peared on the cotyledonary leaves even when the pathogen was found only in the root and hypocotyl regions of the susceptible host[3], indicating the involvement of a toxin. However, the known toxins, fusaric acid, lycomarasmin and vasinfuscarin did not appear to be responsible for this symptom[4,5]. In this note, we report a new toxin which produces 'vein clearing' symptom in *Fusarium* infected cotton plants.

A virulent strain (I 5) of *Fusarium vasinfectum* Atk., isolated from wilt sick soils of Udumalpet, Coimbatore, Tamil Nadu was grown in Richard's medium amended with yeast extract for more than 15 days. A toxin isolated from the culture filtrate induced the typical vein clearing symptom in cut shoots of *Gossypium arboreum* L.The toxic principle was non-dialysable since dialysed (against glass distilled water, pH 6.3) culture filtrate also induced vein clearing. The toxin was not detected when the fungus was grown in unammended Richard's medium or ammended or unammended Czapeck's Dox medium. This indicates the requirement of a specific sugar and cations and optimal C/N ratio for toxin production. Requirement of specific cations has also been shown for fusaric acid[6] and naphthazarines[7].

The concentration of the toxic principle increased with increase in age of the culture up to 50 days. The time course of toxin production indicated that the toxin was either a secondary product formed after the death of the hyphae or a compound in the hyphae that is released after its death. Forced rupture of 6-day old cells of the fungus by ultrasonication and assay of intra-cellular components on cut shoots of cotton indicated the presence of the toxic principle inside the cells as early as six days in concentrations that could incite the symptom. Hence, it appears that the toxin is an endotoxin. Replacement culture filtrates also showed phytotoxicity. The toxin appeared to be host-specific. It induced vein clearing in *G. arboreum* and *G. barbadense* cut shoots only. *G. barbadense* plants when infected with the fungus also developed vein clearing as the early symptom.

The toxic principle could withstand lyophilization and remained stable on storage at – 15° C for 20 days. However, there was considerable loss of toxicity during prolonged storage but after 80 days, no toxic effect could be detected. The toxin was stable up to 60 min at temperatures below 90°C. Exposure to temperatures above 100°C resulted in the loss of ability to produce vein clearing. Fifty percent loss of toxicity was recorded when treated at 121°C for 15 min (autoclaving). Dialysis of the autoclaved toxin resulted in almost complete loss of toxicity. These observations indicate a clevage of the large toxin molecule into smaller units during high temperature treatment and the loss of these smaller units during dialysis. The smaller units, however, seemed to possess reduced ability to cause vein clearing.

Further work on purification of the toxin is in progress. This appears to be the first report on the involvement of a toxin responsible for the vein-clearing symptom in the *Fusarium* wilt disease of cotton.

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1. Sathyanarayana, G. and Kalyanasundaram, R., *Proc. Indian Acad. Sci.*, 1952, **B36,** 54.
2. Charudattan, R., *Proc. Indian Acad. Soc.*, 1969, **B70,** 139.
3. Kalyanasundaram, R., *J. Indian Bot. Soc.*, 1954, **34,** 43.
4. Gäumann, E., *Phytopathology*, 1957, **47,** 342.
5. Naef-Roth, S., *Z. Pflkranh. Pflschutz.*, 1957, **64,** 421.
6. Egli, T. A., *Phytopath. Z.*, 1969, **66,** 223.
7. Kern, H., In: *Phytotoxins in plant diseases.* (eds) R. K. S. Wood, A. Ballio and A. Graniti, Academic Press, New York and London, 1972, p 35.

FERTILE PINNULES OF *MARATTIOPSIS* SCHIMPER FROM THE SIVAGANGA BEDS OF RAMANATHAPURAM DISTRICT, TAMIL NADU

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THE southernmost exposures of the East Coast Gondwana sediments occur in and around the town of Sivaganga in Ramanathapuram district, Tamil Nadu[1]. Gopal *et al*[2] described a small collection of fossil plants from this area for the first time. They reported two species of *Cladophlebis*; three species of *Taeniopteris; Ptilophyllum cutchense; Ginkgoites cassipes; Elatocladus plana; Brachyphyllum expansum; Podozamites lanceolatus* and a few other fragmentary remains tentatively identified as *Sphenopteris* and *Thinnfeldia*. During a recent collection trip to the locality, the present authors collected, among other

specimens, the impressions of fertile pinnules of *Marattiopsis macrocarpa* (Old. and Morr.) Seward and Sahni which is here being reported for the first time from this southern most Upper Gondwana locality. Its occurrence in the Tabbowa beds of Ceylon, still further south, is not known.

