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TAXONOMIC REMARKS ON SOME AMERICAN ALPINE PLANTS

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INTRODUCTION

Critical geobotanists have long realized that in all phytogeographical work exact biological classification is of the utmost importance, since even a minor mistake can result in conclusions so highly fallacious as to make them seriously misleading. It was this requirement that resulted in the chorological species concept by Wettstein (1898) and his school with its sometimes extreme splitting, because its followers felt, quite correctly, that for phytogeographical and other evolutionary purposes it would be a lesser evil to separate units that might be similar than to unite those that perhaps were distinct. The disadvantage of this concept was, however, its difficulty in distinguishing between the level of a species and its subordinate units, since morphological and chorological approaches are unable to observe with certainty the occurrence of the reproductive isolation that characterizes the genetical system which is the natural species. This disadvantage has, however, been overcome by aid of the so-called biological species concept (Mayr 1942, 1963; Á. Löve 1964a, b). That concept is based on the methods of cytogenetics which make it relatively simple to distinguish the species from its subspecific units and, therefore, make it possible to avoid much unnatural splitting. By aid of this concept and its methods, natural classification at lower levels becomes more secure than by aid of previous methods, although morphological and chorological approaches still are essential for the recognition of taxa and for the understanding of their historical development.

Many taxonomical decisions in the past had to be based not only on limited material but also on estimations of the significance of characters of different kinds, especially before the chorological concept became influential. Therefore, it is to be expected that methods which claim a somewhat higher degree of exactness, and concepts that are thought to be more accurate from the evolutionary point of view, will produce some adjustment in classification. This has been so whenever a new approach was added to the classification accepted by taxonomists and phytogeographers. The methods of biosystematists and their biological species concept are no exceptions to this rule, although it ought to be taken as a special eulogy to the great skill of past taxonomists that the classification they established on basis of exact morphological observations alone only rarely seems to require changes when the more advanced methods and points of view are applied.

The present paper deals with some changes in status and nomenclature which seem to be required in order to improve somewhat the classification of some American alpine plants which are of importance to the understanding of certain phytogeographic problems. These changes have been arrived at in connection with cytotaxonomical and experimental studies mainly on the flora of Mt. Washington in New Hampshire. The comprehensive results of these studies, which were performed in order to elucidate the history and evolution of the isolated alpine flora of this highest mountain peak in northeastern America, will be described in a book to be published elsewhere. However, it seems desirable that taxonomic alterations be proposed in a separate paper more easily available to taxonomists. Whenever necessary, results of supporting chromosome studies are mentioned, although a complete list of the chromosome numbers of the entire flora of Mt. Washington will be published elsewhere.

SOME TAXONOMIC REMARKS

DIPHASIUM SITCHENSE (RUPR.) LÖVE & LÖVE

As in ferns (Manton 1950; Pichi-Sermolli 1959; Löve & Löve 1961b), classification at generic and family level of the fern-allies has been greatly improved by aid of intensified morphological and biosystematic studies in recent years (Löve & Löve 1958; Löve 1962; Holub 1964; Rothmaler 1963). These studies have shown, among other matters, that the proposal by Rothmaler (1944) to divide the classical family Lycopodiaceae into several genera is morphologically and cytologically sound, and it has, therefore, been accepted even for the treatment of this group in Flora Europaea (Tutin & alii 1964). Although most of the lycopods of the alpine regions of North America have already been transferred to their appropriate genera when this view is accepted, the combination here proposed does not seem to have been made previously:

Diphasium sitchense (Rupr.) Löve & Löve, comb. nova, based on *Lycopodium sitchense* Ruprecht, in Beitr. z. Pflanzenk. Russ. Reich. 3 (1845), p. 30.

The species *D. sitchense* is met with in alpine regions and open woods and clearings at higher altitudes in eastern North America (Fernald 1923b; Victorin 1925; Hultén 1941-50). It also occurs in western North America and in eastern Asia south to Kamchatka, and in alpine, grassy barrens of Japanese mountains where it is represented by the variety *nikoënse* (Franch. & Sav.).

The chromosome number 2n = 46 is met with in *D. sitchense* from the alpine zone of Mt. Washington. That number has been found to be characteristic of all *Diphasium* species so far studied from elsewhere (Löve & Löve 1961b; Wilce 1961; Damboldt 1963), with the exception of the report of 2n = 68 for var. *nikoënse* from Japan studied by Mehra & Verma (1957). It is likely that this last report actually represents the triploid number 2n = 69 (3 x 23).

DIPHASIUM COMPLANATUM (L.) ROTHM.

SSP. FLABELLIFORME (FERN.) LÖVE & LÖVE

This much discussed eastern North American taxon was originally described as a variety only by Fernald (1901). Later authors have variously regarded it as a variety (Hultén 1962), subspecies (Clausen 1945; Löve &

Löve 1958) or species (Blanchard 1911; Rothmaler 1962). Since we can confirm the observation by Hultén (1962) that this taxon passes freely into the more northern ssp. *complanatum*, forming a zone in which distinctly intermediate but fertile specimens are frequent, we feel confident that Clausen (1945) was right in regarding this taxon as a subspecies of the more widespread main species and, therefore, propose the following new combination:

Diphasium complanatum (L.) Rothm. ssp. **flabelliforme** (Fern.) Löve & Löve, comb. nova, based on *Lycopodium complanatum* L. var. *flabelliforme* Fernald, in Rhodora 3 (1901), p. 280; *D. complanatum* ssp. *flabelliforme* (Fern.) R. T. Clausen, in Am. Fern Journ. 35 (1945), p. 17.

Specimens from various eastern North American sources of ssp. *complanatum* and ssp. *flabelliforme* have the chromosome number 2n = 46.

HUPERZIA SELAGO (L.) BERNH.

One of the most widespread of all lycopods, this variable species has been divided into a number of segregates at the species or various subspecific levels. Despite the fact that some authors, like Tolmatchev (1960a, b), have made careful analysis of material from parts of the range of the species in its wide sense, no general revision of the species has been made so far. Even chromosome studies have been found to be extremely difficult in this group, resulting in conflicting and confusing reports (cf. Löve & Löve 1961a,b).

The boreal and arctic variations of *H. Selago* have variously been classified as formae, varieties, subspecies, or species, and even recent authors show little consistency in selecting these levels. There seems to be ample morphological and geographical evidence (Tolmatchev 1960a,b) in support of the suggestion that the northern ssp. *arctica* (Grossh.) Löve & Löve is a genetically fixed extreme of *H. Selago* of a similar significance as are the alpine-arctic subspecies of *Lycopodium annotinum* and *L. clavatum*. Likewise, the ssp. *dentata* (Herter) Valentine from the Azores is apparently a distinct race at this level (Valentine 1964). The widely recognized alpine and arctic taxon which goes under the name ssp. *appressa* (Desv.) D. Löve, or var. *appressa* (Desv.), seems, however, to be only a modification due to environmental conditions, since a complete series of gradients between typical *H. Selago* with its patent leaves and ssp. *appressa* with its appressed leaves has been frequently observed on Mt. Washington within the same locality but in slightly different habitats. Similar observations have been made in more arctic situations in Greenland by Porsild & Porsild (1920) and Devold & Scholander (1933) and by the present writers in Iceland. Extreme variations in size, like those depicted by Kuzeneva (1953), are also frequent in the northlands and have been observed on Mt. Washington. As far as the observations reach, ssp. *appressa* seems to be produced in nature as easily as the arctic-maritime variation *Hippuris lanceolata* Fr. (= *H. tetraphylla* auct., non L.f., cf. Semenova-Tjan-Schanskaja 1959) can be produced from typical *H. vulgaris* L. in artificially altered environments (McCully & Dale 1961).

In the forest somewhat below the bald summit zone of Mt. Washington, typical *H. Selago* meets the taxon *H. lucidula* (Michx.) Rothm. We have frequently observed gradations between these taxa on New England mountains, indicating common hybridization and back-crossing without reproductive isolation. We are, therefore, of the opinion that this taxon ought to be regarded as a subspecies of *H. Selago* rather than to be retained as a species, since it seems to be no more distinct from the main type than is ssp. *arctica* of the northlands. It is common in cool woods in eastern North America. In its somewhat more southern part of the range it is represented, on sandstone and limestone cliffs, by the taxon *porophila;* since they cannot easily be separated in areas inhabited by both, we prefer to regard the latter as a variety only, in conformity with Clute (1905) and Victorin (1925).

In Pacific North America, the *H. Selago* group is represented by a more narrow-leaved taxon, which has been confused with *H. lucidula* by some authors (cf. Scoggan 1957). Its real identity is with the eastern Asiatic, or rather amphi-pacific, *H. chinense* (Christ) or its synonymous *H. Miyoshiana* (Makino), as pointed out by Hultén (1941-50, 1962). The present writers agree with Hultén (1962), who suggested its inclusion in *H. Selago* as a subspecies, though without proposing a valid transfer.

The Asiatic *H. serrata* (Thunb.) Rothm. certainly belongs to this complex and is, therefore, included here as a subspecies, although it is known only superficially by the present writers. But despite the possibility that several more or less isolated taxa from more southern regions may also belong here, as indicated by Rothmaler (1944) and suggested by Hultén (1962), their inclusion in the complex of subspecies of the polymorphic *H. Selago* ought not to be proposed until closer cytotaxonomical and morphological comparisons have been completed.

On the basis of the studies so far made on the cytotaxonomy of the *H. Selago* complex, we propose the following classification of the taxa within its arctic-boreal area of distribution:

Huperzia Selago (L.) Bernh.
ssp. *Selago.*
ssp. *arctica* (Grossh.) Löve & Löve.
ssp. *dentata* (Herter) Valentine.
ssp. **lucidula** (Michx.) Löve & Löve, comb. et stat. nov., based on *Lycopodium lucidulum* Michaux, Fl. Bor. Am. 2 (1803), p. 284.
    var. **porophila** (Lloyd & Underw.) Löve & Löve, comb. nov., based on *Lycopodium porophilum* Lloyd & Underwood, in Bull. Torrey Bot. Club 27 (1900), p. 150.
ssp. **chinensis** (Christ) Löve & Löve, comb. et stat. nov., based on *Lycopodium chinense* Christ, in Nuov. Giorn. Bot. Ital. N.S. 4 (1897), p. 101.
ssp. **serrata** (Thunb.) Löve & Löve, comb. et stat. nov., based on *Lycopodium serratum* Thunberg, Fl. Jap. (1784), p. 341.

The genus *Huperzia* is an unusually difficult one for cytological studies, as documented by the great variation in chromosome numbers reported not only from the same taxa but even by the same authors (cf. Löve & Löve 1961a,b). After much experimenting with different methods of fixation and staining, it has been at last possible to make exact counts of the chromosomes of material of ssp. *Selago* with appressed and patent leaves from Mt. Washington and also of ssp. *lucidula* from lower levels of that mountain. The chromosome number arrived at is $2n = 272$. This number was also reported by Löve & Löve (1961a) for typical *H. Selago,* whereas the slightly lower number $2n =$ c. 264 has been reported for that species by Manton (1950) and Löve & Löve (1958b), and by Mehra & Verma (1957) for American plants of ssp. *lucidula.* The much lower numbers $2n =$ c. 88 (Harmsen, in Löve & Löve 1948), and $2n =$ c. 90 (Sorsa 1962, 1963a,b) are certainly much too low estimates, and the number $2n =$ c. 68 reported by Löve & Löve (1961a) for ssp. *appressa* was, most likely, counted on an admixture of roots of a species of *Lycopodium* s.str., since it has not been verified in any of our numerous later collections from Mt. Washington.

POA FLEXUOSA SM. SSP. FERNALDIANA (NANNF.) LÖVE & LÖVE

The very critical so-called *Poa laxa* group was revised by Nannfeldt (1935), who found it to be best defined by aid of certain floral properties. He concluded that it could be naturally divided into the three central and south European species *P. laxa* Haenke, *P. minor* Gaud., and *P. Nyaradiana* Nannf., the northern amphi-atlantic *P. flexuosa* Sm., and the eastern North American *P. Fernaldiana* Nannf. According to Hultén (1941-50, 1958), the group is also represented in the northern Pacific region by *P. leptocoma* Trin. and related species. This conclusion seems to be based on some characters other than those typical of the *P. laxa* complex as defined by Nannfeldt (1935) and, therefore, must be regarded as doubtful.

