A NEW LOCALITY FOR THE VENUS' FLY-TRAP (DIONAEA MUSCIPULA)

MR. JOHN BOYD, of Southern Pines, N. C., has been so kind as to send me a number of leaves of the Venus' fly-trap (*Dionaea muscipula*) from a locality in the southeastern corner of Moore County, central North Carolina, a station some distance from any previously recorded. Mr. Boyd writes that the traps range in color from maroon to pink and green. The fringes about the edge are maroon, pink or green. The plants are found growing in open beds, apparently having crowded out all other vegetation.

According to Dr. W. C. Coker,[1] this plant has a range more extensive than is generally assumed. He gives stations in Wayne, Lenoir, Jones, Duplin, Onslow, Sampson, Cumberland, Moore, Bladen, Pender, Columbus, New Hanover and Brunswick Counties, North Carolina, and in north and southeast Horry County and eastern Georgetown County, South Carolina. In other words, it ranges from New Bern, North Carolina, to Murrell's Inlet, South Carolina, and westward to Wayne County and two localities in Moore County, North Carolina. It is, however, very local, and the stations at which it occurs are often widely separated.

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[1] *Jour. Elisha Mitchell Sci. Soc.*, Vol. 43, Nos. 3 and 4, July, 1928, pp. 221–228, map, pl. 33.

SCIENTIFIC BOOKS

TRAY AGRICULTURE

Soilless Growth of Plants: Use of Nutrient Solutions, Water, Sand, Cinder, etc. By CARLETON ELLIS and MILLER W. SWANEY. 155 pp., with 59 figures, including 3 color photographs. Reinhold Publishing Corporation, N. Y., 1938. Price, $2.75.

THE National Resources Committee, appointed by President Roosevelt, in reporting last year on the impact of science and invention upon our social and economic life, picked "tray agriculture" as one of the new developments fraught with great future potentialities. This book is welcome because it gives a practical summary of the authors' experience in this promising field, as well as some information selected from the rather scanty literature and experimental bulletins.

It has long been known that some plants, *e.g.*, bulbs which contain their own nutriment, can grow without soil. The well-known hyacinth vases did not enter Omar's mind when he wrote that "every hyacinth the garden wears dropped in her lap from some once lovely head"; but hyacinths, "Chinese lilies" and other plants have been raised in water or on wet pebbles by the hopelessly mid-Victorian housewife. By adding to the water small percentages of potassium, calcium, magnesium, phosphate and nitrate and very minute amounts of the so-called "trace elements," boron, manganese and zinc, we have what the authors term "nutrient solutions," for which a number of detailed formulae are given. By substituting for the flower vases shallow tanks, troughs or trays which may, if one prefers, be filled with sand, pebbles, cinders, etc., and arranging suitable apparatus for continuous or intermittent circulation and aeration of "nutrient solution," we have, according to size, a household or an industrial "plant" for raising plants without soil—by aquaculture, water-culture, tray agriculture, tank farming or (as suggested by W. F. Gericke in SCIENCE, 85: 177, 1937) hydroponics.[1]

Following a brief Foreword and Introduction, Chapter I discusses the chemistry of plant life; Chapter II, growth in mineral aggregates (sand culture and sub-irrigation methods); Chapter III, growth in nutrient solutions (which are here discussed); Chapter IV, household plant culture (flowers and vegetables); Chapter V, commercial aspects, with some striking photographs of large installations and their results, as well as reference to tanks adaptable to automobile trailers and to ocean-going vessels on long voyages; Chapter VI, special chemicals, including plant "hormones," auxins, colchicine[2] (for chromosome doubling), ethylene, ethylene chlorhydrin (*e.g.*, to shorten the dormancy period in potatoes), thiourea (to improve germination), heavy water; Chapter VII, common detriments, including soil diseases, chemical deficiencies, parasites ("animal, vegetable and bacterial"); Chapter VIII, eight nutrient formulas, with comments.

In the Introduction the authors state that they present "a concise and non-technical discussion of the chemistry of plant life and a review of the three recognized modifications of *soilless growth*, namely, *water-culture, sand-culture* and *sub-irrigation systems*. Numerous household experiments have been included, liberally supplemented by photographs, which may serve to enable the reader to carry on soilless growth experiments at home for the purpose of producing

[1] Professor Gericke (University of California) credits Knop (1859) for early experiments in this field and states: "In the late summer of 1935 a number of large growers of certain vegetables and flowers adopted liquid culture media on a large scale for the growing of crops and have (for two seasons) placed on the market products so grown to compete with those produced by agriculture."

