had previously been made in this laboratory when glucose was used to furnish the aldehyde group instead of Denigès reagent. All of the amino acids tested (approximately 15) formed fluorescing substances when mixed with glucose and autoclaved at 125° C for 1 hr.

The experiments described in this paper were conducted to determine whether a relationship exists between the degree of browning, the production of fluorescing substances, changes in amino nitrogen, and the ability of methionine autoclaved in the presence and absence of glucose to support growth of a methionineless mutant of *Neurospora crassa* No. 38706.

The methionine used in these experiments was treated as indicated in footnotes to Table 1. These differently treated samples of methionine were appropriately diluted for the determination of optical density or brown color concentration, fluorescence, amino nitrogen, and methionine content as evidenced by the ability of the material to support growth of *Neurospora crassa* No. 38706.[3] The results obtained are summarized in Table 1. From these data, it is evident that brown color formation, fluorescence, and decreased amino nitrogen are associated with destruction of methionine brought about by autoclaving in the presence of glucose, but in the absence of an excessive amount of water. Under the experimental conditions in this laboratory, autoclaving methionine in an 8% solution of glucose failed to bring about any marked destruction or changes in brown color, fluorescence, and amino nitrogen.

The data clearly show the important influence of water on the destruction of methionine autoclaved in the presence of glucose, on the loss of amino nitrogen, and on the formation of brown color and fluorescing substances.

[3] Samples were diluted in 0.1 M phosphate solution pH 4.8. Fluorescence was determined in the Coleman Photofluorometer, using the B_1 filter. The instrument was standardized at 100 with quinine sulfate solution (0.1 mg/l 0.1 N H_2SO_4). Brown color was measured as optical density of the phosphate solution at 380 mμ in the Coleman Universal Spectrophotometer. Amino nitrogen was determined by the method of Van Slyke (*9*). The methionine assay was conducted as outlined by Horowitz (*3*).

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Comments and Communications

Characteristics of Some Disease-free Ornamental Plants

Modern medicine has learned that people in good health are worth study. It may be hoped, then, that plant pathologists will learn to give special consideration to those plants which have few diseases or pests. As a step in this direction, information has been assembled in this paper regarding a considerable group of ornamental plants in which, in the eastern United States at least, no important diseases or pests are known.

Dodge and Rickett include in *Diseases and pests of ornamental plants* (1943) the names of approximately 75 plants which are practically disease-free. This is almost unique in such a book. In the introduction, the scope and purpose of the authors are carefully defined. "We have tried to select those [diseases and pests] which have been most injurious in the eastern United States; most of these are also the most troublesome in other parts of the country and of the world. . . . Our selection of cultivated plants is based upon the 3,000 species and varieties grown at the New York Botanical Garden." The book thus serves admirably as a check list of diseases and insect pests of ornamental plants in the northeastern United States; over 500 genera are included.

In studying 75 disease-free plants, answers to three questions were sought. What are their characteristics? What, if any, characteristics do they have in common? Is it possible that these common characteristics have any bearing on their disease-free status in the eastern United States? (Much of the work of compiling the information on which this paper is based was done by members of a class in the epidemiology of plant diseases.)

The plants are not taxonomically related. They are scattered through 38 families; the largest number in any one family being nine in the Compositae. They show diverse growth habits. There is one tree (Ginkgo), one woody vine (Wisteria), eight shrubs, and the rest are herbs. The plants which have no important diseases or insect pests are predominantly seed-propagated and are either annuals or very short-lived. Only one is reproduced by bulbs, 17 are reproduced chiefly by division; the rest either may be, or must be, grown from seed.

They are also predominantly of foreign origin. Only 15 (20%) seem to be natives of the continental United States. Eurasia has furnished 33; others come from Africa, Australia, South America, and various tropical localities. An introduced plant (all but 15 of these 75 plants were introduced into the United States) which has been brought in as seed may well have left its native parasites behind, to its own great advantage. (Bailey, L. H. *Trans. Ind. Hort. Soc.*, 1892, p. 62. See also *The survival of the unlike*, 2nd Ed. New York: Macmillan, 1897, p. 180. Stevens, N. E. *J. Amer. Soc. Agron.* and several papers cited therein, 1948, 40, 841). Many of these plants have no near relatives in the region. Actually more than half (43) of the genera are not mentioned in standard floras of the northeastern United States as either native or established. Finally, all are of minor commercial importance. Many are actually rare: their names are listed in catalogs of dealers in rare seeds. None of them is found growing in large acreages. Indeed, among them are many plants used in rock gardens and borders.