Marattiopsis macrocarpa (Old. and Morr.) Seward and Sahni has been reported earlier from the Upper Gondwana (Middle Jurassic) beds of Rajmahal hills in Bihar[3-7]. From the East Coast Gondwanas, Feistmantel[8] reported it as *Asplenites macrocarpa* from the Golapilli beds in Godhavari district and again[9] from the Athgarh Sandstones in Orissa as *Alethopteris macrocarpa*.

The recent collection from Sivaganga includes five hand specimens of *Marattiopsis macrocarpa*, four of which show fertile pinnae and one, a vegetative pinna. The impressions are on light grey arenaceous shales which were recovered from rocks dug out from a well in a village about 3 km north of Sivaganga town. The largest specimen (SGA/EKP/7) is about 5 cm long and about 2 cm wide. It shows the rachis and about 10–11 oblong pinnules with blunt apices on the one side and about 5 incomplete pinnules on the other side (figure 1). Each pinnule is about 1 cm in length and about 0.4 mm in width. Synangia are seen close to the margin as elliptic depressions, each with a well marked central ridge. Veins are only faintly seen but wherever they are discernible, they are seen to be open dichotomous with the synangia occurring at the end of the veinlets. There are 10–12 synangia on either side of the midrib of each pinnule. The photographed specimen (SGA/EKP/3) shows about 7 pinnules on one side of a rachis, traces of which were obliterated while recovering the fossil (figure 2). In this specimen the synangia are better seen than in any of the others. Here the pinnules are about 8 mm long and about 3 mm wide. There are about 8–9 synangia on either side of the midrib in each pinnule. Each synangium shows a prominent central ridge Under high magnification, some of the synangia show radiating ridges which are obviously the outlines of sporangial compartments. No spores were recoverable. These details agree closely with that given by Sahni and Rao[4] and Surange[10]. However, in our figured specimen, the pinnules seem to show a free base, though the preservation is not good enough to assert this point at present.

The occurrence of *Marattiopsis macrocarpa* (Old. and Morr.) Seward and Sahni, in the Sivaganga beds, extends the geographical distribution of this species to the southern tip of the Indian peninsula. One species of the living genus *Marattia*, namely *M. fraxinea*,

