

TABLE I

Peroxidase, phenoloxidase activities and total phenolic contents in the young, mature and old leaves of spinach infected with Fusarium equiseti

Stage of leaf	Area of leaf	Peroxidase*	Phenoloxidase**	Total phenols***
Young green	Healthy	0.42 ± 0.04	0.24 ± 0.02	410 ± 21
	Diseased	1.58 ± 0.08	0.93 ± 0.03	447 ± 26
Mature green	Healthy	0.31 ± 0.02	0.21 ± 0.06	368 ± 27
	Diseased	0.55 ± 0.05	0.36 ± 0.04	386 ± 33
Old yellow	Healthy	0.21 ± 0.03	0.14 ± 0.02	289 ± 21
	Diseased	0.24 ± 0.01	0.16 ± 0.02	286 ± 27

* ΔA 470 nm. ** ΔA 495 nm/minute/2 mg fresh wt. of leaf tissue. *** Catechol equivalents (mg)/g dry wt. of leaf tissue.

Mean ± Standard deviation based on 6 sets of experiments.

The authors are grateful to Dr. C. Booth for the identification of our isolate of *F. equiseti* (IMI 211014) as this is the first report on this disease and to Profs. Jafar Nizam and U. B. S. Swamy for facilities.

Department of Botany,
Kakatiya University,
Warangal 506 009,
December 12, 1979.

T. SHANKARLINGAM.
T. GIRIDHAR SINGH.
S. SRINIVAS RAO.
V. THIRUPATHAIAH.

COLLECTERS ON THE COTYLEDONS OF IN VITRO RAISED SEEDLINGS OF WITCHWEED—*STRIGA ASIATICA* (L.) KUNTZE

UNDER ordinary conditions witchweed¹ seeds will not germinate unless it be in the presence of some stimulatory substance or a complex of such substances². The putative host plants obviously secrete a stimulant that induces germination of the seeds of the parasite³⁻⁶. Using standard methods³⁻⁶, germination of pretreated seeds has been induced in petridishes in the medium of root exudates of host weeds. The methods employed are as follows. Firstly, pretreated seeds of *Striga* are sandwiched between discs of blotters and introduced on to the surface of the root mass by drilling a hole and then covered with soil. After 2 or 3 days, the discs can be retrieved, the sandwiches opened and germination counted (personal communication of Dr. C. Parker). The second method consists of preparation of witchweed seeds for germination in the host root exudate on one hand and collection of host root exudate on the other. Washed and dried seeds after surface sterilization with sodium hypochlorite (for 5 minutes) were sprinkled in between two moist filter papers in a petri plate and kept in darkness for 3 weeks. The collection of host root exudate involves raising of host seedlings from seed specially for the purpose, transplanting 2-6 each of them in 5 pots filled with manured garden soil. At appropriate ages of the respective weeds, they are knocked out from the pots, thoroughly washed and transferred to suitable containers with sterile distilled water, kept like that for 30 hours, allowing the root exudate to diffuse into the medium. The root exudate so collected is then dispensed into petri plates in which the pretreated seeds are maintained on the discs of filter-papers of diameter of 0.5 mm. Hosmanj⁴ cited that

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under such conditions germination could be induced only to the extent of radicle emergence and further growth leading to the actual seedling differentiation could occur only when transferred to a culture medium with kinetin. However, in a general study of germination behaviour of the witchweed seeds in our laboratory, growth of the seedling upto the differentiation of cotyledons could be followed straight in the root exudate itself (Fig. 1) using several Gramineae [*Aristida depressa* Retz., *A. hystrix* Linn. f., *A. setacea*

The glandular trichomes (Figs. 3-5) in the present study have a stalk and a two- or three-celled bulged head. The cells are packed with copious contents. The epidermis also shows well differentiated stomata of the anisocytic type (Fig. 6).

