VESICULAR ARBUSCULAR MYCORRHIZAE IN TWO CURCUMA SPECIES OF MEDICINAL IMPORTANCE

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ABSTRACT

Two plants of medicinal importance viz. Kachoor (*Curcuma zodoaria* Roseoe) and Haldi (*C. longa* L.) were examined for the presence of Vesicular Arbuscular Mycorrhizae. Not only were VA mycorrhizae recorded in the roots but also in other portions such as scales on the rhizomes and epidermis of the root tubers (so called Maju). Scales of Kachoor had many kinds of spores, majority of which were formed by a *Glomus* sp.

INTRODUCTION

Kachoor (*Curcuma zodoaria* Roscoe.) and Haldi, called turmeric in english (*C. longa* L.) are rhizomatous plants grown as early winter crops in the Indo-Pak sub-continent as well as in many tropical countries. Rhizomes of *C. zodoaria* are white to pale yellow with brownish scale-like leaves while those of *C. longa* are yellowish orange. Rhizomes which have a peculiar musky odour and bitter taste are considered of prime value as a spice and as a constituent of various medicines. Powdered turmeric is also applied on sprains and wounds for antiseptic purposes.

In the present study, the underground rhizomes, and the root-tubers (Maju) were found colonized with VA mycorrhizae. The same was also observed in rhizomes of some other economic plants (Taber & Trapper, 1982; Potty, 1985; Iqbal & Nasim, 1986a,b,c;Iqbal & Firdaus, 1987a,b,c; Nasim *et al.*, 1987; Nasim, 1990) but only a very few workers (Taber & Trappe,1982; Iqbal & Nasim, 1986a,b) have reported the occurrence of this relationship in medicinally important species.

MATERIALS AND METHODS

Collections were made from Changa Manga where these plants are grown as annual crops. Roots, scales and epidermes of rhizomes and root tubers were cleared in 10% KOH. The rhizomes and root tubers were cleared in 10% KOH. The cleared specimens were t hen stained, following the method of Phillips and Hayman (1970)s with some modification (Iqbal & Nasim, 1986a). Stained portions were mounted on a glass slide and examined microscopically for the occurrence of VAM infections.

RESULTS

Roots, root-tubers and rhizomatous stem portions of *C.zodoaria* were observed colonized with vesicular arbuscular mycorchizal infections. Roots had both vesicicles (plate 2,3,4,5) and arbuscules. Finely branched arbuscules were borne on a hyaline mycelium which stained darkly in cotton blue. Vesicle size was found variable (Plate 2,3,4)a. The scales on the underground rhizomes had very heavy vesic ular and spore infections (Plate 2,3).Spores probably belonged to some *Glomus* sp. (Plate 2,3). Countless spores were observed in a single field of microscope at low power (Plate 2). Vesicles in the scales sometimes attained very interesting shapes (Plate 3D,4D & 5B). Cells of scale-like leaves were often seen packed with very small lightly-stained vesicles, metamorphosing into spores (Plate 4D, 6A, 6B). *C.longa* had very different kind of infections and the endophyte-forming VAM was also very much different from *C.zodoaria.* The spores were smaller and in clusters.

DISCUSSION

Vesicular arbuscular mycorrhizae are much more widely distributed in the plant kingdom than it has been considered earlier (Iqbal & Nasim, 1986a,b,c). VAM has been recognized as a morphological category of plant-root fungus symbiosis(Nasim *et al.*, 1987). Through subsequent investigations VA mycorrhizal dependency of many plants has been proved in Phosphorus-deficient soils all over the world. However, the number of reports on the presence of VAM in portions other than roots is not very high (Bagyaraj *et al.*, 1985; Graw & Rhem, 1979; Park & Linderman, 1971; Taber & Trappe, 1982; Potty, 1985; Iqbal & Nasim, 1986a,b,c; Iqbal & Firdaus, 1987a,b,c). The occurrence of these associations in the portions, laden with medicinally important constituents, negate the hypothesis of Daft *et al.* (1981). They claimed that in *Endymion Monscriptus* (L.) Grake, VAM infections in the roots were always confined to the tissues growing in the soil and in the roots within the bulbs due to presence of certain alkaloids in dry pigmented outer sheathing leaves of the members of family Amaryllidaceae (Wood, 1967; Beijersberger & Lemmers, 1971).