Hylander (1945) was of the opinion that although *P. minor* and *P. Nyaradiana* are clearly distinct from *P. laxa*, the two northern species *P. flexuosa* and *P. Fernaldiana* are morphologically so closely related to *P. laxa* that he felt they were conspecific subspecies, validating the transfer for ssp. *flexuosa* (Sm.) Hyl. Although some later authors, including Hultén (1958), accept this treatment, it is clearly refuted by the observation by Nygren (1955) that whereas the three central and south European species of this amphimictic complex are tetraploid with 2n = 28 chromosomes, the two northern and Atlantic taxa are hexaploid with 2n = 42 and cannot, therefore, be races only of *P. laxa* from an evolutionary standpoint. There is reason to believe, mainly on morphological grounds but also on basis of some preliminary hybridization experiments, that the three tetraploid species are alloploids with the haplome constitutions AABB, AACC, and AADD, respectively. The northern taxa, however, seem to have the haplome constitution AABBEE, or the complete haplome of *P. laxa* added to some diploid haplome of another *Poa*, still unidentified. Hybridization studies support the opinion that they are nothing more than geographical races, at the subspecific level, of a single species, a conclusion also supported by their geographical distribution in North America, where *P. flexuosa* ssp. *flexuosa* is northern and ssp. *Fernaldiana* distinctly subarctic-alpine. The transfer of the latter was validated by Löve & Löve (in Löve & Solbrig 1964).

TRISETUM TRIFLORUM (BIGEL.) LÖVE & LÖVE

One of the many collective species, which have defied all efforts of classification by aid of classical morphological and chorological methods, is the species complex related to the grass *Trisetum spicatum* (L.) Richt. Although its variations have been recognized by many botanists, most proposals as to their status have been tentative. A recent attempt by Hultén (1959) is no exception to this rule.

Before the paper by Hultén (1959) was published, two chromosome numbers had been reported from this complex by Böcher & Larsen (1950) and more cytological information was forthcoming from Böcher (1959) and Morrison (1959a,b). Although this cytological information and that published by several earlier and some later authors does not include all the variations named by Hultén (1959), 8 of his 14 subspecies are cytologically known. Although most of these are tetraploid with 2n = 28 chromosomes, two have been found to be hexaploid with 2n = 42 in various localities in Iceland, Greenland, Canada, and New England by the present and earlier authors (Böcher & Larsen 1950; Böcher 1959; Morrison 1959a,b; Bowden 1960; Löve & Löve, unpubl.). The tetraploids are a heterogeneous group that may not be conspecific altogether, although the classification proposed by Hultén (1959) is adequate on basis of available data concerning these tetraploid taxa. These tetraploids are, as far as can be judged from data about the origin of the cytological material and the range informations given by Hultén (1959) for the subspecies: ssp. *spicatum* Spitsbergen: Flovik 1938, 1940; Sweden: Löve & Löve 1944; Greenland: Böcher & Larsen 1950; Holmen 1952; Böcher 1959; Central and northern Canada: Löve 1954; Bowden 1960; Morrison 1959a,b; Iceland (var. *villosissima* [Lge.] Louis-Marie): Löve & Löve 1956; Arctic Russia: Sokolovskaja 1955, 1962; Sokolovskaja & Strelkova 1960); ssp. *Congdonii* (Scribn. & Merr.) Hultén: California: Stebbins, in Myers 1947; ssp. *mongolicum* Hultén: Altai: Sokolovskaja & Strelkova 1948a; ssp. *ovatipaniculatum* Hultén: Caucasus: Sokolovskaja & Strelkova 1948b; ssp. *alaskanum* (Nash) Hultén: Japan: Tateoka 1954a, b, 1959; Sakhalin: Sokolovskaja 1960; Formosa: Chen & Hsu 1962; ssp. *toluccense* (Kunth) Hultén: Mexico: Beaman, De Jong & Stoutamire 1962.

The hexaploids, or ssp. *molle* (Michx.) Hultén and ssp. *pilosiglume* (Fern.) Hultén of Hultén's extremely collective species *T. spicatum*, however, are rather homogeneous and certainly not conspecific with any of the tetraploid taxa. Their possible specific distinction was vaguely suggested by Fernald (1916). There is ample reason to believe, from morphological data and cytological observations on artificial hybrids, that one is evolutionarily superimposed upon the other. This was, also, realized by Pavlov (1939), when he combined ssp. *pilosiglume* (Fern.) Pavlov as a race of *T. molle* (Michx.) Kunth. It was later accepted by Böcher (1959) and Löve & Löve (1961b). As such, this species certainly is morphologically easily distinguished from the tetraploid complex, even from certain hairy types. This was more easily recognized after their cytological differences, commonly observed in sibling species of this kind (Grant 1964; Löve 1964), became known.

Although the species rank for the hexaploid taxon is too evident to need further discussion, the question about its correct name is not as properly settled as indicated above. When Kunth (1833) proposed the specific name *T. molle* he based it upon *Avena mollis* described by Michaux (1803). This name, however, was a homonym that had been used twice, by Salisbury (1796) and Koeler (1802), and, although both these names are to be regarded as synonyms of, respectively, *Bromus mollis* L. and *Holcus mollis* L., the combination based on *A. mollis* doubtlessly is illegitimate and has to be rejected, on the basis of Article 64 of the International Code (Lanjouw & alii 1961). The oldest legitimate name for the hexaploid taxon seems to be *Melica triflora* given by Bigelow (1816) to a plant described from Mt. Washington as "villosa, panicula coarctata, glumis trifloris, corpuscula accessorio; flosculis aristatis" (cf. also Hitchcock & Chase 1951). Since it does not seem to have been previously transferred to the genus *Trisetum*, the combination is here proposed:

Trisetum triflorum (Bigel.) Löve & Löve, comb. nov., based on *Melica triflora* Bigelow, in New Engl. Journ. Med. Surg. 5 (1816), p. 334; Syn.: *Avena mollis* Michaux, Fl. Bor. Amer. 1 (1803), p. 72, non Salisbury 1796 neque Koeler 1802; *Trisetum molle* (Michx.) Kunth 1833.

The subspecies *pilosiglume* of Fernald (1916), Pavlov (1939), and Hultén (1959) is the only subspecies occurring on Mt. Washington, and so it is evidently a synonym only of ssp. *triflorum*. It is an eastern North American race, reaching Greenland and Iceland, and showing some variation that could perhaps be distinguished at varietal levels. Although the ssp.*molle* of Hultén, occurring from northeastern Asia to the Atlantic coast of northeastern America, also is somewhat variable, there is no doubt that it belongs to the same species as ssp. *triflorum*, as concluded by Pavlov (1939), Böcher (1959) and Löve & Löve (1961b). The name of this subspecies is *T. triflorum* ssp. **molle** (Hultén) Löve & Löve, comb. nov., based on *T. spicatum* ssp. *molle* Hultén, in Svensk Bot. Tidskr. 53 (1959), p. 216, since, according to Article 72 of the International Code, this name may be retained at this rank but attributed to Hultén based on his reference to Michaux' description but without direct reference to the illegitimate homonym.

ELYMUS DONIANUS (F.B. WHITE) LÖVE & LÖVE SSP. VIRESCENS (LGE.) LÖVE & LÖVE

The genus *Elymus* L. is typified by *E. sibiricus* L. (Hitchcock & Green 1929, and in Briquet 1935), which is closely related to *E. canadensis* L. but generically distinct from *E. arenarius* L. and its relatives, which are appropriately placed in the genus *Leymus* Hochst. (cf. Pilger 1954). The genus *Roegneria* C. Koch, which has often been placed in *Agropyron* Gaertn. s.l., is apparently congeneric with *Elymus* s.str. as shown by numerous hybridization experiments by various recent authors. It follows that the genus *Roegneria*, of recent Russian and Scandinavian authors, ought to be transferred in its entirety into *Elymus* L., although the necessary transfers for most of the species of this group described mainly by Russian botanists still have not been made. Several of these species may more plausibly be regarded as subspecies of more collective species which have not yet been sufficiently defined. The only species of the genus *Elymus*, so circumscribed, in the alpine zone of Mt. Washington and other New England mountains is *E. Donianus* which here is represented only by its arctic-alpine ssp. *virescens*, which is *Agropyron trachycaulon* var. *majus* of recent American manuals. The transfer of this name, and also of *E. subsecundus* (Link) Löve & Löve occasionally introduced near the railway tracks, was proposed by Löve & Löve (in Löve & Solbrig 1964).

Recent experiments also indicate that the genus *Elytrigia*, which is often included in *Agropyron* s.lat. or *Elymus* s.lat., is so closely related to *Agropyron* s.str. that it ought to be relegated to subgeneric status, as proposed by Nevski (1934).

AVENELLA FLEXUOSA (L.) DREJ.

The validity of the separation of the genus *Vahlodea* as a taxon distinct from the genus *Deschampsia* seems to be indisputable from taxonomic and biosystematic viewpoints. Its logical consequence, however, is a further consolidation of the strict genus *Deschampsia* by detaching from it the equally distinct genus *Avenella*, as pointed out by Löve & Löve (1956). That genus is represented on Mt. Washington and other eastern American mountains by the arctic-alpine ssp. *montana* (L.) Löve & Löve, but not by the lowland ssp. *flexuosa*.

Although the Mt. Washington populations of ssp. *montana* are generally typical, a few individuals have colorless spikes and therefore must represent the rather common mutation f.

pallida (Berlin) Löve & Löve, comb. nova, which was originally described, as *Aira flexuosa* var. *montana* f. *pallida*, from Greenland by Berlin (1884, in Kgl. Vetensk. Öfvers. 7, p. 77). A similar, but hardly identical, semialbino is apparently also rarely met with in ssp. *flexuosa*, at least in Scandinavia, as indicated by Sylvén (1931) mentioning a *Deschampsia flexuosa flavescens*, without description. Cedergren (1923) also mentioned a *pallida* form, without description. The latter name is not available for this corresponding form of ssp. *flexuosa* under Article 24 of the Code, but since it is of certain interest, we wish to validate the name proposed by Sylvén (l.c.) with the following description:

Avenella flexuosa ssp. *flexuosa* forma **flavescens** Sylvén: Panicula effusae, spiculis pallidis. Cf. Sylvén (1931), nomen.

CALAMAGROSTIS NUBILA LOUIS-MARIE

This species was described, by Louis-Marie (1944), on the basis of a single collection made by Boott at the Lakes-of-the-Clouds on Mt. Washington in 1862. It belongs to a group of sexual and highly polyploid species, including the rather widespread *C. Pickeringii* A. Gray and the more local endemics *C. Porteri* A. Gray, *C. insperata* Swallen, *C. perplexa* Scribn., *C. lacustris* (Kearney) Nash, *C. Fernaldii* Louis-Marie, *C. Lepageana* Louis-Marie, and *C. Poluninii* Th. Sör. *C. nubila* has never been found since it was first collected at the type locality of *C. Pickeringii*, a species which still is very frequent on wet slopes at the Lakes-of-the-Clouds. Therefore, it seems reasonable to suggest that it was either a rare mutation of *C. Pickeringii*, or a hybrid between it and some related species, or a related taxon that was succumbing to selection pressure when the last remaining specimen was collected by Boott in 1862.

CALAMAGROSTIS CANADENSIS (MICHX.)PB. and C. LANGSDORFII (LINK) TRIN.

These two species belong to a semiapomictic complex in which not only morphological gradations sometimes seem to transect some character combinations thought to be of importance in separating the taxonomic groups, but in which cytological data may also be confusing. Both can, however, be explained either by the fact that the haplomes making up these complexes are closely related, or by the occurrence of hybridization and rare backcrosses. Often, however, the cytological confusion is probably caused by uncritical acceptance of names used by authors of flora manuals.

The chromosome numbers so far reported for the complex under the name *C. Langsdorfii* are: $2n = 28$ (Tateoka 1954a, 1959; Sokolovskaja 1963), $2n = 42$ (Sokolovskaja 1963), $2n = 56$ (Sokolovskaja & Strelkova 1948a; Böcher & Larsen 1950), whereas the numbers reported under the name *C. canadensis* are: $2n = 42$ (Nygren 1954; Bowden 1960), $2n =$ c. 52 (Jörgensen, Sörensen & Westergaard 1958), $2n = 56$ (Nygren 1954; Stebbins, in Jörgensen, Sörensen & Westergaard 1958; Bowden 1960), and $2n = 45, 48, 49, 51, 62, 65, 66$ (Nygren 1954).

In the alpine zone of Mt. Washington and in the surrounding lowlands, two distinct types of this complex are encountered, in addition to less frequent intermediates. The extremes have been identified as *C. canadensis* var. *scabra* (Presl) Hitchc. and var. *Macouniana* (Vasey) Stebbins, and the somewhat intermediate plants as var. *robusta* Vasey, by recent American authors (Stebbins 1930; Fernald 1950; Hitchcock & Chase

1951; Gleason 1952). The var. *Macouniana* and var. *robusta* are, among other differences, distinguished by having flowers distinctly smaller than those of var. *scabra* (cf. Stebbins 1930; Harris 1964).

