strains[6], but occurrence of infestation is low during summer months. It is also viable for longer periods during transportation than the Indian isolate. This *Azolla* like other species/strains does not carry any rice diseases or pests.

TABLE I

Growth of green Azolla *in rice field [mean of* 32 *replications (Plot size* 12 m^2)]. *Eight kg* P_2O_5*/ha was applied with each incubation*

Month	Temperature (day/night) ° C	Incubation (week)	Inoculum fresh wt. (kg)	Final yield fresh wt. (kg)
August	38·9/28·4	One	10	24·8
September	34/28	One	11	26·4
do		One	14	35·0

Thus, introduction of green *Azolla* has enhanced the scope in the utilization of this technology in this country.

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THE DEVELOPMENT OF EMBRYO SAC, ENDOSPERM AND THE STRUCTURE OF FRUIT WALL IN *BLUMEA MOLLIS* (D. DON) MERR.

IN a review on the embryology of the Asteraceae, Davis[1] stated that only 15–20% of the genera have been investigated. Sundara Rajan[2] also felt that further contributions are needed to generalise the embryological characters in the family. In the present study, the development of the embryo sac, endosperm and the structure of the seed coat and fruit wall in *Blumea mollis* (D. Don) Merr. (= *B. wightiana* D.C.) are described.

The solitary basal ovule is anatropous, unitegmic and tenuinucellate. The single hypodermal archesporial cell functions directly as the megaspore mother cell (Fig. 1). The chalazal megaspore of the linear tetrad develops into an embryo sac of the Polygonum type (Figs. 2 and 3). An endothelium is organised from the innermost layer of the integument even before the formation of the megaspore tetrad. Unlike in *Helianthus annuus* and *H. debilis*[3] the endothelial cells remain single layered and remain active during early embryo sac development. They remain uninucleate but some of the cells become binucleate at the organised embryo sac stage (Fig. 3). As in *Tridax trilobata*[4] and *Spilanthes acmella*[5] a linear row of 3–4 antipodal cells persist in the developing seed till the globular stage of the embryo (Fig. 8). There is no increase in the number of antipodals. A great variety in the number of antipodals is also noticed in the tribe Heliantheae[2].

As in *Tridax procumbens* and *T. trilobata* the endosperm is of nuclear type (Fig. 4) wall formation begins at the 16-nucleate stage (Fig. 6). A cellular endosperm appears to be characteristic of the tribe Inuleae, and it has been recorded in the genera *Antennaria, Gnaphalium* and *Helichrysum*[5]. Banerji[6] also reports the same type of endosperm in *Blumea laciniata*. The endosperm tissue is fully consumed by the developing embryo. Deshpande[7] in *Tridax procubens* also observes the same condition. However, Padmanabhan in *T. procumbens*, Kapil and Sethi[4] in *T. trilobata* and Davis[9] in *Podolepis jaceoides* have observed the persistence of endosperm in mature seeds.

The cells of the 5-layered homogeneous integument elongate at the mature embryo sac stage (Fig. 5). After fertilization till the early proembryo stage the seed coat remains unchanged (Fig. 7). However in the later stages the entire coat is consumed as the cypsell matures. Tiagi and Taimini[10] in *Vernonia cinerea*, Venkateswarulu and Devi[11] in the tribe Helineae also observed the utilization of all integumentary layers and the mature embryo is directly covered by the pericarp.

The wall of the ovary is 6–7 layered at the megaspore mother cell stage. There is a distinct outer epidermal layer consisting of uniform quadrangular cells with a prominent nucleus and dense cytoplasm (Fig. 1). The inner layers are all uniformly thin walled. The wall layers before and after fertilization remain unchanged, except the cell elongation. The embryo when attain maturity occupies almost the whole of the fruit and is directly protected by the pericarp. About 4–6 layers of the pericarp towards the periphery become highly sclerosed, and forms a fibrous strand. The pericarp could be differentiated into three regions, the outermost rectangular, thick-walled epicarp, the polygonal sclerosed mesocarp and the innermost elongated thin-walled endocarp. The number of sclerosed layers are more at the ridges while it is lesser at the furrow regions (Fig. 9).

