TORREYA

Vol. 27 No. 3

May-June

THE FLORA OF YEZO (JAPAN)

By T. D. A. Cockerell

In the *Japanese Journal of Botany*, Vol. 2, No. 4 (1925) is an extremely interesting analysis of the vegetation of Yezo, the northern island of Japan, by Yushun Kudo of the Hokkaido Imperial University. My first thought, on reading it, was, how much it would have pleased Asa Gray. The full enumeration of species, based on many years of collecting and study. The tabulated lists showing their distribution elsewhere. The ecological details, all together give us a picture of the flora in its true relation to other floras of the northern hemisphere. Having been in the coast region of Siberia opposite Yezo, and being also more or less familiar with the boreal flora of America, the paper is doubly interesting to me, so I venture to offer a few comments.

The known plants of Yezo, including the southern Kuriles adjacent to it, include 597 genera and 1629 species. This enumeration includes only flowering plants and pteridophytes. The largest genus is *Carex*, with 107 species. In the Rocky Mountains and adjacent plains, as shown in Rydberg's Flora, *Carex* is also the largest genus, with 162 species. According to Kudo's tabulation on p. 285, *Viola* is the next largest genus in Yezo, with 32 species. There is some confusion here, as in the complete list of species, we see only 13 names under *Viola*. Turning over the page, we find the rest, catalogued by mistake as *Hypericum*. The next largest genus is *Polygonum* (in the broad sense), with 29 species; then comes *Epilobium* with 20. The grasses have the greatest number of genera, 49, and 117 species. The Compositae are almost as numerous, with 116 species. There are 85 endemic species, if we include the Southern

Kuriles. The genera with more than one endemic species are *Athyrium* (2), *Tofieldia* (2), *Salix* (2), *Cerastium* (2), *Aconitum* (5), *Thalictrum* (4), *Cardamine* (2), *Saxifraga* (3), *Spiraea* (2), *Astragalus* (2, one only in S. Kuriles), *Oxytropis* (2), *Hypericum* (2), *Viola* (3), *Epilobium* (3), *Primula* (2), *Gentiane* (3), *Adenophora* (2), *Cirsium* (5), *Saussurea* (5). The only one of these we fail to get in America is the Campanulaceous *Adenophora*, which has its center of distribution in Siberia. Of the 1629 species, no less than 1298, or 79.68%, also occur in Honshu, the main island of Japan. Considering the proximity of Sakhalin Island, and its approach to the Siberia mainland, it is surprising to learn that only 38.37% of the plants also occur on Sakhalin, and 43.65% on the mainland in the Amur, Ussuri and Manchurian area. This is especially striking when we find that 26.70% of the species are common to North America. In this class of statistics, however, there lies a fallacy which is liable to mislead. Thus, for instance, 18.83% of the Yezo species are common to Kamtschatka, 17.86% to the Northern Kuriles. Are we then to say that the flora shows more affinity with that of North America than that of Kamtschatka? The fallacy lies in the fact that the comparatively small northern peninsula has a poor flora, whereas America has a large and varied one, in which many diverse plants find a place. Thus, again, it is stated that 45.24% of the Yezo plants live in Korea a larger number than in the mainland opposite Yezo. Does Yezo, then, have a more southern type of flora than the mainland? Perhaps so, but Korea has a richer flora, and is better known to the Japanese, and hence it might be expected that more species would be found in common. The flora of Yezo certainly strikes one as typically boreal.

Comparing Yezo with the opposite Siberian mainland, certain facts are especially noteworthy. Out of 70 species of ferns in Yezo, it appears that only 32 grow in the Manchuria-Amur, Ussuri region. Ferns are excessively abundant on Honshu, as I myself observed, and they so indicate relatively warm and moist conditions. Yezo has 14 species of conifers (*Abies mayriana* is endemic) of which only four are listed from the adjacent mainland. I have, however, a list of nine species from the maritime province of Siberia. Professor A. Henry has written calling my attention to the remarkable endemism exhibited by some of the East Asiatic trees, referring especially to the

genus *Larix*, the members of which have been lumped under the name *L. dahurica*. The species I saw so abundantly along the Siberian coast, a few miles from the sea, is *L. olgensis* A. Henry. Across the strait in Sakhalin is *L. Kurilensis* Mayr. I presume it is really the latter which Kudo reports from Yezo as *L. dehurica* var *kamtschatica*. It is actually unknown as a wild plant on Yezo proper, but exists on two islands of the southern Kuriles.

