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# INTRODUCTION

Floras of high mountains of the temperate zone are fascinating for the botanist for several reasons. Sometimes, their study is a substitute for a visit to the far-away northlands, where low-growing plants struggle with the elements and bring forward colors and forms which are matched nowhere else. Frequently, the mountains give the student the feeling of perfection because only in such regions can he find plant growth so limited that he can easily comprehend it in its entirety within a limited period of time. But if he is interested in studying the effects of the processes of evolution, slow and erratic as they may be, on plants which have been forced to live for long periods under rugged conditions widely isolated from their relatives, then no material is more appropriate for his study than the floras of the bald summits of mountains deep south in the temperate zone. The fascinating landscapes and stimulating weather conditions which unavoidably accompany the climbs needed to reach these plants are additional conditions which make studies of these floras still more captivating.

Temperate North America is a moderately mountainous area, although the Rocky Mountains cover a considerable part of its western regions. In the east the Appalachians range from cool Canada to the frostless southeast, but they are mainly gentle in height and therefore covered with protective forests in most places. Only occasionally do their summits reach heights where the climate becomes comparable to that of the northlands so that the friendly forests are replaced by the low-growing vegetation of the lands of the midnight sun.

The White Mountains of New Hampshire have long been known for their many peaks with summits which to the wanderer on the lowland look bald and hostile, yet inviting. Of these peaks, which are collectively named the Presidential Range because they carry the names of early American presidents, Mt. Washington is the tallest with its about 1915 meters high summit and extensive treeless area. The flora of this mountain has attracted botanists for three centuries, and its accessibility and closeness to some of the greatest centers of botanical learning has resulted in a more detailed knowledge of its flora than that of any other alpine region in America.

During six summers we have enjoyed long stays in the alpine zone of Mt. Washington, because we wanted to collect extensive material on the history and relationships of its remarkable flora. The comprehensive re-

sults of these investigations are being prepared for a separate publication, whereas some taxonomical remarks have been published elsewhere (Löve & Löve 1965). Our studies also included chromosome investigations of all the 165 species of vascular plants known to be native in the alpine zone of the mountain. Since it seems desirable that specialized biosystematic discussions be made available also to those who may have more limited interest in other details of the comprehensive investigation, the present contribution has been composed as a separate report of the cytotaxonomy of the flora concerned.

Although various aspects of the botany of high mountains have been thoroughly investigated by numerous scientists in various parts of the world during the past century or two, chromosome studies in alpine plants have been incidental and made mainly on selected genera. Intensive cytological studies of many of the species of such floras still are restricted to a handful of mountains, and the present study seems to be the first such investigation including all the native species of a restricted alpine flora. Comprehensive studies of the chromosome numbers in alpine floras were first performed by Sokolovskaja & Strelkova (1938, 1940, 1948a, b) in Altai, Pamir, and Caucasus, mainly in order to investigate the increase in the frequency of polyploids under adverse conditions. Later studies on chromosome numbers in alpine floras have been made by Favarger (1949, 1950, 1953, 1957, 1959, 1964a, b, 1965) in the Alps, Knaben (1950, 1961) and Knaben & Engelskjön (1966) in the Norwegian mountains, Löve (1953) and Löve & Löve (1956) in Iceland, Quézel (1957) in North Africa, Hedberg (1958) in Scotland, Funabiki (1960) in western North America, Diers (1961) in Peru, Morton (1961) in the Cameroons of West Africa, Borgmann (1964) in the Bismarck Mts. of New Guinea, Beaman, DeJong & Stoutamire (1962) in Mexico and Guatemala, and Skalińska (1963) in the Tatra Mountains of Poland. The approaches and scopes of these studies have, however, little more in common than that alpine plants and their cytological characteristics were considered.

The importance of cytological studies on alpine plants is manifold. Critical taxa can be more exactly defined if the number and morphology of their chromosomes is known so this character can be compared to that of closely related taxa which may have been confused with them; this kind of work is based on the fact that a biologically well-defined species can have but a single chromosome number and a limited variation in choromosome morphology (cf. Darlington 1963, 1965; Löve 1954c, 1960, 1964, 1965; Mayr 1942, 1962). Even a simple chromosome count has often proven of greater value for recognizing the distinctness of a species than do hours of morphological comparison; the flora of Mt. Washington includes a number of demonstrations of the validity of this claim. Cytological studies are also of value in investigations of the degree of differentiation, subspecific or specific,

of temperate mountain races of species of arctic or subarctic regions or of species reaching from the lowlands to the summits, and can, thus, give information as to the speed of these processes. Likewise, the occurrence of cytological deviations in alpine races of species otherwise met with at lower levels may be indicative of the evolutionary history of the former, and studies of polyploids in alpine and lowland regions often give a clue to the history of the particular genera and of the significance of polyploidy for their evolution and survival. Last but not least, the frequency or spectrum of polyploids under alpine and other adverse conditions seems to be an important indicator of the past history and climatic conditions under which a particular flora has evolved, similar to but distinct from the long-known phenomenon of the biological spectrum (Raunkiær 1934; Cain 1944; Löve 1964, 1965; Löve & Löve 1949, 1953, 1963, 1964). The cytological data here presented will be analyzed elsewhere from this point of view, in connection with an evaluation of the geobotanical significance of polyploids for an increase in altitude (Löve & Löve, 1966b).

The cytological material of the species of vascular plants in the flora of Mt. Washington was collected during numerous visits to the summit of the mountain in the summers of 1957-1963. A few cytological studies were made on meiotic material with the aid of a portable microscope during these visits at the Mt. Washington Summit Hotel where we stayed, whereas the bulk of the work was based on root-tip fixations made when the plants were collected on the mountain, or, in a few cases, on specimens transplanted to Montreal and cultivated in a greenhouse at the Institut Botanique of the Université de Montréal. A few counts were also verified on Mt. Washington plants cultivated in the greenhouses of the Department of Biology of the University of Colorado in Boulder.

Almost all the fixations were made in the Svalöv modification of Navashin's fixative (Löve & Sarkar 1956), sectioned, and stained in crystal violet with a small addition of anilin. Although only a single voucher is given for each chromosome number here reported, no number has been counted on a single specimen only, and usually the report has been verified on several fixations of various individuals collected in different years in several localities on the mountain. The voucher specimens referred to in the text will be kept in the Herbarium of the University Museum in Boulder (COLO).

# THE MT. WASHINGTON TAXA

1. **LYCOPODIUM ANNOTINUM** L.
SSP. **ANNOTINUM**
*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7768. $2n = 68$.
SSP. **ALPESTRE** (HARTM.) LÖVE & LÖVE
*Voucher:* Lakes-of-the-Clouds, July 1, 1960, Löve & Löve 7510. $2n = 68$.

The present authors share the opinion of Hultén (1962) that the two major races above ought to be treated as variations of the same species, and not as distinct species as proposed by some authors. The lowland race, ssp. *annotinum,* has been divided into some varieties by some botanists, of which the boreal eastern American var. *acrifolium* Fern. (Fernald 1915b) with long and relatively lax leaves, is met with in small forest isolates in the subalpine zone on Mt. Washington up to about 1600 m.s.m. in the Tuckerman's Ravine, but it is common in the forests below.

The arctic-alpine race, ssp. *alpestre,* however, grows fairly commonly in exposed habitats and heathlike conditions in the alpine zone, almost up to the summit and as far down as to about 1370 m.s.m. in the Oakes Gulf. Although the American plant, var. *pungens* (La-Pylaie) Desvaux, differs from the Scandinavian taxon, var. *alpestre,* which Rothmaler (1964) regards as the species *L. dubium* Zoëga, in having narrower, thicker and harder and dorsally convex entire, not serrate leaves, we regard it only as a variety *pungens* of the arctic-alpine subspecies.

The chromosome number 2n=68, or c. 68, has previously been reported for ssp. *annotinum* by Manton (1950), Ehrenberg (1945, c. 66), Harmsen (in Löve & Löve 1948, c. 66), Löve & Löve (1958), and Sorsa (1958, 1961, 1962, 1963), whereas Harmsen (in Löve & Löve 1948) counted 2n = 66 for ssp. *alpestre* (from Greenland, var. *pungens*?), and Löve & Löve (1958) reported 2n = 68 for ssp. *alpestre* var. *alpestre* from Iceland.

2. **LYCOPODIUM CLAVATUM** L.
SSP. **CLAVATUM**
*Voucher:* Cape Horn, July 28, 1958, Löve & Löve 7571. $2n = 68$.
SSP. **MONOSTACHYUM** (DESV.) SEL.
*Voucher:* Chandler Ridge, August 8, 1962, Löve & Löve 7761. $2n = 68$.

As mentioned by Hultén (1962), this variable species has been divided into several more or less distinct varieties. Of these, three were regarded as subspecies by Selander (1950) and Löve and Löve (1958), i.e. ssp. *clavatum,* ssp. *monostachyum* ("Grev. & Hook.") Sel., and ssp. *megastachyum* (Fern. & Bissell) Löve & Löve. It is possible that the American ssp. *megastachyum* would be more correctly treated as a variety only of ssp. *clavatum,* although it has a sizeable area of its own and seems to be able to grow together with this race without disappearing. However, ssp. *monostachyum* certainly is an old and major geographical race, morphologically clearly distinct but still able to mix with the main race where they meet. It has been named as the species *L. lagopus* (Laest.) Zinzerl. by Zinzerling

(in Kuzeneva 1953), but Tolmatchev (1960) agrees that it is better classified at the subspecific level. The arctic-alpine subspecies prefers exposed situations and is best characterized by its single strobilus with a short, 0.5 - 2.5 mm. long, peduncle and short branches with densely imbricate leaves, whereas the typical subspecies is a plant of boreal woods, characterized by having two (or three) strobili with a long, 3.5 - 15 mm., peduncle.

On Mt. Washington, ssp. *clavatum* is common in the forests on the slopes, but it reaches the subalpine region only on Cape Horn. The ssp. *monostachyum* is also rare on the mountain and seems to be known only from heath vegetation and wind exposed northeast-facing slopes of Chandler Ridge.

The chromosome number 2n = 68 has been reported previously for the ssp. *clavatum* by Manton (1950), Mehra & Verma (1957), Löve & Löve (1958), and Sorsa (1958, 1961, 1962, 1963). It has also been reported for ssp. *monostachyum* by Löve & Löve (1958). The number 2n = 136 characteristic of certain Indian plants identified as *L. clavatum s.l.* by Ghatak (1965) seems to indicate the need for further taxonomic studies of this group outside its boreal area of distribution.

3. **LYCOPODIUM OBSCURUM** L.
*Voucher:* Tuckerman's Ravine, July 27, 1958, Löve & Löve 7559. *2n = 68.*

We agree with Hultén (1941) that the difference between the typical race of this American—eastern Asiatic species and the so-called *L. dendroideum* Michx. is, most likely, caused by modification in exposed places and, therefore, of no taxonomic significance.

*L. obscurum* is common in the conifer forests around Mt. Washington, where it has been observed as high up as at about 1470 m.s.m., just at the limit of the subalpine zone.

The only previous chromosome count for this species is 2n = 68 reported by Löve & Löve (1958) from the Lac Ouareau region of Quebec, and by Wagner & Wagner (1966) from Virginia. The same number has also been counted by the present writers from Pointe du Bois, Manitoba (Löve & Löve 5533, June 22, 1952, WIN) and from Thunder Cape on the Sibley Peninsula in western Ontario (Löve & Löve 6946, August 15, 1955, WIN, "var. *dendroideum*").

4. **DIPHASIUM SITCHENSE** (RUPR.) LÖVE & LÖVE
*Voucher:* Ball Crag, July 8, 1961, Löve & Löve 7629. *2n = 46.*

This North American—eastern Asiatic subarctic-subalpine species is rare in the Alpine Garden of Mt. Washington, from where it was reported by Eggleston (1902) and Harris (1944, 1964). It grows also in heath on the warm and protected southeast slope of Ball Crag at about 1700 m.s.m. where it was discovered by H. Harris in 1961. This chromosome number has also been counted by Wilce (1965) from Labrador.

5. **DIPHASIUM COMPLANATUM** (L.) ROTHM.
SSP. **FLABELLIFORME** (FERN.) LÖVE & LÖVE
*Voucher:* Cape Horn, July 3, 1959, Löve & Löve 7529. *2n = 46.*

It is our feeling that this much discussed eastern North American taxon (cf. Löve & Löve 1965) is a race that survived at least some part of the Pleistocene south of the glaciers, as suggested by Hultén (1962). Although typically a forest plant, it reaches the subalpine zone of Mt. Washington at Cape Horn (Pease 1924, 1964), but it is also frequent in the barren areas along the

carriage road, probably thanks to human influences. In addition to the specimen here given as a voucher for our chromosome determination, we have also counted the chromosome number 2n=46 from various forest localities elsewhere within the area of distribution of the race (cf. Löve & Löve 1965). Some of these determinations were reported as 2n = 48 by Löve & Löve (1958), but corrected to 2n = 46 after recountings made when Wilce (1961, 1965, and in Löve & Löve 1961d) had shown this to be the correct number for all *Diphasium* species studied by her.

6. **HUPERZIA SELAGO** (L.) BERNH.
*Voucher:* Near Summit of Mt. Washington, July 25, 1958, Löve & Löve 7513. Great Gulf, July 3, 1960, Löve & Löve 7717. *2n = 264.*

Although the alpine eastern North American representatives of this species have long been identified as the arctic-alpine race, ssp. *appressa* (Desv.) D. Löve, usually at the level of variety or even forma, it was shown by Löve & Löve (1965) to be merely a modification of the typical race, ssp. *Selago*. It is replaced at lower levels in eastern North America by its truly vicarious taxon, ssp. *lucidula* (Michx.) Löve & Löve, which also is characterized by the chromosome number 2n = 264. All other numbers previously published from this group are probably only inexact approximations, including the 2n = 272 arrived at by Löve & Löve (1965). It ought also to be mentioned that the proposal to place *H. serrata* (Thunb.) Rothm. as a subspecies only of *H. Selago,* made by Löve & Löve (1965), is clearly contradicted by the recent report of the chromosome number 2n = 528 for this species, or twice the number characteristic for the other taxa of the *H. Selago* complex (Ghatak 1965).

7. **ISOËTES SETACEA** LAM. SSP. **MURICATA** (DUR.) HOLUB
*Voucher:* Upper Lake-of-the-Clouds, August 31, 1962, Löve & Löve 7826. *2n = 22.*

Although Boivin (1961), Löve & Löve (1961), Fuchs (1962), Löve (1962c) and others have accepted the view of Rothmaler (1944) in rejecting the name *I. setacea* Lam. as a *nomen confusum* in favor of the long accepted name *I. echinospora* Dur., Rothmaler (1963) rejected the latter to the advantage of *I. tenella* Léman, an unidentifiable Scandinavian plant most likely identical with *I. lacustris* L. (cf. Lange 1887; Löve 1962c). Since we agree with the reasoning of Holub (1963) that the argumentation against the name *I. setacea* is contrary to the International Code, this name has to be used for the circumpolar complex discussed by Löve (1962c). The subspecific names used by Löve (1962c) were all transferred to this species by Holub (1963) and his conclusions were also accepted by Jermy (1964) in Flora Europaea.

The only place in the alpine-subalpine zone of Mt. Washington where *Isoëtes* is known to occur, is the muddy bottom beneath several feet of water of the larger, or upper, Lake-of-the Clouds, where it is extremely rare (Harris 1944) and represented by the var. *Braunii* (Dur.), a possible cold climate modification. The chromosome number 2n = 22 has previously been reported for all the subspecies of *I. setacea* by several authors (cf. Löve 1962c).

8. **OSMUNDA CLAYTONIANA** L.
*Voucher:* Ball Crag, July 8, 1961, Löve & Löve 7630. *2n = 44.*

The species of moist woods in eastern North America is represented in eastern and southern Asia by a race at the subspecific level. The plant reaches the subalpine zone of Mt. Washington on

the southeast face of Ball Crag, where it has been collected by H. Harries (301) at 1580 m.s.m. in snowbed vegetation. It is highly intolerant to crowding by other species and forms a dominant single-species community in this habitat.

The chromosome number 2n = 44 for ssp. *Claytoniana* was reported by Britton (1964 and in Fabbri 1963), but it has also been reported for plants of the Asiatic race from Kashmir by Bir (1962).

### 9. PHEGOPTERIS CONNECTILIS (MICHX.) WATT

*Voucher:* Slope above Alpine Garden, July 25, 1958, Löve & Löve 7561. Lakes-of-the-Clouds, July 1, 1960, Löve & Löve 7688. *2n = 90.*

This is a boreal species reaching into the subalpine, alpine, and subarctic zones only in favorable habitats and warm niches. On Mt. Washington it occurs in snowbed vegetation on steep and wind-protected slopes, especially at the foot of rock faces, and reaches up to about 1700 m.s.m. on the headwall of the Alpine Garden. In the forest below it is common. It is an apomictic species with the chromosome number 2n = 90, which we have verified on plants from Mt. Mansfield of the Green Mountains in Vermont, and on plants from various forest localities in New England, Quebec, and British Columbia. It is a confirmation of previous reports from America by Britton (1953) and Wagner (1955) and from Europe by Manton (1950), Sorsa (1958, 1962), Löve & Löve (1961c), and Vida (1963).

### 10. CARPOGYMNIA DRYOPTERIS (L.) LÖVE & LÖVE.

*Voucher:* Alpine Garden, July 5, 1958, Löve & Löve 7506. *2n = 160.*

The name *Gymocarpium* Newm. has recently been declared illegitimate (Taxon 15, 1966, p. 287). We propose its replacement with *Carpogymnia* Löve & Löve, gen. nov. (based on *Gymocarpium* Newm., Phytol. 4 (1), 1851, p. 371: *Thelypteris* sect. *Carpogymnia* H. P. Fuchs). The species *C. Dryopteris* (L.) Löve & Löve, comb. nov. (based on *Polypodium Dryopteris* L., Sp. pl. 1753, p. 1093) reaches 1600 m.s.m. in sheltered niches at the foot of rocks or among krummholz of *Abies* at the headwall of the Alpine Garden.

The chromosome number here reported is a confirmation of earlier American and European reports by Britton (1953), Wagner (1963), Sorsa (1958, 1962, 1963), and Löve & Löve (1961c). We have also counted this number on plants from the Gaspé Peninsula in the province of Quebec.

### 11. ATHYRIUM FILIX-FEMINA (L.) ROTH SSP. ANGUSTUM (WILLD.) R. T. CLAUSEN

*Voucher:* Lakes-of-the-Clouds, August 30, 1959, Löve & Löve 7612. *2n = 80.*

Though this is a very variable species if taken in the wide sense, the morphological and cytological evidence available does not support the splitting of it into several species, as proposed by some authors, whereas this evidence is in favor of the treatment suggested by Hultén (1962). He distinguishes five subspecies, i.e., ssp. *Filix-femina* of Eurasia, ssp. *cyclosorum* (Rupr.) Hultén and ssp. *californicum* (Butters) Hultén of western North America, and ssp. *angustum* (Willd.) R. T. Clausen and ssp. *asplenioides* (Desv.) Hultén of eastern North America. According to Fernald (1950), the var. *sitchense* Rupr. which is the ssp. *cyclosorum* of Hultén, occurs on mountains of northeastern Newfoundland and the Gaspé Peninsula and should, therefore, be grouped as a bicentric American taxon. Although this is accepted by Scoggan

(1950) and Gleason (1952), but not by Gleason & Cronquist (1963), it is based on misidentification since all eastern plants so determined by Fernald and seen by us are either diseased or poorly developed specimens of ssp. *angustum*.

The northeastern American ssp. *angustum* is a variable plant of damp thickets, meadows, and swamps, and it passes freely into the southeastern ssp. *asplenioides*. Although several more or less easily distinguishable formae of the northeastern race have been described, there seems reason to doubt if at least some are anything more than modifications; this needs experimental verification.

On Mt. Washington, ssp. *angustum* is frequent in the forests but also in subalpine snowbed vegetation on steep slopes facing south or southeast. It is often associated with krummholz, as near the Lakes-of-the-Clouds, or with rocky shelters, as on the headwall of the Alpine Garden, but it has also been reported from the very summit of the mountain, by Harris (1944), though we have not seen it there.

The voucher specimen from Mt. Washington for our count of 2n = 80 chromosomes, seems to be referable to the so-called f. *rubellum* (Gilbert) Farwell, which is perhaps only an alpine modification; similar plants from Mt. Albert on the Gaspé Peninsula also had 2n = 80 chromosomes. This number has been reported previously for the var. *Michauxii* (Spreng.) Farwell, which is synonymous with ssp. *angustum*, by Wagner (1955), whereas Britton (1953) studied an individual with 2n = 80 + 1. Eurasiatic ssp. *Filix-femina* also has 2n = 80 chromosomes (cf. Löve & Löve 1961d; Fabbri 1963), and the same number has been reported by Wagner (in Fabbri 1963) for plants from the state of Washington, presumably belonging to the ssp. *cyclosorum* (cf. Hultén 1962). The other two subspecies remain cytologically unknown.

12. **DRYOPTERIS CAMPYLOPTERA** (Kunze) Clarkson

*Voucher:* Lakes-of-the-Clouds, July 25, 1958, Löve & Löve 7517. *2n = 164.*

This eastern North American species of the *D. dilatata* complex closely resembles European *D. dilatata* (Hoffm.) A. Gray, as pointed out by Walker (1961). It is, however, most easily distinguished from that species by aid of the prostrate habit of the rhizome and the usually glabrous indusia. It has no glands on the underside of the pinnae, and the dark brown central stripe on the scales is seen only on the most basal scales. On Mt. Washington this species seems to be common in the *Abies* forests, especially in habitats influenced by seepage water. At altitudes above these forests it is frequent in subalpine snowbeds on steep and protected slopes, and it reaches 1580 m.s.m. on the headwall of the Alpine Garden. We have been unable to confirm the report of the diploid species *D. intermedia* (Muehl.) A. Gray (*D. spinulosa* var. *intermedia*) from the alpine zone of Mt. Washington (Harris 1944), although its occurrence below the Tuckerman's Ravine (Pease 1964) is factual.