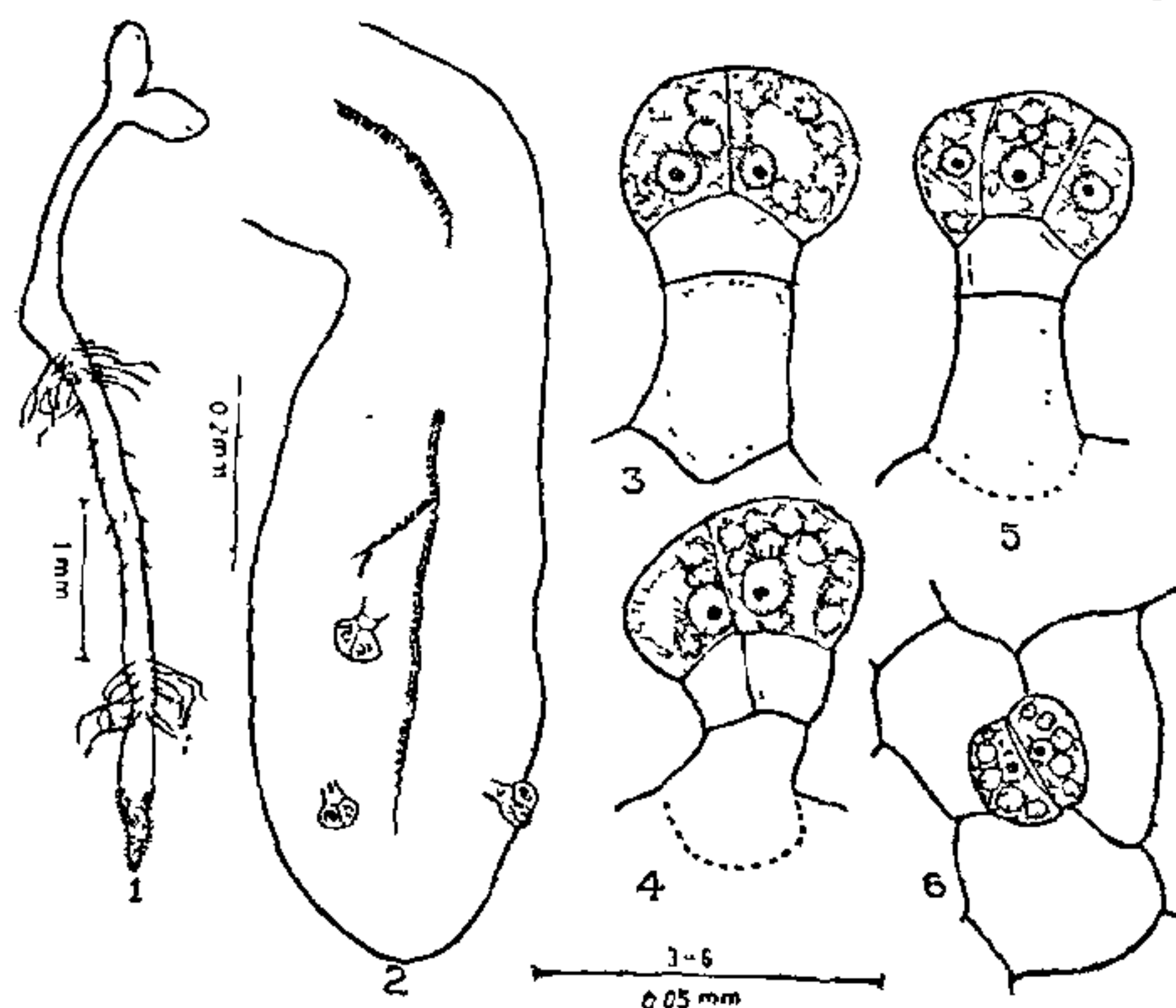
A brief analysis of the parameters comprising the length of the seedling, number, length of the stalk and diameter of the head of the trichomes, length and width of the cotyledons gathered from twenty observations are given in Table I.