The actual divergence in species between Yezo and the adjacent mainland is really very remarkable, and must depend very largely on diversity of physical conditions. The Siberian coast is under deep snow all winter and the sea is frozen. In the summer, however, the climate is quite warm, and the vegetation is extremely luxuriant. In the following list of genera, the first figure following the name shows the number of species in Yezo, the second the number of these in the Manchuria, Amur, Ussuri country. *Lilum*, 6, 3; *Iris*, 4, 3; *Cypripedium*, 4, 1; *Salix*, 18, 7; *Quercus* 4, 2 (I found only *Q. Mongolica*); *Aconitum*, 10, 1; *Aquilegia*, 2, 1; *Acer*, 9, 3; *Rhododendron*, 8, 2; *Gentiana*, 11, 2. Yezo is very rich in orchids, with 61 species, of which 21 are reported from the mainland opposite.

A conspicuous feature in the forest about the Kudia River in Siberia is the family Araliaceae, formidably armed plants to be avoided in going through the brush. One I collected proves to be *Acanthopanax senticosus* (Maxim.) Harms, this and other trees having been kindly identified for me by Mr. Rehder. Yezo has similarly a group of these plants, but with two exceptions, the species are different. *Berberis amurensis* Rupr., which I collected on the Kudia R., is represented on Yezo by *B. regeliana*. The Betulaceae are represented on both sides by the same genera, *Betula*, *Carpinus*, *Corylus* and *Alnus*, but the majority of the species are different. The conspicuous *Campanula punctata* Lam. is found on both sides, and I observed it as far south as Tsuruga in Honshu. *Viburnum sargentii* Kochne, which I found on the Kudia R., is lacking in Yezo, which nevertheless has three other species of *Viburnum*. *Tilia amurensis* Kom., a handsome tree of the Kudia R., is represented by two other species on Yezo. Such examples could be multiplied over several pages, but enough has been given to show the marked diversity of species in those two lands, separated by no great expanse of sea, and nearly continuous northward.

Turning now to comparisons with the North American flora is is rather surprising to find such a long series of species (435!) in common. The number common to Europe (454) is only a little greater. When we list these species, and examine their distribution more in detail, it becomes evident that we are dealing with the circumpolar flora, certain members of which have presumably died out in Europe or America. Some of the species (as *Chenopodium album*, *C. glaucum*, *Atriplex patula*, *Rumex acetosella*, etc.) are obviously under suspicion of having been introduced into Yezo by man, though now thorougly established. In some cases it may be that more critical studies would show hitherto unobserved differences. For example, of the 29 species of *Polygonum* in Yezo, 14 are also reported from North America; but recent investigations show that there are more closely related species of this group than were formerly recognized. Twenty-three of the ferns are also North American and of these sixteen are also European. There is a separate enumeration of the species common to Yezo and Alaska (with the Aleutian Islands), but only 122 (7.49% of the Yezo flora) are listed. The flora of the interior of Alaska is, I suppose, still very imperfectly known, but one would have expected the list to be longer.

The general outcome seems to be that species of plants are little or slowly affected by mere time or space, but respond rather rapidly to new conditions of life. Or to put it another way, there is little evidence for obligatory evolution, regardless of circumstances.* The age and area postulate does not hold as a

* This statement has to do with the process of evolution, and not with the causes of mutation. Any plant population, closely studied, exhibits diversity in hereditary qualities, the material for evolution thus being everywhere present. Hybridism produces extraordinary diversity under uniform conditions. The breaking down of polyploids is doubtless an important cause of diversity in some genera. Yet the establishment of permanent species (permanent in the sense of lasting for long periods) appears usually to depend on adaptation or response to new conditions. Whether, as Harrison believes, there is a definite chemical response in the germ plasm to diverse substances in the soil, or whether changes occur in a miscellaneous manner and are merely of survival value in the presence of new conditions, the objective results are about the same.