The present study not only reports the occurrence of the VAM endophytes in underground modified stems but also their sporulation in the scales. Presence of the same kind of spores (Plate 1,2,3,4,5,6) throughout the scales of *C .zodoaria* and in *C.longa* (Plate 2,3,4,5.6) suggests that only very few endophytes may be able to resist the toxic principle in the rhizome and not all of them. These scales thus can

very effectively be employed in culturing those particular species of endophytes which are of usual occurrence in these scales and epidermes. VAM in root-tubers of Kachoor and Haldi are hither to being reported for the first time. (Plate 1).

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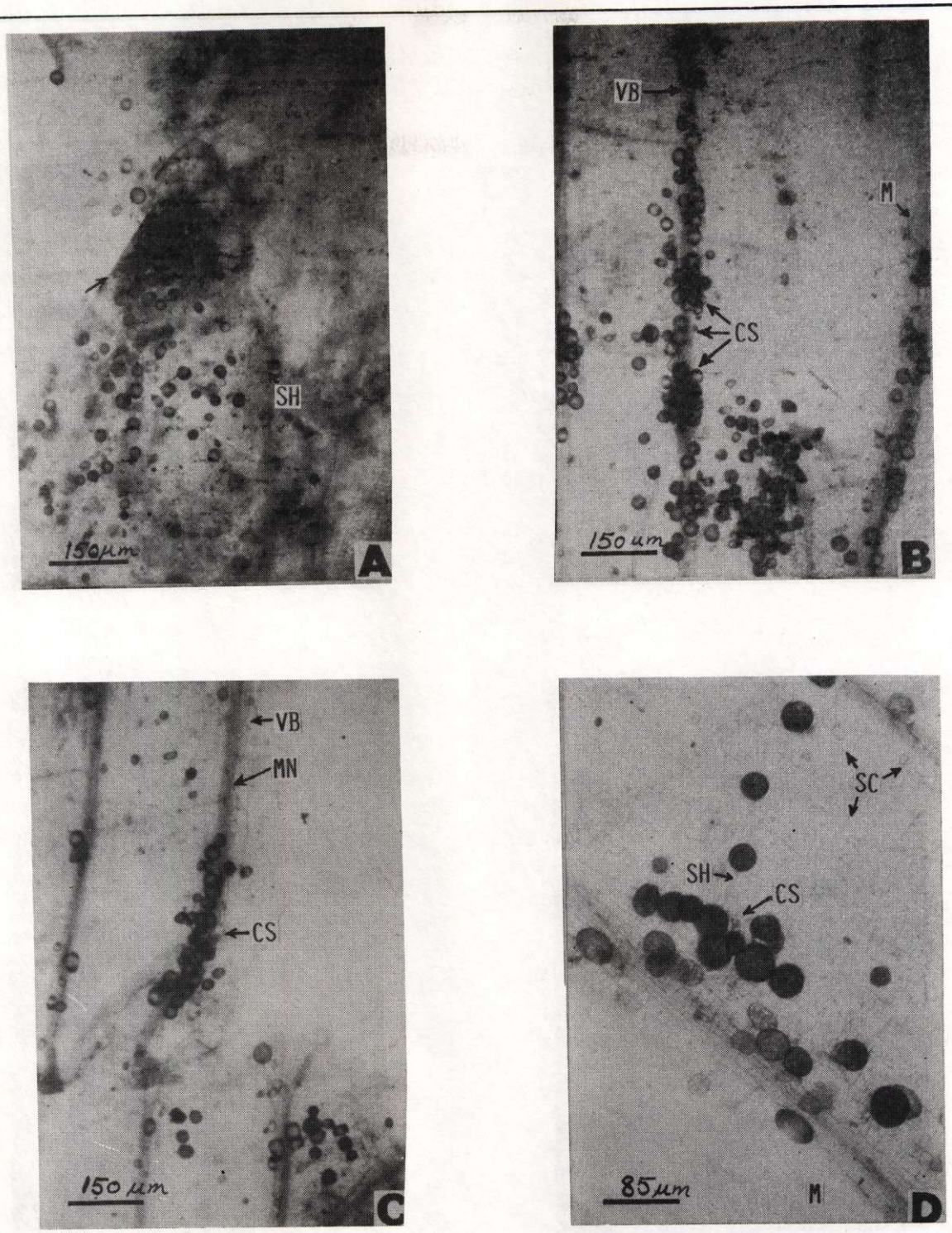