The chromosome number 2n = 164 here reported from Mt. Washington is a confirmation of previous reports by Walker (1959, 1961), Wagner & Hagenah (1962), Wagner (1963), Britton (in Fabbri 1963), Löve & Löve (in Löve & Solbrig 1964b), Wagner & Wagner (1966), and Britton & Soper (1966). Although it is the same number as typical of *D. dilatata* from Europe (cf. Löve & Löve 1961d; Fabbri 1963), this does not necessarily confirm or contradict the proposal by Hultén (1958), who includes it in his ssp. *americana* (Fisch.) Hultén, apparently confusing its distribution also with that of the good diploid (2n = 82) species *D. assimilis* S. Walker (cf. Löve & Löve 1966a).

13. **PICEA MARIANA** (MILL.) BRITT., STERNS. & POGG.
*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7541. $2n = 24$.

The North American counterpart of the Old World *Picea Abies* (L.) Karst. is formed by the two taxa, *P. mariana* and *P. rubens* Sarg., the latter of a more southern and eastern distribution which may indicate that it has been formed from an isolate during the Pleistocene, whereas the former is one of the important forest trees of the boreal zone. Since they occasionally form apparently fertile hybrids where they meet and may have been intergrading since the end of the Pleistocene as suggested by Morgenstern & Farrar (1964), they are hardly to be regarded as good species. Both are known to be interfertile with the Eurasiatic taxon, and so it may seem plausible to regard *P. mariana* as a subspecies only of *P. Abies,* with the two varieties *mariana* and *rubens,* although experimental evidence in support of such a suggestion still seems to be incomplete (Eklundh 1943; Wright 1955). A perhaps comparable amalgamation of the western American species *Picea glauca* (Moench) Voss and *P. Engelmannii* (Parry) Engelm. at the subspecific level has recently been proposed by Taylor (1959), although their relationship seems to be more exactly reflected as that of two varieties only. *P. mariana* forms, together with *Abies balsamea* (L.) Mill., the krummholz zone on Mt. Washington and persists even in sites too severely exposed for *Abies,* whereas at lower elevations it is partially replaced by *P. rubens.* The report of the latter species in the alpine zone (Pease 1924, 1964; Harris 1944) is likely based on upright but severely frost-damaged specimens with reddish-hairy twigs, yellowish needles, and blue cones, which we regard as typical *P. mariana.*

The chromosome number $2n = 24$ here reported from Mt. Washington confirms previous reports by Sax & Sax (1933) and Löve & Löve (1961d). The same number is typical of *P. rubens,* as shown by Santamour (1960) and confirmed by us on specimens from lower levels in New Hampshire and the province of Quebec.

14. **ABIES BALSAMEA** (L.) MILL.
*Voucher:* Great Gulf, August 8, 1962, Löve & Löve 7806. $2n = 24$.

Morphological similarities between the eastern North American species *Abies balsamea* and its western counterpart *A. lasiocarpa* (Hook.) Nutt. seem to indicate a relationship closer than that of two well-distinguished species, but it would be premature to unite them as two subspecies before more biosystematic evidence has become available also from their Asiatic relatives. In the case of the southeastern North American taxon *A. Fraseri* (Pursh) Poir, however, the knowledge is somewhat more conclusive. That tree of the mountains of Virginia, North Carolina, and Tennessee, is best characterized by its strongly reflexed bracts which are much longer than the scales, as contrasted to the typical *A. balsamea,* the bracts of which are usually shorter than the scales. However, alpine and northern populations of the latter, classified by Fernald (1909) as the variety *phanerolepis,* often simulate the southern taxon, though its bracts are, most frequently, almost equal to the scale. Therefore, it may be suggested that *A. Fraseri* actually is a remnant of a Pleistocene southern isolate in which the gene pool characterizing the larger populations in the northeast has been drastically reduced (cf. Myers & Bormann 1963). It is, thus, hardly a good species but, more likely, a variety of a limited geographical importance or, at the most, a weak subspecies.

The characters distinguishing var. *phanerolepis* from the main race of *A. balsamea* seem to form a gradual change

from the pure var. *balsamea* in the spruce-hardwood zone below 750 m.s.m. on Mt. Washington, with intermediates up to about 1500 m.s.m., and pure var. *phanerolepis* above that level and throughout the alpine tundra and krummholz zone. Since similar trends are met with also on Mt. Katahdin and some other eastern North American mountains as observed by Myers & Bormann (1963), there seems good reason to suggest that the condition recognized as var. *phanerolepis* is the extreme of a cline which can be formed from the gene pool of lowland *A. balsamea* by genetic recombination and natural selection wherever the populations climb a mountain. Therefore, it is a matter of convenience if this extreme is given a taxonomical recognition.

The chromosome number here reported for *A. balsamea* was counted on root-tips of a typical var. *phanerolepis* specimen from the krummholz zone. It confirms an old report from cultivated material of the species studied by Miyake (1903) and recent counts by Löve & Löve (1961d and in Löve & Solbrig 1964a) and Löve & Ritchie (1966) from the typical var. *balsamea* from Quebec and Manitoba respectively.

15. **GLYCERIA STRIATA** (LAM.) HITCHC.
SSP. **STRICTA** (SCRIBN.) HULTÉN
*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7803. $2n = 20$.

Judging from their morphological similarity, the American *Glyceria striata* has a true vicariad (cf. Löve 1954a, b, 1955) in the Eurasiatic *G. lithuanica* (Gorski) Lindm. and, inferred from their morphological resemblance, ecological preferences, geographical distributions, and number and, especially, morphology of the chromosomes, it would hardly be a great mistake to regard the latter as an Eurasiatic boreal subspecies of the former, although necessary experimental support for this suggestion is still lacking. The typical American ssp. *stricta* is a grass of moist or peaty forests or meadows, whereas in richer soils in alpine and subarctic regions it is represented by a race nicely distinguished by its lower growth and narrower leaves, longer and usually purplish spikelets, and a broadly scarious tips on the lemmas. Fernald (1929), who accepted this taxon as a "very strong variety," even mentioned that it might be a distinct species, whereas Hultén (1942) named it as a subspecies. It is our opinion that this is an appropriate status for this important alpine-subarctic American taxon, although Hitchcock & Chase (1951) almost ignored its existence and only mentioned it in passing.

The boreal ssp. *striata* is not rare in the New England and Quebec lowlands, where we have found the chromosome number $2n = 20$ in several collections. The same number has also been reported by Church (1949), Bowden (1960a), and Packer (1964). Our plant of ssp. *stricta* was a single individual collected on the headwall of the Tuckerman's Ravine, where the taxon must be extremely rare, because we only observed it once and it seems to have been collected there only twice before, by Pease in 1908 and 1933 (cf. Pease 1964). It had the chromosome number $2n = 20$. That number has also been reported for *G. lithuanica* by Tateoka (1954a, b, 1959).

16. **SCHIZACHNE PURPURASCENS** (TORR.) SWALLEN.
*Voucher:* Oakes Gulf, July 7, 1960, Löve & Löve 7739. $2n = 20$.

This Asiatic-North American grass has recently been treated by Koyama & Kawano (1964), who divided it into two subspecies, the North American ssp. *purpurascens* which also is known from Kamtchatka, and the Asiatic ssp. *callosa* (Turcz.) Koyama & Kawano. The former is common in woods and meadows at

lower elevations in the White Mountains and reaches into the subalpine zone of Mt. Washington only at about 1520 m.s.m. in the Oakes Gulf where it grows among *Alnus* shrubs. The chromosome number 2n = 20 of that population confirms reports by Boyle (1944) and Bowden (1960a) for ssp. *purpurascens* and by Tateoka (1957) for ssp. *callosa*.

17. **FESTUCA RUBRA** L.
SSP. **RICHARDSONII** (HOOK.) HULTÉN
VAR. **PROLIFERA** PIPER
*Voucher:* Great Gulf, August 30, 1962, Löve & Löve 7817. *2n = 49.*

We share the views of Hultén (1962), who includes the major variations of the *Festuca rubra* complex as subspecific entities of a single species. Of these the circumpolar arctic-alpine taxon often misidentified as var. *arenaria* (cf. Kjellqvist 1964) is accepted as the somewhat variable but reasonably distinct ssp. *Richardsonii*. This major race is represented in subarctic eastern North America and in some eastern mountains by a viviparous minor race, which was recognized by Fernald (1933) as the species *F. prolifera* (Piper) Fern. Its type locality is Mt. Washington. As shown by Fernald (1933), this viviparous taxon is represented in parts of Newfoundland, Anticosti Island, and most of the arctic-subarctic parts of the Labrador Peninsula by a plant with hairy lemmas and spikelets, var. *lasiolepis* Fern. Fernald (1933) claimed that his plant is occasionally floriferous, as contrasted to the always viviparous typical plant with glabrous spikelets. The viviparous plant has a wide distribution, or the amphi-atlantic area of the hairy taxon and the more southern northeast area of the glabrous taxon. We are of the opinion that the collective viviparous taxon is a good variety of ssp. *Richardsonii*, contrary to Hylander (1945, 1953), who regarded it as a *forma* only. It follows that if it is given this rank, then the entire viviparous complex must be named var. *prolifera* Piper as validated in Robinson (1908). We see no reason to propose any change in this reference, despite the fact that we here insert a subspecific category between the species and variety, since this does not affect the rank of the latter. The glabrous and hairy taxa are, then, correctly spearated as the boreal-montane North American f. *prolifera* and the more northern and amphi-atlantic f. *lasiolepis* (Fern.) Löve & Löve, statd. nov. (based on *F. prolifera* (Piper) Fern. var. *lasiolepis* Fernald, in Rhodora 35, 1933, p. 136).

It is the glabrous f. *prolifera* of var. *prolifera* which occurs on Mt. Washington. It is a fairly common and important component of the vegetation of moist subalpine meadows between 1500 and 1700 m.s.m. at the headwall of the Great Gulf, whereas it is rare in the Alpine Garden and unknown from elsewhere on the mountain. The chromosome number 2n = 49 is a confirmation of a count made by Kjellqvist (unpubl.), who also found individuals with 2n = 63 chromosomes in the Great Gulf population in 1962. Typical ssp. *Richardsonii* has 2n = 42 chromosomes, as has also ssp. *rubra* (cf. Löve & Löve 1961d).

18. **FESTUCA BRACHYPHYLLA** SCHULTES
*Voucher:* Summit, below the hotel, July 27, 1958, Löve & Löve 7568. *2n = 42.*

This arctic-alpine representative of the *Festuca ovina* group is characterized by rather broad scales, a glabrous culm, and short anthers. Its occurence on Mt. Washington was apparently unknown to Fernald (1950), who did not record it south of the Gaspé Peninsula; likewise, neither Pease (1924, 1964) nor Harris (1964) knew of its existence on the mountain. It is, however, mentioned from high mountains of Vermont, New

Hampshire, and New York by Hitchcock & Chase (1951), and from New England mountains by Scoggan (1950); and Hultén (1962) marks a dot on Mt. Washington. We have collected flowering specimens at the summit, where it grows in sandy soils clearly affected by human activities, but it also grows in more natural vegetation elsewhere on the mountain, though the rarity of flowering specimens makes its identification difficult, except by aid of cytological methods.

The chromosome number here given for Mt. Washington plants is the same as reported from arctic populations by Holmen (1952, 1964), Jörgensen, Sörensen & Westergaard (1958), Bowden (1956, 1960a), Mosquin (in Savile 1964), and Zhukova (1965a, b).

19. **POA RIGENS** HARTM.
*Voucher:* Huntington's Ravine, July 27, 1958, Löve & Löve 7565. *2n = 72.*

This is the plant reported from Mt. Washington as *Poa alpigena* (Fr.) Lindm. by Pease (1964). It is an arctic-alpine circumpolar representative of the *Poa pratensis* L. complex. It is most easily distinguished from other taxa of that group by its rather dense and contracted panicle; the second glume reaches only to the middle of the lemma, and the intermediate nerves of the lemma are minutely pubescent. It is a plant of somewhat moist meadows, rare on Mt. Washington, and it seems to flower infrequently in the alpine zone though it does not thrive in the forested zone below. It is an apomictic species which has been found to have chromosome numbers varying from 2n = 28 to 2n=127 in other regions (cf. Löve & Löve 1961d). The voucher specimens and several other collections studied by us from Mt. Washington all had 2n = 72 chromosomes, thus indicating that the population here is completely apomictic and perhaps derived from a single individual. This is supported by the fact that we found no morphological variation between plants from different localities on the mountain.

20. **POA FLEXUOSA** SM.
SSP. **FERNALDIANA** (NANNF.) LÖVE & LÖVE
*Voucher:* Headwall of Great Gulf, July 27, 1958, Löve & Löve 7539. *2n = 42.*

This taxon, which was described from Mt. Washington by Nannfeldt (1935), has recently been transferred to the more northern amphi-atlantic species *Poa flexuosa*, by Löve & Löve (in Löve & Solbrig 1964b). It is the most common species of *Poa* in the alpine zone of Mt. Washington, where it grows in rocky and gravelly soils, along brooks, and in exposed localities on and around the summit. It is occasionally met with at elevations below the alpine zone, but then only in exposed places. The chromosome number 2n = 42 has been reported from the Gaspé Peninsula, by Nygren (1955), from Mt. Marcy, N.Y., by Bowden (1961), and from Mt. Washington, by Löve & Löve (in Löve & Solbrig 1964b), for ssp. *Fernaldiana*. The same number is also typical for ssp. *flexuosa* (Nygren 1950a,b, 1953; Löve 1954b; Tutin in Löve & Löve 1956; Löve & Löve 1956).

21. **POA GLAUCA** VAHL
*Voucher:* Above Huntington's Ravine, August 30, 1962, Löve & Löve 7824. *2n = 42.*

This complex and variable species of circumpolar distribution has been divided into a number of subspecies and varieties with more or less distinct morphology and distribution areas, though the significance of some of these variations still remains uncertain. The Mt. Washington taxon is a low-grown grass with short and dark spikelets and a densely crowded panicle and, thus, referable to what Butters & Abbe (1947) regarded as *P. glauca* ssp. *conferta*

(Blytt) Lindm. It is, however, still uncertain if this identification of the American plant is correct, and its relationship to the often ignored but distinct *P. Balfourii* Parn., of Britain, Scandinavia, Iceland, and Greenland, has not been sufficiently studied (cf. Chrtek & Jirásek 1964). Although chromosome numbers between 2n = 42 and 2n = 78 have been reported for *P. glauca* from Europe (cf. Löve & Löve 1961d), nobody has tried to identify these numbers with morphological variations recognized by taxonomists. Apomixis is supposed to be as frequent in this species as in related *Poae,* though this has not yet been satisfactorily demonstrated. The most frequently reported chromosome number from this species in its wide sense is 2n = 42, or the same number as found to be typical of the rare and exclusively alpine populations from Mt. Washington.

22. **POA SALTUENSIS** FERN. & WIEG.

*Voucher:* Oakes Gulf, July, 1960, Löve & Löve 7674. *2n = 28.*

This boreal eastern North American grass is, in the Mt. Washington area, a lowland plant, reaching the subalpine or alpine area only in meadows in the protected habitats of the Oakes Gulf (cf. Fernald & Wiegand 1918; Pease 1924, 1964). Its chromosome number, 2n = 28, has previously been reported by Bowden (1961), who studied plants from Nova Scotia and Quebec.

23. **ELYMUS DONIANUS** (F. B. WHITE) LÖVE & LÖVE

SSP. **VIRESCENS** (LGE.) LÖVE & LÖVE

*Voucher:* Above Huntington's Ravine, August 30, 1962, Löve & Löve 7820. *2n = 28.*

As shown by Löve & Löve (1965), this is the more appropriate name for the taxon usually named *Agropyron trachycaulon* var. *majus* in American manuals. It is especially frequent along brooks in the Alpine Garden of Mt. Washington, where it is represented by the typically arctic and alpine var. *virescens* of gravelly soils, whereas at lower elevation on the mountain and elsewhere in more peaty soils in the boreal regions it seems to be replaced by the var. *novae-angliae* (Scribn.) Fern.

The chromosome number 2n = 28 here given for ssp. *virescens* var. *virescens* of Mt. Washington has been reported previously by Jörgensen, Sörensen & Westergaard (1958) and Löve & Löve (in Löve & Solbrig 1964b), and for other races of *E. Donianus* by Melderis (1955), Löve (1954b), Löve & Löve (1956), and Schulz-Schaeffer & Jurasits (1962, as *Agropyron pseudorepens).* This tetraploid species has developed races which are morphologically and geographically rather distinct and, therefore, may often be of considerable significance for studies of past dispersals and speed of some subspeciation processes.

24. **TRISETUM TRIFLORUM** (BIGEL.) LÖVE & LÖVE

*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7560. *2n = 42.*

The Mt. Washington taxon usually classified as *Trisetum spicatum* (L.) Richt. var. *pilosiglume* Fern., or, more lately, as *T. molle* (Michx.) Kunth ssp. *pilosiglume* (Fern.) Pavlov, is more correctly named as the typical subspecies of *T. triflorum,* as recently demonstrated by Löve & Löve (1965). It is a hexaploid species as contrasted to the tetraploid *T. spicatum* s.str. The ssp. *triflorum* is an arctic-alpine taxon, reaching Greenland and Iceland but otherwise confined to northeastern America. On Mt. Washington it is an important component in the vegetation of alpine meadows, especially in moist areas and around brooks in the Alpine Garden and in the Great Gulf. The chromo-

some number here reported has been counted previously for ssp. *triflorum* by Böcher & Larsen (1950), Böcher (1959), Morrison (1959a, b), Bowden (1960b), and Löve & Löve (1965), and for ssp. *molle* (Hultén) Löve & Löve by Morrison (1959a, b), Bowden 1960b), and Löve & Ritchie (1966).

25. **AVENELLA FLEXUOSA** (L.) DREJER

SSP. **MONTANA** (L.) LÖVE & LÖVE

*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7781. $2n = 28$.

Although the typically boreal lowland race ssp. *flexuosa* of this species is common around Mt. Washington, all the populations in the alpine zone studied by us belong to the arctic-alpine race, ssp. *montana*. It is our impression that this race and other similar races of other species actually are remnants of a previously continuous distribution of the arctic-alpine plant, and not modifications or ecotypes later formed from the lowland races on each particular mountain, although that possibility can only be ruled out by aid of detailed genecological experiments. The ssp. *montana* has glumes 5-7 mm long, the spike is large and the panicle is contracted, usually deep red or violet in color, with short and soft callus hairs, and short, or non-visible, awn, contorted and attached 1/3 from the base of the lemma. Whereas ssp. *flexuosa* is characterized by shorter (4-5 mm) glumes, open panicle, which is pale grey-violet, the callus hairs are relatively long, firm and straight, and the awn is firm, bent once and attached to the base of the lemma.

The chromosome number of ssp. *montana,* counted on the voucher specimen and on several other individuals from elsewhere on the mountain, is $2n = 28$, and the same number was also counted in the f. *pallida* (Berlin) Löve & Löve. This number has been reported for this subspecies and typical *A. flexuosa* from elsewhere by many authors (cf. Löve & Löve 1961d; Knaben & Engelskjön 1966). Bowden (1960b), who studied extensive Canadian material, reported the number $2n = 32$ for a single individual; since we also found one of our Mt. Washington plants to have $2n = 28 + 2B$ chromosomes, it is possible that this deviation may have been caused by the occasional occurrence of B chromosomes in this species.

26. **VAHLODEA ATROPURPUREA** (WG.) FR.

*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7800. $2n = 14$.

It is possible that Hultén (1942, 1958) and Porsild (1951) are right in defining this species so widely that it includes, at the subspecific level, the Pacific *V. latifolia* (Hook.) Hultén and the South American *V. magellanica* (Hook. f.); if this is correct then its area indicates a drastic reduction in distribution (cf. also Hämet-Ahti 1965). However, since no evidence on possible miscibility of the Pacific and South American plants and the amphi-atlantic species is available, and only the last-mentioned taxon is cytologically known, it seems advisible not to heed the recommendation by Hultén and Porsild and instead regard these three taxa as potentially distinct species, though biosystematic evidence may later confirm the suggestion that they are closer related.

It is the amphi-atlantic species which occurs on Mt. Washington. It is very local in the alpine zone also elsewhere in the White Mountains, whereas it is rather common in similar localities in the Green Mountains and the Gaspé Peninsula farther north. The plant grows mainly in snowbeds and at the heads of ravines on Mt. Washington, but it is also known from the summit at 1915 m.s.m.

In addition to the voucher material referred to above, we have counted the

chromosome number 2n = 14 in several collections from Mt. Washington and Mt. Jefferson, and also from Mt. Mansfield in the Green Mountains. It is the same number as previously reported from northern Scandinavia by Nygren (in Löve & Löve 1948), from Greenland by Jörgensen, Sörensen & Westergaard (1958), from Norway by Knaben & Engelskjön (1966), and by Löve & Löve (1961d) from Mt. Mansfield and the Gaspé Peninsula.

