[Ed. II, 1986, p. 129-131]

Conspectus of the Distributions

In this atlas 2,483 species, 12 hybrids, and 14 varieties are recognized as well-established members of our flora, and another 220 waifs, etc., and 8 hybrids make a total of 2,703 species, 20 hybrids and 14 varieties. Four species are endemic to the state: *Betula uber*, *Helenium virginicum*, *Clematis viticaulis* in western Virginia, and *Bacopa stragula* in the eastern part.

Of the 2,056 well-established native species, no less than 120 are known from only one county. A large proportion of these one-county species appear to be environmentally sensitive, and many are at the edge of their ranges in this region. They should form an excellent group to study relationships of our flora and past environmental influences on migration patterns. Reference to the *Atlas of the Carolinas* shows that North Carolina has a figure close to the 120 species, but for Pennsylvania, only 92 are listed in the atlas. Thus, Virginia is in a region with large numbers of relict populations when compared to comparable areas in states to the north of us.

Figure 1 shows the numbers and distributions of species known from only one county in Virginia, as well as their regional grouping within the state: SE, SW, NW, NE and S Central. Of the 55 in the SE group, 15 occur in Virginia Beach. Only 5 of this entire group are northern and 3 of them are Wisconsin relicts *(Myriophyllum tenellum, Hypericum boreale* and *Limosella subulata).* The remaining 30 are southern, with the bulk of their populations south of the Mason-Dixon line, and southward extensions range from South America to North Carolina. When the last great migration started, some 16,500 years ago (Delcourt and Delcourt, 1985), the coastal plain extended out far beyond its present limits, and was formed largely of unconsolidated materials. Thus, storms and fluctuating sea levels provided open areas for migrations which became a gateway from the tropics.

The southern species are *Lycopodium carolinianum, Ophioglossum petiolatum, Hypoxis sessilis, Carex chapmanii, Eleocharis radicans, Hemicarpha micrantha, Psilocarya nitens, Rhynchospora filifolia, R. milacea, Scirpus etuberculatus, Lilium catesbaei, Smilax smallii, Andropogon mohrii, Calamovilfa brevipilis, Digitara serotina, Leersia hexandra, Manisuris rugosa, Muhlenbergia bushii, M. expansa, Sparganium androcladum, Xyris fimbriata,* X. *iridifolia, Lilaeopsis carolinensis, Oxypolis filiformis, Cirsium repandum, Elephantopus elatus, Erigeron quercifolius, Rudbeckia heliopsidis, Solidago salicina, Lithospermum caroliniense, Calycanthus floridus, Arenaria caroliniana A. lanuginosa, Stipulicida setacea, Cycloloma atriplicifolium, Diamorpha smallii, Psoralea canescens, Gentiana autumnalis, Hypericum adpressum, Collinsonia verticillata, Litsea aestivalis, Cynoctonum sessilifolium, Osmanthus americanus, Ludwigia virgata, Polygonella polygama, Crataegus aestivalis,* C. *spathulata, Physalis viscosa, Lippia nodiflora* and *Verbena canadensis.* Other northern species are *Amaranthus pumilus* and *Limosella subulata.*

Among the 26 one-county species of southwestern Virginia, 10 came from the southwest, 7 came from the middle west, 5 are Wisconsin relicts (4 circumboreal*): **Carex pallescens, *Arabis glabra, *Campanula rotundifolia, Gentiana crinita, *Juncus articulatus;* 2 are Southern Appalachian species, *Carex purpurifera* and *Spiraea virginiana;* 1 came from the south, *Botrychium jenmanii;* and 1 is endemic to the state, *Betula uber.* The comparatively large number in Lee County (9) may be due largely to extensive areas of open forests and glades at low elevations.