Some authors have been of the opinion (Britton & Brown 1913; Rydberg 1922; Böcher, Holmen & Jakobsen 1957) that the var. *scabra* is the species *C. Langsdorfii*, whereas Stebbins (1930), Fernald (1950), Gleason (1952), Hitchcock & Chase (1951), Jörgensen, Sörensen & Westergaard (1958), Nygren (1954, 1958) and others maintain that all the North American plants belong to *C. canadensis* and its races mentioned above. Hultén (1941-50, 1962) and Tolmatchev (1964), however, maintain that what is called *C. canadensis* var. *scabra* actually is *C. Langsdorfii*, whereas the other American varieties belong to *C. canadensis* s.str. As far as the present writers are able to judge from their comparisons of descriptions and material, the latter view ought to be retained, and it can easily be supported by available cytological evidence. When these species are strictly delimited, the species *C. Langsdorfii* is a plant with 2n = 56 chromosomes, and its distribution is almost circumpolar, since it reaches from Greenland westward to Scandinavia (cf. Hultén 1962; Tolmatchev 1964). The species *C. canadensis* s.str. is then an American plant with 2n = 42 chromosomes, ranging from Newfoundland to Alaska as shown by Hultén (1962), whereas the eastern Asiatic plants with 2n = 28 chromosomes reported by Tateoka (1954a, 1959) and Sokolovskaja (1963) apparently belong to the species *C. angustifolia* Kom. (cf. Tolmatchev 1964). The aneuploid numbers reported from American localities by Nygren (1954) apparently are hybrid derivatives, whereas the number 2n = 42 mentioned by Sokolovskaja (1963) from Kamchatka is likely to have been either an occasional triploid *C. angustifolia* or a hybrid between this species and *C. Langsdorfii.*

On Mt. Washington, *C. Langsdorfii* is frequent between stones in unprotected places in many parts of the alpine and subalpine zones. Our material, from different localities, had 2n = 56 chromosomes, although one sterile plant morphologically resembling *C. Langsdorfii* may have been a hybrid derivative with 2n = 66. The more heat-loving *C. canadensis,* however, reaches into the subalpine zone only in snowbeds and sheltered localities with much seepage water, such as those above Huntington's Ravine and Lakes-of-the-Clouds. The specimens we have seen in these places all belong to var. *robusta* as circumscribed by Fernald (1950), and their chromosome number as counted on several specimens from both the habitats mentioned and also from lower elevations always has been 2n = 42.

HIEROCHLOE FRAGRANS (WILLD.) R. & S.

Recent cytological investigations have demonstrated that the circumpolar grass species *Hierochloë odorata* (L.) PB. of manuals is a complex of numerous segregates, characterized by different chromosome numbers combined with sterility and apomixis. The chromosome number so far most frequently reported is 2n = 28, whereas 2n = 42 and 56 have only been discovered recently. All three numbers have been reported from Scandinavia by G. Weimarck (1963), who is making a detailed cytotaxonomical review of the complex, whereas in North America 2n = 28 has been reported by Church (in Myers 1947), Löve & Löve (1956) Norstog (1960) and Reeder & Norstog (1961), and 2n = 56 by Church (in Myers 1947), Norstog (1957, 1960, 1963), Bowden (1960), Reeder & Norstog (1961) and Löve & Löve (in Solbrig & Löve 1964). The number 2n = 42, however, has not yet been reported from the North American continent, but it has been found in populations on the Eurasiatic continent from Japan and Sakhalin in the east to Scandinavia in the west (Avdulov 1928, 1931; Vaarama, in Löve & Löve 1948; Sokolovskaja 1960; Tateoka 1954a,b, 1959; Sorsa 1963b; G. Weimarck 1963).

These data are in conformity with the observations by many critical taxonomists, from Willdenow (1805) to Chrtek & Jirásek (1964), who have tried to classify the variation of the collective species into more distinctly defined taxa at the specific and subspecific levels. It is not their fault that taxonomists, seeing only a continuous intergrading series of external morphological characters, have ignored their efforts and continued to treat the complex as a single species without subdivisions. Few have gone as far as Hultén (1962) when he claimed the complex to be "not very variable," recognizing only the typical subspecies and a single additional subspecies.

In fact, the *Hierochloë odorata* complex is typical of groups of sibling species whose morphological characters are unreliable as the prime basis of identification. Knowledge of the chromosome numbers, however, is an important additional datum which makes possible the grouping of characters that are connected with the reproductive barriers effected by the difference in chromosome number. In this particular case, these groups of characters have already been observed by conventional taxonomists, for the American populations and probably also for the Eurasiatic taxa. Further detailed studies may improve upon the available groupings and give clearer indications as to which variations are specific and which are better regarded as subspecific.

Authors of recent North American manuals generally ignore the fact that what is called *Hierochloë odorata* in this part of the world differs from the common Eurasiatic plant which must be regarded as *H. odorata* s.str., whereas authors of the early 19th century were aware of its distinction. Willdenow (1805) described the American plant as the species *Holcus fragrans* on the basis of material collected in the Hudson Bay region of Canada. He was, however, in some doubt as to the correctness of its specific rank, since it could be distinguished from typical European plants only by its much longer glumes that are smooth-tipped in the staminate flower, and the lemma margins which are not villous ciliate. Later authors, however, observed that the spikelets are larger and violet or dark-brown and the ligules about half as long (1-2 mm) as those of the European plant. Pursh (1814) accepted the taxon as a species, and so did also Roemer & Schultes (1817), who transferred it to the then recently described (Brown 1810) genus *Hierochloë* as *Hierochloë fragrans* (Willd.) R. & S.

There can be no doubt that the North American 56-chromosome taxon is identical with *H. fragrans*, and its distinction from the 28-chromosome *H. odorata* of Europe is clear. It is an apomictic plant which is widespread in North America within the limits mapped by Hultén (1962) for *H. odorata* on this continent; it seems likely that *H. Bungeana* Trin. from eastern Asia (Roshevitz 1934) may be one of its subspecies and probably also *H. odorata* ssp. *pannonica* recently described by Chrtek & Jirásek (1964), since both these taxa bear certain resemblances to the American plant and the chromosome number 2n = 56 apparently occurs all the way to Scandinavia, although this cannot be verified without additional cytotaxonomical studies in Europe and Asia.

The 42-chromosome taxon from

Japan studied and reported by Tateoka (1945a,b, 1959), from Sakhalin by Sokolovskaja (1960), from Russia by Avdulov (1928, 1931), from Finland by Vaarama (in Löve & Löve 1948) and Sorsa (1963b), and from Sweden by G. Weimarck (1963) seems to be, at least as to its easternmost populations, identical with the species *H. glabra* Trin.; Hultén (1962) interpreted it as ssp. *dahurica* (Trin.) Hultén of his very inclusive *H. odorata.* The Russian and Scandinavian reports may indicate that this species from eastern Asia actually is an Eurasiatic plant ranging from the Pacific to the Atlantic Ocean, although the western populations may perhaps represent a different and distinct species not previously recognized by taxonomists.

In addition to *H. fragrans*, another species of the *H. odorata* complex occurs in eastern North America. It was described by Bicknell (1898) as *Savastana Nashii* and later transferred to *Hierochloë* by Kaczmarek (1914) as *H. Nashii* (Bickn.) Kaczmarek. It is distributed along the coast in temperate northeastern America and differs from *H. fragrans* in its slender growth habit, its glumes pointing forward instead of being slightly bent upwards at the tips, and in the narrower, distinctly awned glumes. In addition, it flowers much later than does *H. fragrans.* It was accepted as a species by Fernald (1950) but included in the synonymy of *H. odorata* by Hitchcock & Chase (1951), Gleason (1952) and Gleason & Cronquist (1963). Its specific status was confirmed by Norstog (1960) and Reeder & Norstog (1961), who showed it to be an amphimictic and fertile tetraploid with 2n = 28 chromosomes, as contrasted to the highly infertile and probably apomictic Eurasiatic tetraploid *H. odorata* s.str. The 28-chromosome plants studied by Church (in Myers 1947) likely belonged to this American species, whereas the tetraploid colony observed by Löve & Löve (1956) near Winnipeg in Manitoba belonged to the highly sterile European species which seems to be met with occasionally as an introduction near cultivated areas on this continent.

HIEROCHLOE MONTICOLA (BIGEL.) LÖVE & LÖVE

As demonstrated by Sörensen (1954), the Greenland and eastern North American plant, until then regarded as the circumpolar *Hierochloë alpina* (Sw.) R. & S., actually includes two distinct and apomictic taxa, of which *H. alpina* s.str. is a widespread arctic plant of continental climates, whereas the more southern taxon, *Hierochloë monticola* (Bigel.) Löve & Löve of which *H. orthantha* Th. Sör. is a synonym (cf. Löve & Löve, in Löve & Solbrig 1964), seems to be better adapted to a more oceanic climate. Cytologically, the typical *H. alpina* is characterized by the chromosome number 2n = 56, as reported from Spitsbergen by Flovik (1938, 1940), Greenland by Sörensen (1954), Japan by Tateoka (1954a, 1959), the Russian Arctic by Sokolovskaja & Strelkova (1960), Sakhalin and Kamchatka by Sokolovskaja (1960, 1963), and northern and eastern Canada and the northeastern United States by Bowden (1960) and Löve & Löve (unpubl.). *H. monticola,* however, has 2n = 63 chromosomes, as reported from Greenland by Sörensen (1954) and Jörgensen, Sörensen & Westergaard (1958), and from Mt. Washington, New Hampshire, by Löve & Löve (in Löve & Solbrig 1964).

The northeastern apomictic *H. monticola* differs from *H. alpina* in having seven additional chromosomes whose origin is uncertain. It also differs from *H. alpina* in several morphological characters, though its most apparent characteristics are the straight awns, not or only slightly twisted and inserted near the apex of the staminate lemmas, whereas the awns of *H. alpina* are geniculate and strongly twisted and inserted below the middle of the staminate lemmas. The loosely caespitose or shortly creeping habit of *H. monticola* may be contrasted with the densely caespitose habit of *H. alpina*. Good pictures of the northeastern American species are given by Sörensen (1954), who also refers to Flora Danica tab. 1508, but they are also found in Hitchcock & Chase (1951, fig. 793, p. 547) and Harris (1946, p. 69; 1964, p. 43).

Hultén (1962) regarded the 63-chromosome taxon as a variety of the "comparatively uniform species" *H. alpina* and proposed but did not validate a new combination. The still too limited evidence on the origin of this taxon seems to favor a treatment at the species level rather than at the agamospecies (subspecies) level (cf. Löve 1960). The map of its distribution given by Hultén (1962) shows it as occurring only in Greenland, whereas Sörensen (1954) listed it also from some northeastern American mountains south to Mt. Washington; in fact, it replaces *H. alpina* in a sizeable area in northeastern America.

The original description of the species *Holcus monticola*, on which the combination *Hierochloë monticola* is based (Löve & Löve, in Löve & Solbrig 1964), was given by Bigelow (1816) in his report of his first studies of the flora of Mt. Washington, with the words "glumis trifloris, hermaphrodito intermedio diandro, masculis lateralibus triandris, valvulâ exteriore dorso aristata." It was redescribed, as *Hierochloë orthantha*, by Sörensen (1954) from Greenland. The type locality of the species is Mt. Washington, most likely what is now called the Alpine Garden, where this grass is very common in moist meadows along brooks.

ERIOPHORUM VAGINATUM L.

This circumpolar species falls into three reasonably distinct geographical races which ought to be regarded as good subspecies. The typical ssp. *vaginatum* has a European, west and north Asiatic range, whereas ssp. *spissum* (Fern.) Hultén occurs in North America. The southeast Asiatic plant, of Manchuria, North Korea, Japan, Sakhalin, and the Kuriles (Koyama 1958), which was mapped by Hultén (1962) as *E. humile* Turcz., an apparently invalid name for *E. Fauriei* E. G. Camus, does not seem to have been named at the subspecies level. We therefore propose for it the name *Eriophorum vaginatum* ssp. **Fauriei** (E. G. Camus) Löve & Löve comb. et stat. nov. (based on *Eriophorum Fauriei* E. G. Camus, in Lecomte, Not. Syst. 1 (1910), p. 249).

The plants of the alpine zone of Mt. Washington belong, naturally, to the American ssp. *spissum*. Its chromosome number is $2n = 58$ as determined on plants from Manitoba by Löve (1954) and confirmed on material from Mt. Washington by the present writers. The ssp. *vaginatum* from Scandinavia has the same number, as reported by Håkansson (1928), Löve (1954), and Sorsa (1963b), and the eastern Asiatic ssp. *Fauriei* likewise has $2n = 58$ chromosomes as reported by Tanaka (1942, 1948) from Japan.

BAEOTHRYON CAESPITOSUM (L.) A. DIETR.

Cytotaxonomical criteria are recognized as being extremely important in distinguishing closely related taxa at or below the level of species (Löve 1964), whereas their significance is minor at or above the generic level (Löve 1963). However, there are cases in which knowledge of basic numbers and chromosome morphology seems to be fundamental in recognizing differences between evolutionary lines and critical levels within large and variable genera in which the more or less intergrading morphology has defied previous attempts at a phylogenetic classification. This seems to be the case in the tribe Scirpeae of the family Cyperaceae, which has been categorized by certain morphological and anatomical criteria into a few genera by some authors and into many by others (Clarke 1908; Beetle 1945; Koyama 1958, 1961). Available cytological data seem to indicate that a splitting into several small genera is phylogenetically sound within this tribe. The classification proposed by Koyama (1958, 1961a,b, 1962) seems to be generally supported by cytological evidence, with the exception of the unnecessary lumping in the genus *Scirpus*.