## 27. CALMAGROSTIS PICKERINGII A. GRAY

*Voucher:* Slope at the Upper Lake-of-the-Clouds, July 25, 1958, Löve & Löve 7522. *2n = 28.*

Pickering's reed grass, which was described by Gray (1856) from the slope above the Upper Lake-of-the-Clouds on Mt. Washington, belongs to a critical group of eastern North American arctic-alpine taxa showing an apparent and marked reduction in their areas of distribution. The most widespread species, *C. Pickeringii,* is known from several New England mountains, but also from Nova Scotia, Newfoundland, and from Isle Royale in Lake Superior. It is somewhat variable, and some specimens from lower altitudes and from coastal regions have been described as the var. *debilis* (Kearney) Fern. & Wieg. The chromosome number 2n = 28 for *C. Pickeringii* has not only been counted from its type locality, as here reported, but also from the Alpine Garden, and from sheltered places further south on Mt. Monroe and in the Oakes Gulf. The same number was reported, by Bowden (1960b), from Gander in Newfoundland, where the var. *debilis* is common. Other segregates of this group are *C. perplexa* Scribn., from Thatcher's Pinnacle in Tompkins Co. in the state of New York, characterized by 2n = 70 chromosomes, according to Nygren (1954, 1958); *C. Porteri* A. Gray, which is very local in the Appalachians of New York, Ohio, Pennsylvania, Virginia, and West Virginia, and has 2n = 84 chromosomes, according to Nygren (1954, 1958); *C. Poluninii* Th. Sör. from southern Greenland has 2n = 56 chromosomes, as reported by Jörgensen, Sörensen & Westergaard (1958); whereas no chromosome counts are available for *C. insperata* Swallen from Ofer Hollow in Jackson Co. in Ohio, a possible synonym of *C. Porteri* (Louis-Marie 1944); for *C. lacustris* (Kearney) Nash from Ontario, Vermont, eastern New York State, northern Michigan, and eastern Minnesota; for *C. Fernaldii* Louis-Marie of the Boarstone Mt. in Piscataquis Co. in Maine; and for *C. Lepageana* Louis-Marie from Rimouski in the province of Quebec. According to Gleason (1952), the two last-mentioned taxa ought to be ignored, whereas they are accepted by Fernald (1950) who also adopts *C. nubila* Louis-Marie, a doubtful species described from a single collection probably from the type locality of *C. Pickeringii* on Mt. Washington in 1862 and never observed again (cf. Löve & Löve 1965).

## 28. CALAMAGROSTIS CANADENSIS (MICHX.) PB.

*Voucher:* Huntington's Ravine, July 27, 1958, Löve & Löve 7566. *2n = 42.*

The delimitation of this species and the following one was discussed by Löve & Löve (1965). *C. canadensis,* as we understand it, reaches from the boreal forests up into the subalpine zone of Mt. Washington only in snowbeds and sheltered localities with much seepage water. We have counted the chromosome number 2n = 42 not only from the voucher collection listed above but also from the Lakes-of-the-Clouds, and from west of Kenora near the Lake-of-the-Woods in westernmost Ontario (Löve & Löve 6499, July 27, 1954, WIN). For earlier reports, cf. Löve & Löve (1965); Löve & Ritchie (1966).

29. **CALAMAGROSTIS PURPUREA** (TRIN.) TRIN.
SSP. **LANGSDORFII** (LINK) TZVELEV
*Voucher:* Lakes-of-the-Clouds, July 4, 1960, Löve & Löve 7683. $2n = 56$.

As shown by Löve & Löve (1965), the taxon *Calamagrostis Langsdorfii* (Link) Trin. is to be separated from the American species *C. canadensis* (Michx.) PB, of which it has often been regarded as a variety (Stebbins 1930; Fernald 1950; Hitchcock & Chase 1951; Gleason 1952) or subspecies (Hultén 1942). Although we accepted it as a distinct species, we agree with Tzvelev (1965) that it is better placed as a subspecies of *C. purpurea*, which, in addition to morphological similarities, also is characterized by the same chromosome number (Nygren 1948, 1949, 1958, 1962), as determined on material of the Scandinavian ssp. *phragmitoides* (Hartm.) Tzvelev; the eastern Asiatic ssp. *purpurea* and the Siberian ssp. *barbata* (V. Vassil.) Tzvelev remain cytologically unkown.

The ssp. *Langsdorfii* is common between stones in otherwise unprotected places in the alpine and subalpine zones of Mt. Washington. Its chromosome number $2n = 56$ has been reported previously from widely scattered parts of its distribution area (cf. Löve & Löve 1965).

30. **AGROSTIS BOREALIS** HARTM.
*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7786. $2n = 56$.

The luxuriant and tall-grown var. *americana* (Scribn.) Fern. of the grass species *Agrostis borealis* is met with at lower altitudes in the subalpine and montane regions of Mt. Washington, whereas the plants of the meadows in the alpine zone seem to belong exclusively to var. *borealis*. Though the former seems to be reasonably constant, it is not unlikely that cultivation experiments may reveal that its size and luxuriance might be caused by favorable environmental conditions and that it actually is only a modification of var. *borealis*, invading the montane zone from above. Viviparous individuals belonging to the f. *macrantha* (Eames) Fern. are frequent in the alpine zone. They have been found to have $2n = 56$ chromosomes as do also non-viviparous specimens of the typical race and var. *americana* from elsewhere on the mountain. This number has been reported previously from different parts of the wide distribution area of the species by Sokolovskaja (1937, 1938, 1955, 1962b, 1963), Sokolovskaja & Strelkova (1938, 1960, 1962), Böcher & Larsen (1950), Björkman (1951, 1954a, b, 1960), Jörgensen, Sörensen & Westergaard (1958), and Bowden 1960b).

31. **CINNA LATIFOLIA** (TREV.) GRISEB.
*Voucher:* Tuckerman's Ravine, July 6, 1960, Löve & Löve 7643. $2n = 28$.

A grass of moist woods of the boreal zone in North America and scattered parts of Eurasia, *Cinna latifolia* reaches the subalpine zone of Mt. Washington only in favorable habitats, often in places protected by krummholz. Its chromosome number, counted on the voucher referred to above but not on other Mt. Washington plants, is the same as reported previously from elsewhere by Sokolovskaja (1938), Ehrenberg (1945), Tateoka (1954b), Bowden (1960b), and Löve & Löve (1961d).

32. **PHLEUM COMMUTATUM** GAUD.
*Voucher:* Huntington's Ravine, July 27, 1958, Löve & Löve 7563. $2n = 28$.

This is the arctic-alpine tetraploid taxon of the *Phleum alpinum* L. complex, as shown by Hylander (1945, 1953) and Nordenskiöld (1945). Although its area of distribution is much disrupted, it is essentially circumpolar

and certainly not amphi-atlantic, as Hultén (1958) maintains. It is frequent in somewhat protected habitats in the alpine zone of Mt. Washington, mainly in the ravines and the Alpine Garden, but it reaches almost to the summit on the headwall of the Alpine Garden. The chromosome number 2n = 28 is the same as reported from elsewhere by several authors (cf. Löve & Löve 1961d; Packer 1964; Tateoka 1964; Laane 1965; Knaben & Engelskjön 1966).

33. **HIEROCHLOË FRAGRANS** (WILLD.) R. & S.

*Voucher:* Tuckerman's Ravine, July 6, 1960, Löve & Löve 7639. *2n = 56.*

The probably circumpolar and apomictic *Hierochloë fragrans,* which has long been misidentified as the European *H. odorata* (L.) PB. (Löve & Löve 1965), is very rare in the alpine zone of Mt. Washington and also in the lowlands around the White Mountains. We have collected it only in meadows and snowbeds in the Tuckerman's Ravine, whereas Pease (1924, 1964) reports it also from the Alpine Garden and the Lakes-of-the-Clouds. Its chromosome number 2n = 56, counted on plants from the Tuckerman's Ravine, confirms previous reports from other North American localities by Church (in Myers 1947), Norstog (1957, 1960, 1963), Bowden (1960b), Reeder & Norstog (1961), and Löve & Löve (in Löve & Solbrig 1964b).

34. **HIEROCHLOË MONTICOLA** (BIGEL.) LÖVE & LÖVE

*Voucher:* Lakes-of-the-Clouds, July 4, 1958, Löve & Löve 7498. *2n = 63.*

This northeastern subarctic-alpine American apomictic species (Sörensen 1954; Löve & Löve 1965) is frequent in alpine meadows and occasional in barrens on Mt. Washington, from close to the summit at about 1910 m.s.m. down to about 1460 m.s.m. in the Great Gulf. Its chromosome number 2n = 63 has been reported previously from Greenland by Sörensen (1954) and Jörgensen, Sörensen & Westergaard (1958) under the synonym *H. orthantha* Th. Sör., and from Mt. Washington by Löve & Löve (in Löve & Solbrig 1964b).

35. **ERIOPHORUM VAGINATUM** L.

SSP. **SPISSUM** (FERN.) HULTÉN

*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7781. *2n = 58.*

We take issue with Fernald (1925, 1950), Gleason (1952), and Gleason & Cronquist (1963), who regard this taxon as a species distinct from the Eurasiatic *E. vaginatum,* whereas we agree with Hultén (1942, 1962) and Porsild (1957, 1964) who classify it as an American subspecies of *E. vaginatum,* distinguished by its depressed and globose spike, shorter anthers, and less inflated upper sheaths. On Mt. Washington it is very local in bogs above the Lakes-of-the-Clouds, whereas it is more frequent below the alpine zone. Its chromosome number 2n = 58 is the same as reported from other races of *E. vaginatum* (cf. Löve & Löve 1965).

36. **BAEOTHRYON CAESPITOSUM** (L.) DIETR.

*Voucher:* Lakes-of-the-Clouds, July 25, 1958, Löve & Löve 7514. *2n = 104.*

This is the plant usually named *Scirpus caespitosus* L. or *Trichophorum caespitosum* (L.) Hartm. We agree with the opinion that this group of species is generically distinct from *Scirpus* s.str.; consequently, since the generic name *Trichophorum* is misapplied if this species and its relatives are included in it, the only correct name for the restricted genus seems to be *Baeothryon* (Löve & Löve 1965).

*B. caespitosum* is common in a var-

icty of habitats on Mt. Washington, wind exposed as well as sheltered, in rocky ground with seepage water and in peat bogs. It is most frequent in the lower parts of the alpine zone, and all the populations belong to the ssp. *caespitosum,* which is the *Scirpus bracteatus* of Bigelow (1816) and *S. caespitosus* var. *callosus* of Bigelow (1824) and later American authors.

The chromosome number 2n = 104 is a confirmation of previous reports for this subspecies from Europe, Greenland, and eastern North America, by Scheerer (1940), Löve & Löve (1956), Jörgensen, Sörensen & Westergaard, (1958), and Lövkvist (in Weimarck 1963). The same number has also been counted for ssp. *germanicum* (Palla) Löve & Löve by Lövkvist (in Weimarck 1963), and for ssp. *delicatulum* (Fern.) Löve & Löve by Löve & Löve (1965).

37. **SCIRPUS ATROCINCTUS** FERN.

*Voucher:* Bigelow Lawn, July 5, 1958, Löve & Löve 7483. *2n = 68.*

We agree with Fernald (1899, 1950) that this taxon seems to be distinct from *S. cyperinus* (L.) Kunth, although Gleason (1952) and Gleason & Cronquist (1963) regard it either as synonymous with the latter species or as a variety of it only. Hicks (1928) reported the chromosome number 2n = 68 for various collections of *S. atrocinctus,* whereas his count for *S. cyperinus* was 2n = 66. Since his counts seem to have been very exact, this difference is, most likely, real. If small numerical variations in chromosome number caused by agmatoploidy are as effective in producing reproductive isolation in this genus as in some sections of *Carex* (Löve, Löve & Raymond 1957), then this difference supports the separation of these closely related taxa at the level of species.

*S. atrocinctus* is a rather slender plant of meadows and swamps below the subalpine zone, although it has been found on Mt. Washington on the Bigelow Lawn, in the Gulf of Slides, and on the headwall of the Tuckerman's Ravine. The specimen from the Bigelow Lawn in which we counted 2n = 68 chromosomes was growing in a community of tall perennial herbs in a locality facing southeast, and it seems to be referable to the forma *brachypodus* (Fern.) S. F. Blake, which is a variation that probably is created by environmental influences only.

38. **CAREX DEFLEXA** HORNEM.

*Voucher:* Lakes-of-the-Clouds, August 30, 1959, Löve & Löve 7620. *2n = 36.*

This subarctic-boreal North American species is rare on the western prairies. Although ordinarily a plant of the forests at lower elevations, it reaches up into the alpine zone on Mt. Washington. Prior to our studies it was known only from the Alpine Garden and from above the Huntington's Ravine (Pease 1964; Harris 1949), whereas we have found it in the shelter of the solifluction banks near the boggy area above the upper Lake-of-the-Clouds and also on the Bigelow Lawn. Since it seems to flower rarely in these places, it easily escapes attention.

In addition to the count on the voucher specimen, we have also counted 2n = 36 chromosomes in a specimen from Mt. Mansfield in the Green Mountains of Vermont (Löve & Löve 7468, July 3, 1958). This number is double the count for *C. pilulifera* L. (cf. Löve & Löve 1961d), the closest relative of the species. Before this can be established as one of the few examples of direct polyploidy in *Carex,* more material needs to be investigated, especially in the light of the observation by Jörgensen, Sörensen & Westergaard (1958) who got the impression from late root-tip prophases of *C. deflexa* from south-

western Greenland that the somatic number was "not lower than 20 and not higher than 24."

39. **CAREX ARCTATA** BOOTT
*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7587. *2n = 54.*

This is a species of a wide amplitude of habitats in woodlands and on hillsides in boreal eastern North America, but it rarely reaches above timberline. On Mt. Washington it is met within the subalpine zone only in a wet shrubbery of *Alnus* at about 1480 m.s.m. in the Tuckerman's Ravine.

We counted 2n = 54 chromosomes on plants from the Tuckerman's Ravine population, and also from specimens collected at lower levels on the mountain and from Mt. de Calvert at Oka in the province of Quebec (Löve & Löve 7441, June 4, 1957). The only previous report for this species seems to be that of n = 27 and 28 counted by Wahl (1940) on material from central Pennsylvania.

40. **CAREX DEBILIS** MICHX.
SSP. **RUDGEI** (BAILEY) LÖVE & LÖVE
*Voucher:* Huntington's Ravine, July 27, 1958, Löve & Löve 7564. *2n = 60.*
Headwall of Tuckerman's Ravine, July 3, 1958, Löve & Löve 7598. *2n = 60.*

The taxonomy of this eastern North American sedge was discussed by Löve & Löve (1965). On Mt. Washington the var. *Rudgei* of the ssp. *Rudgei* is common at lower altitudes, barely reaching up into the subalpine shrubs, though Pease (1924, 1964) has observed it as high up as to about 1585 m.s.m. The var. *strictior* Bailey of the same subspecies, described from a collection by Williams in 1895 at the first water-tanks of the cog-railway, occasionally reaches the alpine zone in sheltered localities like, e.g., on the southeast facing headwall of the Tuckerman's Ravine, where we collected it at about 1500 m.s.m.

The chromosome number 2n = 60 was counted on var. *Rudgei* (7564) and var. *strictior* (7598). It was published by Löve & Löve (1965) and confirms a recent report for var. *Rudgei* from the province of Quebec by Moore & Calder (1964).

41. **CAREX LEPTONERVIA** (FERN.) FERN.
*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7585 & 7588. *2n = 38.*

This boreal eastern North American species reaches the subalpine zone of Mt. Washington only in the *Alnus* shrub region and then mainly in the sheltered ravines. Its chromosome number 2n = 38 seems to be slightly higher than the n = 18 previously reported by Wahl (1940) from central Pennsylvania, though this is probably caused by difficulties in counting the meiotic chromosomes rather than by any real differences between these populations.

42. **CAREX CAPILLARIS** L.
*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7550. *2n = 54.*

It was shown by Löve, Löve & Raymond (1957), that two races need to be recognized in C. *capillaris,* at the subspecific level, one mainly arctic-alpine and the other mainly boreal-lowland. Since the former is at least the most common race in Sweden and certainly the plant best known by Linnaeus and the only form met with in his herbarium (cf. Lindberg 1958), it has, by tradition, been regarded as the typical race, and so it was accepted as the ssp. *capillaris* by Löve, Löve & Raymond (1957). The other race they named ssp. *chlorostachys.* Recently, however, Egorova (1964, and in Tol-

matchev 1966) has reversed this selection of type without any consultation of Swedish material, and given the new name *C. fuscidula* Krecz. to the arctic-alpine plant. Such a procedure is contrary to the letter and spirit of the International Code and is, fortunately, to be rejected to prevent confusion. *C. fuscidula* is, without doubt, a superfluous synonym of *C. capillaris* ssp. *capillaris*, whereas *C. capillaris* of Egorova (l.c.) is identical with *C. capillaris* ssp. *chlorostachys* (Steven) Löve, Löve & Raymond, a circumpolar boreal lowland race which in North America is often named var. *major* Olney, though it has nothing in common with the older var. *major* Drejer.

Although ssp. *chlorostachys* grows in some bogs south to the state of New York (cf. Fernald 1950; Gleason 1952), it does not seem to occur in or around the White Mountains (cf. Pease 1964). Here only the typically arctic-alpine low-grown ssp. *capillaris* is known from a few localities along brooks in the alpine zone of the Alpine Garden. Its chromosome number 2n = 54 is the same as previously reported from elsewhere by Heilborn (1924), Levan (in Löve & Löve, 1942) Löve & Löve (1956), Löve, Löve & Raymond (1957), and Jörgensen, Sörensen & Westergaard (1958).

43. **CAREX PAUPERCULA** MICHX.
*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7774. *2n = 58.*

This variable and widespread boreal-circumpolar species has often been regarded as synonymous with the austral South American *C. magellanica* Lam. This was, most recently, accepted by Hultén (1962), although he regards the boreal plant to be a distinct race, ssp. *irrigua* (Wg.) Hultén of *C. magellanica*, on basis of recent observations made on the austral plant by Roivainen (1954). It is our opinion that as long as cytotaxonomical and experimental studies have not demonstrated the correctness of this conclusion, it is safer to regard the morphological evidence presented by Roivainen (1954) as a substantiation of the opinion by Fernald (1906a) that the austral and boreal plants are distinct species, contrary to Hultén's (1962) impression. As shown by Fernald (1906a, 1950), the northern North American plant is referable to the same taxon as the European race ssp. *irrigua* (Wg.) Löve & Löve (cf. Löve & Löve, 1961b). Somewhat farther south occurs the var. *pallens* Fern., which we prefer to include as a variety in the ssp. *paupercula* of boreal North America, the typical variety of which, var. *paupercula*, is a somewhat dwarfed plant of alpine peats of Labrador and Ungava, the Shickshock Mts. of Gaspé, and the White Mountains. It is this last-mentioned taxon which grows in the alpine *Sphagnum* bogs in somewhat sheltered localities on Mt. Washington.

The chromosome number 2n = 58 here reported for ssp. *paupercula* var. *paupercula* is a confirmation of previous reports, mostly from ssp. *irrigua*, by Heilborn (1928), Löve & Löve (1956), Favarger (1959), Löve & Löve (in Löve & Solbrig 1965), and Löve & Ritchie (1966), and it is close to the report of 2n = c. 60 by Moore & Calder (1964).

44. **CAREX ATRATA** L.
SSP. **ATRATIFORMIS** (BRITT.) KÜK.
*Voucher:* Oakes Gulf, July 7, 1960, Löve & Löve 7658. *2n = 54.*

The still very confused *Carex atrata* complex (Kükenthal 1909, Kreczetovicz 1935; Hultén 1958; Koyama 1962; Meusel, Jäger & Weinert 1965) is represented in eastern North America by the taxon ssp. *atratiformis* which in its more western localities tapers into the weak variety *Raymondii* (Calder). It is the var. *atratiformis* which is met with on Mt. Washington, where we have

counted the chromosome number 2n= 54 on specimens from the subalpine zone in a meadow at the head of the Oakes Gulf, which seems to be the only place for the taxon on the mountain, except at lower altitudes. We have also counted this number on plants from lower altitudes in New Hampshire and the province of Quebec. The plants from Manitoba studied by Löve (1954b) and reported as *C. atratiformis* with 2n = 54 chromosomes actually belonged to the var. *Raymondii* (cf. Calder 1952).

Most authors studying *C. atrata* ssp. *atrata* have found it to have the chromosome number 2n = 54 (Heilborn 1922, 1924, 1939; Okuno 1939, 1940; Levan in Löve & Löve 1942; Tanaka 1948; Davies 1956a, b; Löve & Löve 1956; Jörgensen, Sörensen & Westergaard 1958; Knaben & Engelskjön 1966), though some have mentioned other numbers (Tanaka 1942b, 1948; Sokolovskaja & Strelkova 1948a). The number 2n = 54 is also typical of the Central European ssp. *aterrima* (Hoppe) Hartm., according to Hadač & Hašková (1956) and of the likewise Central European ssp. *nigra* (All.) Hartm. (= *C. parviflora* Host), according to Dietrich (1964).

### 45. **CAREX BIGELOWII** TORR.

*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7781. *2n = 70.*

The species *Carex Bigelowii* was originally described from Mt. Washington. It was long identified with *C. rigida* Good. until Polunin (1940) pointed out that that name has an older homonym, by Schrank. Furthermore, Fernald (1942) pointed out that typical *C. Bigelowii* in the White Mountains of New Hampshire has linear-cylindric and elongate pistillate spikes, mostly 2-5 cm. long and 3-5 mm. thick, with the perigynia and scales rather loosely disposed, the usually long-peduncled staminate spike 1-2.5 cm. long and commonly well overtopping the pistillate. This is apparently also typical of the Greenland plants, whereas the populations in Iceland, the Faeroes, Scotland, Scandinavia, and the mountains of Central Europe have densely flowered and thick-cylindric spikes which are mostly 1-2 cm. long and 3-7 mm. thick, the usually short staminate spike being overtopped at base by the pistillate ones.

The chromosome number 2n = 70 here reported for the population in the type locality of the species *C. Bigelowii* has also been counted on Greenland material, by Jörgensen, Sörensen & Westergaard (1958). It is, likewise, typical of Icelandic material (Löve & Löve 1956), of plants from the Faeroes (Böcher 1938), and of populations from Scandinavia (Heilborn 1924, 1928), whereas Scottish plants were reported to have only 2n = 68 chromosomes (Davies (1956b). We doubt that the last number is a factual deviation, since Scottish plants to do not differ morphologically from other European plants. Therefore, it is our opinion that the complex mapped as *C. rigida* by Hultén (1962) is most correctly classified as a group of conspecific subspecies which, then, ought to be included under the oldest legitimate name, *C. Bigelowii*. As shown by Jurtzev (1965) and Egorova (in Tolmatchev 1966), the artic-alpine plant from Eurasia west to Iceland is a distinct race, *C. Bigelowii* ssp. *arctisibirica* (Jurtzev) Löve & Löve, comb. nov. (based on *C. ensifolia* Turcz. ssp. *arctisibirica* Jurtzev, in Novit. Syst. Plant. Vasc. 1965, p. 308; *C. rigida* Good. 1794, non Schrank 1789). Other taxa, which are probably of the same rank, have been described from western North America and eastern Asia (cf. Hultén 1962; Kreczetovicz 1935; Egorova, in Tolmatchev 1966); since they are cytologically unknown, it would be premature to change their rank.