The 23 species of the NW group include 14 Wisconsin relicts (8 circumboreal*): **Equisetum sylvaticum, *Carex atherodes, Cyperus houghtonii, *Juncus trifidus, * Streptopus amplexifolius, *Corallorhiza trifida, Poa languida, Gnaphalium viscosum, *Arabis hirsuta, * Arctostaphylos uva-ursi, Geranium robertianum, Rhamnus alnifolia, Ribes lacustre,* and ** Scutellaria galericulata;* 6 from the west, 1 Southern Appalachian, *Heuchera alba,* and 2 coastal plain species, *Cyperus dentatus* and *Eleocharis robbinsii,* which migrated across northern Virginia in late Wisconsin or early Holocene and persist in Augusta County. Soils of the northern piedmont have more organic matter and greater water-holding capacity than their counterparts in the southern piedmont of Virginia (Wingo, 1949), thus making the movement of many species possible, especially in pluvial times.

The 12 species in the NE include 7 Wisconsin relicts: *Carex silicea, Puccinellia fasciculata, Cicuta bulbifera, Myriophyllum humile, Utricularia cornuta, Epilobium strictum* and *Plantago maritima;* and 5 southern species: 1 from the southwest, *Tomanthera auriculata,* and 4 relicts of Holocene migrations, *Eriocaulon compressum, Baptista alba, Polygala brevifolia* and *Centunculus minimus.*

Anemone berlandieni of Pittsylvania County is 1 of the 4 species of the southern-piedmont group, It grows in the Triassic area, a good distance from the main population which extends from Mexico to Arkansas and Alabama. Halifax County harbors the other 3 species of this group: *Cirsium carolinanum,* rare and scattered in the Carolinas, ranges from east Texas and Missouri to Georgia; *Enemion biternatum,* with a few populations in South Carolina and North Carolina, extends from Texas to northwest Florida, and from Alabama to Ontario and Wisconsin southward; *Gillenia stipulata,* with an area of disjunct populations on the piedmont of North Carolina, ranges from east Texas to Georgia and western New York and Kansas southward.

The Coastal Plain - Mountain Disjunctions

Long-known disjunctions of populations occur between the coastal plain and the mountains (Figs, 2 & 3), There are 36 species with such a gap recognized now in Virginia, and 20 of them are southern and 16 are northern species. In Virginia, at least 18 of the 20 southern species appear to have reached the mountains from the coastal plain, to be localized during the xeric interval from 8,500 to 4,000 B, P. (Delcourt and Delcourt, 1985), Two reached the mountains from the southwest: *Scirpus fluviatilis* and *Polygala polygama*.

Other southern species with this disjunction are *Lycopodium alopecuroides, Carex barrattii Lachnanthes caroliniana, Juncus debilis, Helonias bullata, Trillium pusillum, Cleistes divaricata, Glyceria obtusa, Panicum hemitomum, Xyris ambigua, Helenium brevifolium, Sabatia campanulata, Myriophyllum pinnatum, Utricularia radiata,* and *Lysimachia radicans*.

For the 16 northern species, 4 are circumboreal: *Carex buxbaumii, C. canescens, C. lasiocarpa and Drosera rotundifolia; and Glyceria pallida* is also in eastern Asia. All 16 of these species must have been widespread in the state during the Wisconsin and disjunctions of their populations must be largely the result of the xeric period, which was mentioned earlier, and local conditions which permitted their persistence.

Other northern species of this group are *Carex bullata, C. tetanica, Cladium mariscoides, Scirpus subterminalis, Eriocaulon septangulare, Juncus balticus, Glyceria canadensis, G. grandis, Hypericum canadense* and *Utricularia geminiscapa*.

The Southwestern Virginia Gap

Many of our native species skip areas of western Virginia and turn up again in the far southwestern part of the state. Fifty of these species are now recognized, and they have been an intriguing problem for many years (Fig. 4).

Two of the best known of these plants are sweet gum, with a vast blank area in western Virginia, and persimmon with only six counties missing in southwestern Virginia. The counties most often lacking such species are Grayson, Wythe, Bland, Tazewell and Smyth.

After a thorough analysis of the overall distributions of the 50 species with the southwestern - Virginia disjunction, it was discovered that they have three patterns in common: (1) all are southern species with the bulk of their populations south of the Mason-Dixon line; (2) all are missing from the region just south of the listed Virginia counties; and (3) all occur just to the south or west of the far-southwestern part of Virginia.

