TABLE 1

Mycorrhizal spores in the root-zone soil and percent mycorrhizal infection of three plantation crops

Plant species	No. of one cm root segments: Spore/ 50 ml soil	Exa-mined	+ve for VA in-fection	Infec-tion (%)
E. cardamomum	208	104	78	75.0
P. betle	150	104	44	42.2
P. nigrum	132	104	36	34.6
Non root-zone soil	98			

TABLE 2

Number of endomycorrhizal spores in root zone soil as influenced by cultivars of Lablab purpureus

Cultivar	Source	Spores/50 ml soil: Low fertility	High fertility
1. EC 36417	Australia	204	196
2. Rangoon white	Burma	160	159
3. EC 36856	Czekoslovakia	198	190
4. Chikkabala-pur local	India (Karnataka)	134	144
5. IC 648	India (Maharastra)	150	187
6. PLS 94	India (Himachal Pradesh)	134	140
7. EC 18176	Nepal	139	174
8. PLS 62-2	Pakistan	113	134
9. EC 24637	Tanzania	138	144
10. EC 24652	Senegal	183	197
11. EC 33015	U.S.S.R.	170	176
12. Soil away from roots		93	94

CD at 5% = 25.14; All the values are the mean of four replications.

The mycorrhizal spore numbers in the root zone of different cultivars of field bean differed (table 2). Highest spore numbers were recorded in the Australian cultivar EC 36417 and the least in cultivar PLS 62-2 from Pakistan. Three Indian cultivars grown at low fertility level harboured more or less the same number of spores in their root zone. Higher level of fertiliser application did not have significant effect on sporulation by VA mycorrhiza, except on the cultivar from Nepal and one cultivar from India (IC 648). Effect of fertilisers on sporulation by endomycorrhiza seem to vary with the soil type, and the kind and the level of fertiliser. Khan[9] and Khrushcheva[10] observed a decrease in spore numbers due to phosphatic fertiliser application where as Kruckelmann[3] observed an increase due to application of fertilisers and organic manure. Spore production by mycorrhizal fungi in the root zone is closely related to the root infection and is known to vary with the plant species. The present study brings out that not only plant species, but also different cultivars of the same species vary in the extent of harbouring mycorrhizal fungi in their root system.

20 August 1981

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EMBRYOLOGY OF *SONCHUS OLERACEUS* LINN

