been based on a misidentification.

Hepatica nobilis Miller

Vouchers: Provincia de Teruel: Sierra de Albarracín, Cerro de San Felipe and Casa Forestal; N. 0437 and N. 0425. $2n = 14$.

This is a confirmation of numerous reports from other regions. Our material belongs to the var. *hispanica* Willk., a taxon of doubtful importance.

Pulsatilla rubra (Lam.) Delarbre subsp. **hispanica** Zimmermann

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0486. $2n = 32$.

This chromosome number has previously been reported for other collections of this southwest European species, but not for material belonging to the subsp. *hispanica*, which differs from subsp. *rubra* in having blackish or purplish-violet flowers, though this character is not easily recognizable on herbarium specimens, and the leaves developing with the flowers (cf. ATICHELE & SCHWEGLER, 1957). It is possible that this race ought to be lowered to varietal level, although we hesitate to propose this without additional evidence.

Clematis vitalba L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Arroyo Maillar; N. 043. $2n = 16$.

This is a confirmation of previous reports. Our material came from a dense *Pinus* forest with dominant *Pteridium berediae* on calcareous soil.

Ficaria verna Hudson subsp. **ficariiformis** (F. W. Schultz) Rouy & Fouc.

Voucher: Provincia de Jaén: Sierra de Cazorla, Pico Cabañas, N. 01. $2n = 16$.

This is a confirmation of previous reports for the diploid mainly western European species which ought to be maintained as distinct from the tetraploid and bulbiferous species *F. bulbifera* (Marsden-Jones) Holub. The Iberian race is at least very closely related to the subsp. *calthifolia* (Reichenb.) Velen. of more eastern parts of the Mediterranean and southeastern Europe, and both may perhaps be regarded as two varieties only of the same southern subspecies. Our plants also seem to belong to the more local and doubtful var. *degenii* (Hervier) Pau.

Batrachium omniophyllum (Ten.) C. D. Cook

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0559.
 $2n = 16$.

This is a confirmation of earlier reports for this species in its restricted sense.

Batrachium rhipiphyllum (Bast.) Dum.

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0525.
 $2n = 32$.

This is a confirmation of earlier reports for this taxon, which in the genus *Ranunculus* carries the name *R. peltatus* Schrank (cf. COOK, 1966).

Batrachium trichophyllum (Chaix) F. W. Schultz, s. str.

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 059.
 $2n = 48$.

This confirms the hexaploid number for this species in its strict sense, as reported from elsewhere by several authors (cf. LARSEN & LAEGAARD, 1971), whereas some others have given the tetraploid number $2n = 32$ for material so named. It is possible that at least some of these latter reports have been caused by misidentification of the next taxon, although other errors are also thinkable.

Batrachium confervoides Fries subsp. **lutulentum** (Perr. & Song.) Viehr.

Voucher: Provincia de Cuenca: Tragacete; N. 0401. $2n = 32$.

This count confirms the chromosome number of this south European alpine race of the arctic-alpine species, which sometimes is erroneously regarded as a race only of the previous species. This is also a confirmation of its occurrence in the mountains of Spain, from where it was previously known only in the Pyrenées (COOK, 1966).

Ranunculus repens L.

Vouchers: Provincia de Jaén: Sierra de Cazorla, Vadillo; N. 047. Provincia de Cuenca: Tragacete; N. 0419. $2n = 32$.

This is a confirmation of numerous previous reports from elsewhere.

Ranunculus acris L.

Voucher: Provincia de Teruel: Sierra de Albarracín, Cerro de San Felipe; N. 0457. $2n = 14$.

This is a confirmation of several previous reports for the typical race of this widespread species.

Ranunculus granatensis Boiss.

Voucher: Provincia de Jaén: Sierra de Cazorla, Laguna de Valdeazores; N. 018. $2n = 28$.

This is the first report of the chromosome number of this Spanish endemic taxon, which was tentatively placed as a subspecies of *R. acris* by TUTIN (1964a), following NYMAN (1878). Although our observation clearly invalidates that earlier conclusion for this taxon, all the other races placed at the subspecific level of *R. acris* by TUTIN (l. c.) are diploid with $2n = 14$ chromosomes and thus may be fully interfertile although this has not yet been experimentally demonstrated. COLES (1971) concluded, however, that the most correct classification of the complex would be to place it into the three species *R. acris* s. str., *R. granatensis*, and *R. strigulosus* Schur, the first one including three subspecies and five varieties.