Plate 1: **A, B, C, D: Spores in the scale-like leaves of *Curcuma zodoaria*. CS = Cluster of Spores; M = Mycelium; MN = Mycelial Network; SC = Scale Cells; SH = Subtending Hypha; VB = Vascular Bundle.**

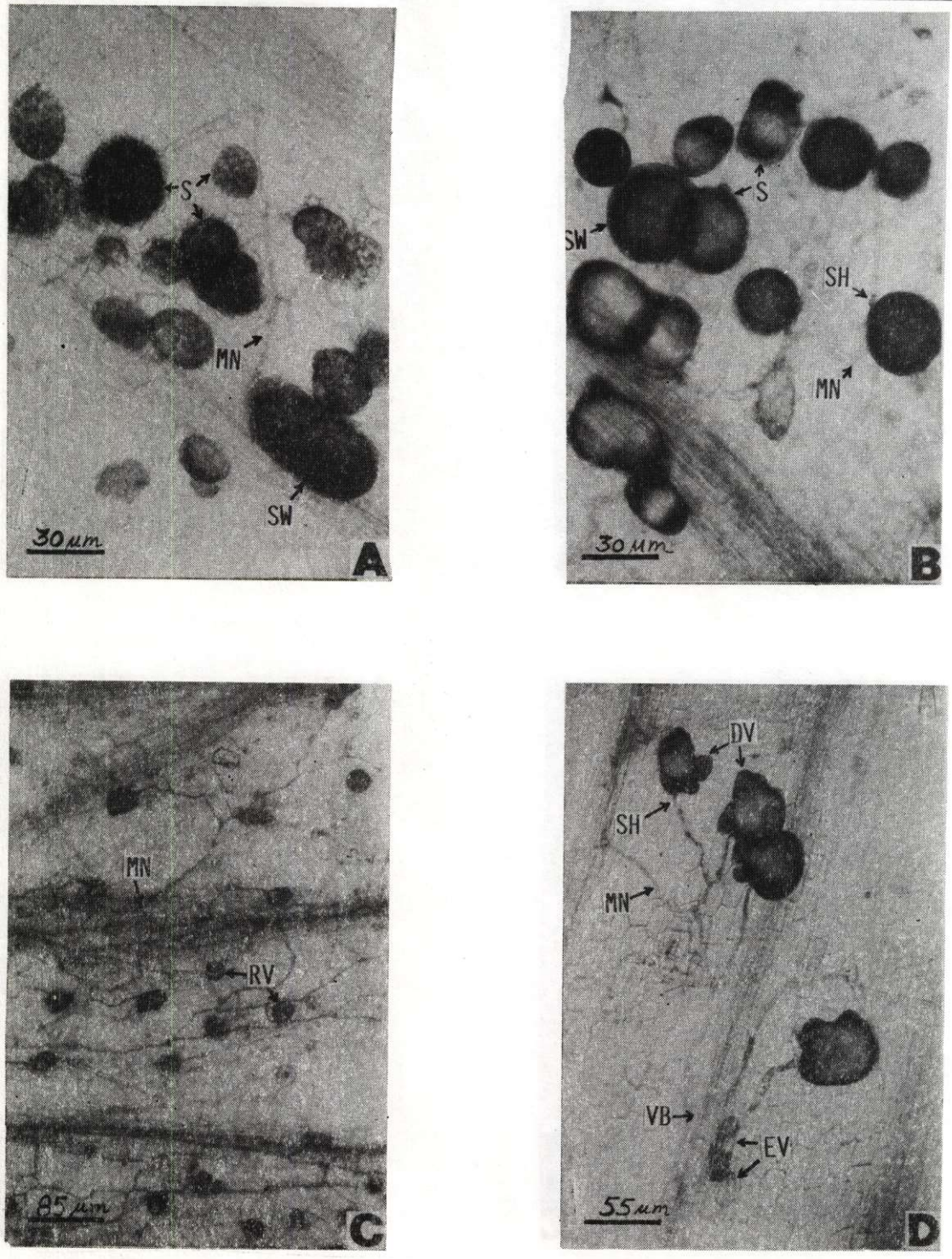


Plate 2: **A, B: Spores in the scale-like leaves of *Curcuma zodoaria* (Enlarged) C, D: Vesicles in the scale leaves of *C. longa*. DV = Deformed Vesicles; EV = Elongated Vesicles; S = Spores: SH = Subtending Hypha; SW = Spore Wall; VB = Vascular Bundle.**