*C. Bigelowii* ssp. *Bigelowii* is very common in the alpine zone of Mt. Washington, from the summit down to

timberline, but below it it occurs only in exposed places. It is possible to identify some individuals as f. *anguillata* (Drej.) Fern. as delimited by Fernald (1950), though the variation of this restricted mountain population is so wide as to defy all attempts at a further subdivision. We suggest that the morphological variations of ssp. *Bigelowii* in its type locality are the results of an unusually wide amplitude of reactions to variations in the environmental conditions; if this suggestion can be experimentally substantiated, then one has to be extremely critical when revisions are made of material from regions from where several taxa have already been described like, e.g., easternmost Asia.

46. **CAREX LENTICULARIS** MICHX.

*Voucher:* Tuckerman's Ravine, July 5, 1958, Löve & Löve 7501. $2n = 68$.

A variable species of cool regions in North America, this plant has been divided into a few varieties by some authors (Fernald 1950), whereas others have ignored its variations (Gleason 1952). One of these varieties, var. *albi-montana* Dewey, described from the White Mountains, seems to replace the typical race at higher altitudes. However, we have observed both it and the typical variety growing together with all degrees of intermingling in subalpine localities, and so it is possible that the separation of these races at the varietal level is untenable, as indirectly suggested by Gleason (1952).

*C. lenticularis* reaches the subalpine zone of Mt. Washington on the headwalls of the Tuckerman's Ravine and the Huntington's Ravine, but it has also been observed near the Lakes-of-the-Clouds. The chromosome number $2n = 68$, which seems to be a first count, was determined on plants which could be identified not only as var. *lenticularis* and var. *albi-montana* but also as their intermediates, though the voucher specimen given above belonged to typical var. *lenticularis*.

47. **CAREX TRISPERMA** DEWEY

*Voucher:* Sphinx Basin, August 2, 1962, Löve & Löve 7763. $2n = 60$.

A species of mossy woods and bogs in eastern North America. It is common at lower altitudes, but reaches the subalpine zone at about 1420 m.s.m. in a bog in the Sphinx Basin on Mt. Jefferson, where it was first collected in 1961 by H. Harries. The chromosome number here reported is a confirmation of a previous count from central Pennsylvania by Wahl (1940).

48. **CAREX CANESCENS** L.

*Voucher:* Lakes-of-the-Clouds, July 25, 1958, Löve & Löve 7519. $2n = 56$.

This circumpolar species of wet habitats is more common at lower than at higher altitudes on Mt. Washington, where it reaches the Alpine Garden, the ravines and the gulfs, and the Lakes-of-the-Clouds area, everywhere below 1600 m.s.m. The chromosome number $2n = 56$, which is typical of the plant not only from the Lakes-of-the-Clouds but also from the Alpine Garden, is a confirmation of reports from Greenland (Jörgensen, Sörensen & Westergaard 1958), and various European countries (Heilborn 1924; Levan in Löve & Löve 1942; Löve & Löve 1944b, 1956; Tanaka 1948; Knaben & Engelskjön 1966). The slightly lower numbers $2n = 54$ from central Pennsylvania (Wahl 1940) and $2n = 52$ from Japan (Okuno 1939, 1940) may be due to inexact counts on difficult meiotic material.

49. **CAREX BRUNNESCENS** (PERS.) POIR.

*Voucher:* Headwall of the Great Gulf, July 27, 1958, Löve & Löve 7537. $2n = 56$.

Although this sedge sometimes is difficult to distinguish from *C. canescens* on

Mt. Washington, it is always characterized by the thin-walled perigynia with distinctly raised veins, a fairly long and broad scabrous beak cut open at least on the upper side and frequently with the cut extending down to the perigynium. Also, its habitats are preferably dry, in contrast to the boggy situations harboring *C. canescens*. The species is represented in the alpine zone of Mt. Washington by the amphi-Atlantic race ssp. *brunnescens*, which in eastern North America seems to be subarctic-alpine (Kalela 1965). In the lowlands around the mountain this race is replaced by ssp. *sphaerostachya* (Tuckerm.) Kalela. The chromosome number 2n = 56 has been counted previously for ssp. *brunnescens* by Löve & Löve (1956), for ssp. *sphaerostachya* by Wahl (1940), Jörgensen, Sörensen & Westergaard (1958), and Löve & Ritchie (1966), whereas the report by Tanaka (1942a, 1948) from central Europe and Heilborn (1939) and Levan (in Löve & Löve 1942) from northern Scandinavia may represent either ssp. *brunnescens* or ssp. *vitilis* (Fr.) Kalela.

50. **CAREX ANGUSTIOR** MACK.
*Voucher:* Tuckerman's Ravine, July 28, 1961, Löve & Löve 7758. *2n = 52.*

This boreal North American plant is common at low altitudes on Mt. Washington and seems to reach the subalpine zone only in moist places on the headwall of the Tuckersman's Ravine. The chromosome number 2n = 52 has previously been counted from Pennsylvania by Wahl (1940) and from Manitoba by Löve (1954a, b, 1955). Although Hultén (1958) and some other prefer to include this taxon in the then collective *C. echinata* Murr., this is contradicted by the chromosome number which in the latter species is 2n = 58 (cf. Löve & Löve 1961d).

51. **CAREX CAPITATA** L.
SSP. **ARCTOGENA** (H. SM.) BÖCHER
*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7551. *2n = 50.*

The circumpolar arctic-alpine species *Carex capitata* includes an amphi-atlantic race which seems to prefer basic soils and low-arctic or high-alpine conditions. It was described as a species, *C. arctogena*, by Smith (1940), but reduced to a *forma* only by Raymond (1949), who observed that it is the only representative of the complex in eastern North America, despite the mistaken identification of both taxa even from the same locality on Mt. Washington by Smith (1940). The race was given the proper rank of a subspecies by Böcher (1952). In southernmost South America the complex is represented by the related *C. antarctogena* described by Roivainen (1954). The ssp. *arctogena* grows exclusively but abundantly in periodically moist meadow-like vegetation in the Alpine Garden and near the Lion's Head on the eastern ranges of Mt. Washington.

The chromosome number 2n = 50 has also been reported for ssp. *arctogena* by Jörgensen, Sörensen & Westergaard (1958) and Moore & Calder (1964) and for ssp. *capitata* by Heilborn (1928) and Löve & Löve (1956).

52. **CAREX SCIRPOIDEA** MICHX.
*Voucher:* Alpine Garden, July 3, 1960, Löve & Löve 7730. *2n = 62.*

This is an eastern Asiatic-North American alpine-subarctic sedge with a very remarkable outpost in a single locality in the mountains of northern Norway (cf. Gjaerevoll 1963). The very isolated European population has been separated as the variety *europaea* by Kükenthal (1909), a procedure claimed by Raymond (1951) to be "to say the

least justified," whereas Hultén (1958) points out that similar specimens occur in the northern part of the American area. Our experience seems to support the latter claim. Occasionally, a few female flowers are met with at the base of the male spike of the Norwegian plant (f. *isogena* Dyring, cf. Blytt & Dahl 1906), but since this character is known from Greenland and has also been observed in the small population on Mt. Washington, it only seems to indicate some instability in the sex determination mechanism of this dioecious species. Of all the many varieties which have been separated from this taxon in North America (cf. Polunin 1940; Hultén 1958), only the western ssp. *stenochlaena* (Holm) Löve & Löve seems to be worthy of separate recognition (Löve & Löve, in Löve & Solbrig 1964b).

The population on Mt. Washington is confined to the Alpine Garden, Huntington's Ravine, and the Great Gulf, preferably along brooks, although a few localities at lower levels have been reported (Pease 1924, 1964), due to occasional dispersal by running water.

We have found the chromosome number 2n = 62 to be typical of male and female plants from the Alpine Garden. This confirms previous studies by Jörgensen, Sörensen & Westergaard (1958), Löve & Ritchie (1966), and Löve & Löve (in Löve & Solbrig 1964b), the latter of whom also reporting this number for ssp. *stenochlaena*. The somewhat higher number 2n = 64 was reported by Moore & Calder (1964) and 2n = 68 by Heilborn (1939), on Canadian and Greenlandic specimens respectively. It is likely that these higher numbers are results of too high estimates from difficult fixations rather than counts caused by meiotic irregularities, as suggested by Jörgensen, Sörensen & Westergaard (1958), since at least Heilborn (1939) clearly states that his counts were made on root-tip fixations.

53. **JUNCUS FILIFORMIS** L.

*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7775. *2n = 80.*

The boreal circumpolar species *Juncus filiformis* is relatively frequent in moist habitats along drainage channels on Mt. Washington, up to about 1700 m.s.m. and down into the forests below. Two varieties, sometimes regarded as species, have been described from eastern Asia and Siberia (Kreczetovicz & Gontscharow 1935; Hultén 1963), whereas elsewhere the species is regarded as uniform (Jörgensen, Sörensen & Westergaard 1958; Hultén 1962), despite the report of two chromosome numbers, 2n=40 (Vaarama in Löve & Löve 1948) and 2n=80 (Wulff 1938; Löve & Löve 1955a, 1956; Jörgensen, Sörensen & Westergaard 1958) from Finland and other parts of its area respectively. Our Mt. Washington specimens were collected from near the Lakes-of-the-Clouds, where the plant is not very rare, and they all were characterized by the chromosome number 2n=80.

54. **JUNCUS BREVICAUDATUS** (ENGELM.) FERN.

*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7801. *2n = 80.*

A boreal North American plant of muddy or wet places, common in the forests on Mt. Washington, but able to make occasional advances into the alpine zone in protected places, since it occurs rarely up to 1500 m.s.m. in the Tuckerman's Ravine. The chromosome number 2n = 80 is a confirmation of a report from Canadian material by Snogerup (1963) and Löve & Ritchie (1966).

55. **JUNCUS TRIFIDUS** L.

*Voucher:* Great Gulf, August 30, 1962, Löve & Löve 7812. *2n = 30.*

The amphi-atlantic arctic-alpine species *Juncus trifidus* is common in

windswept areas above the timberline on Mt. Washington, whereas at lower levels it is rare, occurring on cliffs or in places with scanty vegetation. Variation in the number of flowers has been observed on the mountain, but it seems to be of a doubtful importance (Löve & Löve 1965). The chromosome number 2n = 30 here reported for the Mt. Washington population confirms previous counts from Sweden (Löve & Löve 1944a), Iceland (Löve & Löve 1956), Poland (Wcisło in Skalińska & alii 1957), and Greenland (Jörgensen, Sörensen & Westergaard 1958). A report of 2n = 20, by Hadač & Hašková (1956) from the same mountain range as the plants studied by Wcisło, is probably inexact.

56. **LUZULA CONFUSA** LINDEB.
*Voucher:* Great Gulf, August 8, 1962, Löve & Löve 7808. *2n = 36.*

Scandinavian authors often claim inability to separate this arctic-alpine species from its close relative, *L. arcuata* (Wg.) Sw., though there is no certain evidence that they hybridize and mix in places where both grow together. This problem is absent from Mt. Washington, where only *L. confusa* is met with (cf. Hultén 1962). It is rare, since though it has been collected in the Alpine Garden, according to Pease (1924, 1964), we have been unable to find it there, whereas it grows abundantly in a limited area in the Great Gulf, at about 1525 m.s.m. The plants in that locality have more than a single head and, thus, do not belong to the var. *eradiata* Hultén, said to predominate in unglaciated areas.

The chromosome number 2n = 36 is a confirmation of previous reports by Löve & Löve (1944a, 1956), Nordenskiöld (1949, 1951, 1953), Knaben (1950), Holmen (1952), and Jörgensen, Sörensen & Westergaard (1958).

57. **LUZULA SPICATA** (L.) DC.
*Voucher:* Alpine Garden, July 8, 1960, Löve & Löve 7726. *2n = 24.*

It is the amphi-atlantic ssp. *spicata* which occurs on Mt. Washington (Löve & Löve 1965), where it is common on rocks in barrens, from the summit throughout the alpine zone. It is rare in the forested zone and absent below 990 m.s.m. as far as is known. The chromosome number here reported has been counted previously on Mt. Washington plants by Nordenskiöld (1951); it is the same number as known to be characteristic of both the races of *L. spicata* s.str. according to various authors (cf. Löve & Löve 1961d, 1965).

58. **LUZULA PARVIFLORA** (EHRH.) DESV.
SSP. **MELANOCARPA** (MICHX.) TOLMATCHEV
*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7589. *2n = 24.*

The circumpolar alpine - lowarctic species *Luzula parviflora* has been divided into some geographically distinct taxa, of which ssp. *melanocarpa* ranges from northeastern Asia to Greenland (Tolmatchev 1963). This race is widespread and common in meadows on the eastern side of Mt. Washington up to 1830 m.s.m., but is only occasionally met with below the timberline. The chromosome number 2n = 24 has also been counted on plants from the Lakes-of-the-Clouds region, and it has previously been reported for Mt. Washington material by Nordenskiöld (1951) and Löve & Löve (in Löve & Solbrig 1964b). It is the same number as previously reported from different parts of the distribution area of the species by Löve & Löve (1944a), Nordenskiöld (1949, 1951, 1953), Böcher & Larsen (1950), Jörgensen, Sörensen & Westergaard (1958), and Packer (1964).

59. **CLINTONIA BOREALIS** (AIT.) RAFIN.

*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7771. $2n = 32$.

This eastern North American boreal-montane species is a forest plant which reaches 1830 m.s.m. altitude on the eastern slope of Mt. Washington, in habitats sheltered from the wind. It flowers abundantly every summer and seems to be able to set seed in the alpine zone. The chromosome number of specimens from the Lakes-of-the-Clouds area is a confirmation of a previous report by Walker (1944) from elsewhere in New England.

60. **SMILACINA TRIFOLIA** (L.) DESF.

*Voucher:* Foot of Mt. Monroe, July 5, 1958, Löve & Löve 7485. $2n = 36$.

An eastern North American boreal species, which is common in moist places in the lowland, but occurs rarely in the alpine zone of Mt. Washington. According to Pease (1924, 1964) it is known to occur near Star Lake on the northern peaks of the Presidential Range, whereas in the Mt. Washington complex it has only been found, without flowers, at the foot of Mt. Monroe, at about 1530 m.s.m. The chromosome number 2n = 36 has been reported previously from northern Manitoba by Löve & Ritchie (1966).

61. **MAIANTHEMUM CANADENSE** DESF.

*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7543. $2n = 36$.

This boreal North American species is replaced in the continental part of its area by ssp. *interior* (Fern.) Löve & Löve (cf. Löve & Löve 1954). It is closely related to the Pacific discontinuous *M. dilatatum* (Wood) Nels. & Macbr. and to the Eurasiatic *M. bifolium* (L.) F. W. Schmidt and some less well understood Asiatic taxa (Voroshilov 1960; Sokolovskaja 1962a).

The eastern American race, ssp. *canadense,* is common on the lowland and in the forests around Mt. Washington. On the eastern slope of the mountain it reaches up to at least 1830 m.s.m. Naturally, it is dwarfed at high altitudes, but it flowers everywhere and develops fruits every year, in protected areas.

The chromosome number 2n = 36 from the Alpine Garden is a confirmation of a count by Therman (1956) from plants of unknown origin. We have also counted this number on plants of ssp. *canadense* from Oka in the province of Quebec (Löve & Löve 7432, June 4, 1958), and on specimens belonging to the ssp. *interior* collected at Maskwa Rapids in Manitoba, July 27, 1954 (Löve & Löve 5517, WIN).

62. **STREPTOPUS AMPLEXIFOLIUS** (L.) DC.
SSP. **AMERICANUS** (SCHULTES) LÖVE & LÖVE

*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7804. $2n = 32$.

The classification of this species into subspecies and varieties has been discussed by Fassett (1935) and Löve & Löve (1965). The North American race, ssp. *americanus,* is predominantly boreal-montane, but it reaches almost 1600 m.s.m. altitude in the subalpine regions of the White Mountains, where it flowers and sets fruit regularly. The chromosome number 2n = 32 has been reported previously for American plants by Therman (1956) and Löve & Löve (1965), for European material by Mattick (in Tischler 1950), and for eastern Asiatic populations by Matsuura & Sutô (1935), Satô (1942), and Sokolovskaja & Strelkova (1963). The diploid number 2n = 16 reported from Colorado by Wiens & Halleck (1962) needs to be confirmed.

63. **STREPTOPUS ROSEUS** MICHX.
*Voucher:* Lakes-of-the-Clouds, July 6, Löve & Löve 7712. *2n = 16.*

Though represented by geographical races at the subspecies level in western mountains and the Great Lakes area, this species is predominantly eastern North American as to its frequency and variability (Löve & Löve 1965). It is represented on Mt. Washington by the var. *perspectus* Fassett of the ssp. *roseus,* growing in sheltered seepage areas. The chromosome number 2n = 16 has previously been reported from Mt. Washington by D. Löve & Harries (1962, 1963), who also demonstrated that *S. oreopolus* Fern. actually is the triploid hybrid *S. amplexifolius* × *S. roseus.* The number 2n = 16 has also been counted on cultivated plants of unknown origin by Therman (1956) and on ssp. *curvipes* (Vail) Hultén and ssp. *longipes* (Fern.) Löve & Löve, by Löve Löve (1965).

Fassett (1935) mentions a single giant specimen of *S. roseus,* collected on the Mingan Islands by Marie-Victorin and Rolland-Germain in 1926. We have seen this specimen, which Fassett named f. *giganteus,* and found it to be highly sterile and characterized by several of the morphological characteristics of an occasional panautoploid (cf. Löve 1964). It is, therefore, likely that this plant has been the single and ephemeral representative of this form and already extinct when it was described, though a further check at this remote locality might be worth while.

64. **VERATUM VIRIDE** AIT.
*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7593. *2n = 32.*

The typical eastern North American race, ssp. *viride,* of the species *Veratrum viride* (Löve & Löve 1965) occurs in wet, boggy, and somewhat sheltered localities in the alpine zone of the slopes of Mt. Washington, preferably in seepage hollows and snowbeds. It rarely flowers above 1700 m.s.m. The chromosome number 2n = 32, here reported for ssp. *viride,* has been counted previously for that subspecies and ssp. *Eschscholtzii* (A.Gray) Löve & Löve by Löve & Löve (1965). It is the same number as reported for the *V. album* L. complex of Eurasia by several authors (cf. Löve & Löve 1961d).

65. **LISTERA CORDATA** (L.) R. BR.
*Voucher:* Burt Ravine, July 7, 1959, Löve & Löve 7611. *2n = 36.*

The amphi-atlantic ssp. *cordata* of this species (Löve & Löve 1965) is mainly confined to the forests on Mt. Washington, though it reaches the subalpine zone in sheltered places in the ravines and the Great Gulf, or in the krummholz on the western side of the mountain. We found the chromosome number 2n = 36 in plants from several localities on the mountain. It is a number only hinted at by Löve & Löve (1956), whereas 2n = 38 is the number most frequently reported for the species from elsewhere, for ssp. *cordata* (Sokolovskaja & Strelkova 1940, 1948b; Löve & Löve 1956; Banach-Pogan & Wcisło in Skalińska & alii 1961), and for ssp. *nephrophylla* (Rydb.) Löve & Löve (Sokolovskaja 1960b), although 2n = 40 has been reported by Kliphuis (1963), Gadella & Kliphuis (1963), and Knaben & Engelskjön (1966), and 2n = 42 by Harding (in Tischler 1950) and Blackburn (in Maude 1939) for ssp. *cordata,* and 2n = 42 for ssp. *nephrophylla* var. *japonica* Hara by Sinotô & Shoji (1962). It is possible that the variations in chromosome number in this and other species of *Listera* (cf. Löve & Löve 1961d) may be due to the occurrence of a variable number of B-chromosomes, although the real nature of these variations may be caused only by difficulties in counting the crowded and long chromosomes exactly without the help of photomicrographs.

66. **PLATANTHERA DILATATA** (PURSH) LINDL.

*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7793. $2n = 42$.

This species of subarctic-boreal montane North America reaches from the coasts of Labrador and Newfoundland to the Commander Islands of eastern Asia. It is reported from Disco in Greenland by Ames (1910), Correll (1950), and Gleason (1952), but this is apparently a mistake, since the species is not even mentioned by Böcher, Holmen & Jakobsen (1957) and Jörgensen, Sörensen & Westergaard (1958). Likewise, the report of the species from Iceland by Ames (1910), Fernald (1950), and Scoggan (1957) is erroneous (cf. Löve 1945; Löve & Löve 1948).

This orchid species is common at lower elevations on Mt. Washington but it reaches the subalpine zone in shrubby and protected habitats, up to about 1580 m.s.m. on the Bigelow Lawn. The chromosome number 2n = 42 from Mt. Washington has been confirmed on plants from about 30 miles from Golden, near the old Big Bend Highway of British Columbia (Löve & Löve 6672, July, 1955, WIN). It is also highly probable that the number 2n = 42 for *Habenaria hyperborea* from Minnesota reported by Humphrey (1933, 1934) has been counted on plants of *P. dilatata* and not on specimens belonging to the distinctly 84-chromosome species *P. hyperborea* (L.) Link (cf. Löve & Löve 1961d).

67. **LYSIELLA OBTUSATA** (PURSH) RYDB.

*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7481. $2n = 42$.

The splitting of this genus from the very collective genus *Habenaria* and the less comprehensive genus *Plathanthera* was discussed by Löve & Löve (1965), who also showed that Hultén (1943, 1962) was mistaken in uniting the Eurasiatic and American taxa of this small genus as two subspecies of the same species. *Lysiella obtusata* is very rare on Mt. Washington except at lower levels, and it reaches the subalpine zone only in a few protected places in the ravines. The chromosome number 2n = 42 (cf. Löve & Löve 1965) has also been counted by us on plants from near Troy in Nova Scotia (Löve & Löve, in Löve & Solbrig 1964b), but it has been reported previously from Minnesota by Humphrey (1933, 1934), and from northern Manitoba by Löve & Ritchie (1966).

