2.9 Mosaic disease of Tobacco :

A. OCCURRENCE AND IMPORTANCE—Tobacco mosaic is cosmopolitan in distribution. This disease causes serious losses on tobacco, tomato and some other crop plants.

Tobacco mosaic affects plants by dwarfing of the plant and by damaging the leaves, flowers and fruits, but this disease never kills plants. In tobacco, this disease lowers the quantity and quality of the crop.

B. SYMPTOMS—The symptoms of tobacoo mosaic virus-infected plants vary with the virus strain, age and vigour of the plant at the time of inoculation and the nutrition, temperature, light factors etc. after infection. In general, the symptoms consists of various degrees of chlorosis, curling, dwarfing, mottling, distortion and blistering of the leaves ; dwarfing, distortion and discolouration of flowers and dwarfing of the entire plant.

The appearance of mottled dark green and light green areas on leaves after inoculation is the most common symptom on tobacco plant. The

dark green areas are thicker and appear somewhat elevated in a blister-like structure over the thinner, chlorotic, light green areas presenting a mosaic pattern. Dwarfing of young plants is also common—this is accompanied

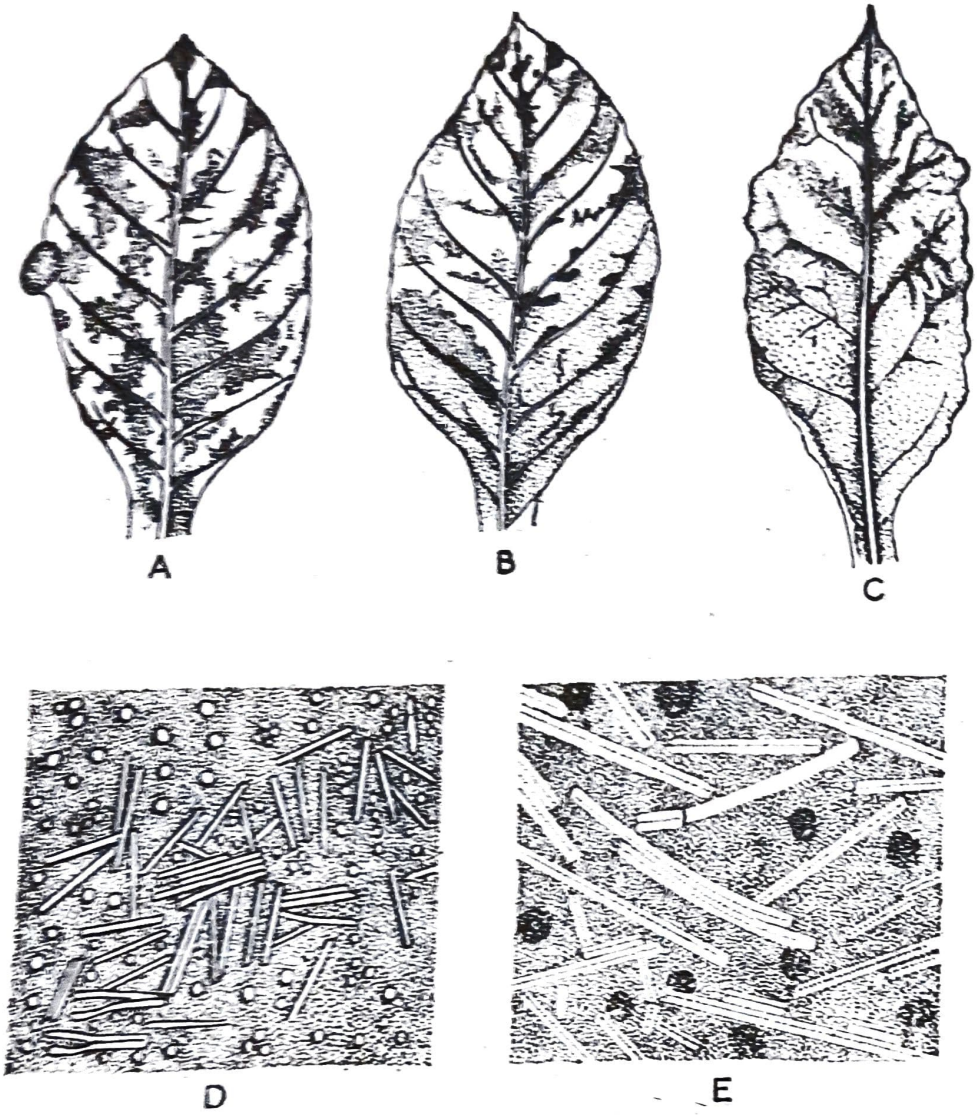

Fig. 2.10—Tobacco mosaic virus. A—C, symptoms on tobacco leaves. D—E, TMV particles in different shades.

by a slight downward curling and distortion of the leaves—leaves may also become narrow and elongated rather than the normal oval-shaped structure.

