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MEMORABILIA BOTANICA, II.

(*Edited by Erwin F. Smith, B.S., D.S., Washington, D.C.*)

A JOURNEY INTO THE TROPICS.

IN recent years the botanical garden at Buitenzorg, Java, has become a sort of Mecca for European botanists. Solms-Laubach, Schimper, Goebel, and many others have there studied tropical vegetation. Probably no other botanical garden in the tropics offers as good facilities for study, and certainly no other is so well-equipped, has been used as extensively or has been productive of anything like as much good work.

One of the results of a sojourn at Buitenzorg is a new book of 300 pp. by Dr. Haberlandt ("Eine Botanische Tropenreise") giving travel sketches and graphic accounts of the Indo-Malaysian vegetation. The author has not confined himself to dry dissertations, but has had his eyes open to the biological side of botany, has known how wisely to omit, and has mixed in enough general observations and human interest to make a readable book and one of considerable general interest, even without the useful illustrations of characteristic vegetation, reproduced from pencil drawings. To describe all the interesting things in this book would be nearly equivalent to translating it. It must suffice, therefore, to call attention to some of the leading features. The book begins with the departure from Triest; gives a chapter or two on the outward voyage, including some account of Bombay; describes the garden at Buitenzorg; discusses its climate and devotes a chapter to each of the following topics: The tree of the tropics, tropical foliage, flowers and fruits of the tropics, lianas, epiphytes, tropical antplants, the primeval forest, the mangroves, etc. The reader will also find fresh and interesting notes on a variety of cultivated plants,—tea, coffee, rice, cocoa-nut, cinnamon, cinchona, banana, etc. Various excursions into the island are described, and one chapter is devoted to the animals of Java and another to the inhabitants,—their language, customs, amusements, etc. On the return journey Dr. Haberlandt spent a few days in Ceylon and finally crossed the Arabian desert in Egypt, already classic ground by reason of the admirable researches of George Volkens on the adaptations of the desert flora.

Not least attractive is the poetic and artistic feeling and the strong personal element that pervades the book. The following are some of the things that attracted special attention: The extent to which variegated leaved plants have been substituted for flowers in tropical landscape gardening; the broken contour of the forest, certain species towering far above the rest and noticeable at a long distance; the general whiteness of the tree trunks; the preponderance of woody growths; the form of branching, in many cases quite unlike that of European trees; the very rapid pushing of leafy shoots which hang down, pale or reddish, weak and limp, until they have reached full size and then gradually become green, erect and self-supporting; the nearly uniform absence of periodicity in leaf fall; the marked tendency of the foliage to be entire, smooth and coriaceous, to which is often added a lacquer-like lustre; the dazzling reflected light of tropical foliage, in striking contrast with the mild transmitted light of European foliage; the numerous modifications of leaves and changes of position to avoid very intense light; the enormous assimilative power of individual leaves and the comparatively small number on a tree; the excessive brightness of the sky and the great amount of light in the interior of a tropical forest, the shade being not nearly so dense as in an European beech wood; the enormous vegetative activity, the sharp struggle for light, and the occupancy in the forest of every available foot of space, an almost impenetrable thicket on the ground, epiphytes and lianas on the trunks of trees in great profusion lifted up out of the surface tangle, and individual trees reaching the necessary light by expanding their tops above the rest of the forest; the general lack of protective adaptations against cold, so that one comes to understand the full meaning of many northern modifications only after he has studied the tropical vegetation; the very rapid growth (in young trees frequently as much as five metres a year), which takes place in an atmosphere so moist that transpiration is greatly diminished or at times stopped altogether, and which goes to show that there is no necessary connection between the transpiration stream and the upward movement of plant foods from the roots, osmotic action being sufficient to bring it about; the noticeable absence of palms from the forest; the curious adaptations to conserve moisture, roots within pitchers, etc.; the occurrence of breathing roots in the swamp plants, *Sonneratia* and *Avicennia*, and of bracing roots in many trees, in *Sterculia* enormously developed; the numerous extra functions of tropical roots, most striking of all "the change of the aërial roots of various Orchideae into green, ribbon-shaped organs of assimilation" (*Tæniophyllum Zollingeri* has no other); the preponderance of bright colors in tropical flowers (white, yellow, orange, and bright red) and the rarity of blue flowers; and, finally, the many leaves, stems, etc., in which a particular form seems to be of no value to the plant but has been retained because not harmful, the hypothesis being put forward that many of these forms, not all, are mere "Luxus Anpassungen," due to the internal energy of the plant, and are not modifications brought about by external agencies, such as food and climatic changes, the author pointing out that the multiplicity of these variations is greatest in the places where, according to the Darwinian law, they should be least, viz., in the tropics, where the climate varies but little,—"Zwecklose Blattgestalten und ebensolche Verzweigungsformen, phantastischsinnlose Blütenmodelle und tausend anderer morphologische Eigenschaften, die nutzlos sind, bleiben erhalten weil ihre Ausmerzung kein unbedingtes Erforderniss für der Fortexistenz der betreffenden Pflanzen war."