Ranunculus bulbosus L. subsp. adscendens (Brot.) Neves

Voucher: Provincia de Jaén: Sierra de Cazorla, Laguna de Valdeazores; N. 016. $2n = 16$.

This is a confirmation of several previous reports of the diploid number for this species, and a first report for the Iberian subspecies. We follow COLES (1973) in accepting only two subspecies of this taxon, since the other races so classified by TUTIN (1964a) are apparently either synonyms or hybrids. One such fertile hybrid, subsp. *aleae* (Willk.) Rouy & Fouc., or subsp. *bulbosus* x subsp. *adscendens*, was observed in our material from the provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0496, and found to be diploid, as expected.

Ranunculus arvensis L.

Voucher: Provincia de Cuenca: Tragacete; N. 0413. $2n = 32$.

This is a confirmation of several previous reports.

Ranunculus parviflorus L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Laguna de Valdeazores; N. 020. $2n = 28$.

This confirms previous reports. There seems to be a reason to doubt the identification of the diploid plant so named by NEVES (1944), since it stands alone and unconfirmed.

Ranunculus flammula L.

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0534. $2n = 32$.

This confirms previous reports from elsewhere.

Ranunculus gramineus L.

Vouchers: Provincia de Jaén: Sierra de Cazorla, Guadahornillos; N. 0105.
Provincia de Teruel: Sierra de Albarracín, Cerro de San Felipe; N. 0455. $2n = 16$.

This confirms previous reports for this southern European endemic.

BERBERIDACEAE

Berberis hispanica Boiss. & Reuter

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 061. $2n = 28$.

This is the first report from Europe for this western Mediterranean mountain taxon, which has been studied earlier by QUÉZEL (1957) on North African material. As in the case of the other tetraploid Mediterranean taxon, *B. aetnensis* C. Presl, this plant has sometimes been regarded as a subspecies or variety only of *B. vulgaris* L. with which they hybridize (GALIANO &

HEYWOOD, 1960). As long as good experimental evidence to support the assumption of their complete interfertility is not available, it seems safer to accept them all as distinct species, as did WEBB (1964).

PAPAVERACEAE

Papaver rhoeas L.

Voucher: Provincia de Jaén: Sierra de Cazorla, roadsides between Cazorla and Peal de Becerro; N. 0356. $2n = 14$.

This confirms several previous reports.

Papaver hybridum L.

Voucher: Provincia de Jaén: Sierra de Cazorla, roadsides between Cazorla and Peal de Becerro; N. 0341. $2n = 14$.

This confirms numerous previous reports.

BRASSICACEAE

Barbarea vulgaris R. Br.

Voucher: Provincia de Teruel: Sierra de Albarracín, Cerro de San Felipe; N. 0446. $2n = 16$.

This is a confirmation of numerous earlier reports. The material seems to belong to the subsp. *arcuata* (Opiz) Simk., which according to BALL (1964b) is not worthy of separate recognition, a claim that we doubt although the taxon may be more correctly accepted as a variety only.

Nasturtium officinale R. Br.

Vouchers: Provincia de Jaén: Sierra de Cazorla, El Chorro; N. 0128. Provincia de Cuenca: Tragacete; N. 0424. $2n = 32$.

This confirms numerous previous reports from elsewhere.

Cardamine rivularis Schur

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0511.
 $2n = 16$.

The plants of the *C. pratensis* L. complex belonging to this collection seem to verify the suggestion by JONES (1964) that this species from the mountains of southeastern Europe also occurs in the mountains of southern and western Europe, including the Iberian peninsula. Although it is the only taxon of the group studied by us from Spain, it is not the only species of this complex occurring in this part of southwestern Europe.

Cardamine hirsuta L.

Vouchers: Provincia de Jaén: Sierra de Cazorla, Vadillo, and Valley of Rio Borosa; N. 052 and N. 082. $2n = 16$.

This is a confirmation of numerous earlier reports.

Arabis parvula Dufour

Voucher: Provincia de Jaén: Sierra de Cazorla, El Chorro; N. 0378. $2n = 32$.