Are there any natural features in the region just south of Grayson and Carroll counties which would slow down or impede migrations of such species? Fenneman (1938, p. 172) presents a map of the Southern Blue Ridge province showing the region to be between 3,000 and 5,000 feet elevation, and he states such areas embrace most of the higher mountains in the province. Later (p. 177), "Just south of the Virginia - North Carolina boundary, monadnocks begin to rise above the peneplain … at no great distance south of the state boundary the peneplain is seen with difficulty among mountains which rise from a few hundred feet to 2,000 above it. Its level near the Watauga and New Rivers is 3,400 to 3,700 feet."

Here primeval forests were almost universal and covered the highest mountains. Such high-level areas with a closed forest vegetation would certainly slow, if not impede, the northward migration of many species. In contrast, the valley of Powell River extends from Tennessee into Lee and Wise counties, and the valley of Clinch River extends into Scott, Russell and Wise counties, and the valley of Holston River extends into Scott and Washington counties. These valleys are little more than 1,000 feet in elevation on the state's boundary and the vegetation in these regions consists of much open forest and glades.

The gap in plant distributions results from species of the south and west not moving onto the high Blue Ridge plateau. The reason why they did not invade the plateau could have been time and their starting area (during the last full glacial advance), the high elevation of the plateau with its low temperatures, and/or its vegetation, or both time and the nature of the plateau.

As we have seen, these northward migrations started about 16,500 years ago and continued until the xeric interval from 8,500 to 4,000 B.P, Thus by 8,500 years ago the ranges of most of our species were largely in place, to be adjusted by drier climates of the xeric times, during which many populations were able to persist in very favorable sites, and continue to this day, thus making the many bizarre disjunctions. The last 4,000 years have seen only minor natural adjustments, but major changes have come from human activities.

Beyond those mapped, this group includes *Scleria pauciflora, Sisyrinchium albidum, Juncus coriaceus, J. diffusissimus, Corallorhiza wisteriana, Sphenopholis obtusata, Sporobolus asper, S. clandestinus, Heteranthera reniformis, Ruellia caroliniensis, R. purshiana, R. strepens, Eryngium yuccifolium, Sanicula smallii, Aralia spinosa, Asclepias variegaia, Matelea obliqua, Antennaria solitaria, Aster dumosus, Coreopsis auriculata, Elephantopus carolinianus, Liatris squarrosa, Prenantbes alba, Pyrrhopappus carolinianus, Silphium perfoliatum, Bignonia capreolata, Dentaria heterophylla, Viburnum dentatum, Croton glandulosus, Euphorbia commutata, E. spathulata, Phyllanthus caroliniensis, Clitoria mariana, Galactia regularis, G, volubilis, Lespedeza virginica, Quercus falcata, Q. marilandica, Ludwigia decurrens, Oenothera laciniata, Passiflora incarnata, Phlox carolina, Lysimachia tonsa, Diodia virginiana, Salix caroliniana, Comandra umbellata, Saururus cernuus, Mimulus alatus*.