Although Koyama (1958) united *Scirpus* and *Eriophorum* and deposed the subgenus *Eriophoropsis* (Palla) Raymond from the latter to form a series of the group *Baeothryon*, available cytological data support the treatment proposed by Raymond (1954). *Eriophorum* subgenus *Eriophorum* and subgenus *Eriophoropsis* are closely related as far as number and morphology of chromosomes are concerned, and both differ in these respects from species of *Baeothryon* s.str. Cytological information is still lacking regarding species of *Eriophorum* subgenus *Erioscirpus* (Palla) Raymond, which Koyama (1958) placed as the series *Lachnophorum* of his collective *Baeothryon*. However, for reasons of morphological similarity we are inclined to prefer the treatment proposed by Raymond (1957), at least until contrary cytological evidence shows this to be untenable. The species of Koyama's (1958) group *Baeothryon* section *Baeothryon*, which he divided into the arctic-alpine-boreal series *Baeothryon* and the high-alpine-tropical Asiastic series *Anthelophorum*, apparently form a morphologically and cytologically homogeneous group if the species *Scirpus hudsonianus* (Michx.) Fern., with its relatively broad, silky, hypogynous bristles and 58 chromosomes of the *Eriophorum* type, is restored as *Eriophorum alpinum* L. Since *Baeothryon* so restricted is as distinct from *Eriophorum* and *Scirpus* s.str. as these genera are different from each other, it deserves recognition as a genus in its own right and has been so accepted under the name *Trichophorum* Pers. by many European taxonomists, including Hartman (1849), Roshevitz (1934), Hylander (1955), Löve & Löve (1961b), Clapham, Tutin & Warburg (1962), Lid (1963), and H. Weimarck (1963). This is, however, a misapplication of the generic name *Trichophorum*, since its type species is *Scirpus cyperinus* Kunth (Koyama 1958), and so the correct name for the genus seems to be *Baeothryon* Ehrh. ex A. Dietr. of which *B. caespitosum* (L.) A. Dietr. is the type species.

The genus *Baeothryon* in the strict sense as here proposed includes the following seven species grouped into two subgenera:

subgenus *Baeothryon*

Baeothryon caespitosum (L.) A. Dietr.

Baeothryon pumilum (Vahl) Löve & Löve, comb, nov., based on *Scirpus pumilus* Vahl, Enum. II (1806), p. 243.

Baeothryon Clementis (M.E. Jones) Löve & Löve, comb. nov., based on *Scirpus Clementis* M. E. Jones, in Contrib. West. Bot. 14 (1912), p. 21.

Baeothryon Clintonii (A. Gray) Löve & Löve, comb. nov., based on

Scirpus Clintonii A. Gray, in Amer. Journ. Sci. II, 38 (1864), p. 290.

Baeothryon verecundum (Fern.) Löve & Löve, comb. nov., based on *Scirpus verecundus* Fernald, in Rhodora 50 (1948), p. 284.

subgenus **Anthelophorum** (Ohwi) Löve & Löve, comb. et stat. nov., based on *Scirpus* subgenus *Trichophorum* sectio *Anthelophorum* Ohwi, in Mem. Coll. Sci. Kyoto Imp. Univ. Ser. B, 18 (1944), p. 95.

Baeothryon subcapitatum (Thwaites) Löve & Löve, comb. nov., based on *Scirpus subcapitatus* Thwaites, Enum. Pl. Zeyl. (1864), p. 351.

Baeothryon Mattfeldianum (Kűk.) Löve & Löve, comb. nov., based on *Scirpus Mattfeldianus* Kűkenthal, in Feddes Repert. 27 (1929), p. 108.

The type species of the genus, *B. caespitosum,* occurs on Mt. Washington. It is a variable plant which in western Europe is met with as ssp. **germanicum** (Palla) Löve & Löve, comb. nov., based on *Trichophorum germanicum* Palla, in Ber. Deutsch. Bot. Ges. 15 (1897), p. 468, whereas the typical ssp. *caespitosum* is considerably more widespread and northern circumpolar. North American and Japanese authors (Beetle 1941; Fernald 1950; Gleason 1952; Koyama 1958; Gleason & Cronquist 1963) seem to have mistaken ssp. *germanicum* for the typical subspecies, therefore accepting as an American race the so-called *Scirpus caespitosus* var. *callosus* Bigel., named from Mt. Washington material by Bigelow (1824) and based on *Scirpus bracteatus* of Bigelow (1816). As pointed out by Hylander (1945), this variety is identical with the North European ssp. *austriacum* which is ssp. *caespitosum,* and it does not even "deviate slightly" from the European plant, as maintained by Gleason (1952). Both these subspecies are distinctly calciphobous.

In lowlands and hills in eastern North America a calciphilous race occurs, with slender, soft and more flexuous culms than occur in the typical northern and alpine taxon. It has black to dark gray, submembraneous to scarious basal sheaths. This taxon was described, by Fernald (1921), as *Scirpus caespitosus* var. *delicatulus.* Since most botanists have ignored this variety and have even left it out of manuals (Gleason 1952), it has not been widely collected. Its range is likely to be extended westward when it catches the attention of botanists collecting in calcareous regions from the east coast toward the Great Lakes. We are of the opinion that this is a major geographical race of considerable significance and worthy of subspecific rank, since on a morphological and ecological basis it is at least as distinctive as the western European ssp. *germanicum.* Although it is not met with in the alpine zone of Mt. Washington, where the typical ssp. *caespitosum* is rare, a new combination at the subspecific level is here proposed: *Baeothryon caespitosum* ssp. **delicatulum** (Fern.) Löve & Löve, comb. et stat. nov., based on *Scirpus caespitosus* var. *delicatulus* Fernald, in Rhodora 23 (1921), p. 25.

The present writers can confirm the chromosome number $2n = 104$ for Mt. Washington material of ssp. *caespitosum* and report the same number for ssp. *delicatulum* from the Gaspé Peninsula of the Province of Quebec. That number has been reported from European and Greenland material of ssp. *caespitosum* (cf. Löve & Löve 1961b) and from Swedish material of ssp. *germanicum* (Lövkvist, in H. Weimarck 1963).

CAREX DEBILIS MICHX.

Carex debilis is an eastern North American species which has developed very distinctive populations some of which have been described as species. The typical ssp. *debilis* is a plant of the southeast, reaching northward to southeastern Massachusetts and growing in thickets, swamps, and clearings of low woods. In open woods, thickets, and meadows northward to Newfoundland and as far south and west as Tennessee and Missouri this race is replaced by a subspecies which we prefer to name *Carex debilis* ssp. **Rudgei** (Bailey) Löve & Löve, stat. nov., based on *C. debilis* var. *Rudgei* Bailey, in Mem. Torrey Bot. Club 1 (1889), p. 34; it was described as *C. tenuis* by Rudge (1804) and *C. flexuosa* by Muehlenberg (in Willdenow 1805), and as *C. debilis* var. *Rudgei* by Bailey (1889), a name accepted by Fernald (1942) and later authors. Another race, also worthy of subspecific rank because of its morphological and ecological distinctness, grows mainly east of the Alleghenies, in low woods and meadows of Pennsylvania south to Georgia; it was named *C. alleghenienesis* by Mackenzie (1935) but *C. debilis* var. *pubera* by Gray (1867) and was accepted as that variety by Fernald (1942). We prefer to regard it as a subspecies and propose the following combination: *Carex debilis* ssp. **pubera** (A. Gray) Löve & Löve, stat. nov., based on *C. debilis* var. *pubera* A. Gray, Man. ed. 5 (1867), p. 593.

C. debilis ssp. *Rudgei* is common at low altitudes on Mt. Washington, rarely occurring in the subalpine zone, whereas in the alpine zone the var. *strictior* Bailey is a little more common in sheltered places. This variety differs from var. *Rudgei* in the wider leaves and the mature green perigynia which are only slightly longer than the scales, whereas the ripe perigynia of var. *Rudgei* are brown and twice as long as the scales. It is our impression that this taxon is a genetically conditioned alpine variety, although there still is the possibility that it may be only a climatic modification, since it has not been cultivated outside the mountain zone.

In addition to the three subspecies mentioned, Fernald (1942) accepted the two varieties *interjecta* Bailey and *intercursa* Fern. Our observations confirm the suggestion by Fernald (1942) that the var. *intercursa* is only a group of fertile intersubspecific hybrids between ssp. *debilis* and ssp. *pubera;* likewise, var. *interjecta* shows all signs of being the corresponding hybrid swarm between ssp. *debilis* and ssp. *Rudgei.* For these reasons these varietal names can be considered superfluous.

The chromosome number 2n = 60 has been counted by us on ssp. *Rudgei* var. *Rudgei* and var. *strictior* from Mt. Washington. The same number was reported from plants of var. *Rudgei* from the province of Quebec by Moore & Calder (1964).

CAREX CAPILLARIS L.

On Mt. Washington and other eastern North American mountains this variable species is represented by its typically arctic-alpine ssp. *capillaris,* and not by the much taller, lowland and forest ssp. *chlorostachys* (Steven) Löve, Löve & Raymond, which in American floras is usually designated as var. *major* Olney, an illegitimate homonym (cf. Löve, Löve & Raymond 1957).

CAREX CAPITATA L.

At least in eastern North America and probably all over the North American arctic-alpine area, the species *Carex capitata* is represented only by its ssp. *arctogena* (H. Sm.) Böcher. This subspecies is not even mentioned by Harris (1964) in his recent treatment of the alpine plants of New England.

JUNCUS TRIFIDUS L.

This arctic-alpine species of sterile soils is typical of windswept areas above timberline on Mt. Washington and other eastern North American mountains. A one- or two-flowered variation which has a looser and more slender habit with most of the basal sheaths prolonged into filiform blades often equalling the culm length, occurs locally. It has been reported from Mt. Pleasant and some lower localities by Pease (1924, 1964) and Harris (1964). The value of this variation needs to be tested through cultivation experiments, since there are indications that it may be affected by the environment. It has been identified as the variety *monanthos* (Jacq.) Bluff & Fingerh. (= *J. trifidus* ssp. *Hostii* [Tausch] Hartm.; *J. monanthos* Jacq.) by Fernald (1950) and Gleason (1952), and as such accepted by Hultén (1958) who noted the information that it grows on limestone. This ecological distinction is typical of this taxon in the eastern Alps, the Apennines, and the Illyric Mountains (Janchen 1956-59), but it is not appropriate for the North American plant, which is unlikely to be identical with this endemic southern European taxon. It is better regarded as a nameless and doubtful taxon.

LUZULA SPICATA (L.) DC.

The species *Luzula spicata*, in the wide sense, has been reported to include taxa with the three chromosome numbers 2n = 12, 14, and 24 in Europe (cf. Löve & Löve 1961b), whereas only the last number has so far been counted in populations west of the Atlantic. As shown by Chrtek & Křísa (1962), the plants with 2n = 24 chromosomes from northern Europe, the Alps, and some other central European mountains, belong to the reasonably uniform ssp. *spicata*, whereas the populations with 2n = 12 chromosomes were described as ssp. *mutabilis* Chrtek & Křísa. Since these taxa not only differ in chromosome number but in morphology and distribution, it is hardly constructive to clutter up a species with a new subspecies which, without doubt, has a strong miscibility barrier towards the species in which it is placed, especially since a sounder and more valid conclusion would have been the revival of the name *L. glomerata* Mielichhofer for the taxon with 2n = 12 chromosomes. Although Chrtek & Křísa (1962) apparently include the plants with 2n = 14 chromosomes in the new subspecies, this seems premature, because the cytological evidence (Nordenskiöld 1951) seems to indicate another status for these populations.

When *L. glomerata* and the 14-chromosome unnamed taxon are excluded from *L. spicata* it becomes a reasonably uniform species with a considerable range in northwestern Eurasia. It occurs in central European mountains, and its range extends to eastern and western North America with some outposts in the mountains of Quebec and New England. The population of Mt. Washington is very uniform and is similar to plants from Greenland, Iceland, and northern Scandinavia; it is also characterized by 2n = 24 chromosomes. However, the plant of western North America, likewise tetraploid with 2n = 24 chromosomes (Nordenskiöld 1951; Löve & Löve, unpubl.), differs from the European and eastern North American populations in having distinctly shorter capsules; it was described as a variety *nova* by Smiley (1921), but its distinct distribution supports the view that it would be more correctly treated as a subspecies: *Luzula spicata* ssp. **saximontana** Löve & Löve, nom. nova, based on *L. spicata* var. *nova* Smiley, in Univ. of Calif. Publ. Bot. 9 (1921), p. 128.

STREPTOPUS AMPLEXIFOLIUS (L.) DC.