This is apparently a new record of the species for the area (cf. GALIANO & HEYWOOD, 1960), and also the first report of the chromosome number of this endemic species of the western Mediterranean of Europe and Africa.

Arabis verna (L.) R. Br.

□¹

Voucher: Provincia de Jaén: Sierra de Cazorla, Laguna de Valdeazores; N. 034. $2n = 16$.

A confirmation of a recent report by BURDET (1967) for this widespread Mediterranean species.

Alyssum alyssoides (L.) L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Pantano del Tranco; N. 0176.
 $2n = 32$.

This is a confirmation of several previous reports for this taxon in its strict sense.

***Alyssum minus* (L.) Rothm.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Torre del Vinagre; N. 0264.
 $2n = 16$.

A confirmation of an earlier report for this south European species (cf. BALL & DUDLEY, 1964).

***Draba hispanica* Boiss.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0278.
 $2n = 16$.

This confirms a recent report by MERXMÜLLER & BUTTLER (1965) for this endemic species of rocky areas of high mountains in eastern and southern Spain.

***Draba muralis* L.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Valley of Rio Borosa; N. 072.
 $2n = 32$.

This confirms previous counts from elsewhere by REESE (1952) and MERXMÜLLER & BUTTLER (1965).

***Erophila praecox* (Stev.) DC.**

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro. N. 057.
 $2n = 36$.

This seems to be the first report of the chromosome number for this species, which is common in the Mediterranean but rare further north in Europe. We prefer to ignore the treatment by WALTERS (1964), who groups the taxa of the *E. verna* complex as subspecies only of a single species, and follow WINGE (1940) in regarding them as distinct species, although we must disregard the nomenclature which he proposed.

***Capsella rubella* Reuter**

Voucher: Provincia de Jaén: Sierra de Cazorla, Valley of Rio Borosa; N. 068.
 $2n = 16$.

This is a confirmation of a previous report by HILL (1927), who studied cultivated material from Botanical Gardens.

Hornungia petraea (L.) Reichenb.

Voucher: Provincia de Jaén: Sierra de Cazorla, Laguna de Valdeazores; N. 033. $2n = 12$.

This confirms previous reports for this widespread and small annual.

Thlaspi improprium Jordan

Vouchers: Provincia de Jaén: Sierra de Cazorla, Valley of Rio Borosa; N. 070.
Provincia de Teruel: Sierra de Albarracín, Casa Forestal; N. 0435.
 $2n = 42$.

According to MARKGRAF (1961), the variable species *T. perfoliatum* L. falls nicely into the two varieties, var. *perfoliatum* and var. *improprium* (Jordan) Gren., the latter of a south European distribution. Our material belongs to the variation of the latter taxon, which has also been regarded as the species *T. improprium* Jordan which is not even mentioned by CLAPHAM (1964). Its chromosome number is apparently $2n = 42$, although $2n = 40$ was reported by POLATSCHEK (1966) from the eastern Alps under the name *T. perfoliatum*, whereas *T. perfoliatum* L. s. str. has $2n = 70$, as established for German material by JARETZKY (1932) and Swedish material by LÖVKVIST (in WEIMARCK, 1963)..

Iondraba auriculata (L.) Webb & Berth.

Voucher: Provincia de Jaén: Sierra de Cazorla, roadsides between Cazorla and Peal de Becerro; N. 0338. $2n = 16$.

A confirmation of earlier reports by JARETZKY (1932) and MANTON (1932) for this western Mediterranean species. The occurrence of the two basic numbers $x = 8$ and 9 in the genus *Biscutella* as circumscribed by GUINEA & HEYWOOD (1964) indicates that it would be wiser to revive the generic name *Iondraba* Reichenb. for the $x = 8$ species, at the same time as it ought to be emended to include also the series *Lyratae* Malinovski of the Linnaean genus.

Moricandia moricandioides (Boiss.) Heywood

Voucher: Provincia de Jaén: Sierra de Cazorla, roadsides between Cazorla and Peal de Becerro; N. 0361. $2n = 28$.

This is a confirmation of previous reports by VALDÉS BERMEJO (1970) and FERNÁNDEZ-CASAS (1973) for this endemic species of south-central and eastern Spain. Our plants have shortly cucullate sepals and seeds less than 2 mm. long so they are referable to the var. *microsperma* (Willk.) Heywood.