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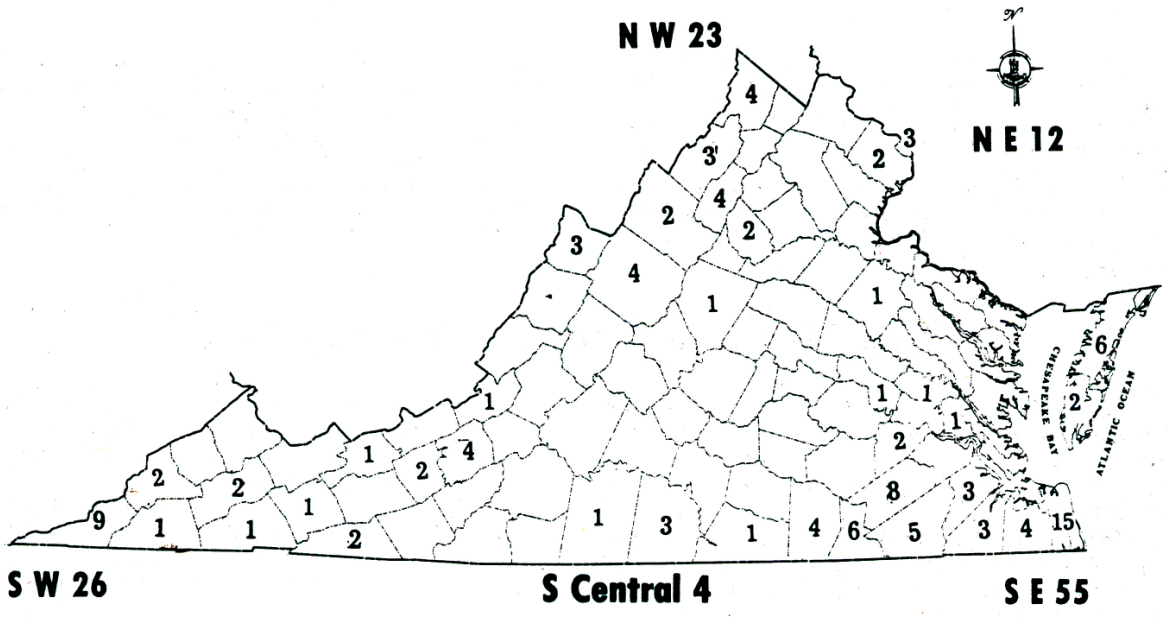

Fig. 1. Numbers of species known from only one county in Virginia.

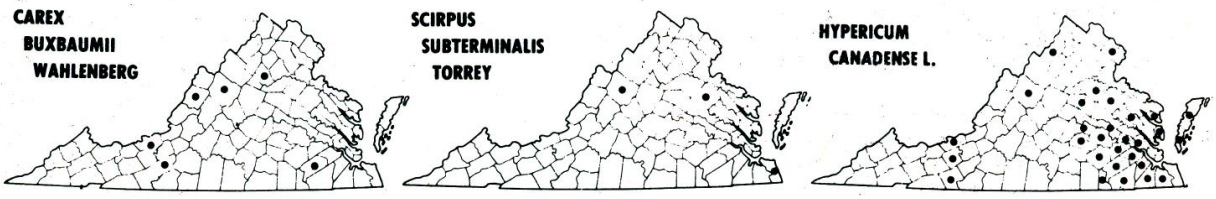

Fig. 2. Three northern species with coastal plain - mountain disjunctions.

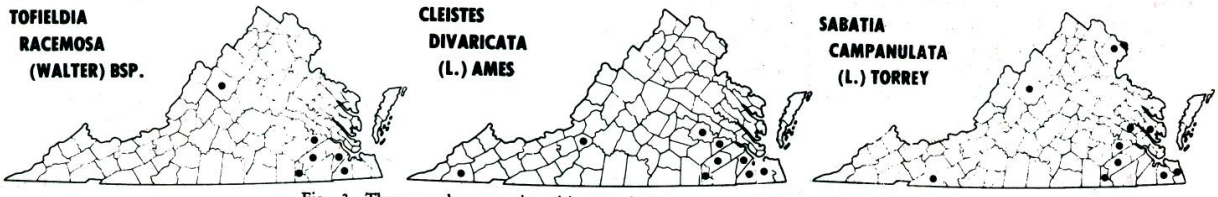

Fig. 3. Three southern species with coastal plain - mountain disjunctions.

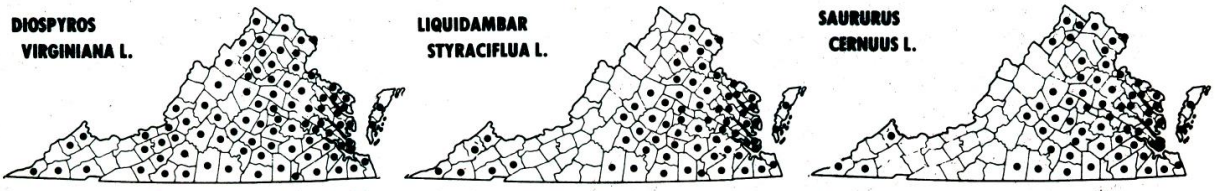

Fig. 4. Three species with a southwestern-Virginia gap in their distributions.