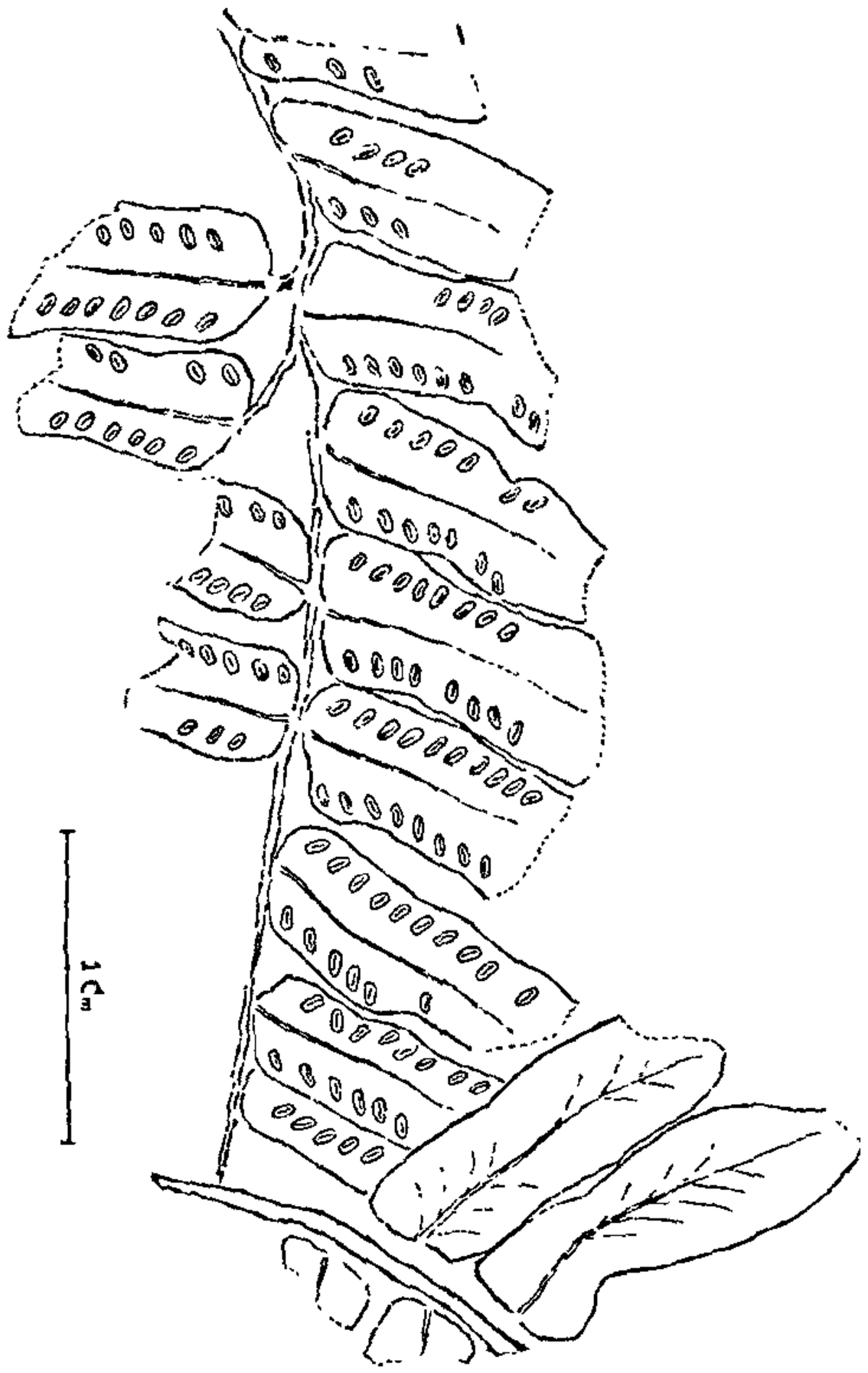

Figure 1. *Marattiopsis macrocarpa* pinnules showing synagia (SGA/EKP/7).

occurs now in the Western Ghats[11]. The pinnules of *Marattiopsis macrocarpa* however differ from this living species in shape and size. Though it is tempting to speculate a phylogenetic relationship between the Jurassic *Marattiopsis* and the living species of *Marattia*, in the absence of any post-gondwana records of *Marattia* in the peninsula, such a speculation may be premature.

The camera-lucida sketches were made using a Nikon SMZ-10 microscope. The fossil specimens are preserved in the Laboratory of Palaeophytology, Department of Botany, Madras Christian College, Madras. The senior author wishes to thank the University Grants Commission for a research grant (Grant No. F-4 (13527/83) for a megafloristic study of the East Coast Gondwanas.