Diplotaxis muralis (L.) DC.

Voucher: Provincia de Jaén: Sierra de Cazorla, Quesada; N. 0318. $2n = 42$.

Although LÜBBERT (1951) reported $2n = 44$ for German material of this species, six reports of $2n = 42$ seem to make it safe to conclude that her counts were either inexact or made on specimens with B-chromosomes (cf. HARBERD, 1972).

Sinapis alba L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Quesada; N. 0317. $2n = 24$.

This confirms numerous previous reports.

Eruca vesicaria L. subsp. **sativa** (Miller) Thell.

Vouchers: Provincia de Jaén: Sierra de Cazorla, Quesada, and roadsides between Cazorla and Peal de Becerro; N. 0319 and 0359. $2n = 22$.

This is a confirmation of several previous reports.

Rapistrum rugosum (L.) All. subsp. **orientale** (L.) Arcangeli

Voucher: Provincia de Jaén: Sierra de Cazorla, roadsides between Cazorla and Peal de Becerro; N. 0363. $2n = 16$.

Although this number is a confirmation of several previous reports for the species, it seems to be the first count for the Mediterranean subspecies, which is probably met with only as an introduction in this area.

RESEDACEAE

Reseda phyteuma L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Guadahornillos, N. 0106.
 $2n = 12$.

This is a confirmation of previous reports which were based on material from Botanical Gardens only.

Reseda lutea L.

Vouchers: Provincia de Jaén: Sierra de Cazorla, Quesada, and roadsides between Cazorla and Peal de Becerro; N. 0322 and N. 0370. $2n = 48$.

This confirms earlier reports based on Botanical Garden material and on populations from Italy.

SAXIFRAGACEAE

Saxifraga tridactylites L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0239.
 $2n = 22$.

This is a confirmation of several reports from more northern localities.

Saxifraga granulata L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0241.
 $2n = 52$.

This is the number most frequently reported for this species. Deviating numbers are likely caused by difficulties in counting crowded metaphase plates, rather than being real variations in chromosome number within this mainly apomictic taxon.

MALACEAE

Amelanchier ovalis Medicus

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0234.
 $2n = 68$.

This is a confirmation of three previous reports for this species.

ROSACEAE

Filipendula vulgaris Moench

Voucher: Provincia de Jaén: Sierra de Cazorla, Nava de San Pedro; N. 0255.
 $2n = 14$.

A confirmation of previous reports.

Filipendula ulmaria (L.) Maxim.

Voucher: Provincia de Cuenca: 30 km. from Tragacete on the road towards Cañete; N. 0477. $2n = 14$.

A confirmation of previous reports. Although more authors have counted $2n = 16$ or even $2n = 15$ for this taxon, there can be no doubt that these counts are inexact and thus ought to be omitted from the literature (BAKER & BAKER, 1967).

Rosa canina L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Guadahornillos; N. 097.
 $2n = 35$.

This confirms numerous previous reports.

Geum rivale L. subsp. **rivale**

Voucher: Provincia de Teruel: Sierra de Albarracín, Cerro de San Felipe; N. 0442. $2n = 42$.

Geum rivale L. subsp. **urbanum** (L.) Löve & Löve

Voucher: Provincia de Teruel: Sierra de Albarracín, 11 km. south of Orihuela del Tremedal; N. 0561. $2n = 42$.

This confirms numerous previous reports for these interfertile races, the classification of which has recently been discussed by LÖVE & LÖVE (1974a).

Geum silvaticum Pourret

Voucher: Provincia de Jaén: Sierra de Cazorla, Arroyo Maillar; N. 040. $2n = 28$.

GAJEWSKI (1957), who studied material from Botanical Gardens, reported the hexaploid number $2n = 42$ for this species. However, our plants, which were collected in a dense *Pinus* forest on calcareous soil with dominant *Pteridium herediae*, were found to have the tetraploid number $2n = 28$ only, so perhaps the hexaploid material may have belonged to some other species.

Potentilla rupestris L.

Voucher: Provincia de Teruel: Sierra de Albarracín, Sierra Alta; N. 0490. $2n = 14$.

This is a confirmation of several earlier reports.