C. THE CAUSAL ORGANISM—A type of plant virus, e.g. Tobacco mosaic virus (TMV)—(*Nicotiana* virus I).

D. ETIOLOGY OF THE PATHOGEN—It is a rod-shaped plant virus and is 300 mμ long and 15 mμ in diameter. Its protein core consists of approximately 2130 protein sub-units (capsomeres) and each sub-unit consists of 158 amino acids. The protein sub-units are arranged in a helix. The TMV nucleic acid is a single-stranded ribonucleic acid (RNA) and it consists of approximately 6400 nucleotides. The RNA strand also forms a helix which is parallel to that of the protein and is located on the protein sub-units at a radius of 40 Å.

TMV is one of the most thermostable viruses known, thermal inactivation point of the virus in non-diluted plant sap being 93°C. In dried infected leaves, the TMV virus however retains its infectivity even when heated at 120°C for half an hour, and at dilutions of 1 : 1,000,000. TMV-infected tobacco plants may contain upto 4 gm of virus per litre of plant sap. The virus is inactivated in 4-6 weeks in ordinary i.e. non-sterile plant sap; but in bacteria-free sap the virus may survive for 5 years; again

the virus may remain infectious for more than fifty years in TMV-infected leaves kept dry in the laboratory. TMV is transmitted readily through sap, grafting and dodder—the most common means of transmission of TMV in the field is through the hands of workers handling infected and healthy leaves indiscriminately. TMV exists in various strains which differ from each other in one or more characteristics and form the so-called common TMV strain. The most important TMV strains (other than the common) include the tobacco-distorting strain, ringspot strain, ribgrass strain, tomato strain; tomato streak strain etc.

E. DISEASE CYCLE—TMV particles overwinters in infected tobacco stalks and leaves incorporated in the soil, on the surface of contaminated tobacco seeds and seedbed cloth, and in natural leaf and manufactured tobacco products (cigars, cigarettes, snuff etc.). Initial infections of a few plants take place when the virus comes in contact with wounded tissues of tobacco seedlings in the seedbed or of transplants in the fields—subsequently these serve as a source of inoculum for further spread of the virus to more plants through contaminated hands, tools or equipment during handling of tobacco plants in the cultural practices with that crop.

In all varieties of the common tobacco, the TMV produces systemic infections invading all parenchymatous cells of the host plant; the virus moves from cell to cell through the plasmodesmata and through the phloem. Within the host cell, TMV occurs mainly in the cytoplasm as individual particles, as semicrystalline or crystaline aggregates and as amorphous bodies (X-bodies), ranging in size from sub-microscopic to those seen with the light microscope. Sometimes this virus is also found in the nucleus, chloroplasts and in the vacuoles of the cell.

F. CONTROL—Use of resistant varieties and sanitation practice are the two main means of control of TMV in tobacco fields or green houses.

(1) Several TMV-resistant varieties of tobacco have been raised by crossing susceptible varieties with *Nicotiana glutinosa*—in this the virus causes necrotic lesions rather than systemic infection. Crossing with resistant varieties usually produces hybrids in which the TMV symptoms are either absent or very mild.

(2) Spraying the plants with milk (either whole or skim milk) before transplanting or handling them inhibits the TMV infection—dipping the hands in milk during transplanting and handling plants also reduces the spread of tobacco mosaic virus from plant to plant.

(3) Removal of infected plants and of some solanaceous weeds that shelter the virus often also reduces or eliminates the subsequent spread of the virus to other plants during various cultural practices. Tobacco should not be grown for at least two years in soils where a diseased crop was grown. The chewing and smoking of tobacco during cultural practices requiring handling of tobacco and other susceptible plants should be avoided.