68. **SALIX HERBACEA** L.

*Voucher:* Great Gulf, July 27, 1958, Löve & Löve 7536. $2n = 38$.

This arctic-alpine amphi-atlantic willow is rare in the King's Ravine and Tuckerman's Ravine on Mt. Washington, but rather frequent on or above the headwall of the Great Gulf. It is characterized by the diploid chromosome number 2n = 38, as previously reported from Scandinavia by Marklund (in Holmberg 1931) and Sorsa (1963), from Great Britain by Wilkinson (1944, 1954), and from Iceland by Löve & Löve (1956).

Like some other arctic *Salices*, this species easily forms $F_1$ hybrids with several other species (cf. Hylander 1955). On Mt. Washington, such a hybrid has been formed with *S. Uva-ursi* Pursh, and it is often reported as *S.* × *Peasei* Fern. This hybrid still is met with in King's Ravine from where it was originally described by Fernald (1917), but we also found a small patch of it on the headwall of the Tuckerman's Ravine in 1961, about halfway across from the Tuckerman's trail to the Boott's Spur trail in a moist place between rocks. Both parents grow close to the hybrids in both these localities. We found the hybrids to be typical $F_1$ hybrids, completely sterile and intermediate and with the diploid chromosome number

2n = 38 typical of both parent species. To suggest that this may be a good species in its own right, as done by Pease (1964), must be based on some misunderstanding. This hybrid has also been reported from west of the Hudson's Bay (Polunin 1940), on basis of a collection from Fairway Island at Chesterfield Inlet made by Dutilly (No. 332) on August 4, 1936. We have seen the specimen, which simulates this hybrid as far as we can judge, but since we find it peculiar that one of its parent species, *S. Uva-ursi,* is so far unknown on that side of Hudson's Bay (Raup 1943), we wonder if some mistake may have been made, or if some fungal infection perhaps has altered the morphological characters of the specimen so that it looks like a hybrid without having originated in that way?

69. **SALIX UVA-URSI** PURSH
*Voucher:* Lakes-of-the-Clouds, July 5, 1959, Löve & Löve 7497. *2n = 38.*

The subarctic eastern North American *Salix Uva-ursi* is the most common willow in the alpine regions of Mt. Washington, but apparently not occurring below the timberline. Its chromosome number 2n = 38 is the same as reported previously by Jörgensen, Sörensen & Westergaard (1958) from Greenland.

70. **SALIX ARGYROCARPA** ANDERSS.
*Voucher:* Lakes-of-the-Clouds, July 4, 1959, Löve & Löve 7599. *2n = 76.*

This is a subarctic-alpine eastern North American species with its main area of distribution in the eastern parts of the Labrador Peninsula and with a few outposts in the more southern mountains (Raup 1943). The morphological relationships of the species are obscure (Raup 1943; Fernald 1946), though it is apparently close enough genetically to *S. planifolia* Pursh of the *Phylicifoliae* group to be able to hybridize with it (*S.* × *Grayi,* C. K. Schneid.), at least on Mt. Washington. The species is locally abundant in the ravines and the gulfs and in the Lakes-of-the-Clouds area on Mt. Washington. Its chromosome number 2n=76 seems to be a first count.

71. **SALIX PLANIFOLIA** PURSH
*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7785. *2n = 76.*

This subarctic North American willow is so closely related to the European *S. phylicifolia* L., if judged from their morphological features, that Hiitonen (1950) and later Breitung (1957) proposed that it ought to be regarded as a subspecies only of that species. This is, however, no longer tenable, since at least the plants on Mt. Washington have 2n=76 chromosomes (Löve & Löve in Löve & Solbrig 1964b) and not 2n=114 as is typical of *S. phylicifolia* (cf. Löve & Löve 1961d). The species is restricted to seepage areas near the timberline up to about 1650 m.s.m. on Mt. Washington, but it does not grow in the forests below the sub-alpine zone.

72. **BETULA PUBESCENS** EHRH. SSP. **MINOR** (TUCKERM.) LÖVE & LÖVE
*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7780. *2n = 56.*

The amphi-atlantic and arctic-alpine complex of the species *Betula pubescens* is represented on Mt. Washington by the ssp. *minor,* which is closely related to the somewhat more northern ssp. *borealis* (Spach) Löve & Löve. In the northlands, where both races occur together, they hybridize and mix as do their close relatives in Iceland and Scandinavia (Löve & Löve 1956, 1965). The ssp. *borealis* is met with in its purest state in southwestern Greenland and in the alpine zone of Mt. Mansfield

in Vermont, whereas ssp. *minor* is the sole representative of the complex in the alpine zone of Mt. Washington. It was originally described from the alpine zone of Mt. Pleasant by Tuckerman (1843), who regarded it as a variety of *B. papyrifera* Marsh. It is fairly common in the alpine regions of Mt. Washington where it seems to be restricted to places with a heavy snowcover.

The chromosome number 2n = 56 here reported is the same as has been given for other taxa of the *tortuosa*-complex of *B. pubescens* (cf. Löve & Löve 1956, 1961d; Jörgensen, Sörensen & Westergaard 1958; Knaben & Engelskjön 1966).

73. **BETULA CORDIFOLA** REGEL
*Voucher:* Alpine Garden, August 30, 1959, Löve & Löve 7618. *2n = 28.*

It has long been evident that the conservative treatment of the American species *Betula papyrifera* Marsh as a complex of several varieties (Fernald 1950) cannot be retained, and the treatment by Gleason (1952), who separates *B. papyrifera* s.str. and *B. cordifolia* Regel is a considerable improvement which can be supported not only by morphological and geographical evidence but also by the fact that whereas the former has 2n = 56, 70 and 84 chromosomes, (Brittain & Grant 1965a.) the latter has 2n = 28 only. *B. papyrifera* is a strictly American plant with its closest relatives in northwestern America and eastern Asia, whereas *B. cordifolia* maybe an eastern North American taxon with its closest relatives in the boreal Eurasiatic *B. verrucosa* Ehrh. complex. Although we are of the feeling that it might be correctly classified as a subspecies of *B. pubescens,* vicarious for its ssp. *pubescens,* we still are hesitant to propose this, because of lacking experimental evidence and also because the few dissimilarities may be more significant than the many similarities between these taxa.

In the forests surrounding the Presidential Range, *Betula cordifolia* is a tall tree, but at timberline it forms shrubs. In the alpine zone of Mt. Washington it occurs here and there as small shrubs behind stones in snowbed habitats all the way up to the summit, and it is especially frequent near the Lakes-of-the-Clouds and on and above the Alpine Garden. As far as can be judged from the shrubs we have studied, the individual trees never persist very long under the severe conditions of the alpine zone, whereas in the subalpine region even seed-setting seems to be normal. Extensive hybridization and back-crossing resulting in introgression seems to occur where the taxon meets *B. glandulosa* near the Lakes-of-the-Clouds. The chromosome number 2n = 28 is a confirmation of a previous report by Brittain & Grant (1965b), whereas Woodworth (1929a, 1930) reported 2n=56.

74. **BETULA GLANDULOSA** MICHX.
VAR. **GLANDULOSA**
*Voucher:* Lakes-of-the-Clouds, July 25, 1958, Löve & Löve 7507. *2n = 28.*
VAR. **ROTUNDIFOLIA** (SPACH) REGEL
*Voucher:* Lakes-of-the-Clouds, August 30, 1959, Löve & Löve 7615. *2n = 28.*

This subarctic-boreal-alpine North American species is known to occur in two races differing in the size and form of the leaves. One of these, characterized by small and round leaves, has been named var. *rotundifolia,* and Fernald (1950) claims it to be "too difficult to distinguish" from *B. glandulosa* s.str. Hultén (1944) is of the opinion that it is identical with *B. nana* L. ssp. *exilis* (Sukatch.) Hultén, in which he includes also the eastern American subarctic *B. Michauxii* Spach (cf. Fernald, Rousseau & Raymond 1950). After observing this complex for several summers on Mt. Washington where both var. *glandulosa*

and var. *rotundifolia* occur together, we are inclined to concur with Fernald (1950), though we realize that the relationship within and between the complexes of *B. glandulosa* and *B. nana* are among the many difficult taxonomical and phytogeographical American and circumpolar problems which cannot be solved without an experimental approach.

The variety *rotundifolia* is widespread on Mt. Washington in somewhat protected localities all over the mountain, whereas the variety *glandulosa* seems to be concentrated to the area around the Bigelow Lawn, Lakes-of-the-Clouds, Mt. Monroe, and the Oakes Gulf. These varieties frequently hybridize so that much of the population shows a complete mixture of their characters; we have not been able to ascertain if specimens which may seem to be intermediate between these races and *B. pubescens* ssp. *minor* actually are hybrids, since we have neither been able to study their fertility nor count their chromosomes.

The chromosome number of *B. glandulosa* and its var. *rotundifolia* on Mt. Washington is 2n = 28, as previously reported for the species from Greenland by Jörgensen, Sörensen & Westergaard (1958) and from Canada by Packer (1964) and Dugle (1966). This number is also characteristic for *B. nana* from Eurasia (cf. Löve & Löve 1961d).

75. **ALNUS VIRIDIS** (CHAIX) DC. SSP. **CRISPA** (AIT.) LÖVE & LÖVE
*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7592. *2n = 28.*

The subarctic-boreal-alpine race ssp. *crispa* of the species *Alnus viridis* (Löve & Löve 1965) is typical of the deciduous shrubbery in the upper parts of the ravines and gulfs on Mt. Washington, reaching almost up to 1600 m.s.m. on the eastern slope of Mt. Clay. The chromosome number of var. *crispa* and var. *mollis* Fern. has been found to be 2n = 28, a number previously published for ssp. *crispa* by Woodworth (1929b) and Löve & Löve (1965), and for other races of *A. viridis* by Wetzel (1928, 1929), Jaretzky (1930), Poucques (1949b), and Contandriopoulos (1964).

76. **OXYRIA DIGYNA** (L.) Hill
*Voucher:* Great Gulf, August 30, 1962, Löve & Löve 7815. *2n = 14.*

This circumpolar arctic-montane species is usually regarded as a uniform taxon; this is especially true if the tall-grown taxon of southern Asiatic mountains is recognized as a species in its own right, *O. elatior* R. Br., perhaps with *O. sinensis* Hemsl. as a subordinate race. Nevertheless, the American populations can be classified into two geographically distinct groups on basis of their leaf form and the occurrence of a simple or ramose rhizome (Mooney & Billings 1961), the latter being typical of the southern Rockies. The plant with simple rhizomes is the arctic race, which is also known from seepage areas in the Great Gulf of Mt. Washington and from above snowbeds in the Tuckerman's Ravine, very rare in both places. Its chromosome number is 2n = 14, as reported previously by numerous authors (cf. Löve & Löve 1961d; Mooney & Billings 1961; Sorsa 1963; Packer 1964; Zhukova 1965a).

77. **BISTORTA VIVIPARA** (L.) S. F. GRAY
*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7548. *2n = 120.*

A circumpolar arctic-montane species which shows considerable variability, though none of its variants seems to have acquired an area of distribution sufficiently distinct to warrant taxonomic recognition. It propagates by bulbils, and there seems a good reason to believe that germinable seeds are never formed, despite extensive flowering (Edman 1929).

On Mt. Washington, *B. vivipara* is fairly common in somewhat moist soil, particularly in the ravines and in the Alpine Garden. Its upper limit on the headwall of the Alpine Garden seems to be about 1900 m.s.m., whereas its lower limit is about 1300 m.s.m. in the Great Gulf. We have only noticed plants with white flowers and the stunted growth typically met with in the arctic regions.

Various chromosome numbers, from 2n = 83 to 2n = c. 132, have been reported for this species by various authors (cf. Löve & Löve 1961d), but we feel confident that they all can be regarded as inexact estimations caused by the great difficulties in counting the crowded and relatively long chromosomes, except the number 2n = 120. In addition to from Mt. Washington, it has been securely counted from some other American localities by Löve & Löve (in Löve & Solbrig 1964a), and Löve & Ritchie (1966).

78. **CLAYTONIA CAROLINIANA** MICHX.

*Voucher:* Oakes Gulf, July 2, 1960, Löve & Löve 7634. *2n = 16.*

*Claytonia caroliniana* is an eastern North American temperate species, which reaches from the lowland up into the subalpine and alpine zones of Mt. Washington only in the moist and mossy snowbed habitats of the Oakes Gulf, where it has been collected at 1500 m.s.m. altitude. The chromosome number 2n = 16 confirms a previous count by Rothwell (1959).

79. **STELLARIA CALYCANTHA** (LEDEB.) BONG.

*Voucher:* Summit of Mt. Washington, July 27, 1958, Löve & Löve 7562. *2n = 52.*

This species is a rather variable subarctic-boreal-montane taxon of wide North American range and with amphi-atlantic and amphi-pacific outposts. It is frequent on Mt. Washington in moist soil between rocks and in snowbeds up to 1920 m.s.m. at the summit. Although common in the alpine zone, it is not confined to it and is met with in appropriate localities all down the slopes.

The chromosome number 2n = 52 counted on Mt. Washington plants is a confirmation of a previous report from Iceland by Löve & Löve (1956), slightly higher than the report of 2n = 44–48 by Peterson (1936).

80. **MINUARTIA GROENLANDICA** (RETZ.) OSTENF.

*Voucher:* Summit of Mt. Washington, July 1, 1960, Löve & Löve 7672. *2n = 20.*

The eastern North American *Minuartia groenlandica* (cf. Löve & Löve 1965) is one of the most conspicuous higher plants of the alpine barrens of Mt. Washington. The chromosome count of 2n = 20 is a confirmation of a report by Favarger (1962) which also is based on Mt. Washington material.

81. **SILENE ACAULIS** (L.) JACQ. SSP. **ARCTICA** Löve & Löve

*Voucher:* Cowpasture, 7-mile post, July 25, 1958, Löve & Löve 7530. *2n = 24.*

The alpine population of *Silene acaulis* on Mt. Washington seems to be confined to the Cowpasture and to the region above the eastern side of the headwall of the Great Gulf, since we have been unable to find it in the Alpine Garden or other locations given by Pease (1924, 1964) on basis of old collections. The species is represented by the ssp. *arctica,* which has long been misinterpreted as being identical with ssp. *exscapa* (All.) Vierh. of Central Europe (cf. Löve & Löve 1965).

The chromosome number 2n = 24 here reported for ssp. *arctica* from Mt. Washington has been reported pre-

viously for this and other races of *S. acaulis* by numerous investigators (cf. Löve & Löve 1961d; Skalińska 1963; Sorsa 1963; Packer 1964; Laane 1965; Zhukova 1965a).

82. **THALICTRUM POLYGAMUM** MUEHL.

*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7827. *2n = 84.*

This boreal northeast North American plant reaches into the subalpine scrubs on Mt. Washington. It is frequent in the Tuckerman's Ravine and the Oakes Gulf up to about 1530 m.s.m. altitude. The race var. *hebecarpum* Fern. seems to be predominant at higher levels, and our chromosome report of 2n = 84 is based on plants similar to that variety. Lower down in the ravine var. *polygamum* occurs, and all grades of intermediates are met with where these races hybridize.

The chromosome number 2n = 84 is a confirmation of a report by Jensen (1944) from North Carolina, where only var. *polygamum* seems to grow (Fernald 1950). The source of the report of 2n = 154 by Kuhn (1933) remains unknown.

83. **COPTIS TRIFOLIA** (L.) SALISB.

*Voucher:* Lakes-of-the-Clouds, July 4, 1959, Löve & Löve 7500. *2n = 18.*

A North American and eastern Asiatic subarctic-boreal-montane species reaching into the alpine zone on Mt. Washington, where it is common in localities sheltered by shrubs and rocks. Its chromsome number 2n = 18 is a confirmation of previous counts by Langlet (1932), Nakajima (1933), and Kurita (1958).

84. **RANUNCULUS ABORTIVUS** L.

*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7829. *2n = 16.*

This boreal-temperate plant has most of its area of distribution in southeastern North America. Fernald (1899, 1938, 1942a) described some varieties of the species, of whom the northern and alpine var. *acrolasius* is well-founded and perhaps worthy of subspecific rank, whereas var. *eucyclus* seems to be only a summer modification of var. *abortivus,* according to Wiegand & Eames (1926), and var. *indivisus* is also likely to be only an edaphic modification.

*R. abortivus* is common in the lowlands surrounding the Presidential Range, but it is also represented in the subalpine regions of the Great Gulf and the Tuckerman's Ravine on Mt. Washington by plants with distinctly pilose peduncles characteristic of var. *acrolasius.* The chromosome number 2n = 16 is a confirmation of a report for var. *acrolasius* from northern Manitoba by Löve & Ritchie (1966), as well as of previous reports for the species by Sorokin (1929) and Coonen (1939).

85. **CARDAMINE BELLIDIFOLIA** L.

*Voucher:* Great Gulf, July 26, 1958, Löve & Löve 7529. *2n = 16.*

This circumpolar arctic species has alpine outposts in North America but not in Central Europe. It is local and rare on Mt. Washington, occurring at the heads of ravines and gulfs in moss carpets or near seepage water, though it is also met with on the Cowpasture in ordinary soil. It seems to be confined to altitudes between 1600 and 1750 m.s.m., preferably on the northeast facing parts of the mountain. The chromosome number 2n = 16 has been reported previously from various parts of the area of the species by Jaretzky (1928), Holmen (1952), Löve & Löve (1956), Jörgensen, Sörensen & Westergaard (1958), Sokolovskaja & Strelkova (1960, 1962), Packer (1964), Mulligan (1965), and Zhukova (1965a).

86. **DROSERA ROTUNDIFOLIA** L.
*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7831. *2n = 20.*

This circumpolar boreal species is so far known on Mt. Washington only from the subalpine zone in the Oakes Gulf, where it reaches the altitude of 1400 m.s.m. in a small bog. It is common on the lowland. The chromosome number 2n = 20 confirms many previous reports from elsewhere (cf. Löve & Löve 1961d; Contandriopoulos 1962).

87. **RIBES LACUSTRE** (PERS.) POIR.
*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7830. *2n = 16.*

This boreal-montane North American species reaches into the low alpine zone of Mt. Washington with *Abies* and *Picea* in the krummholz up to over 1600 m.s.m., and it sets fruit at least high up in the Tuckerman's Ravine. The chromosome number 2n = 16 is a confirmation of reports by Tischler (1927), Meurman (1928), and Zielinski (1953).

88. **RIBES GLANDUOSUM** GRAUER
*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7788. *2n = 16.*

Also a lowland plant reaching up into the subalpine zone where it has been seen fruiting in late August on the headwall of the Alpine Garden. Its chromosome number 2n = 16 seems to be a first report.

89. **SAXIFRAGA HYPERBOREA** R. BR.
*Voucher:* Summit of Mt. Washington, July 5, 1958, Löve & Löve 7484. *2n = 26.*

This arctic-alpine species (Löve & Löve 1965) is the only taxon of the *S. rivularis* L. group met with on Mt. Washington, where it is very rare and confined to moist regions in the Great Gulf down to about 1450 m.s.m., though it also grows on the summit, in areas periodically moistened by seepage water behind and close to the buildings. The chromosome number 2n=26 confirms previous reports from Spitsbergen by Flovik (1940), from Greenland by Holmen (1952) and Jörgensen, Sörensen & Westergaard (1958), from the Rocky Mountains of Alberta by Packer (in Löve & Löve 1961d), and from Mt. Washington by Löve & Löve (1961d, 1965, and in Löve & Solbrig 1964b).

90. **CHRYSOSPLENIUM AMERICANUM** SCHWEIN.
*Voucher:* Great Gulf, August 25, 1961, Löve, Löve & Kawano 016. *2n = 24.*

A boreal North American species of the Great Lakes, St. Lawrence, and Appalachian region, barely reaching the subalpine zone on Mt. Washington in boggy areas on the headwall of the Great Gulf. The chromosome number 2n = 24 confirms a report by Löve (1954b) from material grown from seeds from the province of Quebec.

91. **SPIRAEA LATIFOLIA** (AIT.) BORKH.
*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7794. *2n = 36.*

Although this lowland species, as taken in the strict sense (Löve & Löve 1965), is not supposed to grow in the alpine zone of Mt. Washington (Pease 1924, 1964), it reaches high up on the mountain (Harris 1964), and we have found small plants unmistakingly belonging to it high up in the Tuckerman's Ravine. The chromosome number 2n = 36 is a confirmation of earlier reports by Sax (1936) and Löve & Löve (1965 and in Löve & Solbrig 1964b).

92. **SPIRAEA SEPTENTRIONALIS** (FERN.) LÖVE & LÖVE
*Voucher:* Alpine Garden, August 27, 1962, Löve & Löve 7762. *2n = 54.*

A subarctic-alpine taxon which has been regarded as a variety only of *S. latifolia* until recently (Löve & Löve 1965, and in Löve & Solbrig 1964b). It grows in the krummholz area and in other protected places on Mt. Washington, but does not seem to occur below the subalpine zone. Its chromosome number 2n = 54 has been reported previously by Baldwin (1951) and Löve & Löve (in Löve & Solbrig 1964b).

93. **GEUM PECKII** PURSH
*Voucher:* Lakes-of-the-Clouds, July 5, 1958, Löve & Löve 7495. *2n = 42.*

According to Fernald (1950) and Pease (1964), this species is endemic in the White Mountains and on Brier Island in western Nova Scotia, whereas Gleason (1952) and Gleason & Cronquist (1963) report it from the high mountains of Maine and New Hampshire. Since Roland (1944-1945) does not mention it from Nova Scotia, and since we know of no basis for the report of its occurrence on the mountains of Maine, it seems safe to regard it as an endemic in the White Mountains only. Together with the also very local and endemic *G. radiatum* Michx. of the southern Appalachians of North Carolina and Tennessee (cf. Radford, Ahles & Bell 1964, 1965), it forms the easternmost outposts of the section *Megacomastylis* of the subgenus *Acomastylis* of *Geum,* which in western North America is represented by the recently described (Calder & Taylor 1965) *G. Schofieldii* of the Queen Charlotte Islands of British Columbia and by the amphi-pacific *G. calthifolium* Menzies, ranging to Kamtchatka and Japan. The westernmost outposts of this group are *G. sikkimense* Prain of Sikkim and *G. elatum* Wall. of the Himalayas. Bolle (1933) included all these species in the genus *Acomastylis* Greene, whereas Nakai & Hara (in Hara 1935) separated the section *Megacomastylis* as the genus *Parageum,* an action accepted by Juzepczuk (1941). It is, however, hardly well-founded to separate this group from *Geum* at the generic level, and so the treatment of it as a section of the subgenus *Acomastylis* is recommended by Gajewski (1957).

