With one exception the oils as grouped suggest a close similarity in each group as might be expected. Thus the density of the cohobated oils is, as a group, slightly higher than that of the original oils, the last oil to be separated after cohobation having the highest density. The index of refraction of the cohobated oils is, likewise, somewhat higher than that of the original oils. With one exception the optical rotation of the cohobated oils is about one-half of that of the original oils, whereas the aldehyde content is slightly higher. Both differences are such as one might expect from the chemical constituents of the oil and their relative solubility in water. Again it may be assumed that the high angle of rotation of the first cohobated oil recorded in the table is due to original oil carried mechanically into the cohobated oil by the aqueous distillate in which the oil was suspended and from which it had not been carefully separated. The acid values show no such regularities. These differences may readily be accounted for by the differences in the containers in which the oils were kept during the long interval between distillation and examination.

As already stated, these results may be of interest since they supplement the earlier investigation of Schimmel & Company. Although their chemists examined other parts of the shrub as well, they did not examine separately the oils from the leaves and twigs. As a biochemical study their investigation is much more complete. Yet, from a practical point of view it seemed desirable to examine the leaves and twigs separately since these are the two principal elements that enter into the distillation of the commercial oil. As Schimmel & Co. themselves point out, the other parts examined by them play but a minor, if not a negative, rôle in the distillation of the commercial oil.

## PHARMACOGNOSY IN THE GARDEN.*

BY E. E. STANFORD.

A botanical garden devoted mainly to medicinal and poisonous plants was established at Western Reserve University in the spring of 1921. This beginning, for reasons which will be noted later, was far from being a pretentious one, but it was a beginning, at least, with several distinct ends in view, some obvious and some less so. Without attempting to present these objects or their stages of fulfilment in any very logical order—leaving some of them, indeed, quite out of the immediate question, these random remarks on our successes and failures to date are offered with the idea that they may be of some interest and encouragement to those of our colleagues who, in somewhat similar situation, may be contemplating a similar experiment. From those of longer pharmacultural experience, who plant in acres as we in footage, we crave an indulgent smile and perhaps a word of helpful criticism.

Lack of interest in courses in pharmaceutical botany and pharmacognosy may not infrequently be traced to the static nature of the work. Under the microscope, except in an occasional elementary microchemical test, nothing happens. Cells, tissues, organs, preserved in balsam or cleared in chloral hydrate, are fragments only, they do not function. In pharmacy or chemistry a nodding head may get blown off, but even that wakening stimulus is absent here. As digitalis or belladonna develops under his hand from seed to sprout, from sprout to maturity, from ma-

* Scientific Section, A. Ph. A., Cleveland meeting. 1922.

turity to the finished drug, vital processes unfold before the student. The plant is a living thing—not a corpse in a can. Life calls to life.

Cleveland School of Pharmacy, located in a crowded down-town area since its inception, was destitute of garden space. Commerce and industry claimed every inch—save a near-by scanty acreage—a garden of a sort—a thickly crowded one, in the planting of which pharmacy would not boast the part it may have had.

Cleveland School of Pharmacy, attached for some years to Western Reserve University by a tenuous thread of "affiliation," became an integral part of the larger institution in 1919. In the summer of 1921 the down-town quarters were sold, and the school moved to the University Campus. There it occupies a building remodeled to furnish it temporary offices and some laboratory space, while the remainder of its work is carried on in various other buildings of the university.

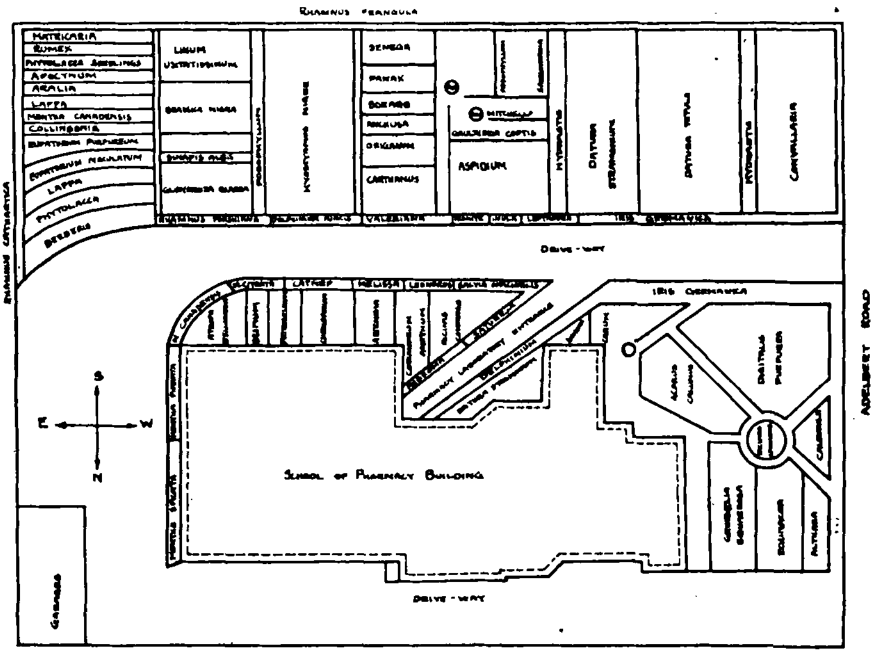


Fig. 1.—Western Reserve Botanical Garden.