TABLE I
Data from Twenty Readings

	Seedling length mm	Glandular trichomes			Cotyledons	
		No. of glands per cotyledon	Head diameter mm	Stalk length mm	Length mm	Breadth mm
Mean	3.8	7.1	0.01	0.02	0.47	0.36
Range	3.2 to 4.7	5.0 to 9.0	0.01 to 0.013	0.02 to 0.024	0.43 to 0.54	0.32 to 0.39
Standard deviation	0.7	1.3	0.002	0.003	0.05	0.03
Standard error	0.3	0.4	0.001	0.001	0.02	0.01

Retz., *Chloris barbata* Sw., *Cymbopogon coloratus* (Nees.) Stapf., *C. flexuosus* (Nees. ex Steud.) Wats., *Dactyloctenium aegyptiacum* (L.) Beauv., *Dinebra retroflexa* (Vahl) Panz., *Eragrostis maderaspatana* Bor., *E. viscosa* (Dalz.) Trin., *Echinochloa colonum* (L.) Link., and *Panicum psilopodium* Trin.] and non-gramineae (*Alysicarpus monilifer* DC., *Blepharis molluginifolia* Pers., *Desmodium triflorum* DC., *Evolvulus alsinoides* L., *Oldenlandia corymbosa* L., *O. umbellata* L., *Phyllanthus fraternus* Webster, *P. simplex* Retz., *Portulaca oleracea* L., *Trianthema portulacastrum* L. and *Zornia diphylla* Pers.) hosts. Further, the cotyledons have become chlorophyllous also.

Interestingly, the cotyledons of the seedlings showed conspicuous collectors (stalked glandular trichomes) on their surface (Fig. 2), a feature not recorded by any previous worker on witchweed. No data are available regarding their occurrence in the seedlings nursed even in the medium with kinetin². The leaves of several parasitic figworts (Scrophulariaceae) other than *Striga* are frequently covered with small, few celled glands or other trichomes as in the remarkable instance of species of *Lathraea* where the glandular hairs are associated with their carnivorous habit³. Among those listed by Musselman and Mann⁶, collectors occur as a distinctive feature on the foliage of *Aureolaria pedicularia* (Feinleaf false foxglove) and *Seymeria cassioides* (Senna seymeria). However, there is no record of their occurrence on the cotyledonary leaves of witchweed²⁻⁷.



FIGS. 1-6. Fig. 1. Seedling of witchweed. Fig. 2. Magnified view of the cotyledon to show the glands. Figs 3-5. Glandular trichomes. Fig. 6. Stomatal apparatus.

It is possible that the secretion of the glands on the mature leaves may aid the parasite in its transpirational pull on the host tissue^{8, 7}. It is generally stated that the virulence of the witchweed, during haustorial establishment, may be maximum in the seedling stage³ of emergence of the radicle in the soil. The occurrence of these glands and their secretions in the present case may foster a protective function on the witchweed seedlings.