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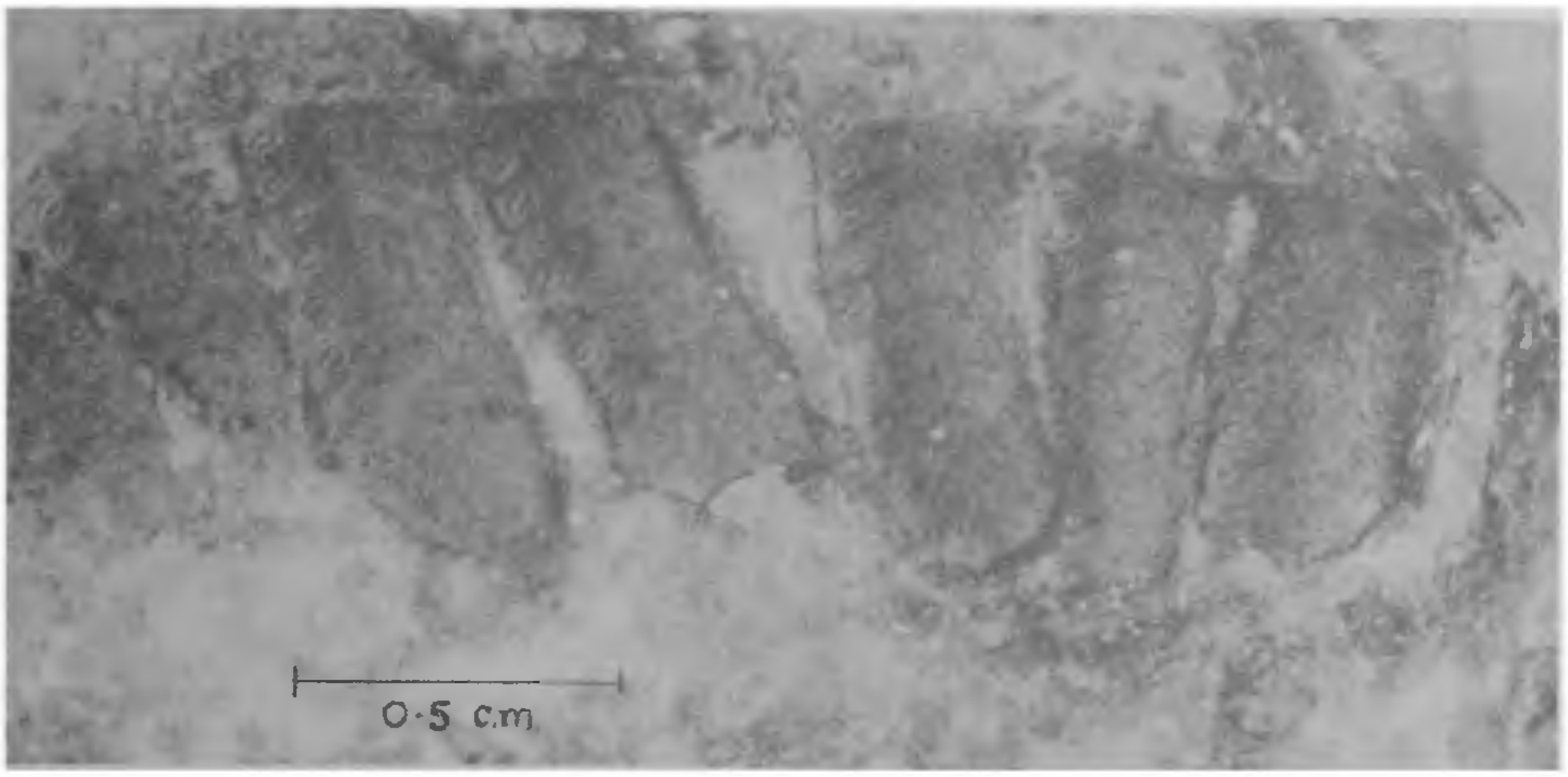

Figure 2. Specimen showing fertile pinnules on one side of the rachis (SGA/EKP/3)

1. Sastry, M. V. A., Acharya, S. K., Shah, S. C., Satsangi, P. P., Ghosh, S. C., Raha, P. K., Gopal Singh and Ghosh, R. N., GSI pub., Calcutta, 1977, 85.
2. Gopal, V., Jacob, K. and Jacob, C., *Rec. Geol. Surv. India*, 1957, **84**, 477.
3. Seward, A. C. and Sahni, B., *Palaeont. indica*, N.S., 1920, **7**, 20.
4. Sahni, B. and Rao, A. R., *J. Asiat. Soc. Beng.*, N.S., 1933, **27**, 189.
5. Sahni, B. and Rao, A. R., *Proc. Indian Acad. Sci.*, 1934, **1**, 262.
6. Ramanujam, C. G. K., *Sci. Cult.*, 1957, **23**, 253.
7. Bose, M. N. and Sah, S. C. D., *Palaeobotanist*, 1958, **16**, 12.
8. Feistmantel, O., *Palaeont. Indica*, 1877b, **1**, 53.
9. Feistmantel, O., *Palaeont. Indica*, 1977c, **1**, 163.
10. Surange, K. R., Botanical Monograph No. 4, CSIR, New Delhi, 1966, 81.
11. Beddome, R. H., Thacker Spink and Co., Calcutta, 1983, 460.

A NEW DISEASE OF COCONUT KERNEL

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FOLLOWING a survey of local fruit market during June-July, 1981 (temperature 26.5–38.6°C and RH 40–94.2%) in Agra, a soft rot disease was noticed on coconuts (*Cocos nucifera* Linn.). Fresh disease spots were irregular, water-soaked and reddish-brown or violet whereas the mature ones turned black. Profuse sporulation rendered the spots violet in colour. Following the usual mycological techniques, the causal organism was isolated, purified (single spore culture) and identified as *Drechslera hawaiiensis* (Bungicort) Subram and Jain.

The disease was reproduced on healthy fruits by inoculating the spore suspension (360 spores/ml) through cork borer[1] and pin pricks at natural depressions (eyes). Fifteen fruits were taken for each experiment and five for control. The treated and control fruits were incubated at 28 ±2°C for 15 days to record the symptoms.

The typical rot symptoms that included maceration, tissue discoloration and emission of the foul smell, appeared 12 days after inoculation (figure 1). Later the entire diseased portion was covered by mycelia bearing