Potentilla erecta (L.) Rauschel

Voucher: Provincia de Cuenca: 30 km. from Tragacete on the road towards Cañete; N. 0476. $2n = 28$.

This confirms more than twenty previous reports for this species.

Potentilla reptans L.

Voucher: Provincia de Jaén: Sierra de Cazorla, Laguna de Valdeazores; N. 019. $2n = 28$.

This is a confirmation of almost a score of earlier reports.

Potentilla reuteri Boiss.

Voucher: Provincia de Teruel: Sierra de Albarracín, Cerro de San Felipe;
N. 0444. $2n = 42$.

This is the first chromosome number for this taxon. According to BALL, PAWLOWSKI & WALTERS (1968), it is probably a hybrid between *P. erecta* L. and *P. nevadensis* Boiss. The former putative parent is known to have $2n = 42$ chromosomes, whereas the latter remains cytologically unknown.

Fragaria vesca L.

Voucher: Provincia de Teruel: Sierra de Albarracín, Casa Forestal; N. 0434.
 $2n = 14$.

This is a confirmation of almost forty previous reports for various races of this very widespread species.

BIBLIOGRAPHY

- AICHELE, D. & H. W. SCHWEGLER (1957) Die Taxonomie der Gattung *Pulsatilla*. *Feddes Rept.* **60**: 1-230.
- ARGUS, G. W. (1973) The genus *Salix* in Alaska and the Yukon. *Natl. Mus. Canada Publ. Bot.* **2**: 1-279.
- BAKER, H. G. & I. BAKER (1967) The cytotaxonomy of *Filipendula* (Rosaceae) and its implications. *Amer. Journ. Bot.* **54**: 1027-1034.
- BALL, P. W. (1964a) *Parietaria* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* **1**: 68-69.
- (1964b) *Barbarea* R. Br., in T. G. TUTIN & al. (eds.), *Flora Europaea* **1**: 281-282.
- BALL, P. W. & T. R. DUDLEY (1964) *Alyssum* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* **1**: 297-304.
- BALL, P. W., B. PAWLOWSKI & S. M. WALTERS (1968) *Potentilla* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* **2**: 36-47.
- BLACKBURN, K. B. (1928) Chromosome numbers in *Silene* and the neighbouring genera. *Zeitschr. Ind. Abst. Vererbungsl., Suppl.* **1**: 439-446.
- BLACKBURN, K. B. & J. K. MORTON (1957) The incidence of polyploidy in the Caryophyllaceae of Britain and Portugal. *New Phytol.* **56**: 344-351.
- BOIVIN, B. (1966) Énumération des plantes du Canada. III - Hérbidées, 1^{er} partie: Digeratae: Dimerae, Liberae. *Nat. Canad.* **93**: 583-646.
- BURDET, H. M. (1967) Contribution à l'étude caryologique des genres *Cardaminopsis*, *Turritis* et *Arabis* en Europe. *Candollea* **22**: 107-156.
- CLAPHAM, A. R. (1964) *Thlaspi* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* **1**: 318-322.
- COLES, S. M. (1971) The *Ranunculus acris* L. complex in Europe. *Watsonia* **8**: 237-261.
- (1973) *Ranunculus bulbosus* L. in Europe. *Watsonia* **9**: 207-228.
- COOK, C. D. K. (1966) A monographic study of *Ranunculus* subgenus *Batrachium* (DC.)