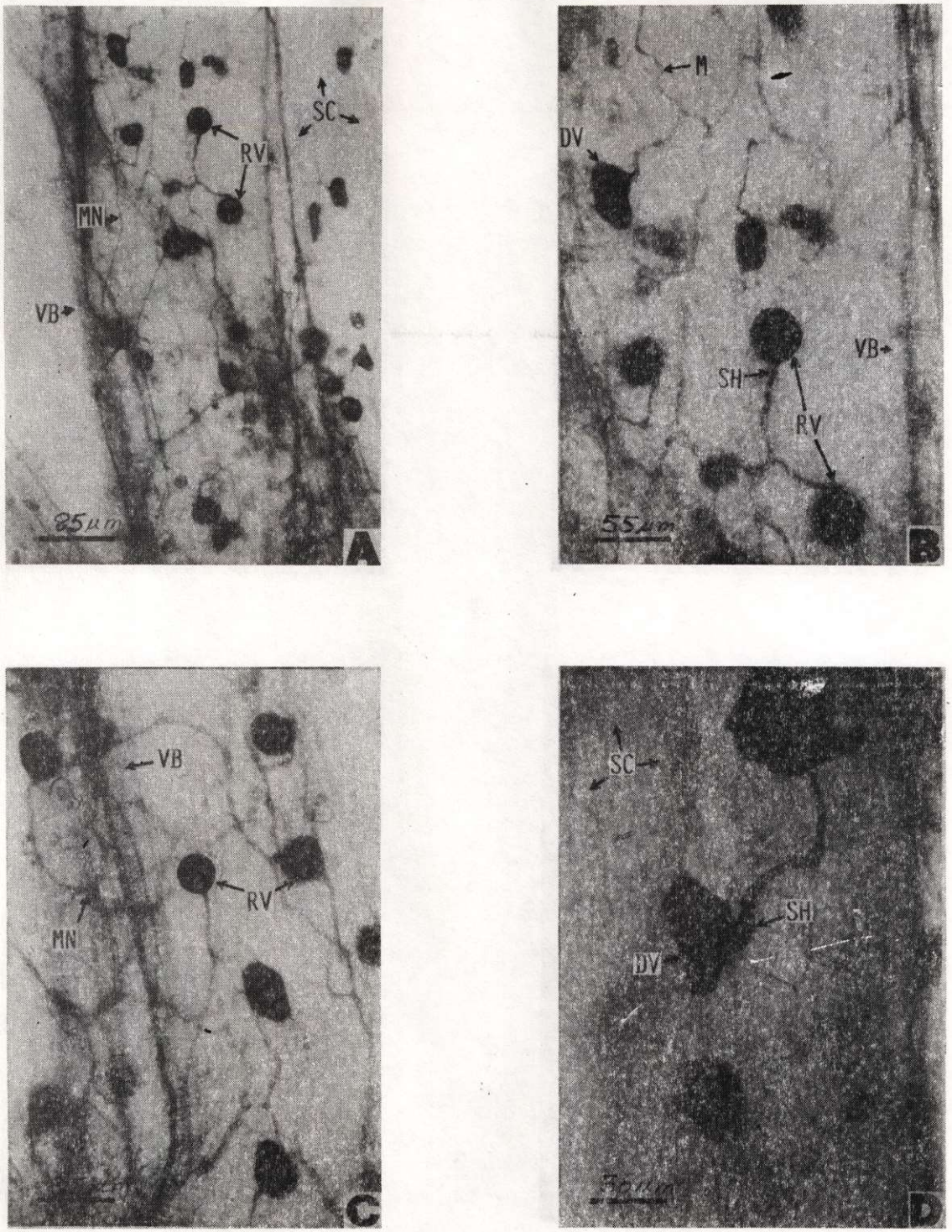


Plate 3: **A, B, C, D: Vesicles in the scale leaves of *Curcuma zodoaria*. DV = Deformed Vesicles; M = Mycelium; MN = Mycelial Network; RV = Rounded Vesicles; SC = Scale Cells; SH = Subtending Hypha; VB = Vascular Bundle.**