Bolle (1933) regarded the Japanese populations as a species *Acomastylis japonica,* but Japanese botanists accept it as a variety only of *Geum calthifolium* (cf. Hara 1952; Ohwi 1965). As far as can be seen from the description, the newly described *G. Schofieldii* seems to constitute the eastern end of the same variation as the var. *japonicum* represents the western end, and so is, most likely, given a too high rank when accepted as a species. Gray (1865) regarded *G. Peckii* as a variety of *G. radiatum.* There can be no doubt that all the taxa of the section *Megacomastylis* are closely related, as pointed out by Hultén (1946), Gajewski (1957), and others. It is likely that further studies of the entire group and its biosystematic interrelationships will reveal that it would be most correctly classified as a single species with two or three subspecies each of which would include two or more varieties, but this ought not to be done on basis of the presently available evidence alone. It would, moreover, logically require similar changes in other groups of *Geum,* especially in the subgenus *Geum* in which mounting experimental evidence shows a lack of distinct reproductive barriers between at least most of the so-called species (Gajewski 1957).

*Geum Peckii* is common in moist situations on Mt. Washington between 1350 and 1710 m.s.m. altitude. It is equally common on the southern peaks but rarer north of Mt. Washington in the Presidential Range.

The chromosome number 2n = 42

here reported from Mt. Washington was first counted on the voucher specimen but later confirmed on more recently collected living plants gathered in 1965 by Dr. Maynard C. Bowers. This number has been reported previously from Mt. Washington by Raynor (1946, 1952), who also found this number for the southern *G. radiatum*. The same number has also been reported for Japanese material of *G. calthifolium* by Sakai (1934).

94. **POTENTILLA HYPARCTICA** MALTE
SSP. **ROBBINSIANA** (OAKES) LÖVE & LÖVE
*Voucher:* Above Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7783. *2n = 49.*

A much discussed endemic race (Löve & Löve 1965), this taxon is confined to two solifluction areas on bedrock of calcium silicate in the Presidential Range and the Franconia Range. The former locality is above the Lakes-of-the-Clouds at the foot of Mt. Monroe. The race is apparently an apomictic segregate from *P. hyparctica,* characterized by 2n=49 chromosomes (cf. Löve & Löve 1965 and in Löve & Solbrig 1964b), a number once observed also in *P. hyparctica* by Dansereau & Steiner (1956), though that species is characterized by 2n = 42 chromosomes as demonstrated by Flovik (1940), Dansereau & Steiner (1956), Jörgensen, Sörensen & Westergaard (1958), and Zhukova (1965a).

95. **POTENTILLA LABRADORICA** LEHM.
*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7833. *2n = 42.*

Since the relationships and taxonomy of the *Potentillae* related to *P. norvegica* L. still are confused and in need of an experimental study at the same time as their nomenclature needs to be revised, we think (cf. Löve 1954a) that it is a lesser evil to keep them as distinct species than to include some of these taxa as subordinate of others which may later prove unrelated to them. As far as is known, they are all completely apomictic and, therefore, likely to be unable to form the overlapping variations claimed by Hultén (1946) as a reason for his inability to see their distinction. The North American subarctic-alpine glabrous *P. labradorica* is certainly the most distinct taxon of this group on this continent, and it can always be distinguished from native *P. monspeliensis* L. which is less easily separable from the widespread, introduced, *P. norvegica* L.

*P. labradorica* seems to be confined to gravelly or turfy localities on Mt. Washington, where it is restricted to the ravines. The chromosome number 2n = 42 is a first report. Since it differs in this respect from *P. monspeliensis* and *P. norvegica* with their 2n = 56 and 70 chromosomes, respectively, this is at least a strong indication of its species status (Löve 1960, 1964, 1965).

96. **FRAGARIA VIRGINIANA** DUCHESNE
SSP. **GLAUCA** (WATS.) STAUDT
*Voucher:* Oakes Gulf, August 8, 1962, Löve & Löve 7834. *2n = 56.*

This subspecies was recently distinguished by Staudt (1962), without other information on its distribution than that it grows in North America, and without proper and much needed synonymy. It seems to include the variety *terrae-novae* (Rydb.) Fern. & Wieg., which grows in forests below the subalpine regions of Mt. Washington from where it occasionally reaches into the subalpine zone. It has been collected in the Oakes Gulf at the border of an *Abies* krummholz at about 1500 m.s.m. altitude.

The chromosome number 2n = 56 is a confirmation of several previous reports from North American and foreign

material (cf. Löve & Löve 1961d; Staudt 1962; Packer 1964; Löve & Ritchie 1966).

97. **SIBBALDIA PROCUMBENS** L.
*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7797. *2n = 14.*

This circumpolar arctic-alpine species with many disjunctions in its area is met with on Mt. Washington only in snowbed localities high up on the cliffs on the southern side of the headwall of the Tuckerman's Ravine, at about 1350-1400 m.s.m. altitude. The plant covers only a few square meters and forms a dense mat with some other herbs and grasses.

The chromosome number 2n = 14 is a confirmation of previous reports from various alpine regions in Eurasia and North America by Böcher (1939), Sokolovskaja & Strelkova (1941, 1948a, 1960, 1962), Löve & Löve (1944b, 1956), Larsen (1954), Wiens & Halleck (1962), Sorsa (1963), Packer (1964), and Knaben & Engelskjön (1966).

98. **SIBBALDIOPSIS TRIDENTATA** (SOLAND.) RYDB.
*Voucher:* Lakes-of-the-Clouds, July 25, 1958, Löve & Löve 7511. *2n = 28.*

We do not like to accept a large and very diversified genus *Potentilla* but prefer to separate it into smaller and more natural genera, since this can be supported not only on morphological but also on chemical and genetical grounds. The species in question is, then, included in the genus *Sibbaldiopsis,* as proposed by Rydberg (1898), as *S. tridentata,* which is an eastern North American subarctic-boreal taxon. It is common everywhere on Mt. Washington in fissures between rocks and in dry and exposed habitats.

The chromosome number 2n = 28 is the same as previously reported from Greenland by Jörgensen, Sörensen & Westergaard (1958), and by Shimotomai (1930) from an unknown source.

99. **RUBUS PUBESCENS** RAFIN.
*Voucher:* Huntington's Ravine, July 27, 1958, Löve & Löve 7559. *2n = 14.*

As mentioned by Hultén (1958), this boreal North American species is related to the Eurasiatic *Rubus saxatilis* L. In addition to morphological differences, these species differ in their chromosome number, since the Eurasiatic plant is tetraploid and the American one diploid.

Although *R. pubescens* is a plant of boreal forests at low altitudes, it occasionally reaches into the alpine zone on Mt. Washington, where it is met with in the ravines and on Bigelow Lawn. It is unlikely that these specimens propagate with seeds, since they are never seen to flower, but they are probably the result of seed dispersal by birds from lower altitudes.

The chromosome number 2n = 14 is a confirmation of a previous report by Vaarama (1954) on cultivated material.

100. **RUBUS IDAEUS** L.
SSP. **SACHALINENSE** (LÉVL.) FOCKE
*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7839. *2n = 14.*

This North American-eastern Asiatic race of the circumpolar boreal species *Rubus idaeus* (cf. Cronquist, in Hitchcock, Cronquist, Ownby & Thompson 1961) is frequent at lower levels on Mt. Washington. It reaches the subalpine regions in *Alnus* shrubs in protected areas, as at the Gulf-side of Mt. Clay and in Oakes Gulf, where ripe berries have been tested in late August. Its chromosome number is 2n = 14, as previously determined on American plants by Longley (1924), Longley & Darrow (1924), and Yarnell (1931), and on Eurasiatic material by numerous other authors (cf. Löve & Löve 1961d).

101. **AMELANCHIER BARTRAMIANA** (TAUSCH) ROEMER
*Voucher:* Lakes-of-the-Clouds, July 25, 1958, Löve & Löve 7521. *2n = 68.*

This eastern North American species of subarctic-boreal-alpine distribution is common in the krummholz clumps and in sheltered snowbed habitats in the subalpine and alpine zones of Mt. Washington. It reaches at least 1650 m.s.m. altitude on the headwall of the Alpine Garden and it flowers at least up to 1600 m.s.m. in southfacing localities. It has not been observed in the subalpine or alpine zones on the northwestern side of the mountain.

The chromosome number 2n = 68 seems to be a first count for this species.

102. **SORBUS AMERICANA** MARSH
*Voucher:* Jewell Trail, July 6, 1959, Löve & Löve 7609. *2n = 34.*

This northeastern American tree is common at the foot of Mt. Washington, and reaches only locally into the subalpine zone. Its chromosome number 2n = 34 confirms previous counts by Sax (1931), Löve (1954b), and Löve & Löve (1965).

103. **SORBUS GROENLANDICA** (C.K. SCHNEID.) LÖVE & LÖVE
*Voucher:* Alpine Garden, August 30, 1959, Löve & Löve 7617. *2n = 68.*

The taxonomical position of this small tree or shrub of subarctic and alpine northeastern America has recently been clarified by Löve & Löve (1965). It is an alloploid plant which replaces *S. americana* above timberline on Mt. Washington, but does not occur below the subalpine zone. It sets fruit rarely and grows often only as a dwarf, 50-100 cm. tall or lower, in shelters behind rocks, up to at least 1620 m.s.m. altitude in the Alpine Garden.

The chromosome number 2n = 68 has been reported previously by Böcher & Larsen (1950), Holmen (in Jörgensen, Sörensen & Westergaard 1958), and Löve & Löve (1965).

104. **PRUNUS PENSYLVANICA** L.f.
*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7836. *2n = 16.*

Dwarfs of this boreal North American species grow in the sheltered subalpine habitats on the headwalls of the ravines and in Oakes Gulf at about 1450 m.s.m. altitude. Their chromosome number is 2n = 16, as reported from other populations by Sax (1931).

105. **OXALIS ACETOSELLA** L. SSP. **MONTANA** (RAFIN.) HULTÉN
*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7597. *2n = 22.*

The circumpolar *Oxalis Acetosella* is composed of several subspecies of which ssp. *montana* is widespread in eastern North America (cf. Hultén 1958). This race reaches up into the alpine zone of Mt. Washington where it seems to prefer the deep shade in the krummholz, and so it can only be found by crawling into the elfinwood. Its chromosome number 2n = 22, previously reported for ssp. *montana* by Löve (1954b), is the same as established for the ssp. *Acetosella* by Heitz (1927), Löve & Löve (1944b, 1956), Löve (1954b), Marks (1956), Czapik (in Skalińska & alii 1959), Sorsa (1962), and Gadella & Kliphuis (1963), and for ssp. *japonica* (Franch. & Sav.) Hara by Nakajima (1936). The number 2n = 30 reported for Indian material of *O. Acetosella* by Sharma & Chatterji (1960) has, most likely, belonged to another taxon.

106. **NEMOPANTHUS MUCRONATA** (L.) TREL.
*Voucher:* Oakes Gulf, August 3, 1962, Löve & Löve 7837. *2n = 40.*

A northeastern American boreal shrub, which reaches up into the subalpine zone on Mt. Washington only in the thickets of Oakes Gulf at about 1380 m.s.m. altitude. It does not reach up into the subalpine zone in the Tuckerman's Ravine. Its chromosome number 2n = 40 is apparently a first count.

107. **ACER SPICATUM** LAM.
*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7838. *2n = 26.*

This eastern North American temperate shrub or small tree reaches from the lowland into the montane regions and, occasionally, into the subalpine zone of the White Mountains. This it does, e.g., in a protected niche at about 1380 m.s.m. in Oakes Gulf. The chromosome number counted on this population, 2n = 26, is a confirmation of a recent count by Santamour (1962) and by Löve & Löve (in Löve & Solbrig 1964a).

108. **VIOLA PALUSTRIS** L.
*Voucher:* Lakes-of-the-Clouds, July 25, 1958, Löve & Löve 7516. *2n = 48.*

The *Viola palustris* complex in North America seems to be in some state of confusion, according to Hultén (1958). He claims that the western American populations so named (cf. Baker 1936; Davis (1952) are closer related to *V. epipsila* Ledeb. and he accepts them as its ssp. *repens* (Turcz.) W. Becker, an amphi-pacific taxon. It is true, that these populations deviate from typical and amphi-atlantic *V. palustris* from eastern North America, but they cannot be retained within the Eurasiatic *V. epipsila* for the simple reason that this species is characterized by 2n = 24 chromosomes (cf. Löve & Löve 1961d), whereas Bold & Gershoy (1934) have found the number 2n = 48 in plants of so-called *V. palustris* from British Columbia. The problem can perhaps be solved by retaining *V. repens* Turcz. as a species including the western American plants, or by transferring ssp. *repens* to *V. palustris,* but more detailed morphological and cytotaxonomical studies are needed before the problem can be properly settled.

Hultén (1958) gives a very schematic and restricted distribution area in eastern North America for *V. palustris,* including material from the prairies in ssp. *repens* of *V. epipsila.* It is true that plants from southwestern Alberta belong to the western taxon, but other plants from the prairies of Alberta to Manitoba (Budd 1957; Scoggan 1957; Moss 1959) and north of the Great Lakes seem to be more correctly placed with the eastern and amphi-atlantic taxon, which is the only one met within the eastern United States and then only in the White Mountains of New Hampshire (Russell 1965).

*V. palustris* is frequent along brooks and in moist and mossy habitats on Mt. Washington, at least up to 1650 m.s.m. altitude in Great Gulf. Its chromosome number 2n = 48 confirms previous reports from elsewhere by Clausen (1927, 1931a,b,c), Gershoy (1928, 1932), Fernandes (1950), Löve & Löve (1956), Jörgensen, Sörensen & Westergaard (1958), Schmidt (1960), Gadella (1963), and Gadella & Kliphuis (1963). The number 2n = 24 reported from Algiers by Quézel (1957) may have been counted on *V. Juressii* Neves, often reduced to subspecies of *V. palustris* in these regions.

109. **VIOLA CUCULLATA** AIT.
*Voucher:* Tuckerman's Ravine, July 4, 1960, Kawano, Löve & Löve 91. *2n = 54.*

This boreal-temperate eastern North American species has been found, in

recent years, to reach up to at least 1450 m.s.m. altitude in moist places on the headwall of Tuckerman's Ravine. The specimens collected appear to belong to the var. *microtitis* Brainerd, with auricles of sepals only 1-2 mm. long, a race previously unknown so far south (cf. Fernald 1950). Its chromosome number 2n = 54 is the same as reported previously for the typical race of the species by Gershoy (1928, 1932, 1934), Miyaji (1930), and Bamford & Gershoy (1930).

### 110. **VIOLA PALLENS** (BANKS) BRAINERD

*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7790. *2n = 24.*

A boreal North American species, reaching up to around 1450 m.s.m. in Tuckerman's Ravine, in wet and mossy localities. The chromosome number 2n = 24 is the same as reported by Bamford & Gershoy (1930) and Gershoy (1932, 1934).

### 111. **VIOLA LABRADORICA** SCHRANK

*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7799. *2n = 40.*

Mounting cytological evidence seems to support the opinion that the American taxon hitherto regarded only as the glabrous variety *minor* (Hook.) Fern. of *Viola adunca* J. E. Sm. by Fernald (1949, 1950), Gleason (1952), Gleason & Cronquist (1963), and others, actually is a species in its own right, *V. labradorica* Schrank, as accepted by Böcher, Holmen & Jakobsen (1957), Jörgensen, Sörensen & Westergaard (1958), and some others. The chromosome number 2n = 20 seems to be typical of the puberulent *V. adunca* s.str. and its races (Gershoy 1934; Clausen, Keck & Hiesey 1940; Clausen 1964; Löve & Löve, unpubl., from Sanford, Manitoba, June 6, 1952, coll. No. 5402 WIN.). The chromosome number here reported for V. *labradorica* from Mt. Washington has also been counted on glabrous plants from Pine Ridge in Manitoba (Löve & Löve 5352, May 30 1952, WIN). It seems likely that the plant of *V. adunca* with 2n = 40 chromosomes reported from Alberta by Packer (1954) may also belong here. The same may have been the case of the single population of *V.* adunca with 2n = 40 chromsomes mentioned by Gershoy (1928), whereas *V. labradorica* studied by him (Gershoy 1928, 1932) and reported to have 2n = 20 chromosomes has probably been a misidentified race of *V. adunca.* The problem is in need of a closer and critical cytotaxonomic study.

*V. labradorica* is rather rare on Mt. Washington where it grows in moist and sheltered habitats, up to the altitude of about 1600 m.s.m. on the headwall of the Alpine Garden.

### 112. **EPILOBIUM PLATYPHYLLUM** (DANIELS) LÖVE & LÖVE

*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7583. *2n = 72.*

It has recently been shown, by Mulligan (1957), Löve & Löve (1961d), and Mosquin (1963, 1966), that the species passing as *E. angustifolium* in North America actually includes two taxa, which differ in chromosome number, some morphological characteristics, and geographic distribution. The more northern plant, which doubtlessly belongs to the variable Eurasiatic arctic-boreal species in its strict sense, has 2n = 36 chromosomes, as previously demonstrated by numerous investigators (cf. Löve & Löve 1961d; Raven & Moore 1964). Its southern counterpart, endemic to North America as far as is known, has 2n = 72 chromosomes.

It is possible that some other names have been applied to the 72-chromosome taxon elsewhere, but it is clearly identical with *C. angustifolium* var. *platyphyllum* Daniels, orginally describ-

ed from the canyons in the Green Mountain in Boulder County, Colorado, by Daniels (1911), since only the 72-chromosome plant grows there. Although Fernald (1918, 1950) was unaware of the cytological distinction of this taxon, he recognized its morphological and geographical importance when he placed all the southern material of the western populations, and also certain populations from eastern Canada, under this name (Fernald 1950). Mosquin (1966) regards this taxon as the ssp. *circumvagum* Mosquin of *E. angustifolium* L. We are of the opinion that this is a misuse, albeit common, of the subspecific category in its classical (cf. Chater & Brummit 1966) and biological sense (cf. Löve 1964), because of the reproductive isolation between the 2n = 72 taxon and the 2n = 36 typical *E. angustifolium*. Therefore, we prefer to regard both taxa as distinct species and name the 2n = 72 chromosome plant as the species *Epilobium platyphyllum* (Daniels) Löve & Löve, stat. nov. (based on *Chamaenerion angustifolium* var. *platyphyllum* Daniels, Flora of Boulder, Colo., Univ. Miss. Studies II, 2, 1911, p. 176). This is also the basonym of ssp. *circumvagum* Mosquin. The new species is a boreal and montane North American and eastern and southern Asiatic plant, as shown by Mosquin (1966).

### 113. **EPILOBIUM PALUSTRE** L.

*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7841. *2n = 36.*

The species *Epilobium palustre* seems to be a mainly circumboreal taxon with some few outposts in arctic-alpine regions. Its typical race is common at lower levels around Mt. Washington, but in shrubby and moist habitats in the subalpine zone, particularly in the ravines, its arctic-alpine eastern North American var. *labradoricum* Hausskn. is frequent. It is possible that this race is only an alpine modification or an ecotype of the typical race, though experimental studies of that possibility still are lacking. Its chromosome number 2n = 36 is the same as reported previously from various regions by Böcher (1938), Rutland (1941), Löve & Löve (1948, 1956), Gagnieu & Linder (1954, 1955), Raven & Moore (1964), and Löve & Ritchie (1966).

### 114. **EPILOBIUM HORNEMANNII** RCHB.

*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7582. *2n = 36.*

This arctic-alpine amphi-atlantic and amphi-pacific taxon (cf. Hultén 1958) is frequent in moist, mossy, and shrubby habitats in the ravines and gulfs and in the Alpine Garden, between about 1200 and about 1560 m.s.m. altitude on Mt. Washington. Its chromosome number 2n = 36 has been reported previously from Greenland (Böcher 1938), Iceland (Löve & Löve 1948, 1956), the Rocky Mountains of Alberta (Packer, in Löve & Löve 1961d), and from the Beringian area of Siberia (Zhukova 1965a).

### 115. **EPILOBIUM LACTIFLORUM** HAUSSKN.

*Voucher:* Tuckerman's Ravine, July 3, 1960, Löve & Löve 7659. *2n = 36.*

This species has approximately the same area of distribution as has *E. Hornemannii,* and since they cross freely and give rise to completely fertile offspring, there seems reason to doubt the wisdom in keeping them as distinct species. *E. lactiflorum* is occasional in moist and mossy habitats mainly in the ravines and the Alpine Garden on Mt. Washington. The chromosome number 2n = 36 is a confirmation of previous reports from Greenland (Böcher & Larsen 1950), and Iceland (Löve & Löve 1956).

116. **ANGELICA ATROPURPUREA** L.

*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7594. *2n = 22.*

This boreal-montane eastern North American plant reaches from Newfoundland to the Great Lakes, with an isolated population, named var. *occidentalis* by Fassett (1931), at James Bay (Dutilly, Lepage & Duman 1954, 1958; Dutilly & Lepage 1963). The var. *atropurpurea* is rather rare and local in the subalpine zone of ravines on Mt. Washington, preferably on rocks with running water. The chromosome number 2n = 22 is the same as previously reported from Illinois by Bell & Constance (1957).

117. **HERACLEUM LANATUM** MICHX.

*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7840. *2n = 22.*

An amphi-pacific boreal-montane species, the eastern Asiatic representatives of which belong to a distinct race, ssp. *asiaticum* Hiroe (cf. Hara 1952). All its North American populations seem to represent the not very variable ssp. *lanatum,* which grows in rich damp soil or along brooks at lower levels in the White Mountains and in the boreal zone across the continent. It barely reaches the subalpine zone in the gulfs of Mt. Washington. The chromosome number 2n = 22 is the same as reported previously for ssp. *lanatum* by Bell & Constance (1957) and for ssp. *asiaticum* by Tamamschjan (1933) and Matsuura & Sutô (1935).