- A. Gray. *Mitt. Bot. Staats. München* 6: 47-237.
- FAVARGER, C. (1962) Contribution à l'étude cytologique des genres *Minuartia* et *Arenaria*. *Bull. Soc. Neuchâtel. Sci. Nat.* 85: 53-81.
- (1967) Nombres chromosomiques de quelques taxa principalement balkanique du genre *Minuartia* (L.) Hiern. *Bot. Jahrb.* 86: 280-292.
- FERNANDES, A. & M. T. LEITÃO (1971) Contribution à la connaissance cytotaxinomique des Spermatophyta du Portugal. III. Caryophyllaceae. *Bol. Soc. Brot.* 45: 143-176.
- FERNÁNDEZ CASAS, J. (1973) Números cromosómicos de plantas españolas, I. *Cuad. Ci. Biol. (Granada)* 2: 39-41.
- FRIEDRICH, H. (1962) *Minuartia* Loebl., in G. HEGI, *Illustrierte Flora von Mitteleuropa*, ed. 2, Liefg. 5.
- GAJEWSKI, W. (1957) A cytogenetic study on the genus *Geum* L. *Monogr. Bot. (Warszawa)* 4: 1-116.
- GALIANO, E. F. & V. H. HEYWOOD (1960) *Catálogo de plantas de la provincia de Jaén (Mitad oriental)*. Jaén.
- GUINEA, E. & V. H. HEYWOOD (1964) *Biscutella* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* 1: 325-330.
- HÅKANSSON, A. (1955) Chromosome numbers and meiosis in certain *Salices*. *Hereditas* 41: 454-483.
- HALLIDAY, G. (1964) *Minuartia* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* 1: 125-132.
- HARBERD, D. J. (1972) A contribution to the cyto-taxonomy of *Brassica* (Cruciferae) and its allies. *Bot. Journ. Linn. Soc.* 65: 1-23.
- HEYWOOD, V. H. (1961) The flora of the Sierra de Cazorla, S.E. Spain. I. *Feddes Repert.* 64: 28-73.
- HILL, S. E. (1927) Chromosome numbers in the genus *Bursa*. *Biol. Bull.* 53: 413-415.
- IKONNIKOV, S. (1973) Notae de Caryophyllaceis, 1. *Novit. Syst. Plant. Vasc.* 10: 136-142.
- JARETZKY, R. (1932) Beziehungen zwischen Chromosomenzahl und Systematik bei den Cruciferen. *Jahrb. Wiss. Bot.* 76: 485-527.
- JONES, B. M. G. (1964) *Cardamine* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* 1: 285-289.
- LANGLET, O. (1932) Über Chromosomenverhältnisse und Systematik der Ranunculaceae. *Svensk Bot. Tidskr.* 26: 381-400.
- LARSEN, K. & S. LAEGAARD (1971) Chromosome studies of the Sicilian flora. *Bot. Tidsskr.* 66: 249-268.
- LINNAEUS, C. (1755) *Centuria plantarum*, 1. Holmiae.
- LORENZO-ANDREU, A. & P. GARCÍA-SANZ (1950) Chromosomas somáticos de plantas espontáneas en la estepa de Aragón. II. *Anal. Est. Exper. Aula Dei* 2: 12-20.
- LÖVE, A. (1943) Cytogenetic studies on *Rumex* subgenus *Acetosella*. *Hereditas* 30: 1-136.
- LÖVE, A. & E. KJELLQVIST (1972a) Cytotaxonomy of Spanish plants. I. Introduction. Pteridophyta and Gymnospermae. *Lagascalia* 2: 23-35.
- & E. KJELLQVIST (1972b) Cytotaxonomical vindication of the genus *Conosilene*. *Journ. Indian Bot. Soc.* 50A: 366-376.
- & D. LÖVE (1961) Chromosome numbers of central and northwest European plant species. *Op. Bot. (Lund)* 5: 1-581.
- & D. LÖVE (1974a) Nomenclatural adjustments in the Yugoslavian flora. II. Pteridophytes and Dicotyledons. *Preslia* 46(2).