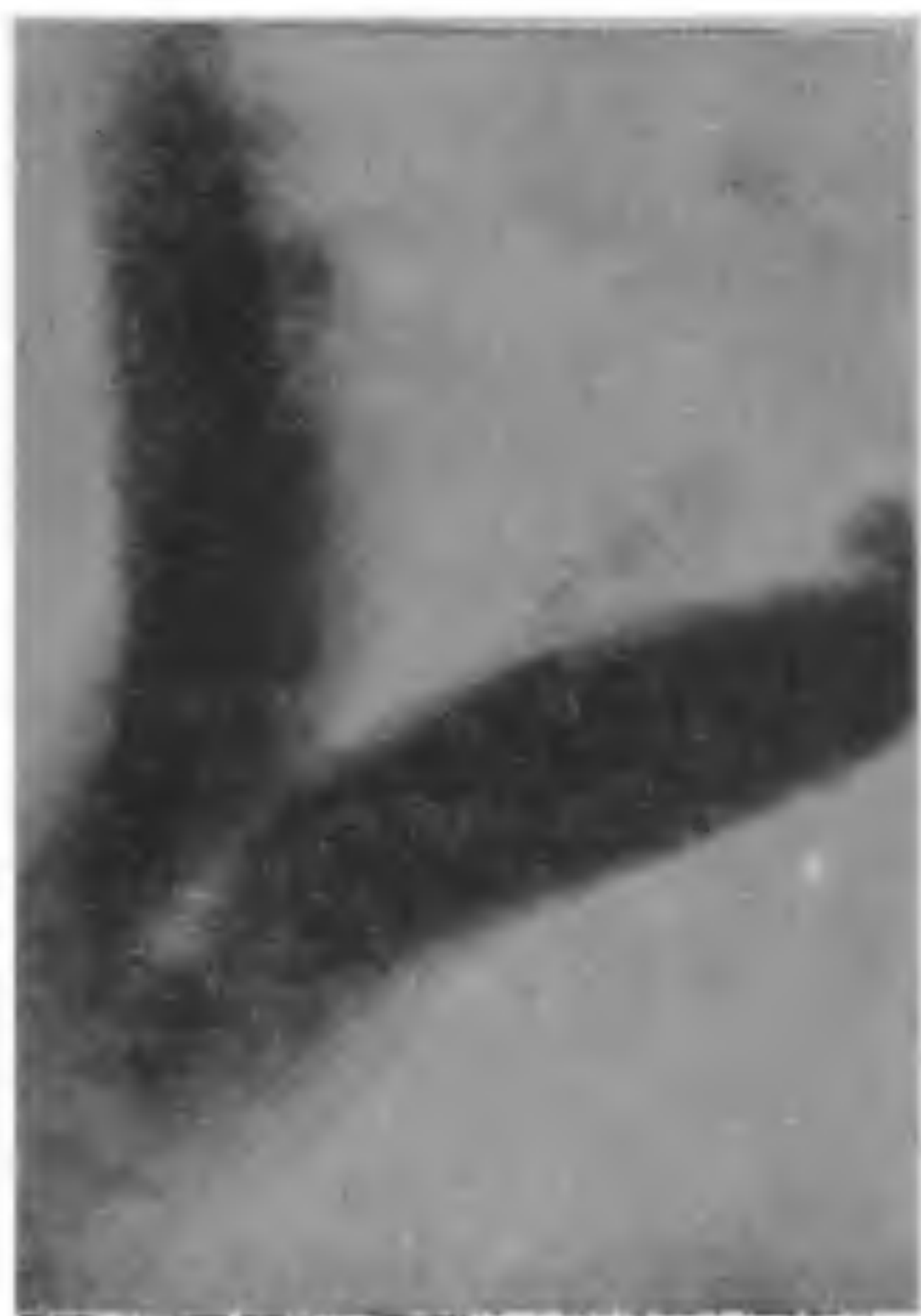


FIG. 7. Photomicrograph: Glands on the cotyledons of witchweed, $\times 525$.

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Department of Botany,
Nagarjuna University,
Nagarjunanagar 522 510,
Guntur Dt., A.P., December 12, 1979.

B. V. N. REDDY.
PIRATLA N. RAO.

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TWO NEW FRUIT ROT DISEASES OF CITRUS

DURING surveys on fruit-rot diseases in Jabalpur, two interesting and hitherto undescribed diseases of citrus (*Citrus medica* and *C. sinensis*) were observed. They have been described here for the first time from India.

Hormonema rot

The symptoms on fruits of *Citrus medica* Linn. started in the form of small, discoloured area changing to greyish brown coloured spots, 2-2 cm in diameter. In the advanced stage, the spots became dark greyish black and shining, mucilagenous mass appeared in the diseased regions. After a week the infected regions dried up and shrank.

Isolations were made on potato-dextrose-agar medium and the fungus was identified as *Hormonema* (Arx¹). The culture (IMI No. 224340) was also examined by Dr. B. L. Bready of Commonwealth Mycological Institute, Kew, who remarked that "It is difficult to determine species in the genus *Hormonema* which consists of the conidial cultural states of various ascomycetes". When compared with the description of the known species of *Hormonema* (De Hoog, *et al.*,²) the cultural and morphological characters of the present isolate agrees well with *H. dematioides*. Since this genus is newly recorded for India a brief description of the fungus is given below.

Colonies on P.D.A. dark greyish black | with collapsed margins, slimy, shining; mycelium hyaline becoming brown to dark brown with age, septate, branched, thick walled; conidia borne from dark cells of hyphae, unicellular, ellipsoidal, hyaline, $4-14 \times 3.5-6 \mu\text{m}$ (Fig. 1).