118. **CHAMAEPERICLYMENUM CANADENSE** (L.) A. & GR.

*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7544. *2n = 44.*

An American species with an amphi-pacific range (cf. Pojarkova 1951). It is common on Mt. Washington, where it flowers and sets fruit at least up to the altitude of 1800 m.s.m. At this altitude the flowers have a strong greenish tint, whereas the berries are of the same red color as on the lowland.

The chromosome number 2n = 44 is the same as reported previously from eastern North America by Dermen (1932) and from Sakhalin by Sokolovskaja (1960), and we have counted it from several other localities in eastern North America, from Manitoba to Quebec and New England.

A deviating chromosome report of 2n = 22 from two collections from Alberta (Packer 1964) needs to be discussed. This number is typical of the species *Ch. suecica* (L.) A. & Gr. as shown by numerous writers (cf. Löve & Löve 1961d), although Packer's collection was from far outside its area (cf. Calder & Taylor 1965). We have also counted this number in fixations made by Dr. Jacques Rousseau in Ungava in 1951, on plants then preliminarily determined as the hybrid *Ch. canadensis* × *Ch. suecica.* Although Hultén (1937, 1947) claims that "there can be no doubt about the hybrid nature of this plant", an opinion shared by Lepage (1946) and some others, it is always fully fertile and is even met with considerably outside the area of its putative parents (Hultén 1958; Porsild 1939). The fact that its chromosome number is 2n = 22 and not the expected 2n = 33 if it were a hybrid between the diploid and tetraploid species, is a conclusive evidence against regarding it as a hybrid. Hultén (1937, 1947, 1958) and others have been misled by the fact that it has some characters in common with both the diploid and tetraploid species whereas they have neglected to check the fertility of the suspected hybrid. This taxon is, undoubtedly, the good amphi-pacific and subarctic North American species *Ch. unalaschense* (Ledeb.) Rydb., as originally described by Ledebour (1844) and more recently recognized by Rydberg (1917) and Po-

jarkova (1950, 1951), and given the specific name *Cornus intermedia* (Farr) Calder & Taylor by Calder & Taylor (1965). The deviating chromosome number reported by Packer (1960) for *Ch. canadense* was, probably, counted on material belonging to *Ch. unalaschense* rather than on material of *Ch. suecicum* far from its area as given by Calder & Taylor (1965), though this is only a guess made in order to alleviate the apparent occurrence of two chromosome numbers in the species *Ch. canadense* which, most likely, is a hemialloploid between the two diploid species of *Chamaepericlymenum*.

119. **LEDUM GROENLANDICUM** OEDER

*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7542. $2n = 26$.
Lakes-of-the-Clouds, June 20, 1965, Bowers, s.n. (Löve & Löve 9967). $2n = 26$.

As mentioned by Löve & Löve (1965), the alpine populations of *Ledum groenlandicum* are morphologically and ecologically different from the lowland populations. Only a single chromosome count had been made, but since it revealed the tetraploid rather than the diploid number expected, we were hesitant as to the interpretation of these differences.

In late June 1965, Dr. Maynard Bowers visited Mt. Washington to collect certain alpine plants for a project in educational experimentation supported by the University of Colorado. Among the material were some specimens of the alpine *L. groenlandicum*, which since then have been cultivated in our greenhouse at Boulder. The plants retain the morphological charteristics given by Löve & Löve (1965). Their chromsome number, as carefully studied by Dr. B. M. Kapoor and the writers, is $2n = 26$, though cells with $2n = 52$ and intermediate chromosome numbers occur rather frequently. Further studies may reveal if this and the observation of a tetraploid cell by Löve & Löve (1965) ought to be interpreted as some variation of endopolyploidy or not. It seems safe to conclude, however, that the correct and primary chromosome number of the alpine population is $2n = 26$. Therefore, the plants belong to the species *L. groenlandicum* as previously assumed, whereas further investigations are needed to decide if the alpine-arctic ecotype may be worthy of a separate taxonomic recognition at the rank of subspecies or variety on basis of its morphological and ecological differences.

120. **RHODODENDRON LAPPONICUM** L.

*Voucher:* Summit of Mt. Washington, July 1, 1960, Löve & Löve 7681. $2n = 26$.

This arctic-subarctic-alpine species is mainly North American, though its occurrence in the mountains of Scandinavia make it amphi-atlantic. If the Asiatic *R. parvifolium* Adams is regarded as synonymous with *R. lapponicum*, as proposed by Hultén (1958), then the species is also amphi-pacific.

*R. lapponicum* is common in the alpine zone of Mt. Washington, between 1380 m.s.m. on Boott's Spur and 1860 m.s.m. close to the summit, on dry barrens, in heath associations with thick lichen cover.

The chromosome number $2n = 26$ is the same as reported from Greenland by Hagerup (1928) and from an undisclosed source by Janaki-Ammal, Enoch & Bridgwater (1950).

121. **RHODODENDRON CANADENSE** (L.) TORR.

*Voucher:* Oakes Gulf, July 4, 1961, Kawano, Löve & Löve 29. $2n = 52$.

This boreal-montane plant of new England and the St. Lawrence region barely reaches into the subalpine zone

of Mt. Washington on southeast facing ledges at about 1500 m.s.m. altitude on Mt. Franklin, but it is more frequent in the protected upper ranges of Oakes Gulf. It is common in bogs and peaty soil on the lowland and on the slopes of the mountains, and more so on the southern than the northern peaks of the Presidential Range.

The chromosome number 2n = 52 is a confirmation of previous reports by Sax (1930) and Janaki-Ammal, Enoch & Bridgwater (1950).

122. **LOISELEURIA PROCUMBENS** (L.) DESV.

*Voucher:* Alpine Garden, July 5, 1958, Löve & Löve 7491. *2n = 24.*

An alpine-arctic plant which occurs exclusively in the barren zone of Mt. Washington in heath communities, from the summit down to 1380 m.s.m. on Boott's Spur and even down to 1030 m.s.m. in exposed habitats on the Glen Boulder. Its chromosome number 2n = 24 is the same as reported from Greenland by Hagerup (1928), Iceland by Hagerup (1928) and Löve & Löve (1956), and the Alps by Mattick (in Tischler 1950).

123. **KALMIA POLIFOLIA** WANGENH.

*Voucher:* Lakes-of-the-Clouds, July 5, 1958, Löve & Löve 7492. *2n = 48.*

The boreal-montane North American *Kalmia polifolia* is represented in its western range by the weakly distinct ssp. *occidentalis* (Small) Abrams (Small 1914; Abrams 1951), whereas ssp. *polifolia* is common in bogs in New England, up to about 1700 m.s.m. on the headwall of the Alpine Garden. The chromosome number 2n = 48 is the same as reported by Hagerup (1928), but slightly higher than the 2n = 44 counted by Callan (1941).

124. **PHYLLODOCE COERULEA** (L.) BAB.

*Voucher:* Lakes-of-the-Clouds, July 5, 1958, Löve & Löve 7502. *2n = 24.*

This is one of the arctic-alpine species with amphi-atlantic and amphi-pacific distribution areas (Hultén 1958). In addition, disjunct areas are known in the Pyrenees in Europe and in the New England mountains in North America. On Mt. Washington the species occurs in the alpine and subalpine zones from about 1440 m.s.m. on the headwall of the Tuckerman's Ravine up to about 1830 m.s.m. near the summit, in seepage areas on moist slopes, probably mainly in snowbeds. The chromosome number 2n = 24 is the same as reported by Wanscher (1934), Böcher (1938), Löve & Löve (1956), Sokolovskaja & Strelkova (1960), and Sorsa (1963).

125. **HARRIMANELLA HYPNOIDES** (L.) COVILLE

*Voucher:* Summit of Mt. Washington, July 5, 1958, Löve & Löve 7489. *2n = 32.*

Again, this is one of the arctic-alpine amphi-atlantic species. It is strictly alpine on Mt. Washington, but rather rare and occurring mainly in seepage areas at the heads of the ravines, or on moist cliffs and rocks. The chromosome number 2n = 32 is a confirmation of reports from Greenland by Jörgensen, Sörensen & Westergaard (1958), Iceland by Löve & Löve (1961d), and Finland by Sorsa (1963).

126. **CHIOGENES HISPIDULA** (L.) T. & G.

*Voucher:* Lakes-of-the-Clouds, August 30, 1959, Löve & Löve 7613. *2n = 24.*

An eastern North American boreal-montane plant, reaching from the lowland to the subalpine zone in the Alpine Garden and the Lakes-of-the-Clouds

area on Mt. Washington, where it grows in shelter of krummholz. The chromosome number 2n = 24 is slightly higher than the previous report of 2n = 22 by Callan (1941).

127. **ARCTOUS ALPINA** (L.) NIEDENZU
*Voucher:* Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7784. *2n = 26.*

A somewhat variable circumpolar arctic-alpine species which is fairly rare on Mt. Washington, occurring only in heath and barren habitats on the southeast slope between 1380 and 1650 m.s.m. altitude. The chromosome number 2n = 26 is a confirmation of reports by Jörgensen, Sörensen & Westergaard (1958) and Sokolovskaja & Strelkova (1960, 1962).

128. **VACCINIUM VITIS-IDAEA** L. SSP. **MINUS** (LODD.) HULTÉN
*Voucher:* Cowpasture, 7-mile-post, July 8, 1960, Löve & Löve 7669. *2n = 24.*

The almost circumpolar ssp. *minus* of *V. Vitis-idaea* is very common all over Mt. Washington, from the lowlands to the summit, in heath in exposed habitats. Its chromosome number 2n = 24 is the same as reported previously for this taxon by Hagerup (1928), Newcomer (1941), Löve (1954b), and Löve & Löve (1956), and for ssp. *Vitis-idaea* by Hagerup (1928), Löve (1954b), Sorsa (1962), Lövkvist (in Weimarck 1963), Hedberg & Hedberg (1964), and Laane (1965).

129. **VACCINIUM ULIGINOSUM** L.
*Voucher:* Alpine Garden, July 6, 1960, Löve & Löve 7687. *2n = 48.*

As most recently pointed out by Löve & Löve (1965) and D. Löve & Bosçaiu (1966), the collective taxon *Vaccinium uliginosum* actually consists of three distinct species in a polyploid series, morphologically, ecologically, and geographically distinct. Two of these species, the diploid *V. gaultherioides* Bigel. and the tetraploid *V. uliginosum* L. s.str., may be circumpolar in their distribution, although their late recognition makes it difficult to evaluate the exactness of previously published maps. The hexaploid is, however, apparently an amphipacific plant, since the chromosome number 2n = 72 previously known only from Japan (Hara 1952b; 1953), has recently been counted also on Alaskan material by Young (1965), who tentatively identifies his specimens with *V. salicinum* Cham. (cf. also Löve & Löve 1965).

The tetraploid species *V. uliginosum* is an allogamous and upright shrub which grows in mires and moist heaths in the boreal-subarctic zone and rarely in high-alpine situations farther south. It is very common on the slopes of Mt. Washington above the tree limit. The chromosome number here reported from the Alpine Garden where the plant is especially abundant, is a confirmation of previous reports by Hagerup (1933), Löve (1950, 1954b), Löve & Löve (1956 and in Löve & Solbrig 1964b), Sokolovskaja & Strelkova (1960), and Hedberg & Hedberg (1964).

130. **VACCINIUM GAULTHERIOIDES** BIGEL.
*Voucher:* Near Summit of Mt. Washington, July 1, 1960, Löve & Löve 7678. *2n = 24.*

This species was originally described from Mt. Washington by Bigelow (1816), though he later (Bigelow 1824) reduced it to the variety *alpinum* of *V. uliginosum*. It is an autogamous plant of alpine habitats where it prefers rather dry heaths, although it is met with also in moist and acid soil in the Arctic (Raup 1947; Porsild 1957, 1964; D. Löve & Bosçaiu 1966), and much farther north than the tetraploid species (Hagerup 1933). The species is rare

near the summits of the White Mountains, but it is easily distinguished by aid of its prostrate growth and small light-green leaves. The chromosome number 2n = 24 is a confirmation of previous reports from Mt. Washington (Löve & Löve 1961d, and in Löve & Solbrig 1964b), Greenland (Hagerup 1933; Jörgensen, Sörensen & Westergaard (1958), Spitsbergen (Flovik 1940), and Iceland (Löve 1950, 1954b; Löve & Löve 1956).

131. **VACCINIUM MYRTILLOIDES** MICHX.

*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7843. *2n = 24.*

A boreal-montane North American species, which is common at lower levels on Mt. Washington and less frequent at high levels, though it reaches over 1600 m.s.m. on Mt. Clay. It is the only *Vaccinium* with hairy leaves met with in the alpine zone. The chromosome number 2n = 24 is the same as previously reported from elsewhere in eastern North America by Camp (1945) and Hall & Aalders (1961).

132. **VACCINIUM CAESPITOSUM** MICHX.

*Voucher:* Felsenmeer near Summit of Mt. Washington, July 5, 1958, Löve & Löve 7488. *2n = 24.*

A boreal North American species with smooth, roundish and serrate light-green leaves and deep-pink flowers. It is common in mossy and dry habitats on Mt. Washington, up into the alpine regions. The chromosome number 2n = 24 seems to be a first count.

133. **VACCINIUM ANGUSTIFOLIUM** AIT.

*Voucher:* Lakes-of-the-Clouds, July 4, 1959, Löve & Löve 7601. *2n = 48.*

As shown by Hall & Aalders (1961), the typification of *V. angustifolium* as the diploid species of this complex by Camp (1944, 1945) was in error and, therefore, his new name for the tetraploid taxon, *V. Lamarckii,* is a superfluous synonym (cf. Löve & Löve 1965). *V. angustifolium* is a boreal-montane eastern North American plant, which is common at low altitudes on Mt. Washington, but it reaches also into the subalpine zone and the lower parts of the alpine region. It is characterized by its relatively long pale-green but not definitely upright leaves, and in the subalpine zone it becomes 30-50 cm. tall.

The chromosome number 2n = 48 is a confirmation of previous reports by Longley (1927), Camp (1944, 1945), Darrow, Camp, Fischer, & Dermen (1944), and Hall & Aalders (1961).

134. **VACCINIUM BOREALE** HALL & AALDERS

*Voucher:* Lakes-of-the-Clouds, July 3, 1960, Löve & Löve 7699. *2n = 24.*

As mentioned above, Camp (1944, 1945) erred when identifying the diploid taxon of the *V. angustifolium* complex with the species described by Aiton (1789). Since this left the diploid plant without a name, Hall & Aalders (1961) described it as *V. boreale,* a very appropriate name for this plant of more boreal and alpine situations than its tetraploid relative. It is a boreal-alpine eastern North American species, characterized by a small, densely branched habit and very small, narrow and definitely erect leaves and small flowers (Löve & Löve 1965). On Mt. Washington it is met with only in the alpine zone between 1470 and 1830 m.s.m., where it appears to be more common at higher levels than the preceeding species.

The chromosome number 2n = 24 is the same as previously published by Camp (1944, 1945), Darrow, Camp, Fischer, & Dermen (1944), and Hall & Aalders (1961).

135. **OXYCOCCUS QUADRIPETALUS** GILIB.
SSP. **MICROPHYLLUS** (LGE.) LÖVE & LÖVE
*Voucher:* Lakes-of-the-Clouds, July 5, 1958, Löve & Löve 7499. *2n = 48.*

The almost circumpolar boreal-subarctic species *O. quadripetalus* is represented in eastern North America and Greenland by ssp. *microphyllus* comb. nov. (based on *O. palustris f. microphylla* Lange, in Medd. om Grönl. 3 (1887), p. 267; cf. Löve & Löve 1965). It is rare in boggy places, often under krummholz, near the Lakes-of-the-Clouds and in Tuckerman's Ravine on Mt. Washington, but it has also been observed on Bigelow Lawn. The chromosome number 2n = 48 is a confirmation of previous reports for this race by Hagerup (1940), Camp (1944), and Darrow, Camp, Fischer, & Dermen (1944), whereas Sorsa (1963) reported 2n = c. 50 for ssp. *palustris* from Finland.

136. **EMPETRUM EAMESII** FERN. & WIEG.
SSP. **ATROPURPUREUM** (FERN. & WIEG.) D. LÖVE
*Voucher:* Alpine Garden, August 31, 1962, Löve & Löve 7845. *2n = 52.*
SSP. **HERMAPHRODITUM** (HAGERUP) D. LÖVE
*Voucher:* Alpine Garden, August 31, 1962, Löve & Löve 7846. *2n = 52.*

The taxonomy of this circumpolar species complex and its relatives has recently been discussed by D. Löve (1960). The two subspecies above are met with on Mt. Washington, where ssp. *atropurpureum* barely reaches into the subalpine region whereas ssp. *hermaphroditum* is common in the subalpine and alpine zones. The chromosome number 2n = 52 seems to be a first count for ssp. *atropurpureum,* whereas it verifies previous counts for the widespread ssp. *hermaphroditum* by Hagerup (1927), Arwidsson (1938), Flovik (1940), Á. Löve (in Arwidsson 1943), Löve & Löve (1956, 1959), Favarger, Richard & Duchert (1959), Favarger (1962b), and Hedberg & Hedberg (1964).

137. **DIAPENSA LAPPONICA** L.
*Voucher:* Tuckerman's Ravine, July 5, 1960, Löve & Löve 7636. *2n = 12.*

As shown by Hultén (1958), the circumpolar arctic-alpine species *D. lapponica* is divided into an amphi-pacific and an amphi-atlantic race at the subspecific level. In the alpine area of Mt. Washington the latter, ssp. *lapponica,* is common in barren and windswept habitats, from the summit down to 1035 m.s.m. in an exposed place at Glen Boulder. The chromosome number 2n =12 is a confirmation of reports by Samuelsson (1913), Hagerup (1928), Baldwin (1939), Löve & Löve (1956), Jörgensen, Sörensen & Westergaard (1958), and Sokolovskaja & Strelkova (1960, 1962).

138. **TRIENTALIS BOREALIS** RAFIN.
*Voucher:* Lakes-of-the-Clouds, July 2, 1960, Löve & Löve 7697. *2n = 96.*

This North American boreal-montane species is present almost everywhere on Mt. Washington up to the summit, where even dwarfy specimens growing in shelter among rocks have been seen flowering. The chromosome number 2n = 96 is a confirmation of a previous report from Mt. Washington by Löve & Löve (in Löve & Solbrig 1964b).

139. **VERONICA WORMSKIOLDII** R. & S.
*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7580. *2n = 36.*

This species of subarctic-alpine North American distribution is locally abundant in the alpine zone of Mt. Wash-

ington, though it seems to be restricted to the ravines and gulfs and their surroundings, preferably along brooks. The chromosome number 2n = 36 is the same as previously reported from Greenland by Böcher & Larsen (1950) and Jörgensen, Sörensen & Westergaard (1958), whereas Packer (1964) found 2n = 18 in plants from the Rocky Mountains of Alberta. This may indicate the need for a closer study of some of the taxa listed as varieties of this species by Hultén (1958) and regarded as species by some earlier authors, from the mountains of western North America.

140. **CASTILLEJA SEPTENTRIONALIS** LINDL.
*Voucher:* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7595. *2n = 24.*

It has recently been shown by Heckard (1964) that polyploidy is frequent within certain complexes of the genus *Castilleja.* Since the two numbers 2n = 24 and 48 have been reported from two of the subspecies of *C. pallida* (L.) Kunth as classified by Pennell (1934), it seems preferable not to accept his classification unrevised. The species *C. septentrionalis* is a subarctic-alpine eastern North American plant which is locally abundant at the heads of ravines and gulfs on Mt. Washington, usually in moist habitats with *Alnus* or close to running water.

The chromosome count 2n = 24 is a confirmation of another report from Mt. Washington by Löve & Löve (in Löve & Solbrig 1964b).

141. **MELAMPYRUM LINEARE** DESR.
*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7842. *2n = 18.*

Different morphological variations of this boreal North American species were discussed by Fernald (1942). The plant merely enters the subalpine regions of Mt. Washington in protected habitats on the southeast slope of Mt. Franklin and in Tuckerman's Ravine, whereas it is more common at lower levels. The specimens we have seen from this area belong to the typical race of the species. The chromosome number 2n = 18 seems to be a first report.

142. **EUPHRASIA OAKESII** WETTST.
*Voucher:* Lakes-of-the-Clouds, August 30, 1959, Löve & Löve 7619. *2n = 44.*

This taxon is the first species of the genus *Euphrasia* recorded from the United States, collected on Mt. Washington by William Oakes in 1844 and described by Wettstein (1896). It was studied closer by Fernald & Wiegand (1915). It is apparently closely related to the more northern *E. frigida* Pugsl., which has an amphi-atlantic area of distribution (Hultén 1958). *E. Oakesii* is a very small plant with pubescent leaves, and only 2–5 nodes below the capitate inflorescence which has closely crowded flowers and a white corolla with violet nerves. It seems to be restricted to Oakes Gulf and the slopes of Mt. Monroe where is grows in boggy habitats at about 1500 to 1550 m.s.m. altitude.

The chromosome number 2n = 44 is a first report for the species, but its closest relatives are also known to have that number (cf. Löve & Löve 1961d).

143. **EUPHRASIA WILLIAMSII** ROBINS.
*Voucher:* Above Huntington's Ravine, August 30, 1959, Löve & Löve 7614. *2n = 44.*

Another microspecies, described from Mt. Washington by Robinson (1901). It is usually a very small plant, with pubescent stems and glabrous leaves, only 4–9 nodes below the capitate in-

florescence, and a deep brownish-purple or chocolate colored corolla. It is known to occur also in some other northeastern American alpine and subarctic regions (Fernald 1950). The species belongs to the *E. frigida* complex and is so closely related to *E. Oakesii* that Fernald (1933) found its Newfoundland-Quebec-Labrador race, *E. Williamsii* var. *vestita* Fern. & Wieg., to be inseparable from *E. Oakesii* f. *lilacina* Fern. & Wieg.; both species would probably be more correctly classified if subordinated to *E. frigida* at the subspecific and varietal levels, though closer studies are needed before such a change can be safely proposed.