This is a volume to go on the shelf with Schimper and Goebel, but not until it has been read and enjoyed from cover to cover.

PARASITIC ALGAE.

ONE of the most interesting botanical finds during the Madison meeting of the A. A. A. S. was made by Mr.

W. T. Swingle at the Dells of the Wisconsin River, where an endophytic alga was discovered in the leaves of the common Indian turnip (Arisaema triphyllum). This parasite causes white spots, which are often one-half inch or more in diameter and in which the bright green threads of the alga are distinctly visible with a low power objective or even with a good hand lens. From Wille's description and illustrations of Phyllosiphon arisari (in Engler and Prantl Nat. Pflanzenf.) this would seem to be that species. Heretofore it has been known only from the leaves and stems of Arisarum vulgare in southern France and some parts of Italy, being first described by Kühn in 1878.

Another algal parasite, Mycoidea parasitica, was described at the same meeting, having been discovered by Mr. Swingle in Florida, where it forms rusty patches on the leaves of Xanthoxylum. This was first described by Cunningham from the leaves of various tropical land plants and is figured by Wille (l.c.) This plant is also new to the United States, and its discovery, with that of the Phyllosiphon following so close upon its heels, suggests the probability that other of our land plants are parasitized by algae, especially in damp situations, aud that many interesting discoveries will be made now that attention has been called to the subject. Mr. Swingle's suggestion that the parasitic phycomycetes, *e.g.*, Peronospora, may have been derived from some such land forms rather than from the water-loving algae, appears to be worth considering. The effect of the Phyllosiphon on the Arisaema leaf suggests a fungus, and it would certainly be considered one but for its chlorophyll.

VEGETABLE FERMENTS.

