

ABSTRACT

Effects of Particulate Pollutants on the Growth and Physiology of Calaloo (Amaranthus dubius Mart.) and Bean (Phaseolus vulgaris L.) Plants

ANUPMA DIXIT

This dissertation investigates comparatively the effects of cement, a well known particulate pollutant ; bauxite, a mined Ore in Jamaican countryside and talc, an inert material used commercially as a pesticide carrier on Calaloo(Amaranthus dubius Mart.) and Bean or Red Peas (Phaseolus vulgaris L.).

Plants were artificially dusted using dust levels occurring on natural vegetation near the pollution sources in Jamaica. A detailed investigation of the internal structure of the leaves was performed both at the light and the transmission electron microscopic levels. Naturally senescing bean leaves were also examined to provide a comparison with the effects of dusts on healthy leaves. Leaf surfaces were studied with scanning electron microscope to observe the distribution of the dust particles and their effects on the surfaces. The effects of dusts on major physiological processes, viz., photosynthesis, respiration and transpiration as well as on the overall growth and yield were studied.

Visual and microscopic examinations revealed that talc caused no injuries to either plant. Bauxite and cement dusts caused injuries; e.g., chlorosis in bean by bauxite, chlorosis, necrosis and epidermal collapse in both plants by cement, and ultrastructural alterations of varying extent in both calaloo and bean. Wound repair and / or defense mechanisms which were activated in plants were not completely effective and eventually gave in to premature senescence.

Very little evidence was found for partial or complete occlusion of the stomata by the dusts. Net photosynthesis, dark respiration and gross photosynthesis were decreased by the three dusts in both plants. Transpiration under different water regimes was reduced by talc and cement but was increased by bauxite. Leaf temperatures were decreased by talc and increased by bauxite. Temperature changes because of cement dust were negligible. These dusts adversely affected the growth and yield of both plants.

In general, the effects of dusts were more pronounced in bean than in calaloo.