A study of these facts leads to the conclusion that many of these plants may well be escaping disease and insect pests because of the way in which they are now grown, rather than because they are actually immune or even resistant. The very fact that these plants are of minor commercial importance and are usually grown in very small groups is a great safeguard. A mutant strain of a fungus, for example, which was seriously pathogenic on a plant or clump of Anoda, an annual so rare as not to be mentioned in Bailey's *Cyclopedia of horticulture,* might well kill its available hosts, produce spores, and itself die out without any viable spores ever reaching another plant of Anoda. Nowhere would a new mutant fungus find large areas of any of these plants on which it might produce the abundant inoculum so essential to the initiation of a great epidemic. Many of these plants are further isolated because they are predominantly grown in cities.

The circumstance that many of these plants have no near relatives among wild plants of the region affords further protection. It is undoubtedly true that some pathogens, particularly some viruses, and such fungi as *Botrytis cinerea* have a wide range among unrelated green plants. It is also true that serious diseases or insect pests of cultivated plants are more likely to come from closely related plants. Slightly more than 100 genera were reported as having no fungi of importance, and the average number of insects was less than one (0.4). On more than 100 genera only one fungus of importance was reported, and there was an average of less than one insect per genus (0.7). Almost 100 genera had two important fungus pathogens, and the average number of insects was almost exactly one. In two groups of 54 genera, 3 and 4 fungi respectively were reported, while the average numbers of insects for these categories were 1 and 2. On only 23 genera were there 5 important fungus pathogens reported and these had an average of 3 insect pests. The 15 genera which had 6 fungi had an average of 3.5 insect pests. On the small groups having 7, 8, and 9 fungi, the average numbers of insects found were 6.0, 7.2, and 6.8 respectively. For the few genera of ornamental plants which had from 10 to 20 fungi, the number of insects ranged from 6 to 13. This gives a correlation of 0.8–0.06. It seems probable that the same qualities in a host which favor parasitism by various fungi also favor parasitism by various insects.

Since the number of insects jumped rather sharply in the group of hosts with 7 important fungi, those plants which had 7 or more fungus pathogens with an average of 6 or more insect pests were classed together as a group in which pathogens might well be considered important. Exactly 40 genera were found to belong in this class.

In one respect only do the ornamental plants on which occur numerous pathogens resemble the disease-free group with which they are here being compared. These plants also are widely scattered taxonomically. Twenty-eight plant families are represented; the largest number of genera in a single family being four each in the Ranunculaceae and Compositae.

In this group also there is a diversity of growth habits, but with a decided difference in distribution. Nine genera, almost one-fourth, are trees as against one in the disease-free group. Shade trees are in general exposed to attacks of fungi and insects more than most ornamental plants, since they remain for many years in one place. Many are very large and receive only a minimum of protective treatments. Woody vines are represented by one genus or two closely related genera. Five genera are wholly or chiefly shrubs and the rest are herbs.

Vegetative reproduction is relatively much more common in this group. Of the 31 herbaceous genera, 7 are propagated by bulbs, and 8 more by rooted cuttings, division, or other vegetative means, the rest by seeds.

Again in contrast to the disease-free group, of which only 15 (20%) appear to be native to the continental United States, 24 or well over half of the genera with many diseases and pests, are native, and 5 more are well established in the area we are considering. The imported plants come from Eurasia, the Orient, the Mediterranean region, the tropics, and South Africa.

The greatest contrast between these two groups, however, is in the abundance—that is, number of individual plants—in most of the genera represented in this disease-susceptible group. Such trees as elm and oak, for example, are among our commonest shade and forest trees. Greater abundance resulting from intensive cultivation is clearly indicated by the commercial importance of many of the shrubby and herbaceous genera.

Stated in another way the material summarized in this communication emphasizes the disease hazards resulting from growing perennial plants as compared to annuals, and from growing large concentrated masses of the same kind of plant—especially if vegetatively propagated. These hazards are of course characteristic of much of present day fruit culture and floriculture. In raising rare, imported plants, these hazards are avoided, especially when plants are grown from seed.

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