MR. J. R. GREEN in *Annals of Botany* (March, 1893), has a long paper on vegetable ferments, embodying a digest of the present state of our knowledge. "Provisionally," says the author, "these bodies may be classified according to the materials on which they work. We may thus make four well-marked groups, excluding those which are obtainable from micro-organisms, as well as one or two whose action has not been thoroughly investigated. These groups will be: (1) Those which attack carbohydrates. These will include the different varieties of diastase, the ferment transforming inulin, the invertase which breaks up cane-sugar, the cytohydrolysts attacking cellulose, and the ferment which forms vegetable jelly from pectic substances. (2) Those which decompose glucosides, with formation of sugar and various aromatic bodies. Of these the best known are emulsin or synaptase, myrosin, erythrozym, and rhamnase. (3) The proteohydrolytic group, including vegetable pepsin, trypsin, and rennet, resembling very closely the animal enzymes bearing the same names. (4) The enzyme that decomposes oils or fats." The common or translocation *diastase* has a wide distribution in plant cells, and Barenetzky suggests that it is universally present so long as the cells are living. It slowly dissolves starch, converting it into sugar. A more active form known as diastase of secretion destroys the starch grain by corrosion. It occurs in various grains but only at the commencement of germination, being apparently secreted by the epithelial cells of the scutellum, but according to Haberlandt by the aleurone layer in the barley grain. *Inulase* occurs in the artichoke, dahlia and various other Compositæ. It first appears in the germinating tubers, converting the inulin into sugar. *Invertase* occurs in a variety of vegetable substances,—yeast, bacteria, fungi, malt, buds and leaves, pollen, grains, etc. It has the power of inverting or hydrolysing cane sugar into dextrose and laevulose. It occurs also in animals. A *cytohydrolytic* ferment probably occurs in the endosperm cells of palm seeds, but no one has yet been able to isolate it. The author cites De Bary's well-known experiments on the extrusion of a cellulose dissolving substance from the hyphæ of certain Pezizas, and Marshall Ward's on the lily Botrytis, and thinks that such bodies are not exceptional in the vegetable kingdom. Brown and Morris have discovered a similar enzyme in germinating barley grains. *Pectase* occurs in a variety of plants, carrots, beets, fruits, etc., and has the power of converting cellulose into gum. *Emulsin* occurs in certain Prunoideæ in the vicinity of the fibro-vascular bundles. It decomposes amygdalin into sugar, benzoic aldehyde, and prussic acid, and also decomposes many other glucosides. *Myrosin* is the characteristic enzyme of the Cruciferæ, but is probably not confined to this order. It breaks up the very complex glucosides abounding in Cruciferous plants into sugar and certain strong-smelling compounds generally containing sulphur. This enzyme occurs in special cells variously distributed. The strong smell of black mustard seed when bruised and covered with water is due to the liberation of sulphocyanate of allyl from contact of this enzyme with the glucoside, sinigrine, contained in other cells of the seed. *Rhamnase* occurs in the seeds of the Persian berry, Rhamnus infectorius. It decomposes a glucoside, xanthorhamnin, into glucose and a bright yellow dye, rhamnetin, the glucoside occurring abundantly in the pulp of the fruit and in the pericarp. Attention was first drawn to this enzyme by the discovery that decoctions of the pericarp alone would not produce the dye but that it developed at once when mixed with a little of the crushed seed. Subsequently Marshall Ward found out that the enzyme was located in a very small part of the seed, viz., the raphe, and that no other part of it would decompose the glucoside and produce the dye. *Erythrozym* occurs in the madder root, and there are yet other glucoside-enzymes, but less well known. *Pepsin*, or ferments very closely resembling it, and provisionally to be classed with it, occur in Drosera, Dionæa, Pinguicula, and other insectivorous plants. Probably the ferments found in Nepenthes, Sarracenia, and Aethalium sapticum also belong here. They are capable of dissolving proteids, connective tissue, cartilage and gelatine, and are most active in a slightly acid medium, strikingly resembling in these particulars the pepsin of the stomach. *Trypsin*, capable not only of converting proteids into peptone but also of breaking up the latter into amide bodies, occurs in the pawpaw (Carica papaya), the fig, and a melon (Cucumis utillisimus), the natives of India having for a long time made use of this fact by cooking certain fruits with tough meat to make it tender. A similar enzyme exists in the juice of the pineapple, in the seeds of vetch, hemp, flax, barley, castor beans and lupins, at the time of germination. Daccomo and Tommasi have also described a proteo-hydrolytic ferment from Annagallis arvensis, the fresh plant disintegrating fresh meat or fibrin in thirty-six hours when kept in contact with it at 60° C. *Rennet* occurs along with trypsin in commercial papain, in the juice of the pineapple, and in the seed of Ricinus. It has also been extracted in recent years from a variety of seeds, some before and others during germination. Lea has given quite a full account of its preparation from the seeds of Withania coagulans, a Solanaceous shrub of Afghanistan and northern India, and the author has found it in seeds of Datura Stramonium, Pisum sativum, Lupinus hirsutus, etc. It also occurs in the pericarp, pulp, and expressed juice of the ripe fruit of the Naras (Acanthosicyos horrida), a Cucurbitaceous plant of South Africa. The power of curdling milk also exists in the flowers of Galium verum, a plant still used in west England by cheesemakers; in the leaves of Pinguicula vulgaris, first noted by Linnaeus as in use by Lapland tribes for this purpose, and said by Pfeffer to be still used in the Italian Alps; in the glands of Drosera, noted by

Darwin; in the stem of Clematis vitalba; and in the petals of the artichoke. *Fatsplitting enzymes* have been discovered in seeds of Ricinus, rape, opium-poppy, hemp, flax and maize. In the castor bean it is distributed throughout the whole endosperm.