[2] The extreme care necessary in handling this highly toxic alkaloid has been recently stressed, and should be referred to here.

vegetables and flowers for the family. . . . Accounts are given of a number of large-scale soilless-growth operations. . . . Finally, the authors have attempted to repudiate some of the widely circulated, but erroneous, claims made for soilless-growth practices. The reader is warned that plants grown without soil need attention just as do those grown in soil."

With a book intended for popular use, extreme care in the choice of terms must be exercised in order that what is written be scientifically accurate as well as simply stated. In courting simplicity, the authors have been led into some statements that will make scientific readers wince. For example, in speaking (p. 12) of "innumerable tiny pores on the under side of the foliage" they say: "On the proper functioning of these infinitesimal stomata and the microscopic cells within the leaves the entire life of the earth is dependent. For without proper breathing of the stomata the production of the entire food supply of all plants and animals would cease." (How about the evolutionary precursors of plants with foliage? And the authors quote the work of the N. J. Agricultural Experiment Station (New Brunswick, N. J.) where Dr. Selman Waksman has done so much work on the autotrophic bacteria). Page 15: "*Cells?* What are they? . . . They differ in size among plants, but are all formed in more or less the same way, and all serve the same purpose." (The differentiation of cells should at least have been mentioned.) Page 21: "In soil farming the purpose of plowing is to break the soil's upper crust and allow better circulation of air among the roots to take place." (Agriculturists recognize many other benefits, *e.g.*, plowing under of nutrient salts which migrate upward as noted on page 94.) Page 36: An important factor in the accumulation of solar heat in glass-covered containers is the penetration of the glass by the short-length incoming radiation and the impounding of the re-radiated longer heat waves which can not so readily pass out, although "cooling by evaporation of water," mentioned by the authors, is also to be reckoned with. Page 54: In discussing pH, a distinction ought to be made between the *total* acidity or alkalinity of a substance, and the *mobilized* acidity or alkalinity represented by the hydrogen ion concentration. The pH of human blood oscillates about 7.45, and even a few tenths of a unit may mean illness or death. Page 140: Algae are not fungi, nor do they arise from fungi. (Among the parasites, no mention is made of viruses or mosaics.)

All told, however, the authors have presented an interesting and useful résumé in an important new field. They are to be congratulated on the warning they give against high-pressure salesmen who try to sell equipment for this work under promise of miraculous results. They caution against excessive optimism or impatient pessimism. Experimenters are advised to construct their own containers and to use relatively inexpensive commercial grades of chemicals. Under ordinary farming conditions, fertilizing chemicals widely scattered are in part washed away by rain, whereas in hydroponic farming the plants are *protected against rain* so that the nutrient solution is not diluted. The effective utilization of chemicals is higher in tray agriculture, and the onslaught of pests and parasites inhibited or prevented.

It is still to be discovered how soilless growth will affect the quality and viability of seeds thus serially produced; also to what extent the fruits, seeds and plants so grown will carry certain substances (*e.g.*, vitamins, trace elements) needed by animals. From recent work it appears that traces of chromium in forage are essential for sheep and inferentially for other animals too. Possibly impurities in the industrial chemicals will serve to supply such substances, or they may be added. Thus most commercial iron salts contain traces of chromium.

The book is clearly and attractively printed.

JEROME ALEXANDER

SPECIAL ARTICLES

ISOLATION OF A FILTRABLE, TRANSMISSIBLE AGENT WITH "NEUROLYTIC" PROPERTIES FROM TOXOPLASMA-INFECTED TISSUES

A HITHERTO undescribed disease-producing agent, of especial interest because of its unique properties and origin, was encountered in the course of certain experiments with toxoplasma in mice. These toxoplasma (obligate, intracellular, protozoon parasites of large size[1]) have undergone numerous brain to brain passages in mice in the past three years, and repeated tests revealed that no other agent separable by centrifugation or filtration was involved in the disease they produced. After about the fiftieth passage, however, in an attempt to preserve the toxoplasma at −80° C. it was found that while they were invariably killed by this procedure, some other agent capable of producing central nervous system disease in mice either became manifest or was liberated in the process. The disease proved to be transmissible by intracerebral injection and the first strain thus isolated has now undergone more than 30 serial passages. At least six other strains obtained in other toxoplasma experiments by freezing or other procedures have been passaged 4 to 12 times. It has proved impossible, thus far, to isolate or demonstrate this transmissible agent in at least two lines

[1] A. B. Sabin and P. K. Olitsky, SCIENCE, 85: 336, 1937.