TAIWANIA

Vol. I, pp. 1—6, May 1948.

FLORISTIC SIGNIFICANCE AND PROBLEMS OF EASTERN ASIA

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On a map of the world, using Taiwan (Formosa) as the center and drawing a circle with a radius of about 1500 miles, we cover an area of great geographical interest and botanical wealth. In the east lies the Pacific, the greatest ocean on the earth. In the south spreads the greatest assemblage of islands, lying between Asia and Australia and covering both the Northern and the Southern Hemispheres. In the west is Asiatic continent, the largest land mass. In this circle, varied types of physiography and wide ranges in latitude and climate provide us a rich and interesting vegetation for study.

Formosa is the only large island of the whole whole that lies on the Tropic of Cancer. It is an island, so the flora is naturally insular in character; yet is is so close to the mainland of Asia and its separation is so recent that continental features in the flora are also evident. It is situated strategically on the very fringe of the continental shelf nearly in the center of the great arch of islands that stretches from the Kuriles and Sachalin in the north through Japan and the Liukius to the Philippines and the Malay Archipelago in the south. Formosa is thus a natural stepping stone for the migration of floras from the north to the south and vice versa, and also from these two directions to and from China on the west. Such a location is unique in botanical geography.

The phytogeography of Formosa and its nearby islands is thus a complicated and interesting problem to study. From the sea level to high mountains of over 3900 meters, varied floras show different origins and affinities. Formosa shares with the Philippines, southern China, and Malaysia many of its lowland tropical elements. Yet many tropical elements, which occur in the Philippines and the small island Botel

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Tobago close to Formosa, do not occur in the latter. Among medium level and temperate elements, Formosa shows affinities with both China and Japan. Some of these, as well as some of the alpine elements, indicate a strong relationship with western China and the Sino-Himalayan region. Asiatic and Himalayan floral elements have two natural routes of southern migration, one through the Malay Peninsula and the other through Formosa. This Formosan bridge of plant migration might have been effective for sometime and may still be functioning.

On all sides of Formosa, in or just along the fringe of this circle mentioned above, interesting features and problems of the floras abound. In the east, the Liukius, the Bonins, and Micronesia are fruitful grounds for plant geographic studies. Between the Bonins and the Marianas probably lies the separating line between the temperate eastern Asiatic and the tropical floral regions[1][2].

The famous land of Wallacea and the Wallace's and Weber's lines are llocated in the south in Malaysia, a land which provides endless problems in botanical geography. The Wallace's line has been modified and extended in its northern part by several authors[3][4].

In this vast area, we have still many regions little known botanically particularly New Guinea, and also Borneo, Sumatra, and others. Floristic studies in these areas have yet to be intensified. When our knowledge of the floras of these islands has been increased and improved, problems in the migration and relationship of boreal and austral floras can also be elucidated and clarified.

In the north and the west lies the great land mass of Asia. In Asia, there is direct continuation between arctic floras in the north and tropical floras in the south. It is only in eastern Asia, in China and Indo-China, that temperate regions adjoin tropical regions without impassable physiographic barrier. In other places in the Northern Hemisphere, temperate land masses are all effectively cut off from the tropics either by wide

1. Hosokawa, T. Phytogeographical relationship between the Bonin and the Marianne islands laying stress upon the distributions of the families, genera and special species of their vascular plants. Journ. Soc. Trop. Agri. 6:201–209. map. 657–670. 1934.

1. Wilson, E. H. The Bonin Islands and their ligneous vegetation. Journ. Arnold Arb. 1:97–115. 1919.

3. Kanehira, R. The phytogeographical relationships between Botel Tobago and the Philippines on the basis of the ligneous flora. Bull. Biogeogr. Soc. Jap. 5:209–211. 1935.

4. Merrill, E. D. An enumeration of Philippine flowering plants. 1:77–154. 1926.

seas, of deserts, or high mountain ranges. The absence of important barriers between the tropical and temperate regions in eastern Asia is unique in the plant geography of the world, a fact which has probably been too little appreciated in the past.

As the result of this commingling of tropical and temperate elements, we find in this region an extraordinarily rich flora with plant elements derived from sundry sources. The Sino-Himalayan region in the west has the richest alpine flora of the world. Desert and central Asiatic elements abound in the northwest. In China and Japan, the original floras of temperate Asia have survived and thrived in better conditions than similar ones in Europe and North America. This land area has not been greatly disturbed since the Paleozoic and has not been greatly submerged since the Tertiary. The long quietness in its geological history favors the development of a marvellously rich flora unequalde in other temperate regions of the world.