Streptopus is a predominantly Asiatic genus, of which S. *amplexifolius* is one of the few species reaching Europe and America. Described from Czechoslovakia, its ssp. *amplexifolius* is typical of central and southern European mountains. The eastern Asiatic populations belong to S. *amplexifolius* ssp. **papillatus** (Ohwi) Löve & Löve, stat. nov., based on S. *amplexifolius* var. *papillatus* Ohwi, in Bot. Mag. Tokyo 45 (1931), p. 185, whereas numerous varieties described by Fassett (1935) are superimposed on S. *amplexifolius* ssp. **americanus** (Schultes) Löve & Löve, stat. nov., based on S. *amplexifolius* var. *americanus* Schultes, Syst. Veget. ed. 7 (1829), p. 311, with the exception of var. *oreopolus* and var. *denticulatus,* which are sterile triploid hybrids between ssp. *americanus* and S. *roseus* ssp. *roseus* and ssp. *longipes* respectively (cf. D. Löve & Harries 1963). The chromosome number of ssp. *americanus* from Mt. Washington is 2n = 32, as previously reported for this and other races of the species by various authors (cf. Löve & Löve 1961b, D. Löve & Harries 1963).

STREPTOPUS ROSEUS MICHX.

This predominantly eastern North American species is represented in western mountains from Alaska to Washington by the ssp. *curvipes* (Vail) Hultén; in the Great Lakes area its populations belong to ssp. **longipes** (Fern.) Löve & Löve, comb. et stat. nov., based on S. *longipes* Fernald, in Rhodora 8 (1906), p. 71; whereas in the eastern states the ssp. *roseus,* with the widespread northern and alpine var. *perspectus* Fassett, is predominant. On Mt. Washington only the variety *perspectus* is met with, and it is characterized by the chromosome number 2n = 16 (D. Löve & Harries 1963), as is also material of ssp. *curvipes* from the Yoho Valley in British Columbia and of ssp. *longipes* from southern Manitoba studied by the present writers.

VERATRUM VIRIDE AIT.

The North American species *Veratrum viride* is represented in the eastern parts of the continent, from the coast to Minnesota, by its typical ssp. *viride,* whereas in the western mountains it is replaced by the ssp. **Eschscholtzii** (A. Gray) Löve & Löve, comb. et stat. nov., based on *V. Eschscholtzii* A. Gray, in Ann. Lyc. Nat. Hist. N.Y. 4 (1837), p. 119 to which Breitung (1957) accorded varietal rank.

These American races are closely related to some eastern Asiatic taxa described as species and recently discussed by Tolmatchev (1962). All these taxa and the Eurasiatic complex *V. album* L. are characterized by the same chromosome number, 2n = 32, and it is possible that they would be more correctly regarded as subspecies and varieties of a single species with a split-up circumpolar distribution. The chromosome number 2n = 32 has been verified by the present writers on Mt. Washington material of ssp. *viride* and of material of ssp. *Eschscholtzii* from the Rocky Mountains of Alberta.

LYSIELLA OBTUSATA (PURSH) RYDB.

Generic delimitation in the boreal orchids has long been a matter of dispute. During the last generations this has involved two opposing viewpoints; the first maintained chiefly by American botanists regards the unity of the wide genus *Habenaria* as a matter of principle (cf. Ames 1910; Correll 1950; Fernald 1950); the other, generally held by European authors, divides this group into several smaller genera, like *Coeloglossum, Leucorchis,* and *Platanthera,* distinguished technically by a number of characters.

Splitting of the genus *Habenaria* into smaller units was primarily based on morphological characters. Lately, cytological observations have given strong support to some, though not all, of these proposals, since it has been found that many of the segregate genera show distinct differences in the size and basic numbers of their chromosomes. This is the case, e.g., in the group separated as *Lysiella* by Rydberg (1900). Though accepted as a part of the genus *Platanthera* by recent Scandinavian botanists (Hultén 1941-50, 1943, 1950, 1962; Hylander 1955; Löve & Löve 1961b), Afzelius (1922) had pointed out that the chromosomes are smaller and more variable in this group than in other European representatives of *Platanthera*. This observation we are able to confirm for the American species. It is our opinion that *Lysiella* is correctly treated as a genus distinct from *Platanthera* proper.

Most authors have kept the American and Eurasiatic taxa of *Lysiella* as distinct species. Hultén (1943, 1962), however, "in view of the conditions in Alaska" where both taxa seem to occur, concluded that they were best treated as two subspecies of a single species. We are at variance with this opinion because we can confirm the observation by Humphrey (1933, 1934) that the American taxon has 2n = 42 chromosomes, whereas the Eurasiatic species has 2n = 126 chromosomes, as shown by Afzelius (1922) and Löve (1954). This is not a case of simple polyploidy, and it provides strong support to the morphological, geographical, and ecological observations which have previously been used in support of the separation of these taxa at the species level. The North American species *L. obtusata* (Pursh) Rydb. is rather common at lower levels and rare in the alpine zone of Mt. Washington and other eastern North American mountains and also in the subarctic, whereas the Eurasiatic-Alaskan species *L. oligantha* (Turcz.) Nevski is very rare and highly localized in a few areas in Eurasia, as demonstrated by Hultén (1962).

LISTERA CORDATA (L.) R. BR.

Listera cordata is rare on Mt. Washington, where it is represented by the amphi-Atlantic ssp. *cordata*, populations of which, on both sides of the ocean and on the oceanic islands, are variable but basically similar, so that no distinct varieties seem to be met with within its limits. In the Pacific area of this circumpolar species, however, the reasonably distinct *Listera cordata* ssp. **nephrophylla** (Rydb.) Löve & Löve, comb. et stat. nov., based on *Listera nephrophylla* Rydberg, in Mem. New York Bot. Gard. 1 (1900), p. 108, occurs, and on it is superimposed at least one distinct variety, var. *japonica* Hara.

ALNUS VIRIDIS VILL.

Hultén (1941-50) suggested that *Alnus viridis* Vill. of central Europe, the subarctic-boreal-alpine *A. crispa* (Ait.) Pursh and the amphi-Pacific *A. sinuata* (Regel) Rydb. ought to be regarded as conspecific subspecies. Difficulties in deciding about the priority of the names *viridis* and *crispa*, which were thought to have been published in the same year, apparently caused Hultén to refrain from making the necessary transfers, although there could be no doubt as to the soundness of this suggestion.

Later investigations on the publishing date of Villar's description (Stafleu 1963) have, however, shown that it was published in 1788, or the year before the publication of *Betula crispa* by Aiton (1789). Therefore, *Alnus viridis* is the oldest name for the collective species. Its ssp. *viridis* is central European, whereas in the subarctic of Eurasia and America it is represented by ssp. **crispa** (Ait.) Löve & Löve, comb. et stat. nov., based on *Betula crispa* Aiton, in Hort. Kew. 3 (1789), p. 339, and in the amphi-Pacific area by ssp. **sinuata** (Regel) Löve & Löve, comb. nov., based on *A. viridis* δ *sinuata* Regel, in De Candolle: Prodromus 16, 2 (1864), p. 183, quoad descr. et spec. ex Kodiak et Sitka; *A. crispa* ssp. *sinuata* (Regel) Hultén, 1941-50. It is possible that a few more subspecies may occur in eastern Asia (cf. Hultén 1941-50), although it is equally likely that these taxa could be more appropriately superimposed as varieties on ssp. *sinuata*, as is the case with at least one variety of ssp. *crispa* in eastern North America, described by Fernald (1904, 1913). *A. viridis* ssp. *crispa* has a circumpolar subarctic-boreal range with a present gap from Greenland to arctic Russia, although it was present in Iceland until the middle of the Pleistocene (Thorarinsson 1963). On Mt. Washington ssp. *crispa* is represented by the typical variety *crispa* at higher altitudes, whereas at lower levels that race is replaced by var. *mollis* Fern. Both are characterized by the chromosome number $2n = 28$ typical of the other subspecies.

BETULA PUBESCENS EHRH.

It is evident that *Betula pubescens* is represented in subarctic-alpine eastern North America by races closely related to what is collectively named ssp. *tortuosa* (Ledeb.) C. K. Schneid. from subarctic Europe and Iceland. In Scandinavia, Scotland, and Iceland the subalpine birches of this subspecies seem to consist of a mixture of several races which are hybridizing away their distinguishing characteristics, although some may occasionally be met with in almost pure condition (Löve & Löve 1956). In North America, however, the subarctic-alpine races of *B. pubescens* are classifiable into two subspecies, one of which, ssp. *minor* (Tuckerm.) Löve & Löve, occurs as a pure population in the White Mountains of New Hampshire, and the other, ssp. **borealis** (Spach) Löve & Löve, comb. et stat. nov., based on *Betula borealis* Spach, in Ann. Sci. Nat. sér. 2, 15 (1841), p. 196, in unmixed stands in the Labrador Peninsula and Greenland. However, in subarctic and subalpine localities in southern Labrador and in the mountains of Gaspé, New York, and New England north of the Presidential Range the two subspecies are mixed so that pure individuals are rare. It is ssp. *borealis* which has been identified as ssp. *tortuosa* from Greenland by Lange (1880, 1887), Fernald (1945), Böcher, Holmen & Jakobsen (1957) and others. It and the other North American subspecies differ from the Icelandic-Scandinavian plants in some technical characters, and also in their autumn coloring which is clearly orange as contrasted to the yellow colors of the Icelandic and Scandinavian birches.

PARONYCHIA ARGYROCOMA (MICHX.) NUTT.

This species is a rare eastern North American plant, typical of the southern Appalachians, where its ssp. *argyrocoma* grows. It is represented in a few localities in the mountains of New Hampshire and Maine and on an island in the Merrimac River near Newburyport, Maine, by a morphologically and geographically distinct race described by Fernald (1906). Although Fernald (1906, 1950) regarded this race as a variety only, it is sufficiently distinct both morphologically and geographically, and completely isolated geographically from the southern populations of the species, to be regarded as a good subspecies. Therefore, we propose for it the following combination: *Paronychia argyrocoma* ssp. **albimontana** (Fern.)

Löve & Löve, stat. nov., based on *P. argyrocoma* var. *albimontana* Fernald, in Rhodora 8 (1906), p. 103. The race is known from some of the southern peaks of the Presidential Range but not from Mt. Washington itself (cf. Pease 1964), and its disjunct range indicates a drastic reduction of a previously wider distribution.

MINUARTIA GROENLANDICA (RETZ.) OSTENF.

The authoritative treatment by Fernald (1919) of the very heterogeneous group *Arenaria* as a single genus has been uncritically accepted by all later North American authors, whereas European botanists have generally distinguished at least the genera *Arenaria, Minuartia, Moehringia,* and *Honckenya.* Recent cytological studies seem to support the latter treatment, and so does the detailed morphological revision of the Alsinoideae recently published by McNeill (1963). He treats the species *Minuartia groenlandica* as a member of the section *Uninerviae* (Engl.) Mattf., which is said to be an eastern North American group, comprised of not more than five species. McNeill is mistaken, however, when he regards all these species as annuals, since typical *M. groenlandica* is distinctly perennial (cf. Lange 1880).

M. groenlandica has a small continuous range in northern Labrador and Greenland and occurs disjunctly in alpine situations further south. In the foothills and low mountains of Maine, New Hampshire, Pennsylvania, and south to South Carolina and Tennessee, it is represented by a race which seems to be either annual or short-lived perennial; with sepals shorter than those of the main race; with stems simple or somewhat branched or indistinctly tufted as contrasted to the tussock-forming typical race. This taxon has been cited as a species by Michaux (1803), Mattfeld (1921), Small (1933) and others, whereas Fernald (1919) argued that it could only be regarded as a variety of what he called *Arenaria groenlandica,* an opinion accepted by Maguire (1951). As far as we are able to judge, it is a geographical race of such a distinction as to warrant its acceptance at the subspecific level. As such its name ought to be: *Minuartia groenlandica* ssp. **glabra** (Michx.) Löve & Löve, stat. nov., based on *Arenaria glabra* Michaux, Fl. Bor. Amer. 1 (1803), p. 274. Both ssp. *groenlandica* and ssp. *glabra* have the chromosome number $2n = 20$. Their relationship to *M. groenlandica* from southern Brazil, reported by Smith & Downs (1960) and discussed by Hultén (1964), is unknown.

SILENE ACAULIS (L.) JACQ.

This arctic-alpine cushion plant occurs at varying latitudes and altitudes and in diverse climates. It has been divided into species, subspecies, and varieties by taxonomists. The eastern and arctic North American plant, which is morphologically distinct from typical *S. acaulis* of Scandinavia, has long been referred to as var. *exscapa* (All.) DC. and identified with the taxon described from the Alps. This interpretation, which was first made by Rohrbach (1868), has been perpetuated in all American manuals published in recent decades, and also in the revision by Hitchcock & Maguire (1947), despite the fact that it does not fit the original description of the Alpique plant.

