Studies concerning mosaic diseases

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by

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SCOPE OF THE STUDIES

In view of the importance of the pathological histology in mosaic diseases and because of the fact that in no publication to date is there any correlation of the histology in this group, the present writer has accumulated evidence regarding the histological characteristics of diseased plants from as wide a field as possible.

To do this many thousands of plants have been examined and studies have been made of hundreds of sections, both freehand and microtome. No statements are made as to technique in staining, etc., except where other than ordinary procedure was followed.

During the course of the studies further evidences of aphid inoculation were obtained, new mosaic diseases discovered or differentiated and inheritance of mosaic through seed determined, and these facts are incorporated in the paper.

In addition the experiments of Lodewijks concerning the relation of colored light to mosaic were repeated under more exact conditions and furthermore preliminary tests were made to determine the effect of light on the expressed juices of diseased plants. Actually the problem of the relation of light to diseased plants and to the "virus" involves an extended series of physiological studies beyond the scope of the present paper.
INTRODUCTION

During the development of phytopathology marked advances have been made as a result of the study of great groups of diseases, such as for instance those caused by bacteria. Investigators are now faced with a group of baffling diseases of profound interest and rapidly growing economic importance collectively known as “mosaic diseases” and it is within the realm of probability that the determination of the etiology in this group will bring about a similar advance.

The name has arisen from a tobacco disease, which, according to Hunger, was first described by Sweiten in 1857, and named by Adolp Mayer in 1886 “Mosaikkrankheit”. In naming it, however, Mayer did not clearly distinguish between “mosaic” proper and another disease known as “Pockenkrankheit”. Nevertheless, to Mayer must be ascribed the origin of the name. “Mosaic” is now generally used as the name for those diseases of unknown etiology in which two characteristic symptoms occur. The first is a mottling, unlike variegation or a chimera, due to modifications in the structure and coloration of the chlorenchyma of certain leaf areas. The second is the infectious nature of the sap from diseased plants, even after filtration, although in this sap no mosaic disease-producing organisms have yet been demonstrated.

The term “infectious” is here meant to cover not only natural and artificial transmission of the disease from plant to plant but systemic transmission in the plant.

The work of Jodidi et al. (75) would seem to point to a third characteristic, biochemical in nature, since these investigators find that in certain mosaic diseases denitrification takes place whereby nitrates are reduced to nitrites which bring about elimination of nitrogen in free state. Until results from other mosaic diseases corroborate these findings this possible characteristic is merely noted.

Within recent years mosaic has been found in many plants other than tobacco as the following list will show.
Solanaceae


According to Nishimura (100) Physalis Alkekengi does not show symptoms of mosaic but is nevertheless an efficient “carrier”.

All attempts by the writer to infect Solanum Melongena, Atropa belladonna, Lycium vulgare and Salpiglossis sinuata have so far failed but Melhus (97) finds that with S. Melongena the symptoms are masked after the seedling stage.

Cucurbitaceae


The last five proved susceptible (48) upon artificial inoculation. Micrampelis (Echinocystis) lobata is common as a wild plant and Doolittle (48) correlates the prevalence of mosaic in cultivated Cucurbitaceae with occurrence of diseased wild cucumber in the same locality.

Gramineae

Saccharum officinarum, Zea Mays, Sorghum vulgare, Panicum dichotomiflorum, Syntherisma sanguinalis, Chatochloa lutescens, Panicum miliaceum.

Leguminoseae

Lathyrus odoratus, Vicia faba, Trifolium pratense, T. hybridum, T. repens, T. incarnatum, Melilotus alba, M. officinalis, Med-
cago lupulina, M. arabica, Phaseolus vulgaris, P. lunatus, P. lunatus macrocarpus, P. acutifolius latifolius, Arachis hypogaea, Pisum sativum, Soja max.

**Rosaceae**

.. *Rubus strigosus*, and cultivated varieties of raspberry, especially Cuthbert and Marlboro.

**Asclepiadaceae**

*Asclepias syriaca.*

**Phytolaccaceae**

*Phytolacca decandra.*

**Anacardiaceae**

*Rhus typhina.*

**Lauraceae**

*Persia gratissima.*

**Convolvulaceae**

*Ipomoea Batatas.*

**Pedaliaceae**

*Martynia louisiana.*

**Lobeliaceae**

*Lobelia erinus var gracilis.*

**Chenopodiaceae**

*Beta vulgaris.*

*Spinacia oleracea.*

— 9 —
Lind (81) states that beet mosaic causes serious losses in the seed crop but that it is never found in sugar beets. It occurs in Denmark chiefly.

Robbins (112), however, describes a mosaic of sugar beet, previously announced by Townsend (149), in which phloem necrosis occurs and in which affected leaves are abnormally thick and brittle with a constant abnormal accumulation of starch. Although the writer has not seen any of this material, the fact that phloem necrosis and abnormal starch accumulation are characteristic symptoms points to it being rather a type of "Curly top" than mosaic.

**AMARANTACEAE**

*Amaranthus retroflexus*. It is stated by Doolittle that there is evidence that *A. retroflexus* is susceptible to cucurbit mosaic.

**CRUCIFERAE**

*Brassica pekinensis, B. japonica, B. rapa.*

**CICHORIACEAE**

*Lactuca sativa*. (Boston Head and Paris White Cos).

**AMBROSIACEAE**

*Ambrosia trifida.*

**COMPOSITAE**

*Helianthus debilis.*

**AMARYLLIDACEAE**

*Hippeastrum equestre.*

**SCITAMINACEAE**

*Canna indica, Musa Cavendishii.*

**COMMELINACEAE**

*Commelina nudiflora.*