In my garden is a briar rose (*Rosa rubiginosa*) which for several yearsh as been full of the galls of *Rhodites rosae*. So close that the twigs touch, is a *Rosa rubrifolia*, but it has remained wholly unaffected by the galls until the

valid generalization. The island of Yezo, from its geographical position, is of very great interest to the student of boreal floras, and it would be a splendid thing if coöperative work could be carried on between the Japanese and American botanists. If those who have so intensively studied their floras on the two sides of the Pacific could now go over the ground in each country together, noting in minute detail the resemblances and differences, examining the critical species in the field, and joining in the search for causes, the contribution to botanical science, and incidentally to international amity, would be of considerable importance. Later perhaps, the investigations could be carried over into Siberia, with the assistance of Russian botanists. In the meanwhile, efforts should be made to increase the representation of northern plants in the large herbaria, and in view of modern requirements, collections from almost any locality are of some value.

There are reasons for thinking that botany will undergo a transformation and development not greatly inferior to that which we have all witnessed in the realm of physics. I hope Dr. C. C. Hurst will forgive me if I quote some portions of his recent letters on *Rosa*, in support of this opinion. He and his wife recently went to the Swiss Alps to study roses, and here is the outcome: "You will be interested to know that our collections in the Alps are proving to be of extraordinary interest, both systematically and cytologically. We took samples from four different Cantons of various forms described and collected by Crépin and Christ, in several cases finding the actual individual plants we believe. We took young flower buds and fixed them in Carnoy's Fluid on the spot, expecting to get about 50% of them with chromosomes dividing. We have taken them up and sectioned them this term, and much to our astonishment have found *all* in action, with good somatic counts. While no less than 90% have given us p. m. c. and e. m. c. reduction divisions or pollen grain and embryo-sac gametic divisions, and

---

past season, when a single gall appeared. We shall see whether, in five years time the *R. rubrifolia* is infested like the briar. If so, will it be due to its influence on the germ-plasm of the *Rhodites*, or did the *Rhodites* on the briar simply produce a mutation capable of living on the other plant? In favor of the latter supposition is the fact that the insect did get a footing on the *R. rubrifolia*, prior to any influence that could be brought to bear on it.

in a few cases actual fertilization embryo divisions. We have already mounted 400 slides for searching next term, and hope to reap a rich harvest of cytological data. Among these are various presumed natural hybrids. . . In each case we brought also a dried specimen of flower buds and leaves for comparison with the original descriptions of Christ and Crépin . . . . We have also about 150 specimens collected in other places this summer, representing as many distinct species of the systematist. These in addition to 445 forms examined and analysed during the last four years by us bring the total of individuals of *Rosa* examined cytologically and analysed taxonomically by five different observers (six with my wife) to over 1000, and since these include almost all the known species, we should soon I think be in a position to do more than state the problems of their probable evolution and classification . . . . I am quite excited to hear of your trip to Siberia, and Lake Gaikal in particular . . . This is precisely the district from which I am expecting some great things in *Rosa*, as it has been so little explored, and it is in the very heart of likely things. We do not yet know for instance how far East the European and Western Asiatic pentaploids and irregular tetraploids and hexaploids extend. Some say to Lake Baikal, while others think the Urals and the Caspian are the limits. There is however much evidence that these *caninæ* forms are more or less coincident with the European glaciation area of the Pleistocene, and if so this throws much light on their origin. It is curious that nowhere else do these so called crypthybrids exist, and they are the main *Rosa* flora in Europe today."

What would it be, now, to be young, and enter into this kingdom of marvels! But it is something to live to see the first act of the play, and perchance have some little part therein. For many reasons, it is the boreal flora which especially lends itself to these investigations, but it must be studied as a whole, right around the world.

University of Colorado,
Boulder, Col.