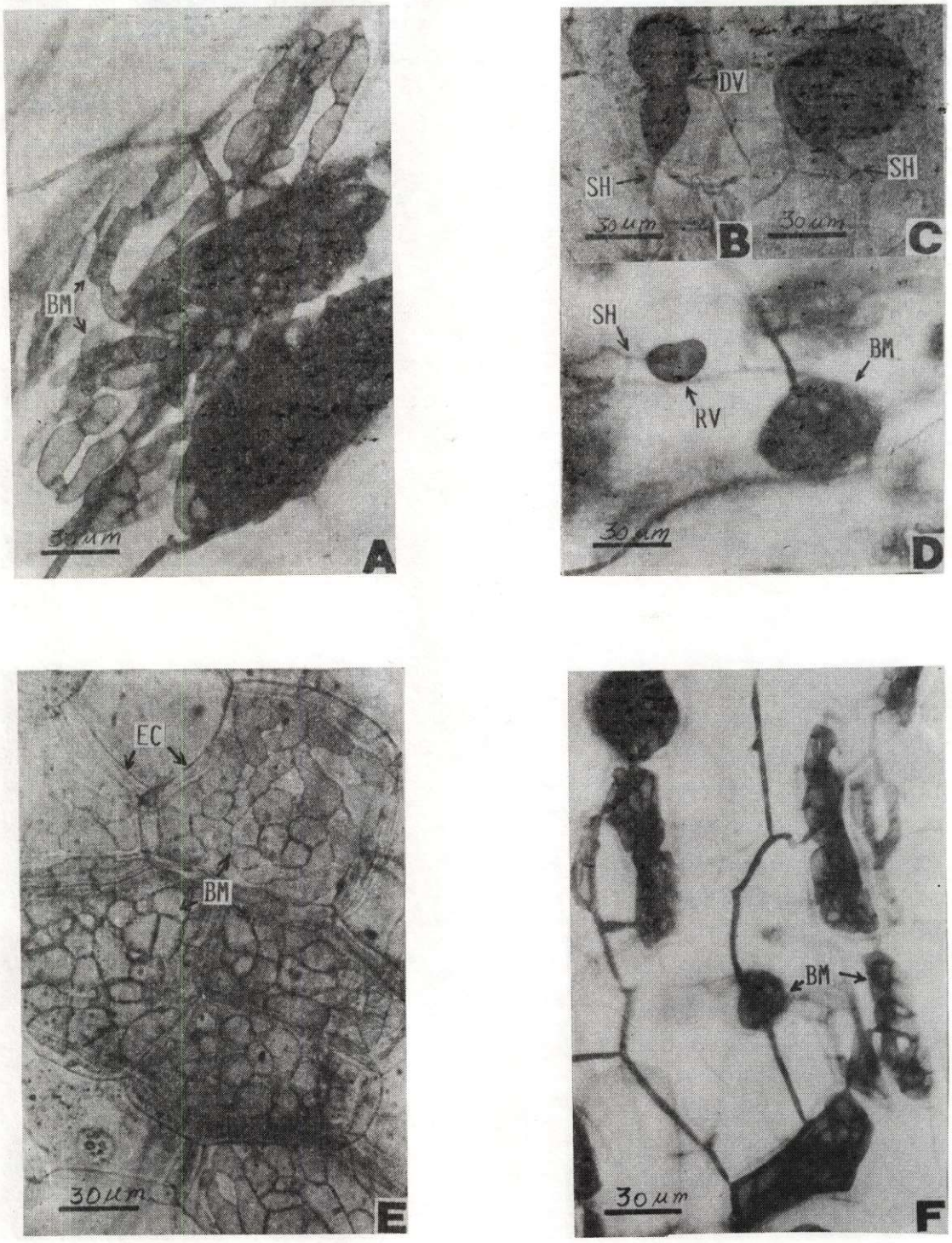
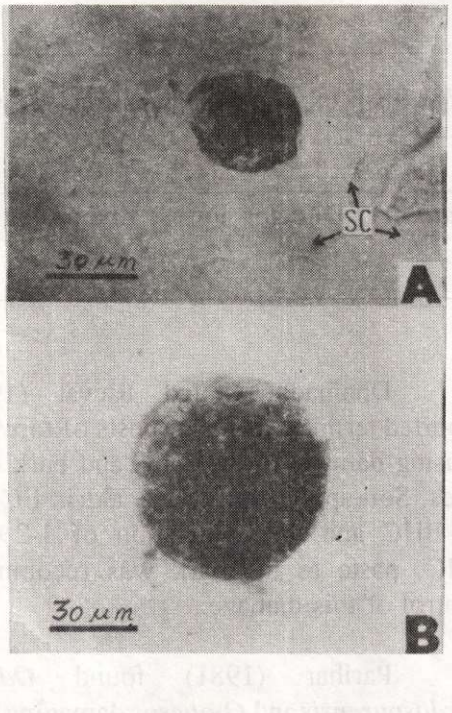
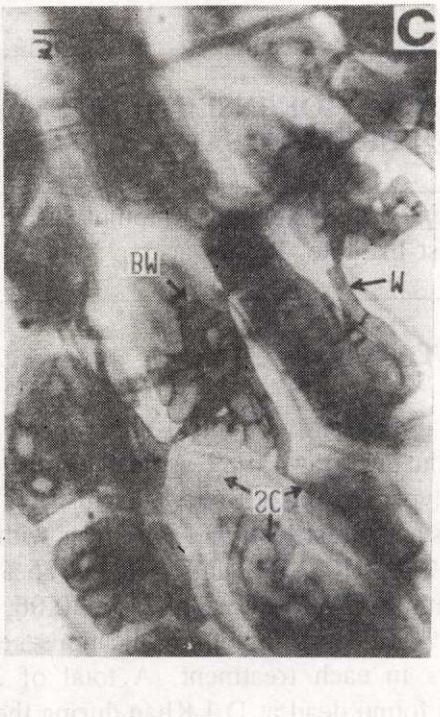
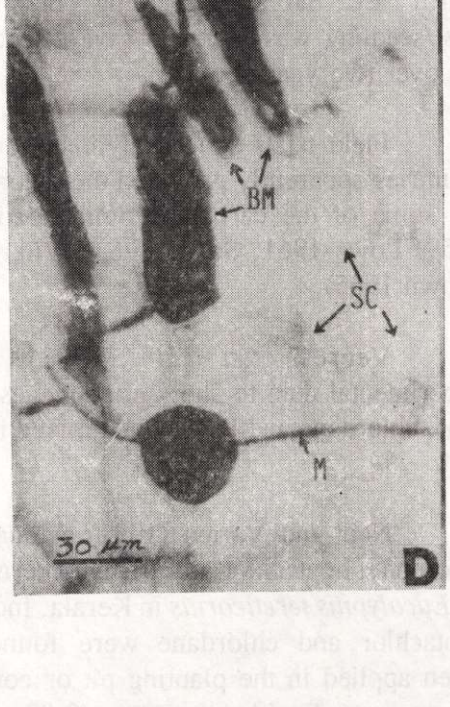