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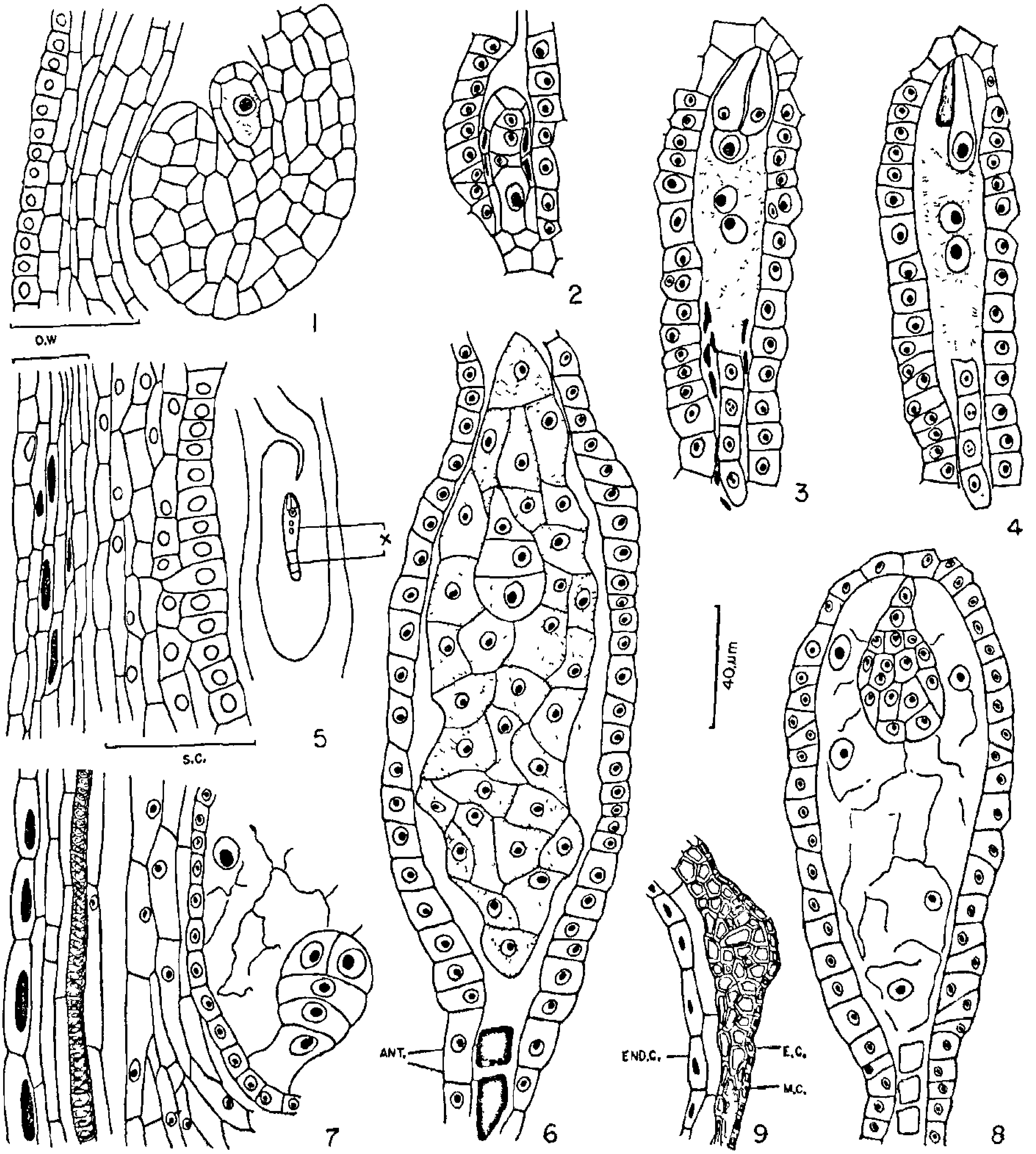

FIGS. 1-9. Fig. 1. L.S. of ovule showing megaspore mother cell with ovary wall (A portion). Fig. 2. Linear tetrad of megaspores. Fig. 3. Organised embryo sac. Fig. 4. P.E.N. division. Fig. 5. A portion of ovary wall at organised embryo sac stage ('X' enlarged). Fig. 6. Cellular endosperm with early embryo. Fig. 7. Ovary wall and seed coat at a few celled proembryo stage. Fig. 8. Persistence of antipodals at the globular stage of the embryo. Fig. 9. T.S. of mature fruit (A portion at ridge and furrows). (ANT : Antipodals. O.W. : Ovary wall. E.P. : Epicarp. ENDC : Endocarp. S.C. : Seed coat. M.C. : Mesocarp.)

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COLLAR ROT OF SOYBEAN—A NEW REPORT FROM INDIA

A SEVERE collar rot disease of soybean, *Glycine max* (L.) Merrill, was first observed from Vellayani, Kerala, during 1979 on the variety E.C. 118307.

The symptoms initiated as brownish black discoloration just at the soil level near the collar region. Gradually the discoloration was found to spread 3–5cm both upwards and downwards along the stem and tap root respectively. Soon it girdled the basal portion of the stem resulting in drooping and drying up of the leaves followed by defoliation. In advanced stages of infection, all the leaves were shed, leaving the stem and branches bare. Whitish mycelial growth often studded with small sclerotia could be seen on the affected collar region and in the soil around the infected plant. Finally the infected plants wilt completely (Fig. 1). Roots of the affected plants showed symptoms of rotting.

The causal organism was isolated on potato dextrose agar (PDA) and repeated isolations from the collar region and roots yielded the same organism. Pathogenicity of the isolated organism was proved following Koch's postulates.

The mycelium of the fungus is creamy white initially turning to light brown at maturity. The hyphae septate, 5·25 to 8·75 µm wide. Fully formed sclerotia measured 1·05 to 1·12 mm in diameter. The causal organism was identified as *Rhizoctonia solani* Kuehn. The perfect state of the organism [*Thanatephorus cucumeris* (Frank) Donk] was not observed. The culture is deposited at the Department of Plant Pathology, College of Agriculture, Vellayani.

FIG. 1. Soybean plants showing wilting symptoms.

A perusal of literature revealed that infection of soybean roots by *R. solani* Kuehn was recorded from U.S.A.[1]. Aerial blight of soybean caused by *R. solani* Kuehn has been recorded from India[2] and Louisiana[3,4] in U.S.A.

This is the first authentic record of collar rot of soybean caused by *R. solani* Kuehn from India.

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