It is the opinion of the present writers, based on studies of considerable material, that the *S. acaulis* complex includes several subspecies, some of which are divided into varieties of less distinction. The arctic and eastern American race is, accordingly, the well-defined ssp. **arctica** Löve & Löve, subsp. nova: Planta caespitosa. Caulibus fere 3-5 mm longis. Foliis fere ciliolatis. Pedunculis brevis. Calycibus 3.5-5.5 mm longis; laminis petalorum obovatis, emarginatis, fere auriculatis. Capsulis 3.5-6.0 mm longis, ovoideis vel urniformis, sessilis, dentis solum exsertis.—Typus: Cowpasture, Mt. Washington, July 26, 1958. Löve & Löve 7530, in Herb. Mus. Univ. Coloradensis.—This subspecies is characterized by short stems, mostly ciliolate leaves, short peduncles and ovoid-urnal sessile capsules of which only the teeth are exserted. Its range outside of arctic-subarctic America includes Iceland, Jan Mayen, and Spitsbergen. It is replaced in the southern Rocky Mountains by ssp. *subacaulescens* (T. N. Williams) Hitchc. & Maguire which also reaches Alaska and perhaps eastern Asia, whereas in northern Europe the species is represented by ssp. *acaulis,* and in central Europe by ssp. *acaulis* and ssp. *exscapa* (All.) Vierh. and their varieties.

SAXIFRAGA HYPERBOREA R. BR.

It has recently been demonstrated (Löve & Löve 1956; Böcher, Holmen & Jakobsen 1957; Jörgensen, Sörensen & Westergaard 1958) that the taxon usually classified as *Saxifraga rivularis* L. from northern lands, sometimes with some subdivisions (Polunin 1940; Hultén 1941-50) but more often without such qualifications (Fernald 1950; Porsild 1957; Wiggins & Thomas 1962) actually consists of two morphologically, geographically, and cytologically distinct species. S. *rivularis* L. s.str. is a subarctic-boreal-alpine taxon with the tetraploid chromosome number $2n = 52$, whereas in the arctic regions and in the alpine zones of some mountains farther south in North America it is replaced by a diploid taxon ($2n = 26$). This diploid is conspicuous by its smaller size and the creeping stems and runners, as compared with the caespitose growth form of the tetraploid. The arctic-alpine taxon was described as S. *hyperborea* R. Br. from arctic Canada by Brown (1823). Its distribution seems to be circumpolar, although the fact that it has been ignored by most botanists until very recently makes it difficult to ascertain its true range. The observation, by Porsild (1964), that both taxa grow together in the Canadian Arctic, indicates their lack of reproductive miscibility and further strengthens the claim of their being distinct species. A related taxon, still cytologically unknown, occurs in the southern Rocky Mountains; it has been named S. *debilis* Engelm.

All previous records from Mt. Washington (cf. Harris 1964) mention but S. *rivularis,* but every plant thus identified from that region belongs to S. *hyperborea,* as do most records of the former species from northeastern American mountains, Labrador Peninsula, and the eastern Arctic. In the Presidential Range, S. *hyperborea* seems to be confined to moist regions in the Great Gulf down to about 1600 m.s.m., although it also grows abundantly in areas moistened by seepage water behind and close to the buildings at the summit of Mt. Washington.

SORBUS GROENLANDICA (C. K. SCHNEID.) LÖVE & LÖVE.

This shrub or small tree of the Labrador Peninsula, Greenland, and a few alpine outposts in eastern North America has long been a controversial taxonomic problem. It was originally described, by Schneider (1906), as a variety of *Sorbus americana* Marsh, which it resembles in many respects. Later, it was transferred, by Jones (1939), to S. *decora* (Sarg.) C. K. Schneid. since its somewhat greater resemblance to this species was regarded as an important taxonomic criterion. Cytological observations have, at last, solved this problem and shown the reason for the difficulties in assigning the taxon to either of these two species. S. *americana* is a diploid species with 2n = 34 chromosomes, as shown by Sax (1931), Löve (1954), and Löve & Löve (unpubl., material from Mt. Washington), and the same number. 2n = 34, characterizes S. *decora* from the Riding Mountains of Manitoba and Bic in the province of Quebec, as counted by the present writers. The taxon *groenlandica,* however, is a tetraploid with 2n = 68 chromosomes, as reported from Greenland by Böcher & Larsen (1950) and Holmen (in Jörgensen, Sörensen & Westergaard 1958) and confirmed on Mt. Washington material by the present writers. Therefore, it certainly is a good species, and the difficulties in assigning it as a variety to either one of its putative parents *americana* and *decora* are simply caused by the fact that it is characterized by a mixture of the external morphology of both these species from which it has, most likely, evolved by alloploidy long ago, as indicated by the relict areas of some of its southernmost populations. We therefore propose the following new combination:

Sorbus groenlandica (C. K. Schneid.) Löve & Löve, comb. et stat. nov., based on S. *americana* var. *groenlandica* C. K. Schneider, in Bull. Herb. Boiss. II, 6 (1906), p. 314.

SPIRAEA SEPTENTRIONALIS (FERN.) LÖVE & LÖVE.

The boreal northeast American *Spiraea latifolia* (Ait.) Borkh. is replaced in subarctic Labrador Peninsula, Newfoundland, on the Magdalene Islands, in subalpine and alpine regions of Mt. Katahdin in Maine, the White Mountains in New Hampshire, Hawksbill Mountain in Virginia, and on the Keweenaw Peninsula in Michigan, by a taxon described as var. *septentrionalis* by Fernald (1917) but raised to specific rank, as S. *septentrionalis,* by Löve & Löve (in Löve & Solbrig 1964). It is distinguished by lower growth habit, distinctly larger flowers, dense cylindric to ovoid panicles which lack elongate lower branches, bluish-green leaves with a glaucous underside and very fine sharp teeth, and a purplish bark as contrasted to the distinctly orange-red bark of S. *latifolia* proper. S. *septentrionalis* is morphologically at least as distinct from S. *latifolia* s.str. as that species is from S. *alba* Du Roi. Additional cytological evidence also supports the view that this taxon is a species in its own right, since it is also characterized by having 2n = 54 chromosomes as compared with 2n = 36 for S. *latifolia* and S. *alba;* this chromosome number was reported by Baldwin (1951) from Hawksbill Mountain and we have confirmed it for plants of the alpine zone of Mt. Washington.

POTENTILLA HYPARCTICA MALTE SSP. ROBBINSIANA (OAKES) LÖVE & LÖVE.

One of the most rare plants of eastern North America is a dwarf *Potentilla,* known only from a small area above the Lakes-of-the-Clouds on Mt. Washington and on Mt. Lincoln a little farther south in the Franconia Range (Pease 1964). It grows, in the former locality, in an extremely wind-exposed solifluction spot which is probably covered with very little snow during the winter; the bedrock is calcium silicate resulting in less acid soils than elsewhere in the Presidential Range. Although much of the ground is without plant cover, other species favoring this spot are *Salix Uva-ursi, Rhododendron lapponicum, Diapensia lapponica, Solidago Cutleri,* and the rare diploid *Campanula Gieseckiana.* This *Potentilla* seems to prefer the narrow transitional belts between stable and frost-disturbed ground. It was described as *P. Robbinsiana* by

Oakes (in Torrey & Gray 1838-40, p. 441).

Ever since the first description of this taxon, its relationship has been a matter of dispute. Torrey & Gray (1838-40) placed it as a var. β of *P. minima* Hall. f., which is the *P. Brauneana* Hoppe of calcareous localities of the alpine zone in the Alps and the Pyrenees. Later on, Gray (1856) transferred it to *P. frigida* Vill., which, however, is calciphobous. Rydberg (1898) found it to resemble both these European species very much, coming nearest to *P. Brauneana* in habit but to *P. frigida* in pubescence. He found it to differ from both in the small petals, the bracts and the sepals, and, therefore, accepted it as a distinct species. Fernald (1931), Scamman (1940), and Hultén (1941-50) all considered *P. Robbinsiana* to be closely related to the amphi-Pacific high-alpine dwarf *P. elegans* Cham. & Schlecht. Again, these two dwarf taxa differ in some morphological characteristics and also in their physiological reactions, since *P. Robbinsiana* flowers in late May and early June, whereas *P. elegans* flowers in July-August, according to Juzepczuk (1941).

All the dwarf high-alpine *Potentilla* species mentioned as relatives of *P. Robbinsiana* belong to the subseries *Frigidae* of the section *Gomphostyles* (Wolf 1908). The only other northeastern American taxon of this group is the arctic-subarctic species *P. hyparctica* Malte (cf. Malte 1934; Fernald 1943; Selander 1942; Hylander 1945), which extends as far south as the Gaspé Peninsula and also prefers calcareous soils. Several morphological similarities are met with between the Mt. Washington plant and dwarf specimens of the southern race of *P. hyparctica* which Fernald (1943) regarded as a distinct taxon, var. *elatior* (Abrom.) Fern. Since specimens from Mt. Washington cultivated in a greenhouse in Montreal became still more like these plants, though not identical in all characteristics, we are convinced that this taxon is nothing but a race, or agamospecies at the subspecific level, of *P. hyparctica;* it was, therefore, validated as *P. hyparctica* ssp. *Robbinsiana* (Oakes) Löve & Löve, by Löve & Löve (in Löve & Solbrig 1964, p. 204). The chromosome number 2n = 49 has been obtained from our Mt. Washington material; that number has been reported for ssp. *hyparctica* by Dansereau & Steiner (1956), although the number most frequently observed for the typical subspecies is 2n = 42. The chromosome number of *P. Brauneana* is 2n = 14 and that of *P. frigida* is 2n = 28 (cf. Löve & Löve 1961b).

LEDUM GROENLANDICUM OEDER.

The genus *Ledum* is a small group of variable taxa which occur in bogs or heaths in the northern hemisphere, preferably in colder latitudes and altitudes. Although Tolmatchev (1953) divided the genus into four series and eight species, most of these taxa were regarded as conspecific by Hultén (1941-50) and Hara (1956). Of these taxa, two are diploid with 2n = 26 chromosomes, whereas the others are tetraploid with 2n = 52. The two diploids are *L. glandulosum* Nutt., from British Columbia and southwestern Alberta south to central California and northern Wyoming, and *L. groenlandicum* Oeder from southern Greenland and New England west to Alaska and northwestern Oregon. These diploids are morphologically rather distinct, but since they are apparently fully interfertile and hybridize and backcross freely wherever they meet (Hitchcock 1956), they can hardly be retained as distinct species in the biological sense of the category (cf. Löve 1964a,b). Therefore, we propose that the western plant be regarded as a subspecies only, or as *Ledum groenlandicum* ssp. **glandulosum** (Nutt.) Löve & Löve, comb. et stat. nov., based on *L. glandulosum* Nuttall, in Transact. Amer. Phil. Soc. II, 8 (1843), p. 270. It includes at least the varieties *glandulosum* and *columbianum* (Piper) C. L. Hitchc. as shown by Hitchcock (in Hitchcock, Cronquist, Ownbey & Thompson 1959); the latter variety seems intermediate and may perhaps represent an early stage in the selective process from ssp. *groenlandicum* towards ssp. *glandulosum*, or later introgressive hybrid swarms. Plants with thin leaves without dense tomentum beneath are also known to occur occasionally in eastern populations of ssp. *groenlandicum*, where they have been named f. *denudatum* Vict. & Rousseau. The possibility should not be excluded that the tetraploids may have been formed by hemiautoploidy (cf. Löve & Löve 1949) from these races, although they bear little or no resemblance to ssp. *glandulosum* and, therefore, may perhaps rather have resulted from polyploidized hybrids between variations within ssp. *groenlandicum* or between it and some other diploid race, now extinct. The apparent hemiautoploid origin of the tetraploids explains not only its great morphological and ecological variability but also the difficulties claimed by some authors in distinguishing it from one of its putative parents (Lange 1880; Hultén 1941-50).

The tetraploid complex is identical with the species *Ledum palustre* L., which has a circumpolar distribution with a gap only in the North Atlantic. It has been divided, on morphological and geographical grounds, into the European-north Siberian ssp. *palustre*, the eastern Asiatic ssp. *diversipilosum* (Nakai) Hara, and the arctic-subarctic North American ssp. *decumbens* (Ait.) Hultén.

The tetraploid species may resemble both its putative parents, but it shows great affinity towards *L. groenlandicum* ssp. *groenlandicum* in many of its characteristics. This is reminiscent of several other hemiautoploid or hemialloploid complexes, like *Anthoxanthum odoratum* (Jones 1964), *Elymus glaucus* (Snyder 1950, 1951), *Gilia inconspicua* (Grant 1964), *Leymus arenarius* (Bowden 1957), *Parnassia obtusiflora* (Löve & Löve, unpubl.), *Petrorhaga Nanteuilii* (Ball & Heywood 1964), and *Rumex Acetosella* (Löve 1943), in which the patterns of morphological variability defied the efforts of taxonomists until the chromosome conditions became known. Despite some morphological similarities, there is no doubt that *L. groenlandicum* and *L. palustre* are distinct species (cf. Grant 1964; Löve 1964a,b; Raven 1963), and that Hultén (1941-50) was very conservative when he placed the former as a subspecies of the latter.