Plate 4: **A: Beaded Mycelium in the scale leaves of *Curcuma zodoaria*. B, C: Vesicles in the cells of Scale Leaves of *C. longa:* D:, Vesicles and Beaded Mycelium in the Scale Leaves of *C. longa;* E, F: Beaded Mycelium in the cells of scale leaves of *C. zodoaria;* BM = Beaded Mycelium; DV = Deformed Vesicles; EC = Epidermal Cell; SH = Subtending Hypha; RV = Rounded Vesicles.**







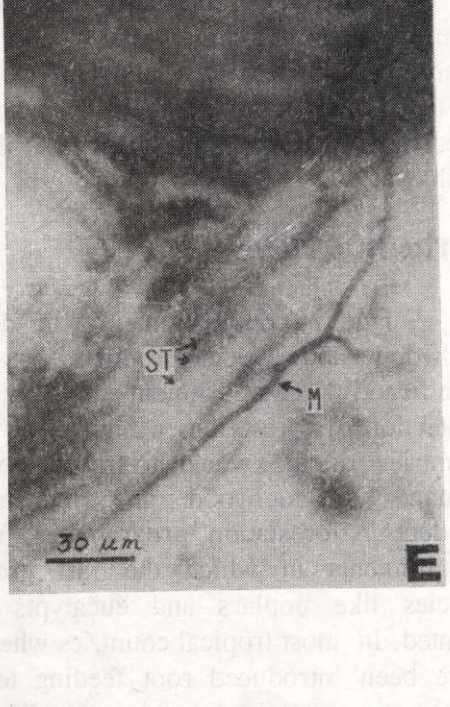


Plate 5: **A, B: Cells of Scale Leaves of *Curcuma longa* filled with spores; C,D,E: Beaded Mycelium in the Scale Leaves of *C. longa*; M = Mycelium; SC = Scale Cells.**