These ferments seem to arise from vegetable zymogens, the existence of which was first established by Vines in experiments on Nepenthes. The constitution of enzymes is still in dispute. Loew, as the result of analyses, considered them to be proteids closely allied to the peptones, but spectrum analysis and other evidence has now made this doubtful. Vegetable ferments are readily destroyed by boiling, and are for the most part very sensitive to acids and alkalies, a slight excess destroying them or stopping all action. They are not readily identified in tissues by use of stains. Some are very unstable. Enzymes have very slight power of diffusion. They can make their way through cell walls, but not through the parchment walls of dializers. They appear to act in an ordinary chemical way, causing hydration (myrosin excepted) and subsequent decomposition. Most of the changes brought about by enzymes can be effected in the laboratory by ordinary chemical processes. They are extracted for experimental purposes by water, salt water, or glycerine, and are quickly precipitated by excess of alcohol. One of their most striking peculiarities is the enormous power of conversion they possess, a sample of invertase being capable of inverting 100,000 times its own weight of cane sugar without injury to itself. The ferments of the fungi and bacteria are also enzymes, and the old view of Naegeli that there are two distinct classes of ferments, organized and unorganized, is no longer tenable. Enzymes have been isolated from a number of bacteria, and even several from the same organism,—in case of the potato bacillus, B. mesentericus vulgatus, no less than five, viz., diastase, invertase, rennet, a proteohydrolytic enzyme and one destroying the middle lamella of vegetable cells.

MAPLES.

In an interesting paper on "Sugar Maples, and Maples in Winter" (Repr. from Fifth Annual Report, Mo. Bot. Garden), Dr. Trelease discusses the synonomy of certain species which has shifted about a good deal of late. He recognizes the western sugar maple as Acer grandidentatum Nuttall; the eastern, as A. saccharum Marshall with two varieties, barbatum (Michx.) Trelease, and nigrum (Michx. f.) Britton; the southern, as A. Floridanum (Chapman) Pax, with variety acuminatum Trelease.

The second part of the paper describes the winter appearance of all our species, the difference in bark, leaf-scars and buds being ample for their determination. The paper is accompanied by sixteen plates illustrating twigs, leaves and fruits. It was written partly for teachers, and it is to be hoped that it may find its way into the hands of a good many. Certainly there are hundreds who have no idea how interesting a study can be made out of bare twigs, and to whom this paper would prove very serviceable.

THE FOSSIL FLORA OF S. E. FRANCE.

