

The Vegetation of Kamchatka.¹

THE vegetation and flora of Kamchatka are still very little known, and the book by V. L. Komarov, recently published by the Russian Academy of Sciences, is therefore of considerable interest. The flora of Kamchatka may be divided into three groups: (1) That of central Kamchatka, with its spruce and larch forests; (2) flora typical of the peninsula, for the greater part composed of *Betula Ermani*; (3) the subalpine and alpine flora. The variety of species is limited, phanerogamous plants and filicoids together scarcely exceeding 780 species. This peculiarity is chiefly due to severe climate and frequent volcanic activity.

The main portion of Kamchatka is stocked with plants of alpine and subalpine character, but the vegetation of the plains, represented by coniferous forests, may be found around the valley of Kamchatka River. Larch groves consisting of *Larix dahurica* Turcz. are replaced by forests of *Picea ajanensis* Fischer. The larch attains its maximum growth in the driest parts of river alluviums. The spruce of Ajan prefers mountain slopes, and is frequently interspersed with aspen and white birch; its boundaries are not known. The larch emerges from the valley in three places only, namely, at Kronotzk Lake, in the region of the lower course of the Kamchatka River, and near the foot of Glavny Khrebet. *Populus tremula* L. is found with the above-mentioned species, but its distribution is strictly confined to the central region. Erman birch composes the rest of the Kamchatka forests. It grows on the borders of forests near the river of Three Sisters and spreads as far as the Isle of Koraginsk.

The wide-spreading crowns of the birches prevent them from growing close together, leaving sufficient room for development of a dense carpet of herbaceous plants. The normal growth of Erman birch is impeded by heavy snowfalls. It avoids alluvial soils, and is invariably found near the sea-shores, where it suffers from wind, frequently forming impassable thickets. The white birch, similar to the Japanese variety (*Betula japonica* Sieb. var. *kamtschatica* (Rgl.) H. Wiucl.), grows in alluvial soils and is an integral item of mixed coniferous forests.

The subordinate part of the Kamchatka forests consists of the bird-cherry, the sorb, the hawthorn (*Crataegus chlorosarca* Max.), while the riverside forests are composed of *Alnus hirsuta* Turcz., *Populus suaveolens* Fisch., *Salix macrolepis* Turcz., *S. sachalinensis* Fr. Schmidt, and *S. Gmelini* Pall.

Shrubby brushes are also widely distributed in Kamchatka. The first place among them is occupied by alder plots (*Alnus fruticosa* Rupr. var. *Kamtschatica* Rgl.). Its branches are usually pressed to the ground, forming densely interlaced thickets. *Pinus pumila* Rgl. occupies the second place. It grows in the same manner as the alder, attaining the height of 5 metres in the forests, and decreasing to 1 metre on mountain ridges. The third place is occupied by *Sorbus samburici-*

folia Roem., which forms close walls and attains its maximum height at the upper border of the mountain forests. *Spiraea Salicifolia* L. and *Rosa amblyotis* Cam. are frequently found in large river valleys.

The following shrubs are found growing in groups: (1) *Lonicera caerulea edulis* Turcz., (2) *Spiraea betulifolia* Pall., and *S. media* Schmidt, (3) *Salix fuscescens*, *S. oblongifolia*, *S. Pallasii* Anderss., (4) *Lonicera chamissoi* Bge., (5) and, more rarely, *Daphne kamtschatica* Max. Dwarf forms of willow are encountered in the Alpine region; amongst them are *S. berberifolia* Pall., *S. arctica* Pall., *S. chamissonis* Andrss., *S. cuneata* Turcz., and *S. reticulata* L. var. *orbicularis* Andrss.

The herbaceous plants *Filipendula*, *Heracleum dulce* Fisch., *Senecio palmatus* Pall., and *Urtica angustifolia* Fisch. develop fully, reaching great heights in the vicinity of river banks. *Angelica ursina* Max. is found on dry meadows. The *Calamagrostis Langsdorffii* Trin. are the most developed of the gramineous herbs, but *Spiraea salicifolia* L. and *Carex Lyngbyei* are also abundant. Groups of *Fritillaria kamtschaticensis* Gawl. are found in dry meadows, and *Lilium avenacium* Fisch. at the outskirts of forests.

The prevailing species of the alpine flora are the following: *Arnica*, *Diapensia*, *Hierochlæ*, *Papaver*, *Alsine*, *Dryas*, *Pedicularis*, *Saxifraga*, *Rhododendron kamtschaticum* Pall., *Phyllodoce*, *Bryanthus*, *Loiseleuria procumbens* Desf., and *Cassiope lycopodioides* G.

Though from a botanical point of view Kamchatka may be considered as an island, it has no sharply defined endemic vegetation. The flora is far from being unique, consisting mainly of circumpolar plants. Violent volcanic catastrophes and ice masses have displaced and deteriorated the ancient vegetation, which united the flora of Kamchatka with the neighbouring parts of America and Japan. The coniferous forests of the centre are the sole remains of floristic antiquity. After the glacial period Kamchatka was stocked with Arctic elements from Anadyr, or from shores which were elutriated by sea currents. Plants migrated from the continent are found on the north-west shore, while plants carried over from Japan are encountered in the southern part of the peninsula. Scarcely more than 50 species, or 6 per cent of the whole flora, are typical or endemic species, which are peculiar to Kamchatka. About 380 species, or 50 per cent of the whole flora, are represented by species bearing close affinities to European plants. There are only 25 species, or 3.73 per cent, which are found in America. These are confined to the narrow strip of the Bering Sea shores. The number of species indigenous to the country is 752: *Filicineæ* 42, *Coniferae* 5, *Monocotyledons* 240, *Archichlamideæ* 291, *Metachlamydeæ* 174. The remaining 40 per cent are those of eastern Asia. *Cyperaceæ* and *Compositæ* occupy the first and the third places, respectively, among the largest of families. This obviously indicates the comparatively great marshiness of the country.

The book contains a full list of the plants of Kamchatka, with keys for their determination and specific diagnoses.

Triangulation of France.¹

THE old triangulation of France is considered as having been begun in 1811 by a body of military surveyors known as 'Ingénieurs Géographes.' The work, however, was really a continuation of that executed by Delambre and Mechain between 1792 and

1801, when the old Arc of Meridian was measured from Dunkirk to Barcelona. Under Brousseau, Bonne, Hossard, Levret, Perrier, and other 'Ingénieurs' of the Dépôt de la Guerre, the triangulation was carried over France and linked with the surveys of Italy, Belgium, Britain, and Germany. The origin for latitudes, longitudes, and azimuth was taken at the Panthéon, whence geodetic latitudes and longitudes

¹ *Bulletin Géodésique*, No. 12 and No. 16, "Formules pratiques pour le calcul des coordonnées géodésiques." By Lieut.-Col. E. Benoit. (Paris: J. Hermann; 1926 and 1927.)