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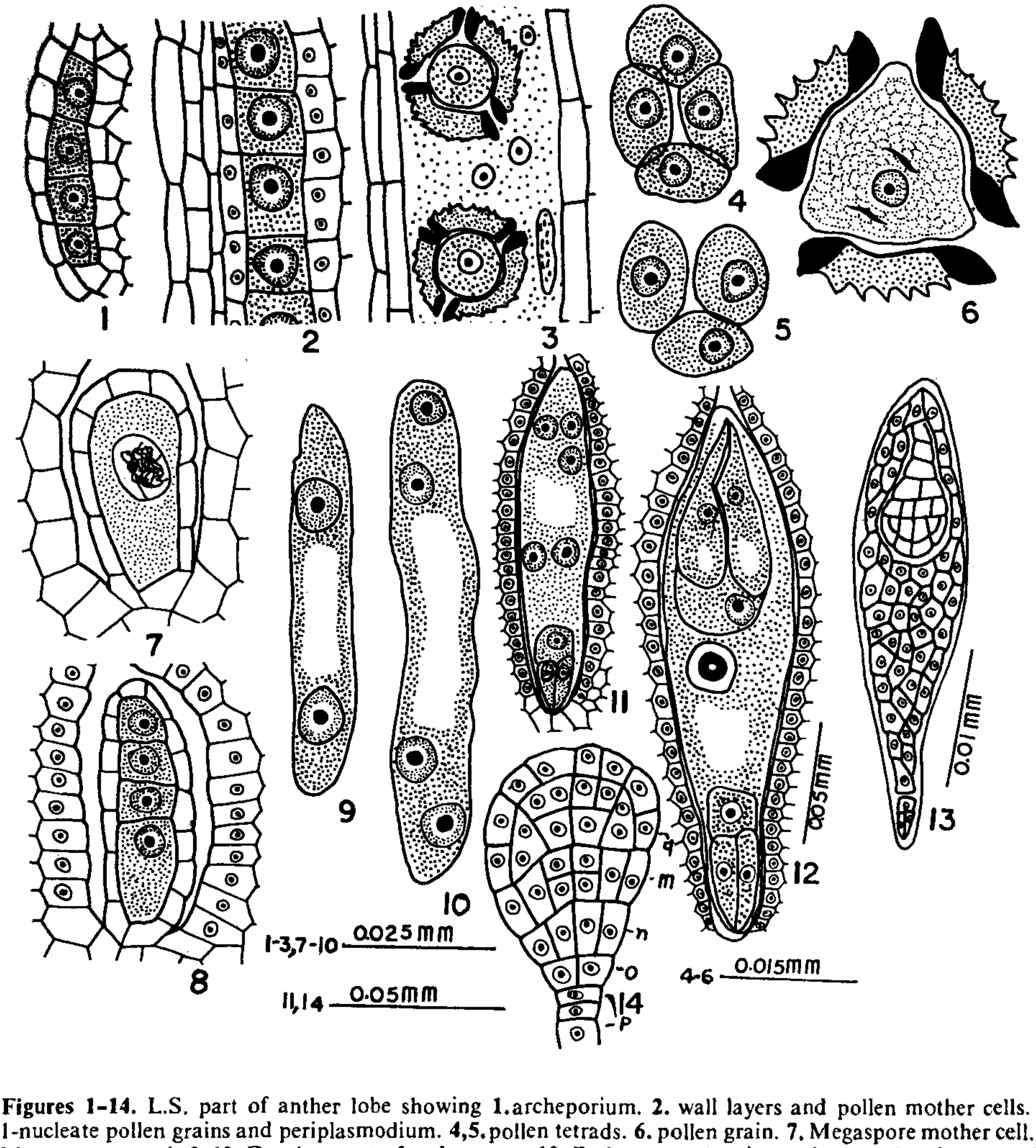
EMBRYOLOGICAL literature reveals that *Sonchus oleraceus* Linn. of Compositae has not been studied



Figures 1–14. L.S. part of anther lobe showing **1.** archeporium. **2.** wall layers and pollen mother cells. **3.** 1-nucleate pollen grains and periplasmodium. **4,5.** pollen tetrads. **6.** pollen grain. **7.** Megaspore mother cell. **8.** Megaspore tetrad. **9–12.** Development of embryo sac. **13.** Embryo sac showing embryo and endosperm. **14.** Embryo.

and hence the present investigation was undertaken.

The anthers contain four microsporangia. The primary archesporium consists of a single hypodermal row of 4–6 prominent cells in each of the four lobes of the anther (figure 1). Three wall layers—fibrous endothecium, middle layer and tapetal layer—are differentiated below the epidermis (figure 2). The anther tapetum is of the Periplasmodial type (figure 3) as in *Chondrilla Taraxacum*[1,2], *Launaca*[3] belonging to the tribe Cichoreae. Contrary to this in *Tragopogon gracile*[4] and in *Sonchus arvensis* and *S. asper*[5] a glandular type of anther tapetum reported. From the present investigation it is found that periplasmodial formation commences only after the formation of one-nucleate pollen grains in the anther locule. Further, the life of the periplasmodium is very short. Hence it may be said that Singh and Kaul[4] and Kaul *et al.*[5] might have missed the stages of formation of a Periplasmodium

and have mistakenly assumed it to be of the glandular type.