- LÖVE, A. & D. LÖVE (1974b) The natural genera of Gentianeae. *Recent Advances in Botany. P. N. Mehra Jubilee Volume* (in press).
- LÖVE, D. (1944) Cytogenetic studies on dioecious *Melandrium*. *Bot. Notiser* 1944: 125-213.
- LÜBBERT, G. (1951) Vergleichende cytologische, morphologische und physiologische Untersuchungen innerhalb der Gattung *Diplotaxis*. *Beitr. Biol. Pfl.* 28: 254-295.
- MANTON, I. (1932) Introduction to the general cytology of the Cruciferae. *Ann. Bot. (Oxford)* 46: 509-556.
- MARKGRAF, F. (1961) *Thlaspi* L., in G. HEGI, *Illustrierte Flora von Mitteleuropa*, ed. 2, Liefg. 4.
- MATTFELD, J. (1922) Geographisch-genetische Untersuchungen über die Gattung *Minuartia* (L.) Hiern. *Feddes Rept. (Beih.)* 15: 1-228.
- MCNEILL, J. (1962) Taxonomic studies in the Alsinoideae: I. Generic and infra-generic groups. *Notes Roy. Bot. Gard. Edinburgh* 24: 79-155.
- (1963) Taxonomic studies in the Alsinoideae II. A revision of the species in the Orient. *Notes Roy. Bot. Gard. Edinburgh* 24: 241-426.
- MERRILL, E. D. (1949) *Index Rafinesquianus*. Jamaica Plain.
- MERXMÜLLER, H. & K. P. BUTTLER (1965) Die Chromosomenzahlen der mitteleuropäischen und alpinen Draben. *Ber. Deutsch. Bot. Ges.* 77: 411-415.
- MOORE, D. M. (1963) The subspecies of *Montia fontana* L. *Bot. Not. (Lund)* 116: 16-30.
- NEUMANN, A. & A. POLATSCHEK (1972) Cytotaxonomischer Beitrag zur Gattung *Salix*. *Ann. Naturhist. Mus. Wien* 76: 619-633.
- NEVES, J. de BARROS (1944) Contribuição para o estudo cario-sistemático das espécies portuguesas do género *Ranunculus* L. *Diss. Univ. Coimbra* 1944: 1-200.
- NYMAN, C. F. (1878). *Conspectus florae europaeae* 1. Örebro.
- PENNELL, F. W. (1921) «Unrecorded» genera of Rafinesque. 1. *Autikon Botanikon* (1840). *Bull. Torrey Bot. Club* 48: 89-96.
- POLATSCHEK, A. (1966) Cytotaxonomische Beiträge zur Flora der Ostalpenländer. I. *Oesterr. Bot. Zeitschr.* 113: 1-46.
- QUÉZEL, P. (1957) Peuplement végétal des hautes montagnes de l'Afrique du Nord. *Encycl. Biogéogr. et Ecol.* 10: 1-463.
- RATTER, J. A. (1964a) Cytogenetic studies in *Spergularia*. I. Cytology of the old World species. *Notes Roy. Bot. Gard. Edinburgh* 25: 293-302.
- (1964b) Cytogenetic studies in *Spergularia*. II. An attempt to discover cytogenetic relationships of some species. *Notes Roy. Bot. Gard. Edinburgh* 26: 203-223.
- RAFINESQUE, C. S. (1840) *Autikon Botanikon*. Philadelphia.
- RAUSCHERT, S. (1973) Zur Nomenklatur der Farn- und Blütenpflanzen Deutschlands (III). *Feddes Rept.* 83: 645-662.
- RECHINGER, K. H. (1964) *Salix* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* 1: 43-54.
- REESE, G. (1952) Ergänzende Mitteilungen über die Chromosomenzahlen mitteleuropäischer Gefäßpflanzen. II. *Ber. Deutsch. Bot. Ges.* 66: 66-74.
- REICHENBACH, H. G. L. (1832) *Flora germanica excursoria*. Lipsiae.
- RODRIGUES, J. E. de M. (1953) Contribuição para o conhecimento cariológico das halófitas e psamófitas litorais. *Diss. Univ. Coimbra* 1953: 1-210.
- TOWNSEND, C. C. (1968) *Parietaria officinalis* and *P. judaica*. *Watsonia* 6: 365-370.
- TUTIN, T. G. (1964a) *Ranunculus* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* 1: 223-238.

- TUTIN, T. G. (1964b) *Thalictrum* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* 1: 240-242.
- VALDÉS BERMEJO, E. (1970) Estudios cariológicos en crucíferas españolas de los géneros *Moricandia* DC., *Vella* L., *Carrichtera* Adans. y *Hutera* Porta. *Anal. Inst. Bot. Cavanilles* 27: 125-133.
- WALTERS, S. M. (1964) *Erophila* DC., in T. G. TUTIN & al. (eds.), *Flora Europaea* 1: 312-313.
- WEBB, D. A. (1964) *Berberis* L., in T. G. TUTIN & al. (eds.), *Flora Europaea* 1: 245.
- WEIMARCK, H. (1963) *Skånes flora*. Lund.
- WINGE, Ö. (1940) Taxonomic and evolutionary studies in *Erophila* based on cytogenetic investigations. *Compt. Rend. Trav. Lab. Carlsberg, Sér. Physiol.* 23,3: 41-74.