Several character combinations have been used to distinguish between *L. groenlandicum* ssp. *groenlandicum* and *L. palustre* in North America, especially where ssp. *decumbens* of the latter occurs together with the former as in Greenland and western North America. Hultén (1941-50) had difficulties in separating these taxa in Alaska except by recourse to the leaves, which are elliptic to oblong and obtuse or rarely mucronate in *L. groenlandicum* s.str., but linear to linear-oblong and acute in *L. palustre* ssp. *decumbens*. Porsild (1951), however, found the most reliable characteristics to be that ssp. *decumbens* has about ten stamens and sharply and abruptly bent pedicels as contrasted to five to eight stamens and evenly arcuate or slightly curved pedicels of *L. groenlandicum* s.str.

In the New England regions, all populations of *Ledum* seem to belong to *L. groenlandicum* as characterized by Porsild (1951), and, consequently, this is the only species of the genus included in manuals of the plants of this region. On Mt. Washington, however, it is possible to discern between two somewhat distinct taxa of this group, one being a low-level plant of boggy habitats, and the other met with only in the alpine zone where it grows in heath. The low-level taxon is a bush 0.5 to 1 m tall with elliptic to oblong leaves, whereas the alpine plant is distinctly smaller, with shorter, oblong to lanceolate and more distinctly acute leaves. The hairy leafy portion of the stem is shorter than in the lowland taxon, whereas in the number of stamens and the bending of the pedicels both taxa are similar. The alpine taxon differs also in having almost glandless scales on the somewhat oblong winter buds which also have a fringe of very short, thin, and pointed unicellular hairs. We have seen herbarium specimens of this alpine taxon from Gaspé, Newfoundland, and the Ungava-Labrador area, westward to Yukon and Alaska, and also from other alpine regions in New England. This plant was apparently observed on Mt. Katahdin by Fernald (1905) and Stebbins (1929), who confused it (cf. Porsild & Porsild 1920) with the broad-leaved var. *dilatatum* Wg. of *L. palustre* from Europe; it is clearly the plant described by Bigelow (1824, 1840) as *L. latifolium*, though it is not quite identical with that species as described by Aiton (1789) which is *L. groenlandicum* s.str.

The morphological characteristics of the alpine plant indicate a great resemblance to ssp. *groenlandicum*, although it differs from it in some characters. Also, the observations on its ecology seem to indicate that it may constitute a somewhat different taxon.

The chromosome number 2n = 26 is typical of *L. groenlandicum* ssp. *groenlandicum*, as shown by Hagerup (1928, 1941) and Wanscher (1934). Because of difficulties in getting proper fixations of the alpine and heath plant, we have succeeded only in counting its chromosome number in a single cell, which was found to have 2n = 52 chromosomes. Since this number is twice as high as that of *L. groenlandicum* (which, however, has only been studied in Greenland), we doubt that it is typical for the Mt. Washington taxon as long as it cannot be excluded that it has been due either to occasional endopolyploidy or to panautoploidy in an otherwise diploid population. However, if further studies should reveal that all populations of the alpine and heath plant are characterized by the tetraploid chromosome number, in addition to its somewhat distinct morphology and ecology, then it might be more correctly classified as a subspecies of *L. palustre*. If such a suggestion holds true, this would be still another case of hemiautoploids resembling one of the parents so closely as to make it difficult to recognize without previous knowledge of the chromosome number.

VACCINIUM ULIGINOSUM L. & V. GAULTHERIOIDES BIGEL.

It has become customary in American floristic literature to follow Fernald (1923a) in his conclusion that the species *Vaccinium uliginosum* L. is represented on this continent only by its glabrous race var. *alpinum* Bigel., despite the fact that Malte (1934) demonstrated that American populations can easily be divided into the two categories *Macrophyllum* and *Microphyllum*, each with a glabrous and pubescent variety. Malte identified his *Microphyllum* with ssp. *microphyllum* described from Greenland by Lange (1880). It differs from typical *V. uliginosum*, or Malte's *Macrophyllum*, in the distinctly prostrate and short-branched habit, small and less-bluish leaves, long anther horns, and corollae which are distinctly urceolate with a clearly contracted opening. *Macrophyllum*, or *V. uliginosum* s.str., however, is a vigorously branched more or less erect plant with large, bluish-green leaves, short anther horns, and corollas which are broadly urceolate. It was shown by Hagerup (1933) that the macrophyllous plant is tetraploid with 2n = 48 chromosomes, whereas the microphyllous taxon is diploid with 2n = 24. His and Malte's results were, however, generally ignored by American taxonomists who still follow the treatment by Fernald (1923a).

The chromosome number differences, in addition to the distinctive morphological features separating these taxa, support the view that they are distinct species, as concluded by Hagerup (in Löve 1950). Hagerup, using the species name *V. microphyllum* (Lge.) Hagerup for the diploid taxon, overlooked, however, that this plant had already been described from Mt. Washington by Bigelow (1816) as *Vaccinium gaultherioides*,—"prostratum, foliis obovatis, integris, floribus subsolitariis; baccis oblongis, stylo coronatis." When Bigelow (1824) later reduced this species to that of var. *alpinum* of *V. uliginosum*, this introduced the confusion which culminated in the judgment made by Fernald (1923a, 1950), that this is the only North American race of the species.

Biosystematic studies performed on American material of this complex by the present writers have shown that the tetraploid *V. uliginosum* is the most widespread of these two taxa in North America. Although some minor variations occur within its populations, these hardly set the American plant apart as a geographical race distinct from the Eurasiatic plants as was suggested by Fernald (1923a). The diploid species *V. gaultherioides*, however, is considerably rarer and favors alpine and arctic situations and in this respect is ecologically distinct from the tetraploid plant (Hagerup 1933). D. Löve & Boscaiu (1965) re-emphasized its ecological characteristics and also reported on its unexpectedly wide geographical distribution in mountains far south of the area of the tetraploid in Eurasia. On Mt. Washington both species are met with, although there *V. uliginosum* is considerably more common than is *V. gaultherioides*.

Although we have so far only studied the diploid and tetraploid taxa from Europe and North America, this complex is known to include at least one higher number of a polyploid series. According to Hara (1952, 1953), populations from alpine regions of the volcano Mt. Asama in central Honshu in Japan are characterized by the octoploid chromosome number 2n = 72. He did not identify these plants with any previously described taxon, but it is possible that it may belong to some of the many varieties and formae described from within *V. uliginosum* s.lat. in the boreal Pacific region, or to some species like the still cytologically unknown Pacific taxa *V. occidentale* A. Gray, *V. salicinum* Cham., or *V. vulcanicum* Kom.

VACCINIUM ANGUSTIFOLIUM AIT. & **V. BOREALE** HALL & AALDERS.

Although recent reports from Mt. Washington and other New England mountains mention only the species *Vaccinium angustifolium* from the alpine zone (Harris 1964), this complex is also represented by two species in the barren areas of these mountains. The one in the subalpine and lower alpine zone is the tetraploid (2n = 48) boreal-montane species *V. angustifolium* s.str., characterized by relatively long, pale green, but not distinctly upright leaves, whereas the other at higher levels is the diploid (2n = 24)

V. boreale, which is a small, densely branched plant, with very small, narrow, and definitely erect leaves, and small flowers. Camp (1945) had noted the distinctions of these species. Since he was mistaken in his typification of *V. angustifolium* as the diploid plant, describing the tetraploid as the new species *V. Lamarckii,* Hall & Aalders (1961) had to retypify the former species and describe the diploid which had not previously been given a valid name; their typification has been confirmed by Dr. J. E. Dandy, keeper of the Botanical Department of the British Museum (Natural History) in London, who also sent us a photograph of the type which now is kept in the herbarium of the University of Colorado Museum.

OXYCOCCUS PALUSTRIS PERS.

As indicated by Hagerup (1940), Camp (1944), and Darrow, Camp, Fischer, & Dermen (1944), *Oxycoccus palustris* is a tetraploid which, most likely, stemmed from hybridization between the two diploid species *O. macrocarpon* (Ait.) Pers. and *O. microcarpus* Turcz. Although most populations are intermediate between these species, it is represented in Greenland and eastern North America by a major race, here named as *Oxycoccus palustris* ssp. **microphyllus** (Lge.) Löve & Löve, stat. nov., based on *O. palustris* f. *microphylla* Lange, in Medd. om Grönl. 3 (1887), p. 267, which in its small leaf size strongly simulates *O. microcarpus.* As mentioned above, such phenomena are not rare in hemialloploids and often cause taxonomic confusion since only if all characters are studied in detail is it possible to distinguish the tetraploid race simulating the characters of one of its diploid parents. In the case of ssp. *microphyllus,* however, several characters other than leaf size clearly show that it has affinities with *O. palustris.* The ssp. *microphyllus* is a rare plant of boggy places, often under krummholz, in the alpine zone of Mt. Washington, whereas at lower altitudes it is common.

HOUSTONIA COERULEA L.

The recently proposed merger of *Houstonia* and *Oldenlandia* under *Hedyotis* (Lewis 1961), on the basis of some morphological similarities, seems to be somewhat disputable since the considerable heterogeneity in basic chromosome numbers within these units may be taken as an indication that such an amalgamation is a step away from natural classification. Some of the species of *Houstonia* as circumscribed by Lewis & Terrell (1962) certainly do not fulfill even the basic requirements of the biological species concept, since even taxa regarded by them as s.str. or typical varieties are reported as having several chromosome numbers. A more critical approach is necessary to bring the cytological and taxonomical observations into concord. One of these reports, for *H. coerulea* "var. *coerulea,*" gives the chromosome numbers $n = 8, 9, 16$, and 24. It is, however, evident that *H. coerulea* s.str., or var. *coerulea* proper as described by Linnaeus (1753) from "Virginia," includes only the number $n = 16$, $2n = 32$, whereas the diploid number $2n = 16$ apparently belongs to an unrecognized southern species, the $n = 9$ occurred in an aberrant individual, and the single plant with $n = 24$ needs confirmation. The species sensu stricto is depicted as pl. 370 in *Curtis Botanical Magazine* XI (1797). Its distribution area is eastern North American or Appalachian.

In the alpine zone of the White Mountains, and also on the islands St. Pierre and Miquelon south of Newfoundland, occurs a race with white flowers and minor differences in leaf and bract form and in the form and size of the corolla tube. The relationships of these large populations and the occasional f. *albiflora* Millsp. of otherwise normal populations elsewhere remain unknown as long as no experimental studies are undertaken. The white-flowered plant from the White Mountains was described as *H. serpyllifolium* Graham at the same time as it was depicted in *Curtis Botanical Magazine* 55, pl. 2282 (1828). Although Fernald (in Louis-Arsène 1927) at one time felt it to be a good species and created the new combination *H. Faxonorum* (Pease & Moore) Fern., it is probably more appropriately classified as the variety *Faxonorum*, as proposed by Pease & Moore (1907). However, if investigations should prove it to be genetically similar to the lowland f. *albiflora*, then its classification at this lowest level is to be preferred. The plant seems to occur most frequently on the southeastern side of Mt. Washington, in and above the Alpine Garden up to the summit and in Huntington's and Tuckerman's Ravines. It is also known from Bigelow Lawn, the Great Gulf, and the Oakes Gulf. The variety and also the typical plants from the lowland are tetraploid with $2n = 32$ chromosomes, as was first reported by Stevens (1912) and later by Lewis & Terrell (1962) and confirmed by the present writers. The number $2n = 36$ reported by Fagerlind (1937) has not been verified.

CAMPANULA DUBIA A. DC. & C. GIESECKIANA VEST.

The *Campanula rotundifolia* complex has long defied efforts of taxonomists trying to subdivide it on the basis of morphological variations, although a number of disputable segregates have been accepted by some authors of flora manuals, mainly in Europe. The cause of this difficulty has been that although in some characters the complex shows distinct variations, these are often blurred by combinations of these characters with variations more or less common throughout the complex so that it appears as a continuously intergrading system.

Studies on the cytology of European and North American populations have so far been confined to observations of chromosome numbers and meiotic divisions in natural populations, whereas hybridization experiments are still lacking. These studies have shown, however, that the complex includes diploid, tetraploid, and hexaploid taxa, which cannot be regarded as conspecific on the basis of the biological species concept. In addition, variations in morphology at each level of ploidy may indicate that the polyploids have been formed from hybridizations between different diploids resulting in character combinations of various amplitude. Since some of these diploids may have been so closely related that their polyploid derivatives may be fully interfertile and therefore conspecific, their real relationships and taxonomic level can only be ascertained by aid of extensive studies of the cytogenetics of hybrids between morphologically and geographically distinct populations at each ploidy level. Hybridization studies on hybrids between different levels of ploidy could perhaps also reveal their parental combinations and the gradual differentiation of haplomes that has led to the differentiation of the diploids and, perhaps, some of the polyploids as well. Although it seems likely that at least many taxa at the same ploidy level may be most correctly classified as subspecies and varieties of a single species, it is safer to accept these categories at the higher level as long as experimental support for this assumption is lacking.