In May, 1893, at the Montpellier meeting of the Botanical Society of France, M. Saporta read a paper of twenty pages (recently published in Bull. de la Soc. Bot. d'France) showing the relationships of the living flora of Provence to that found in the rocks, especially of the Aquitanian. In the author's own words, his conclusions are not drawn from simple and vague analogy, nor even from a more or less close morphological similarity, but rather from resemblances so close (*intime*) as to be indications of a genuine filiation. In other words he supposes the living forms in question to be the direct descendants from those whose fragments have been found in a fossil state. Only woody plants are considered, since herbs have left but insignificant vestiges too scanty for throwing any light on problems of descent. As preliminary to this consideration it should be borne in mind, first, that the farther back we go the fewer and the more vague and general are the resemblances of fossil plants to living ones, and, second, that the earliest relationships close enough to be considered filiative are with exotic species, growing generally in more or less restricted areas. Descendants of other early forms still occur in France but often in exceptional conditions of isolation and retreat. In more recent times, *i.e.*, toward the mio-pliocene, the flora changed gradually, the palms, laurels, magnolias, etc., which had long dominated, giving place to new elements probably derived from the north. These new-comers were principally oaks, of the Robur group, poplars, maples, and lindens. Then only did the vegetation of central and southern Europe begin to resemble its present condition. The most ancient flora considered by M. Saporta is from the gypsum beds of Aix, which belong to the uppermost horizon of the Eocene. They have been explored for twenty years, and about 500 species are known. Fourteen species now indigenous to southern France so closely resemble forms from these beds as to be considered their lineal descendants. These are: Ostrya carpinifolia, Quercus Ilex, Quercus coccifera, Olea Europæa, Fraxinus oxyphylla, Nerium Oleander, Styrax officinale, Hedera Helix, Cornus mas, Paliurus aculeatus, Pistacia Terebinthus, P. Lentiscus, Rhus Coriaria, and Cercis Siliquastrum. Other types occurring in these beds are now represented only by exotic species, *e.g.*, Callitris quadrivalvis in Algeria, Zizyphus spina-Christi in Tunis, Myrsine retusa in the Canaries, Amygdalus communis in Asia minor, and species of Ailanthus and Catalpa in eastern and southern Asia. In the oligocene many additional relationships appear. Notable among these new-comers are the ancestral forms of the California Sequoia, the N. Am. Taxodium, and the Chinese Glyptostrobus. These first appear in England and subsequently in southern France. The greatest interest, however, centres in the Aquitanian flora. From the Manosque beds of this horizon there are no less than thirty ancestral forms of exotic species. These species, although long excluded from France, have varied so little that they cannot be separated from their presumed ancestors. Among them are Sequoia sempervirens in California, Sabal umbraculifera in America, Myrica salicina in Abyssinia, M. sapida in Nepaul, M. Faya in the Canaries, Betula cylindrostachya of interior Asia, Alnus subcordata of the Caucasus, Carpinus viminea of Nepaul, Fagus ferruginea of America, Populus Euphratica of Algeria, Syria and Palestine, Zelkovia crenata of the Caucasus, Z. Protokeoki of Japan, Persea gratissima of the Tropics, Nelumbium speciosum of southern Asia, Magnolia grandiflora of Louisiana, Acer cratægifolium of Japan, Acer rubrum of America, A. rufinerve of Japan and A. sp. of interior China, Berchemia volubilis of America and an unnamed similar species from Yunnan. Among the species which, with slight modifications, have held their own in southern France from the Aquitanian down are the following: Juniperus Oxycedrus, Smilax mauritanica, Alnus incana, Carpinus orientalis, Ostrya carpinifolia, Fagus silvatica (through one or several intermediate forms in the mio-Pliocene), Salix fragilis, Populus nigra, P. alba, P. Tremula, especially Asiatic varieties of the type Tremula, the southern variety of Ulmus montana, Laurus nobilis, Fraxinus oxyphylla, Olea Europæa, Styrax officinale, Acer opulifolium, A. Opulus, A. campestre, Rhamnus frangula, and Cydonia vulgaris. The Aquitanian is still a long way from modern times. In the predominance of Palmaceæ Lauraceæ, Magnoliaceæ, Cedrelaceæ, Sapindaceæ, and arborescent Leguminosæ; in the presence of such genera as Engelhardtia, Ailanthus, Bauhinia, Lygodium, and Chrysodium; and in the frequency of Cinnamomum, Persea, and species of Myricaceæ, Cesalpineæ, and Mimoseæ we are introduced to a vegetation which is certainly very different from that now existing in southern France, and the contrast would be complete were it not that these types are associated with genera still indigenous, such as Alnus, Betula, Carpinus, Ostrya, Populus, Salix, Ulmus, and Acer. The tropical and sub-tropical types were eliminated during the course of the Pliocene, and the other types became variously modified, as shown by a series of intermediate forms extending from the Aquitanian down to recent Pliocene. Another fact of interest is that the greater number of the European descendants of these ancient floras belong exclusively to the Mediterranean flora, while many occur only in isolated localities and seem to have but a slender hold upon the region. The absence of certain species which form an integral part of the present flora lead to the belief that they appeared later than the period represented by the Aquitanian of Manosque. Toward the mio-Pliocene a new alluvion containing vegetable forms was superposed on the preceding, and this was correlative with a partial ellimination of species which Europe had possessed until then. Up to and including the Aquitanian there are no vestiges in southeastern France of any of the following types: Alnus glutinosa, Coryllus Avellana, Carpinus betula; the Robur, Toza and Infectoria sections of Quercus; Platanus, Liquidambar and Liriodendron; Ficus carica; Tillia, Carya, and Pterocarya; Ilex aquilifolium, Acer Pseudoplatinus, A. platanoides, Sorbus torminalis. These came in at a later date and in most cases apparently from the north, appearing lower down in formations further to the north. In the Swiss Helvetian there is a Pterocarya which nothing distinguishes from a living species of the Caucasus, and a Liriodendron scarcely distinct from that of America. The Platanus aceroides seems to have followed the same course as the Tertiary tulip tree, both species growing together in mio-Pliocene times in the valley of the Rhone. The last part of the paper is taken up with a critical consideration of the southern European oaks based on a study of material from the mio-Pliocene beds of Italy and France, in which there are species of the following sections of the genus Quercus,—Cerris, Ilex, Toza, Robur, and Infectoria. The paper is accompanied by three lithographic plates and two figures in the text.