To illustrate the extraordinary richness of the flora of China, it will suffice to mention only the trees and shrubs. They exceed in number of genera and species those of all the rest of the North Temperate Zone. Many of the genera are relics of the past, surving only in China, such as *Tetracentron*, *Euptela*, *Eucommia*, and *Dipteronia*. Others show remarkable discontinuous distribution in eastern Asia and eastern North America such as *Carya*, *Liriodendron*, *Sassafras*, *Hamamelis*, *Gymnocladus*, *Wistaria*, *Cladrastis*, *Stewartia*, *Halesia*, and *Chionanthus*. Some of these also extend to Formosa and Japan. Still others, though much fewer in number, survive also in western North America as well as in southeastern Europe and adjacent western Asia, such as *Cercis*, *Liquidambar*, *Aesculus*, and *Ostrya*. These discontinuously distributed genera as well as other isolated relic genera are among the most studied in plant geography.

The distribution of arctic-alpine plants in eastern Asia is also of immense interest. These elements can migrate southward by several routes. The Kuriles, Sachalin and the Japanese Archipelago form the easternmost route. In the west in Central Asia and western China, the presence of many mountain chains enables many arctic forms to extend southward to the Himalayan region. The elevation of the Himalayas forms a new and fertile ground for the development of alpine plants. Many arctic-alpine plant genera, favored by this environment, deploy

into vast species multiplication. The alpine vegetation of the Sino-Himalayan region in northwestern Yunnan and southern Sikang is one of the wonders of the plant world. Probably nowhere on the earth, outside the tropics, is found a similar congregation of large numbers of species in a limited area as in some of the plateaus of northwestern Yunnan where literally thousands of species of *Anemone*, *Gentiana*, *Meconopsis*, *Pedicularis*, *Primula*, *Rhododendron*. *Saussurea*, and *Saxifraga*, display endless variations in floral beauty.

Because of the high elevation and the varied physiographic features, vegetation of the Sino-Himalayan region is varied and its history complicated. Elements invade and inhabit this region from different directions. Standing on the slopes of one of the deep valleys one can often observe in one view, tropical, temperate, and arctic plants growing at different elevations, passing from one belt to the other. Indo-Malayan elements from the south, Chinese elements from the east, Central and western Asiatic elements from the west, and arctic elements from the north all find suitable developing grounds in this region. An interesting problem of study in plant geography is the distribution of some of the Sino-Himalayan plant elements. In general they may extend southward through the mountain chains of the Malay Peninsula to the Malay Archipelago; but some may also extend eastward to the high mountains of Formosa and thence to the Philippines.

There is still much to be done on the flora of China. In spite of the active botanical survey work of the last decades, many parts of the country remain unexplored. Until we have a thorough knowledge of the flora of China, many of the distribution problems cannot be adequately analyzed. Botanical exploration of Yunnan and Szechuan, which embody the richest flora in China, has been actively and unceasingly pursued during the war, yeidling invaluable rewards. Kwangtung, Hainan, and Kwangsi were also under extensive botanical survey, but the work was largely interrupted by the war. Botanically the provinces of Kwangsi and Kweichow were practically *terræ incognitæ* some twenty years ago. Their floristic wealth was made known only in recent years and still many parts of these provinces have not been visited by botanical explorers. Similarly, adjacent parts of Tonkin and Kwangtung deserve intensive

exploration. Some progress has been made in the preparation of a flora of Fukien,[5] but the province as a whole needs extensive survey. Probably Hunan, especially its western mountainous part, is among the botanically least known provinces in China, Judging from its central location and the richness of the floras of adjacent provinces, collectors visiting this provinces are bound to be amply rewarded for their efforts.

Studies in geographic and taxonomic botany require settled conditions as well as as cooperation among botanists and institutions. Field work cannot be prosecuted in disturbed areas. Adequate communication is imperative for the traveling of field botanists and for exchange of specimens and literature among the different scattered herbaria. A peaceful world to come is thus the beginning of an era of more fruitful botanical studies in eastern Asia.

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5. Metcalf, F. P. Flora of Fukien and floristic notes on southeastern China. lst Fasc. Lingnan Univ. 1942.