On Mt. Washington two distinct types of so-called *C. rotundifolia* occur, as observed by Tuckerman (1843) but ignored by most later authors

(Fernald 1950; Harris 1964; Pease 1964). The more widespread of these plants is a tetraploid (2n = 68), somewhat different from the tetraploids of the neighboring lowlands. It prefers wet and somewhat protected places where snowcover lasts all winter, as in the Alpine Garden, especially above the Huntington's Ravine. These plants are usually 15-30 cm or taller, with long, thin rhizomes and erect stems which are rarely curved at the base; the basal leaves are often many, round-cordate to oval and usually toothed, with long, completely glabrous petioles; the cauline leaves are linear to narrowly lanceolate, rarely less than 2 mm broad, and diminish distinctly above the middle of the stem; the flowers are comparatively large, 20-30 mm long usually with a widely open but variably campanulate corolla, one to many on each stem.

The other taxon is a deploid (2n = 34) which is nowhere as gregarious as the tetraploid taxon, although it may be more widespread in the alpine zone. It seems to prefer, or at least tolerate, solifluction areas like the one with *Potentilla hyparctica* ssp. *Robbinsiana* near the Lakes-of-the-Clouds mentioned above, where it grows in profusion, or wet soil between stones on the Bigelow Lawn and even on the summit in areas disturbed by frost. It is never met with in the wet snowpatches preferred by the other taxon. These diploids are comparatively small, usually less than 10 cm tall, with short, stout rhizomes, and creeping or ascending stems; the basal leaves are few, cordate to ovate or crenate but more usually almost triangular, entire, with long, somewhat hairy petioles; the cauline leaves are linear to lanceolate, rarely broader than 1-1.2 mm, and reduced in size only just below the flowers; the flowers are small, 15-20 mm long with a corolla which is broadly campanulate but not widely open, one or few on each stem.

The tetraploid taxon was identified by Tuckerman (1843) as dwarf specimens of the lowland *C. rotundifolia*, whereas Witasek (1902) did not hesitate to identify it with *C. dubia* A. DC., which was originally described from Newfoundland. That taxon, which was named *C. Gieseckiana* ssp. *groenlandica* by Böcher (1960), is a west-Atlantic plant of the Labrador Peninsula, Newfoundland, and the alpine zones of boreal eastern North American mountains (Gleason 1952); it is common in Greenland and locally frequent in Iceland and on the Faeroes, whereas its occurrence in Scandinavia and the Scottish mountains still is uncertain. It is well distinguished from the typical *C. rotundifolia* L. of Europe, as shown by Böcher (1960), but perhaps less clearly distinguishable from the lowland boreal American *C. intercedens* Witasek.

The diploid taxon was described by Tuckerman (1843) as var. *alpina*, and all its distinctive characters remain unmodified under cultivation on the lowland, as experimentally demonstrated in a garden at Yale University by Nichols (1934) and under greenhouse conditions at Montreal by the present writers. Its identity with *C. Gieseckiana* Vest s.str., or *C. Gieseckiana* ssp. *Gieseckiana* of Böcher (1960), is unquestionable. It is an arctic-alpine amphi-Atlantic species, occurring in northeastern America and Greenland and reaching Svalbard (cf. Rönning 1964), Novaya Zemlya and arctic Russia. It is possible that *C. Parryi* A. Gray of high alpine localities in the southern Rocky Mountains may be a diploid closely related to *C. Gieseckiana,* whereas other diploid relatives are met with in central European mountains.

SUMMARY

1. The plants of Mt. Washington, New Hampshire, and their relatives have been studied with an exact phytogeographical analysis of the history and evolution of this isolated alpine flora in view. Since such studies require a concept of species and subspecific units as phylogenetically precise as possible, the methods employed were those of cytotaxonomy combined with the classical approach to classification. This has resulted in a need for modifications in categories of some taxa met with on the mountain, although several of the nomenclatural alterations here proposed were necessitated by formerly inexact grouping rather than by changes in concept and method.

2. The following new names and combinations are validated: *Diphasium sitchense* (Rupr.) Löve & Löve, comb. nov. (p. 3); *Diphasium complanatum* (L.) Rothm, ssp. *flabelliforme* (Fern., Löve & Löve, comb. nov. (p. 3); *Huperzia Selago* (L.) Bernh. ssp. *chinensis* (Christ) Löve & Löve, comb. et stat. nov. (pp. 4 & 5); ssp. *serrata* (Thunb.) Löve & Löve, comb. et stat. nov. (p. 5); ssp. *lucidula* (Michx.) Löve & Löve, comb. et stat. nov. (p. 5); var. *porophila* (Lloyd & Underw.) Löve & Löve, comb. nov. (p. 5); *Trisetum triflorum* (Bigel.) Löve & Löve, comb. nov. (p. 6); ssp *molle* (Hultén) Löve & Löve, comb. nov. (p. 8); *Avenella flexuosa* (L.) Drej. ssp. *flexuosa* f. *flavescens* Sylvén, f. nov. (p. 9); ssp. *montana* (L.) Löve & Löve f. *pallida* (Berlin) Löve & Löve, comb. nov. (p. 9); *Eriophorum vaginatum* L. ssp. *Fauriei* (E.G.Camus) Löve & Löve, comb. et stat. nov. (P. 13); *Baeothryon caespitosum* (L.) A. Dietr. ssp. *germanicum* (Palla) Löve & Löve, comb. nov. (p. 15); ssp. *delicatulum* (Fern.) Löve & Löve comb. et stat. nov. (p. 15); *Baeothryon pumilum* (Vahl) Löve & Löve, comb. nov. (p. 14); *Baeothryon Clementis* (M.E.Jones) Löve & Löve, comb. nov. (p. 14); *Baeothryon Clintonii* (A.Gray) Löve & Löve, comb. nov. (p. 14); *Baeothryon verecundum* (Fern.) Löve & Löve, comb. nov. (p. 15); *Baeothryon subcapitatum* (Thwaites) Löve & Löve, comb. nov. (p. 15); *Baeothryon Mattfeldianum* (Kük.) Löve & Löve, comb. nov. (p. 15); *Baeothryon* subgenus *Anthelophorum* (Ohwi) Löve & Löve, comb. et stat. nov. (p. 15); *Carex debilis* Michx. ssp. *Rudgei* (Bailey) Löve & Löve, stat. nov. (p. 16); ssp. *pubera* (A. Gray) Löve & Löve, stat. nov. (p. 16); *Luzula spicata* (L.) DC. ssp. *saximontana* Löve & Löve, nom. nov. (p. 17); *Streptopus amplexifolius* (L.) DC. ssp. *americanus* (Schultes) Löve & Löve, stat. nov. (p. 18); ssp. *papillatus* (Ohwi) Löve & Löve, stat. nov. (p. 18); *Streptopus roseus* Michx. ssp. *longipes* (Fern.) Löve & Löve, comb. et stat. nov. (p. 18); *Veratrum viride* Ait. ssp. *Eschscholtzii* (A. Gray) Löve & Löve, comb. et stat. nov. (p. 18); *Listera cordata* (L.) R. Br. ssp. *nephrophylla* (Rydb.) Löve & Löve, comb. et stat. nov. (p. 19); *Alnus viridis* Vill. ssp. *crispa* (Ait.) Löve & Löve, comb. et stat. nov. (p. 20); ssp. *sinuata* (Regel) Löve & Löve, comb.

nov. (p. 20); *Betula pubescens* Ehrh. ssp. *borealis* (Spach) Löve & Löve, comb. et stat. nov. (p. 20); *Paronychia argyrocoma* (Michx.) Nutt. ssp. *albimontana* (Fern.) Löve & Löve, stat. nov. (p. 20); *Minuartia groenlandica* (Retz.) Ostenf. ssp. *glabra* (Michx.) Löve & Löve, stat. nov. (p. 21); *Silene acaulis* (L.) L. ssp. *arctica* Löve & Löve, subsp. nov. (p. 21); *Sorbus groenlandica* (C.K.Schneid.) Löve & Löve, comb. et stat. nov. (p. 23); *Ledum groenlandicum* Oeder ssp. *glandulosum* (Nutt.) Löve & Löve, comb. et stat. nov. (p. 25); *Oxycoccus palustris* Pers. ssp. *microphyllus* (Lge.) Löve & Löve, stat. nov. (p. 28).

3. In addition to detailed discussions on these and other races of the above species, taxa of the following species are also discussed in some detail: *Poa flexuosa* Sm., *Elymus Donianus* (F. B. White) Löve & Löve, *Calamagrostis nubila* Louis-Marie, *Calamagrostis canadensis* (Michx.) P. B., *Calamagrostis Langsdorfii* (Link) Trin., *Hierochloë fragrans* (Willd.) R. & S., *Hierochloë monticola* (Bigel.) Löve & Löve, *Carex capillaris* L., *Carex capitata* L., *Juncus trifidus* L., *Lysiella obtusata* (Pursh) Rydb., *Saxifraga hyperborea* R. Br., *Spiraea septentrionalis* (Fern.) Löve & Löve, *Potentilla hyparctica* Malte, *Ledum palustre* L., *Vaccinium uliginosum* L., *Vaccinium gaultherioides* Bigel., *Vaccinium angustifolium* Ait., *Vaccinium boreale* Hall & Aalders, *Houstonia coerulea* L., *Campanula dubia* A.DC. and *Campanula Gieseckiana* Vest.

4. The following chromosome numbers are reported:

Diphasium sitchense (Rupr.) Löve & Löve: 2n = 46; *Diphasium complanatum* (L.) Rothm. ssp. *complanatum*: 2n = 46; ssp. *flabelliforme* (Fern.) Löve & Löve: 2n = 46; *Huperzia Selago* (L.) Bernh. ssp. *Selago*: 2n = 272; ssp. *lucidula* (Michx.) Löve & Löve: 2n = 272; *Poa flexuosa* Sm. ssp. *Fernaldiana* (Nannf.) Löve & Löve: 2n = 42; *Trisetum triflorum* (Bigel.) Löve & Löve ssp. *triflorum*: 2n = 42; ssp. *molle* (Hultén) Löve & Löve: 2n = 42; *Hierochloë fragrans* (Willd.) R. & S.: 2n = 56; *Hierochloë monticola* (Bigel.) Löve & Löve: 2n = 63; *Hierochloë alpina* (Sw.) R. & S.: 2n = 56; *Eriophorum vaginatum* L. ssp. *spissum* (Fern.) Hultén: 2n = 58; *Baeothryon caespitosum* (L.) A. Dietr. ssp. *caespitosum*: 2n = 104; ssp. *delicatulum* (Fern.) Löve & Löve: 2n = 104; *Carex debilis* Michx. ssp. *Rudgei* (Bailey) Löve & Löve var. *Rudgei*: 2n = 60; var. *strictior* Bailey: 2n = 60; *Luzula spicata* (L.) DC. ssp. *spicata*: 2n = 24; ssp. *saximontana* Löve & Löve: 2n = 24; *Streptopus amplexifolius* (L.) DC. ssp. *americanus* (Schultes) Löve & Löve: 2n = 32; *Streptopus roseus* Michx. ssp. *curvipes* (Vail) Hultén: 2n = 16; ssp. *longipes* (Fern.) Löve & Löve: 2n = 16; *Veratrum viride* Ait. ssp. *viride*: 2n = 32; ssp. *Eschscholtzii* (A. Gray) Löve & Löve: 2n = 32; *Lysiella obtusata* (Pursh) Rydb.: 2n = 42; *Alnus viridis* Vill. ssp. *crispa* (Ait.) Löve & Löve var. *crispa*: 2n = 28; var. *mollis* Fern.: 2n = 28; *Minuartia groenlandica* (Retz.) Ostenf. ssp. *groenlandica*: 2n = 20; ssp. *glabra* (Michx.) Löve & Löve: 2n = 20; *Saxifraga hyperborea* R. Br.:

2n = 26; *Sorbus groenlandica* (C. K. Schneid.) Löve & Löve: 2n = 68; *Sorbus americana Marsh*: 2n = 34: *Sorbus decora* (Sarg.) C. K. Schneid.: 2n = 34; *Spiraea septentrionalis* (Fern.) Löve & Löve: 2n = 54; *Spiraea latifolia* (Ait.) Borkh.: 2n = 36; *Spiraea alba* Du Roi: 2n = 36; *Potentilla hyparctica* Malte ssp. *Robbinsiana* (Oakes) Löve & Löve: 2n = 49; *Ledum groenlandicum* Oeder ssp. *groenlandicum*: 2n = 26, 52; ssp. *glandulosum* (Nutt.) Löve & Löve: 2n = 26; *Vaccinium uliginosum* L.: 2n = 48; *Vaccinium gaultherioides* Bigel.: 2n = 24; *Vaccinium angustifolium* Ait.: 2n = 48; *Vaccinium boreale* Hall & Aalders: 2n = 24; *Houstonia coerulea* L. var. *coerulea*: 2n = 32; var. *Faxonorum* Pease & Moore: 2n = 32; *Campanula dubia* A.DC.: 2n = 68; *Campanula Gieseckiana* Vest: 2n = 34.

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