Vacant inches on the present lot of the Pharmacy Building—back yard, front yard, and the verticality of the fences—totalled an area of about one-fifth of an acre. The soil was a hard, dry sandy clay, plentifully mixed with subsoil from building operations. It contained little humus, and the small amount of natural moisture was further depleted by a number of trees—silver and Norway maples, and elms—not much less efficient, for desiccating purposes, than vacuum pumps. While hardly the most promising locale in the world, it was available, and it was infinitely better than nothing.

The beginning was made in the spring of 1921. Practically all work except manure spreading and preliminary plowing and fencing has been done by students, as part of laboratory courses in botany and pharmacognosy.

Choice of plants had to be governed by soil and shade conditions, and has been, thus far, mainly experimental. We have thought it best to utilize a considerable number of species in small plots rather than a few in larger ones. In all about 100 species have been grown.

Success in all cases was neither anticipated nor realized, but in general the results have been beyond expectation. The accompanying plan (Fig. 1) shows the distribution of the principal plantations only for the current season (1922).

The immediate shade of the maples and elms has proved the most refractory ground. In spring Convallaria furnishes pleasant green and white covering for such soil. The rhizomes, which spread so rapidly through a more favorable soil, make but slow headway in the summer-hardened clay. The Composites make a good growth at first, but later become somewhat spindling, and flower heads do not develop well. Digitalis does well, when once established, but shows reluctance to flower. It is very difficult to germinate this seed even in hotbeds in our soil. Stramónium is good in sun, markedly less vigorous in shade. Even copious watering fails to mellow the soil sufficiently for Hydrastis, Ginseng, Pink Root, and Senega. Podophyllum and Sanguinaria do well in our type of shade, but naturally are plants which make all their visible growth early, and more or less disappear later. Our first planting of these species was apparently ruined by a heavy wind, but the rhizomes survived in the soil and made good growth the second year. Aconite and valerian did well the second season after a poor start the first year.

Indigenous perennial plants have been dug and transplanted by students from woods and fields. These have been planted, for the most part, in full sunlight. Best success has attended fall planting. Rumex and Lappa luxuriated in the unusual privilege of cultivation. *Verbascum thapsus*, another common weed, we found unexpectedly difficult to transplant in the spring; the leaves sometimes wilted and dried altogether, but in many cases a vigorous secondary growth took their place. Phytolacca made a handsome, rapid, hedge-like growth; though many roots, for some unknown reason, failed to survive the winter their places were taken quickly by seedlings. A plentiful second season appearance of Phytolacca seedlings in vacant spots and under shrubbery was no doubt due to birds.

Three species of Eupatorium—*perfoliatum*, *maculatum* and *purpureum*—showed need for wide spacing under cultivation. *Aralia racemosa* adapted itself readily to garden conditions, but several attempts to transplant *A. nudicaulis* failed, possibly because the spreading, sparsely rooted rhizomes were moved during the growing season instead of in the autumn. *Apocynum cannabinum* made a fair growth.

Many of the Labiatae, especially those normally grown from rhizome-cuttings, have succeeded well. Their stony nutlets, however, germinated with considerable difficulty. Catnep quite failed to appear in the season of its sowing, but came up luxuriously twelve months later when the space had been assigned to something else. This species transplants poorly. Hedeoma, Lavandula and Thymus also failed almost wholly to germinate. Possibly hot water or acid treatment of these resistant seeds might stimulate them to action. *Satureja hortensis* and *Ocimum basilicum*, on the contrary, germinated especially well. The latter, a handsome and not commonly seen plant, is deserving of a place in every medicinal garden.

Of the true mints, *Mentha piperita, M. spicata, and M. citrata* have done fairly well in a soil composed chiefly of coal ashes and clay. Growth in late summer, especially during drouth, tends to become wiry and small-leaved. *Mentha cana-*

*densis*, a wild mint with a pennyroyal-like odor, was brought from a New England brook to our semi-arid waste with unexpected success.

*Collinsonia canadensis*, largest of our common Labiates, transplants well. *Melissa officinalis* seems to rank next to the true mints for rapidity of propagation by artificial division; it does not stool out rapidity like the Menthas, but cuttings take root with very little encouragement.

Among medicinal shrubs we have confined our attention thus far chiefly to the genus Rhamnus. A hedge of *R. frangula* 160 feet long borders the south side of the pharmaceutical garden. This was purchased from a supposedly reputable nursery firm as *R. Purshiana*. The buckthorn, now in its second year, is growing vigorously. A smaller plantation of *R. cathartica* has proved less well suited to our environment. A few specimens of *R. Purshiana* obtained this year promise well. Our plans call for a considerable extension of the shrubbery plantation, with special attention to the native flora.