THE BOTANICAL LANDSCAPE.

BY J. W. CHICKERING, NATIONAL DEAF-MUTE COLLEGE, WASHINGTON, D. C.

If there be among either the older or the younger botanists of our country any who, in these days, when so much attention is paid to laboratory work, microscopic investigation, discussion of the laws of nomenclature and other theoretical inquiries, still retain interest in field work, and are not afraid of being considered "mere collectors," I should like to suggest one direction in which there is still opportunity for observation and record.

Distributive botany has always had its fair share of attention. We are familiar with the change in the vegetation, as we go from the equator to the poles, or from sea level to the snow line on our loftier mountains. Our catalogues present us with the percentage of change in the flora, as we pass from New England either west or south. But little has been said in either manuals or local catalogues about what might be called the botanical landscape of different localities. By this is meant a recognition of those species occurring so in mass as to give color and character to the whole landscape, even when seen from a carriage or a railway train.

Our ordinary idea of a local flora is the whole number of species detected by the careful and skilled botanist, in the narrow ravine, or underneath the dark shadows of over-hanging cliffs, or over-arching forests. But I wish now to suggest, especially to those who may edit future manuals or local catalogues, the desirability of noting those plants which thus form a conspicuous part of the landscape, and moreover of noting and recording the gradual change of species, as, for instance, among the *Solidagus* and *Asters* in passing from one section to another.

As an example, I will give a few notes of such social and colonizing species as attracted attention during two or three summers in eastern Maine and Nova Scotia. Many of our sub-Alpine plants here descend from the mountains and take possession of the soil near the level of the sea. Notably is this the case with *Empetrum nigrum*, covering the swamps, intermixed with *Ledum latifolium*, and *Rhododendron rhodora*, and in a few localities *Rubus chamaemorns*, the cloud-berry, sufficiently abundant to have its fruit brought to market, under the name of baked-apple, though, according to Mr. Kennan, much inferior in flavor and juiciness to the same species as found so abundantly on the Siberian steppes.

Along the valley of the Cornwallis River, for miles on either side the railroad, are masses of *Corema conradi*, and all through eastern Maine *Vaccinium vitis-idaea* is the most abundant, as it is the most aromatic in flavor of all the cranberries.

In eastern Nova Scotia a European species, *Senecio jacobaeus*, the ragwort, was noticed as replacing and exterminating the native *Solidagos*, and likely to become a troublesome weed, if it holds on its westward way.

In eastern Massachusetts are seen occasionally patches of *Genista tinctoria*, wonderfully brilliant on Salem hills, and less abundantly *Galium verum*.

In some parts of western Massachusetts, *Potentilla fruticosa* is similarly conspicuous, but a most pestilent invader, over-running and ruining hundreds of acres of good pasture land.

Down in the Shenandoah Valley, in Viginia, the traveller's attention is arrested by the great masses of *Echium vulgare*, known as blue thistle, not only diversifying the landscape with its cerulean hue, but supplying honey to millions of bees.

Perhaps the most beautiful sight I ever beheld of this sort, was along the banks of the Carrabasset River, in Maine, where for four miles *Epilobium angustifolium*, one of the many plants known as fire-weed, covered the ground, reaching a height of three or four feet, and rising and falling with every inequality of the surface, suggesting the idea of a fall of pink snow to that depth.

That was on August 14, and on June 8 fire had devastated that section, lasting for some two weeks, apparently destroying all possibility of vitality remaining in any seeds. And yet less than two months after there was this profusion of inflorescence.

Whence did that growth originate? Our driver said that it had never been very abundant in previous years, and that it began to start about three weeks after the fire.

But it is of course the *Asters* and *Solidagos*, with a few other *Compositae*, that in the autumn give color to the landscape almost to the exclusion of all the other species.