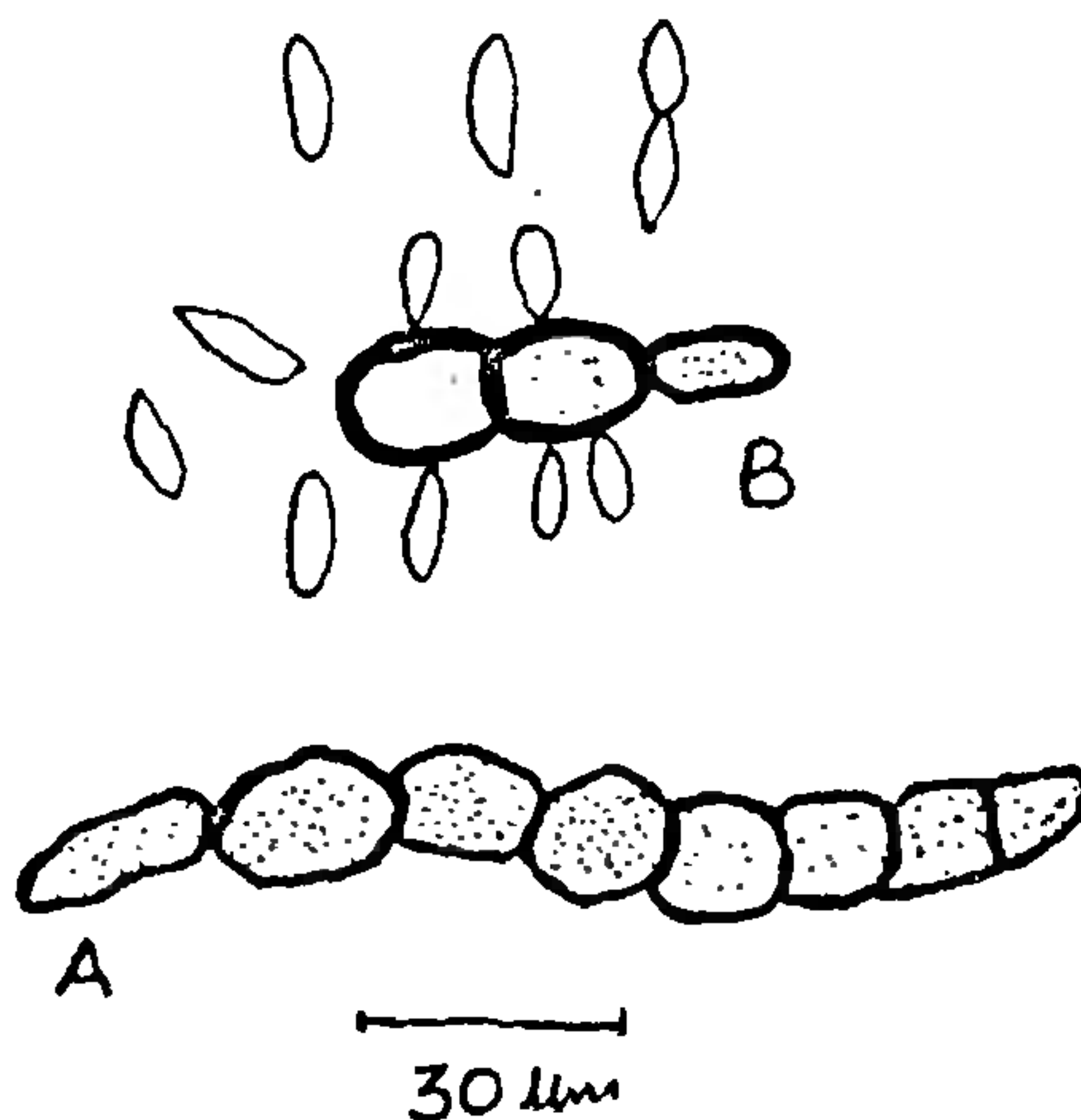


FIG. 1 A-B. A, Thick walled mycelium; B, Sporogenous hyphae.

Pathogenicity test was performed by inflicting a small, shallow wound in the healthy lemon fruits and inoculating with a bit of mycelium and spore (Tandon *et al.*³). The inoculated region was covered with moistened cotton pads for 24 hrs. The symptoms