*E. Williamsii* is very local on Mt. Washington, occurring only on the eastern side of the mountain in somewhat moist and peaty soil in the Alpine Garden near the heads of the ravines.

The chromosome number 2n = 44 is a first report for the species.

144. **RHINANTHUS MINOR** L. SSP. **BOREALIS** (STERNECK) A. LÖVE

*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7832. *2n = 22.*

The amphi-atlantic boreal-subarctic species *R. minor* is represented in the New England mountains only by its ssp. *borealis,* which is widespread in North America but a rare plant in Europe (Löve 1950). It is apparently mostly subalpine and local on Mt. Washington, preferably on the eastern slopes of the mountain, but it does not seem to grow in the forests below. The chromosome number 2n = 22, or 14 large and 8 small chromosomes, is the same as reported for this race by Hambler (1954), Hambler & Godward (1958), Löve (1954b), and Löve & Löve (1956), and for other races of *R. minor* by various workers (cf. Löve & Löve 1961d).

145. **GALIUM KAMTCHATICUM** STELLER

*Voucher:* Great Gulf, July 26, 1958, Löve & Löve 7535. *2n = 44.*

A species with an amphi-pacific distribution and a very disjunct area in eastern North America. It is met with at lower levels around the White Mountains (Pease 1924, 1964), but reaches up into the subalpine zone in the gulfs and ravines on Mt. Washington, where it is occasional and restricted. The chromosome number 2n = 44 seems to be a first count.

146. **HOUSTONIA COERULEA** L.

*Voucher:* Headwall of Alpine Garden, July 5, 1958, Löve & Löve 7490. *2n = 32.*

This eastern boreal-montane North American plant is represented on Mt. Washington by its variety *Faxonorum* (Pease & Moore) Fern., a white-flowered race of disputable significance (Löve & Löve 1965). Its chomosome number is 2n = 32, as reported previously for the typical race of the species by Stevens (1912), Lewis & Terrell (1962), and Löve & Löve (1965).

147. **SAMBUCUS RACEMOSA** L. SSP. **PUBENS** (MICHX.) HULTÉN

*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7849. *2n = 36.*

This North American race of the circumpolar species *S. racemosa* reaches just into the subalpine zone on Mt. Washington in the southfacing and protected areas on the headwall of Oakes Gulf at about 1350 m.s.m. The chromosome number 2n = 36 is a confirmation of reports from this subspecies by Bowden (1940) and Löve (1954b) and also of counts for ssp. *racemosa* by various authors (cf. Löve & Löve 1961d).

148. **VIBURNUM EDULE** (MICHX.) RAFIN.

*Voucher:* Lakes-of-the-Clouds, August 30, 1959, Löve & Löve 7616. *2n = 18.*

This boreal North American species, which replaces *V. Opulus* L. on this continent, is met with in the gulfs and ravines on Mt. Washington, and also in krummholz high up on the headwall of the Alpine Garden and in the shrubbery near the Lakes-of-the-Clouds. Its chromosome number 2n = 18 seems to be a first count, but the same number is known to be typical of the Eurasiatic *V. Opulus* (cf. Löve & Löve 1961d).

149. **LINNAEA BOREALIS** L. SSP. **AMERICANA** (FORBES) HULTÉN

*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7850. *2n = 32.*

According to Hultén (1937, 1949), the widespread but not very distinct ssp. *americana* covers most of the North American continent, but it is replaced in the western mountains by ssp. *longiflora* (Torr.) Hultén, which is claimed to be "considerably more different" from the Eurasiatic race of the species. This opinion is, however, not shared by Cronquist (in Hitchcock, Cronquist, Ownbey, & Thompson 1959), who regards these names to be synonymous for similar populations.

The eastern race is common in the forests around the White Mountains, but it is also met with in krummholz in the alpine zone. The chromosome number 2n = 32 is a confirmation of previous reports for ssp. *americana* by Hagerup (1944 and in Löve & Löve 1942b), Löve (1954b), Packer (1964), and Löve & Ritchie (1966). The same number is characteristic also of ssp. *borealis* as shown by Löve & Löve (1944b), Ehrenberg (1945), Vaarama (in Löve & Löve 1948), Löve (1954b), Sorsa (1962), and Czapik (in Skalińska & alii 1964).

150. **LONICERA VILLOSA** (MICHX.) R. & S.

*Voucher:* Lakes-of-the-Clouds, July 5, 1958, Löve & Löve 7496. *2n = 18.* Tuckerman's Ravine, July 3, 1959, Löve & Löve 7591. *2n = 18.*

An eastern North American plant, which Fernald & Wiegand (1910) divided into several varieties based on variability in pubescence, a character which Gleason (1952) and the present writers regard as doubtful. The species is frequent in bogs in the lowlands, but it reaches the subalpine zone on Mt. Washington among *Alnus* shrubs in the Alpine Garden, at the Lakes-of-the-Clouds, in the Tuckerman's Ravine and in the Oakes Gulf. The plants of the Alpine Garden belong to the variety *villosa,* whereas in the other places var. *calvescens* (Fern. & Wieg.) Fern. is represented; we are of the opinion that these taxa are to be regarded as formae, if at all recognized taxonomically.

The chromosome number 2n = 18 seems to be a first count for the species. The first voucher specimen given above (7496) belongs to var. *calvescens,* but the latter (7591) is the typical var. *villosa.*

151. **DIERVILLA LONICERA** MILL.

*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7802. *2n = 18.*

This eastern North American plant of the Great Lakes-St. Lawrence-Appalachian region reaches up into ravines and gulfs of Mt. Washington, and it has been observed in up to 1500 m.s.m. altitude on the eastern side of Mt. Franklin. The chromosome number 2n = 18 is a verification of previous counts by Poucques (1958, 1949a).

152. **CAMPANULA ROTUNDIFOLIA** L. SSP. **GROENLANDICA** (BERLIN) LÖVE & LÖVE

*Voucher*: Alpine Garden, July 3, 1960, Löve & Löve 7722, *2n=68.*

The taxa of the *C. rotundifolia* complex on Mt. Washington were discussed by Löve & Löve (1965). The most widespread taxon, which they named *C. dubia* A. DC. but which is more appropriately classified as *C. rotundifolia* L. ssp. *groenlandica* (Berlin) Löve & Löve, comb. nov. (based on *C. groenlandica* Berlin, in Öfvers. Svenska Vetensk. Akad. Förhandl. 1884, No. 7, p. 50; *C. gieseckiana* ssp. *groenlandica* (Berlin) Böcher, 1960), is a tetraploid plant with 2n=68 chromosomes, as reported earlier by Löve & Löve (1965, and in Löve & Solbrig 1946b) from Mt. Washington, and from elsewhere by Böcher (1936, 1938, 1960), Böcher & Larsen (1950), Löve & Löve (1956), and perhaps also Gutermann (in Löve & Löve 1961d).

153. **CAMPANULA GIESECKIANA** VEST

*Voucher:* Above Lakes-of-the-Clouds, August 28, 1962, Löve & Löve 7782. *2n = 34.*

The other species of *Campanula* on Mt. Washington is the rare taxon *C. Gieseckiana,* which seems to prefer solifluction areas, or at least tolerates places where snow protection is limited (Löve & Löve 1965). It is a diploid plant with 2n = 34 chromosomes, as previously shown by Böcher (1936, 1960), Flovik (1940), Böcher & Larsen (1960), Löve & Löve (1965 and in Löve & Solbrig 1964b), and Laane (1965), frequently under the collective name *C. rotundifolia* L.

154. **PRENANTHES TRIFOLIOLATA** (CASS.) FERN.

*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7556. *2n = 16.*

This species of the St. Lawrence-Appalachian region in eastern North America is represented on the lowland by its var. *trifoliolata.* When it reaches into the subalpine regions of the White Mountains, it becomes markedly dwarfed, without losing its morphological characteristics. In the alpine zone it is replaced by the morphologically distinct var. *nana* (Bigel.) Fern., which has also been recognized as the separate species, *P. nana* (Bigel.) Torrey. Since its forms a series of morphological intermediates with var. *trifoliolata,* apparently without any reduction in fertility as tested on pollen grains by the present writers, we suggest that it may be a distinct ecotype and, thus, agree with Fernald's (1901) classification of it as a variety only. The chromosome number 2n = 16 seems to be a first report for var. *nana,* but the same number has been reported for var. *trifoliolata* by Babcock, Stebbins, & Jenkins (1937).

155. **PRENANTHES ALTISSIMA** L.

*Voucher:* Oakes Gulf, August 31, 1962, Löve & Löve 7851. *2n = 16.*

A common eastern North American plant which reaches the subalpine regions of Mt. Washington in Oakes Gulf and Tuckerman's Ravine, where it is known up to 1500 m.s.m. altitude. The chromosome number 2n = 16 is the same as reported by Babcock, Stebbins & Jenkins (1937).

156. **PRENANTHES BOOTTII** (DC.) A. GRAY

*Voucher:* Above Lakes-of-the-Clouds, July 25, 1958, Löve & Löve 7523. *2n = 32.*

This small plant of open, windswept habitats in the alpine zone is endemic in the mountains of New England. It is common between 1450 and 1750 m.s.m. altitude on Mt. Washington, from where it was originally described. The chromosome number 2n=32 seems to be a first report.

157. **GNAPHALIUM SUPINUM** L.
*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7798. *2n = 28.*

An amphi-atlantic arctic-alpine plant, which is very rare and local on alpine slopes in eastern North America, preferably in solifluction and snowbed habitats. According to Pease (1924, 1964), it has been collected on Mt. Washington in the Alpine Garden, at the Lakes-of-the-Clouds, and in Tuckerman's Ravine. We have, however, succeeded in finding it only in a few small spots on the headwall of Tuckerman's Ravine, at about 1450-1500 m.s.m. altitude.

The chromosome number 2n = 28 is a confirmation of earlier reports by Rutland (1941), Löve & Löve (1948, 1956), Sokolovskaja & Strelkova (1948b, 1960, 1962), Jörgensen, Sörensen & Westergaard (1958), Skalińska & alii (1959), and Knaben & Engelskjön (1966).

158. **ARNICA LANCEOLATA** NUTT.
*Voucher:* Tuckerman's Ravine, July 6, 1960, Löve & Löve 7642. *2n = 76.*

This eastern North American species of moist habitats, preferably along brooks or in protected places in the subalpine regions, has in the past been misinterpreted as being identical with the western North American *A. mollis* Hook. which, thus, has been regarded as a bicentric American plant (Fernald 1905, 1950; Pease 1924, 1964; Harris 1964), even long after this mistake was corrected by Maguire (1943), Scoggan (1950), Gleason (1952), and Gleason & Cronquist (1963). The species *A. lanceolata* was originally described from the White Mountains, most likely on basis of specimens collected by Pickering in Tuckerman's Ravine, where it reaches its uppermost limit among subalpine *Alnus* shrubs at about 1450 m.s.m. altitude. Though it is most frequent in Tuckerman's Ravine, the species also reaches into the subalpine zone in sheltered places in Great Gulf, Huntington's Ravine, and Oakes Gulf.

The typical var. *lanceolata* of the subalpine regions is replaced at lower altitudes with the var. *petiolata* (Fern.), with slender and more numerous petiolate leaves. Maguire (1943) suggested that it may be a seasonal aspect only of the more robust typical race. We are of the impression that it is an edaphic modification, perhaps affected by shade, and thus of such a small taxonomic value that it could as well be ignored and not transferred to *A. lanceolata* from *A. mollis* of which Fernald (1905) described it a variety.

The chromosome number 2n = 76 has been determined on several collections from Tuckerman's Ravine, and one of these determinations was published by Löve & Löve (in Löve & Solbrig 1954b).

159. **SOLIDAGO MACROPHYLLA** PURSH
*Voucher:* Tuckerman's Ravine, July 6, 1960, Löve & Löve 7650. *2n = 18.*

A boreal-subarctic eastern North American species, which on Mt. Washington is common from the base up to the summit, preferably in snowbed habitats. In more exposed parts of the mountain the typical race is replaced by var. *thyrsoidea* (E. Mey.) Fern. (cf. Fernald 1906b), which gives the first impression of being an arctic-alpine race, though it is likely only a climatic modification rather than an ecotype. All gradations between these taxa are met with in the Alpine Garden, where the variations seem to be closely connected with a different degree of shelter.

The chromosome number 2n = 18 has been counted on material of var. *macrophylla* and var. *thyrsoidea* from different places on the mountain, though the voucher specimen above belongs to the latter taxon. The same

number has been reported for var. *macrophylla* from the Gaspé Peninsula by Beaudry & Chabot (1959), and for var. *thyrsoidea* from Mt. Washington by Beaudry (1963).

160. **SOLIDAGO CUTLERI** FERN.
*Voucher:* Above Lakes-of-the-Clouds, July 5, 1960, Löve & Löve 7690. *2n = 36.*

The species *Solidago Cutleri* is an alpine endemic taxon confined to the highest peaks of the mountains of Maine, New Hampshire, Vermont, and New York. It was originally described by Fernald (1908) from Mt. Washington, where it grows in stony and barren exposed areas in the alpine zone, preferably on the east side of the mountain. Its chromosome number 2n = 36, which has been reported previously by Beaudry (1963) from Mt. Washington material, is polyploid, and morphological similarities may seem to indicate that it is an alloploid derived from ancient hybridization between the widespread North American boreal-subarctic species *S. multiradiata* Hook. and some other diploid species of the genus.

161. **SOLIDAGO RANDII** (PORT.) BRITT.
*Voucher:* Cowpasture, 7-mile post, July 3, 1960, Löve & Löve 7665. *2n = 36.*

This plant is restricted to lower altitudes of the boreal eastern North American mountains, though it occasionally reaches sheltered localities in the subalpine zone of Mt. Washington. Its chromosome number 2n = 36 has also been reported from elsewhere by Beaudry and Chabot (1959) and Beaudry (1963). The species is an alloploid with such a clear resemblance to *S. multiradiata* Hook. that there can hardly be any doubt that the latter is one of its parental taxa. The other diploid involved must, however, be some species other than that involved in the ancestry of the likewise alloploid *S. Cutleri* discussed above.

162. **ASTER PUNICEUS** L.
*Voucher:* Tuckerman's Ravine, August 28, 1962, Löve & Löve 7787. *2n = 16.*

*Aster puniceus* is a variable boreal eastern North American taxon, but although taxonomists seem to agree that it includes some geographical races worthy of recognition, the opinions differ as to the number of these races. Fernald (1950) divides the species into five varieties and seven formae, whereas Cronquist (in Gleason 1952, and Gleason & Cronquist 1963) accepts only the main type and one variety, var. *firmus* (Nees) T. & G.

All the populations of *A. puniceus* which are locally abundant in the valleys below the alpine zone of Mt. Washington belong to var. *puniceus,* whereas the species is represented in sheltered localities in the subalpine parts of the ravines by var. *oligocephalus* Fern. Our observations of this race, supported by its alpine-subarctic range, indicate to us that it is no less important than is var. *firmus,* but we agree with Cronquist (l.c.) that var. *compactus* Fern. and var. *perlongus* Fern. are more local variants of doubtful significance.

The chromosome number here reported was counted on material of var. *oligocephalus* from Tuckerman's Ravine. It agrees with previous reports for var. *puniceus* by Huziwara (1958) from an unknown source, by Van Faasen (1963) from various places in Michigan, and by Löve & Löve (in Löve & Solbrig 1964a) from Calloway in Minnesota.

163. **ASTER CRENIFOLIUS** (FERN.) CRONQUIST
*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7540. *2n = 50.*

This boreal-montane eastern North American species belongs to a critical

complex in need of experimental investigation; it has been misidentified as a race of *A. foliaceus* Lindl. of Alaska (Fernald 1915a, 1950; Harris 1964), to which it is related but not identical (Cronquist 1947; Gleason & Cronquist 1963). On Mt. Washington the species barely reaches the subalpine zone in Great Gulf, Tuckerman's Ravine, and on Cape Horn.

The chromosome number 2n = 50 seems to be a first report.

164. **ASTER UMBELLATUS** MILL.
*Voucher:* Tuckerman's Ravine, August 31, 1962, Löve & Löve 7538. *2n = 18.*

This species, as restricted by Cronquist (1947), is an eastern boreal North American plant. It is very common at lower altitudes on the White Mountains, but reaches the subalpine zone of Mt. Washington only along the railroad and in the ravines and the gulfs.

The chromosome number 2n = 18 is a confirmation of previous reports by Huziwara (1962) and Van Faasen (1963), the material studied by the latter being from several counties in Michigan. The same number was also reported by Löve & Löve (in Löve & Solbrig 1964a) for var. *pubens* A. Gray from Manitoba.

165. **ACHILLEA LANULOSA** NUTT.
*Voucher:* Alpine Garden, July 27, 1958, Löve & Löve 7567. *2n=36.*

This widespread subarctic-boreal North American species (cf. Mulligan & Bassett 1959; Hultén 1950; Gleason & Cronquist 1963) shows such strong anthropochorous tendencies that it is difficult to decide if it is natural or introduced where it grows. On Mt. Washington it occurs as a weed close to human activities, but it is probably indigenous in the Alpine Garden.

In the past this taxon has been erroneously identified with *A. Millefolium* L. of Eurasia, and therefore older records from Mt. Washington use that name (Pease 1924). Recently, however, Pease (1964) and Harris (1964) have maintained that the plant in question is *A. borealis* Bong., a species of the Pacific and Arctic coasts which does not reach south into the eastern mountains (Mulligan & Bassett 1959). Since *A. borealis* is a hexaploid plant with 2n = 54 chromosomes, whereas *A. lanulosa* is a tetraploid species with 2n = 36, the fact that only the latter number is met with in the populations on Mt. Washington clearly shows that the only species of the *A. Millefolium* complex on Mt. Washington is *A. lanulosa,* irrespective of the claim to the contrary by Harris (1964) and Pease (1964).

The chromosome number 2n = 36 has been counted on several collections from various parts of the mountain, in addition to the one referred to the voucher above. It is a confirmation of previous reports by Turesson (1934, 1938), Lawrence (1947), Ehrendorfer (1952, 1959), Hiesey & Nobs (1952), Ehrle (1958), Schneider (1958), Mulligan & Bassett (1959), Turner, Beaman, and Rock (1961), Kyhos (in Raven 1963), De Jong & Longpre (1963), and Löve & Löve (in Löve & Solbrig 1964a).

## SUMMARY

The alpine and subalpine flora of Mt. Washington in New Hampshire includes 165 species of vascular plants. This paper reviews the taxonomy and geography of every one of these species and their eastern American alpine races and gives their chromosome numbers based on material collected on this mountain. Several of the species have been studied cytologically by previous authors, the reports of whom are usually confirmed, whereas new or corrected counts are reported for: *Diphasium sitchense* (Rupr.) Löve & Löve, 2n = 46; *Huperzia Selago* (L.) Bernh. 2n = 264; *Abies balsamea* (L.) Mill. var. *phanerolepis* Fern. 2n = 24; *Glyceria striata* (Lam.) Hitchc. ssp. *stricta* (Scribn.) Hultén 2n = 20; *Festuca rubra* L. ssp. *Richardsonii* (Hook.) Hultén var. *prolifera* Piper 2n=49; *Eriophorum vaginatum* L. ssp. *spissum* (Fern.) Hultén 2n=58; *Carex deflexa* Hornem. 2n = 36; *Carex arctata* Boott 2n = 54; *Carex leptonervia* (Fern.) Fern. 2n = 38; *Carex paupercula* Michx. ssp. *paupercula* 2n = 58; *Carex atrata* L. ssp. *atratiformis* (Britt.) Kük. 2n = 54; var. *Raymondii* (Calder) 2n = 54; *Carex lenticularis* Michx. 2n = 68; *Maianthemum canadense* Desf. ssp. *interior* (Fern.) Löve & Löve 2n = 36; *Salix argyrocarpa* Anderss. 2n = 76; *Ribes glandulosum* Grauer 2n = 16; *Potentilla labradorica* Lehm. 2n = 42; *Amelanchier Bartramiana* (Tausch) Roemer 2n = 68; *Nemopanthus mucronata* (L.) Trel. 2n = 40; *Viola cucullata* Ait. var. *microtitis* Brainerd 2n = 54; *Chiogenes hispidula* (L.) T. & G. 2n = 24; *Vaccinium caespitosum* Michx. 2n = 24; *Empetrum Eamesii* Fern. & Wieg. ssp. *atropurpureum* (Fern. & Wieg.) D. Löve 2n = 52; *Melampyrum lineare* Desr. 2n = 18; *Euphrasia Oakesii* Wettst. 2n = 44; *Euphrasia Williamsii* Robins. 2n = 44; *Galium kamtchaticum* Steller 2n = 44; *Viburnum edule* (Michx.) Rafin. 2n = 18; *Lonicera villosa* (Michx.) R. & S. var. *villosa* 2n = 18; var. *calvescens* (Fern. & Wieg.) Fern. 2n = 18; *Prenanthes trifoliata* (Cass.) Fern. var. *nana* (Bigel.) Torr. 2n = 16; *Prenanthes Boottii* (DC.) A. Gray 2n = 32; and *Aster crenifolius* (Fern.) Cronquist 2n = 50.

The following new combinations are made: *Carpogymnia* Löve & Löve, gen. nov. on p. 8, *Carpogymnia Dryopteris* (L.) Löve & Löve, comb. nov. on p. 8. *Festuca rubra* ssp. *Richardsonii* var. *prolifera* forma *lasiolepis* (Fern.) Löve & Löve on p. 12, *Carex Bigelowii* ssp. *arctisibirica* (Jurtzev) Löve & Löve on p. 22, *Epilobium playtyphyllum* (Daniels) Löve & Löve on p. 42, *Oxycoccus quadripetalus* ssp. *microphyllus* (Lge.) Löve & Löve, on p. 48, and *Campanula rotundifolia* L. ssp. *groenlandica* (Berlin) Löve & Löve, on p. 52.

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