The primary sporogenous cells undergo transverse divisions alone resulting in a single row of pollen mother cells (figure 2) which undergo meiotic divisions and produce either tetrahedral (figure 5) or isobilateral tetrads (figure 4). Cytokinesis is simultaneous. The pollen grains are tricolpate and 3-celled at the sheding stage (figure 6) a report contrary to those of Singh and Kaul[4] and Kaul *et al.*[5]

The ovule is unitegmic and tenuincellate. An integumentary tapetum is differentiated at about the time of megaspore tetrad formation (figure 8). It remains uniseriate with uninucleate cells till it is completely absorbed by the endosperm. The single hypodermal archesporial cell functions directly as the megaspore mother cell and undergoes meiotic division producing a linear tetrad of megaspores (figures 7 and 8). The chalazal megaspore is functional and divides thrice mitotically to produce an 8-nucleate embryo sac of the polygonum type (figures 9–12). The antipodal cells are the first to be organised followed by the egg apparatus (figures 11 and 12). The antipodal cells simulate the egg apparatus and remain persistent upto the time of formation of globular embryo in the embryo sac (figures 12 and 13). The synergids are hooked.

Fertilisation is porogamous. Syngamy and triple fusion occur more or less simultaneously. The endosperm is *ab initio* cellular. The primary endosperm nucleus divides earlier than the zygote and is accompanied by a transverse wall resulting in two cells. Later, these divide in all planes forming a massive cellular tissue (figure 14). The zygote divides transversely resulting in two cells the terminal cell *ca* and the basal cell *cb*. The former undergoes a vertical division while the latter undergoes a transverse division producing two superposed cells *m* and *ci*. Thus a four-celled 'T'-shaped proembryo is formed. Further development of the embryo follows the Senecio variation of the Asterad type.

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OCCURRENCE OF LUMINESCENT BACTERIA IN SEDIMENTS

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OCCURRENCE of luminescent bacteria in the sediments is reported for the first time in the Vellar estuary during April–July 1978. The species diagnostic tests of the bacteria revealed the presence of *Beneckea harveyi*, *Photobacterium fischeri* and *P. leiognathi*.

Luminescent bacteria have been isolated directly from sea water at different depths of tropical[1–3], temperate[4] and polar[5] regions. These bacteria are well adapted to exist in free-living[1,3,4,6], saprophytic[7], symbiotic[1,8–10] and parasitic[7,11] niches; however, no earlier report is available on their occurrence from sediments. The present note deals with their occurrence in the sediments and this appears to be the first of its kind in the world.

Sediment samples were obtained from the marine zone (station 1) and gradient zone (station 2) of the Vellar estuary (Latitude 11°30'N, Longitude 79°46'E), Porto Novo (figure 1) between April and July 1978 using a Petersen grab. The samples taken aseptically from the central portion of the mud were transferred into sterile McCartney bottles and were immediately returned to the laboratory. Serial dilutions were prepared and plated on sea water-nutrient agar (SWC) medium containing 3 ml of glycerol per litre of the medium as followed by Hastings and Mitchell[1]. The cultures were grown at 25 ± 2° C. Luminescent colonies appeared on the medium within 24 hr of inoculation when the petri dishes were viewed in dark. After 36 hr of inoculation well separated luminescent colonies were marked on the outer surface of the lower petri dish using a glass marking felt pen. Forty eight colonies were picked up and transferred to SWC-agar slants for later taxonomic analysis.

To identify the bacterial species the procedure adopted by Reichelt and Baumann[12] and Reichelt *et al.*[13] was followed. The results of the tests conducted showed 39 isolates to belong to *Beneckea harveyi*, 5 isolates to *Photobacterium fischeri* and 4 isolates to *P. leiognathi*.

Though 6 species of luminescent bacteria *viz. Beneckea harveyi*, *B. splendida*, *Photobacterium phosphoreum*, *P. logei*, *P. fischeri* and *P. leiognathi* are known from marine environment[14], only *B. harveyi*, *P. fischeri* and *P. leiognathi* have been reported from Porto Novo waters[2,3]. Occurrence of all the 3 species of luminescent bacteria in the sediments of Vellar estuary as in the estuarine water, backwater,