Among non-flowering plants we have transplanted *Dryopteris marginalis*, normally a species of semi-arid habit, with fair success. *Osmunda cinnamonea* and *O. claytoniana* proved to require more moisture in the soil.

Any reminiscence on the growing of medicinal plants would hardly be complete without a brief mention of our impatient competitor in the harvest—the insect. It is no new thing to center a discussion of insect damage about that important medicinal plant—the henbane. Job had his troubles, but he never tried to grow henbane. Flea-beetles reported for action on germination of seed. Aphids swarmed on the under surfaces of the low-growing hairy leaves to such an extent that it was almost impossible to reach them with nicotine sulphate. Regiments of potato beetles, old-fashioned, new-fashioned, and specially fashioned, throve in hearty, happy symbiosis despite hand picking and arsenicals. Final cohorts of destruction arrived in the shape of the hornworm—a voracious solanaceous plant pest that seems to require only twenty-four hours from the egg to convert a full-sized Hyoscyamus plant to a crawling mass of greenness as large as a man's finger. Southern tobacco planters have an iron-handed way of disposing of this succulent pest—a gentle snap of the fingers, and the hornworm dissolves, so to speak. The pharmacy student, especially in the feminine, lacks the ambition to master the technique of this operation—especially when the instructor refuses to provide a demonstration.

Other solanaceous plants, Stramonium and Belladonna, are much less apt, apparently, to be severely injured by insects. Stramonium is much punctured by flea-beetles, but grows too fast to be greatly damaged. Even the hornworm appears to meet his match in the Daturas.

Three species of Iris—*I. germanica, I. fllorentina*, and *I. versicolor*—have been most disastrously attacked by the larva of an insect which our state entomologist, to our consternation, gravely suspected of being the European Corn-Borer. It proved, fortunately, to be a less omnivorous insect, probably a species of *Macronostua*, which feeds frequently on the Iris and related species. According to the Bureau of Entomology, this insect rarely causes severe damage; it must have found our locality an unusually suitable habitat. Perhaps our dry soil and shade conditions may account for its unusual ravages here.

Plant-lice, besides damaging the henbane, have been particularly abundant on the flowering stalks of Valeriana, and on many of the Composites. On some of these, as the burdock, little real damage was noted—it takes a good deal to damage a burdock—but Carthamus, for instance, was distorted almost beyond recognition, and quite failed to produce well-formed flowers. This species, by the way, was purchased from a seedsman as "Saffron," but the akenes which fell out of the opened envelope were a sufficient demonstration of the substitution.

While on the subject of Composites it may here be noted that *Grindelia squarrosa*, of a genus usually listed as perennials, appears here to be a biennial only.

The pathology of drug plants, for the most part little studied, is full of absorbing problems, and our limited area and limited experience have presented several. Our first-year henbane, surviving heroically the onslaughts of the insects, succumbed ignominiously to what appeared to be a mosaic disease. The extensive studies which have been elsewhere made on the solanaceous mosaics have not, so far as we have noted, reported it on this plant, and correspondence with the Bureau of Plant Industry has not revealed previous record of it. Tobacco growing near-by showed mosaic, and it is not impossible that the infective agent may have been transferred by aphids, some species of which have proved capable of transmitting similar diseases. A second-year planting of henbane on the same spot, for the purpose of studying this disease further, was quite exterminated by insects. Mosaic, however, appeared on Daturas in another plot, and caused considerable injury. If the disease appeared in the previous plantings of these species, it escaped our notice. Investigations of the alkaloidal characteristics of infected leaves have proved of considerable interest, and will be reported in another paper.

From a monetary point of view, of course, such a plantation as ours cannot maintain itself, but, from that point of view, neither can a university! It may be said, however, that many of our small-scale products have found a use in the assaying and dispensing laboratories of the school, in our hospital practice, and are serving as a basis for several more purely scientific studies.

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## SOLUBILITY OF VOLATILE OILS IN AQUEOUS MEDIA.

BY SIMON MENDELSOHN, PH.C., F.A.I.C., CINCINNATI, OHIO.

The experimental data recorded in this publication were obtained from investigations concerning the solubility of certain volatile oils in aqueous solution, with particular reference to the medicated waters of the Pharmacopœia.

The official type process for the preparation of aromatic waters[1] consists essentially of the three following consecutive operations briefly enumerated:

(1) Trituration of the oil with talcum.

(2) Addition of water with continued trituration.

(3) Filtration.

Digression from the official method relative to the empirical selection of the requisite absorptive media, is provisionally conceded upon conformity of the finished preparation with the authoritative requirements.

The descent of a solvent through the oil-impregnated absorptive during filtration, presents the fundamental aspects commonly involved in the extraction (washing) of a partially soluble precipitate. The amount of oil remaining in the

[1] United States Pharmacopœia, Rev. IX, page 60.