FIG. 1 Early diagnostic features of Kresek (wilt) phase of bacterial blight of rice.

leaves or the water as symptoms of the disease in Japan. In India, the infected seedlings wilted rapidly[4]. The early symptoms in the lower leaves of the tiller is believed as a consequence of invasion of the pathogen through the root system where inoculated and subsequent rapid multiplication in the vessels of older leaves. The response of youngest leaf to the internally spreading pathogen seems to be the consequence of its inherent sensitiveness to the infection.

The author is grateful to Dr. R. A. Singh for sustained interest in the work and constant encouragement. He thanks the ASPEE Agricultural Research and Development Foundation, Bombay, for the award of a fellowship during the tenure of which the present investigations were carried out.

May 9, 1980.

1. Reitsma, J. and Schure, P. S. J., *Contr. Gen. Agric. Res. Stn. Bogor*, 1950, **117**, 17.
2. Schure, P. S. J., *Ibid.*, 1953, **136**, 17.
3. Srinivasan, N., Personal Note, 1980.
4. Srivastava, D. N. and Rao, Y. P., *Curr. Sci.*, 1966, **35**, 60.
5. Yoshimura, S. (ed.), In *Rice in Asia,* The Association of Japanese Agric Scientific Societies, University of Tokyo, 1975, p. 340.
6. — and Iwata, K., *Proc. Ass. Pl. Prot. Hokuriku,* 1965, **13**, p. 25.

FOLIAR NECTARIES IN *TERMINALIA ARJUNA* (COMBRETACEAE)

T. M. RAMAKRISHNA
Department of Botany,
Maharani's Science College for Women
Mysore, India
AND
G. RAJASHEKARA
Department of Botany, Manasa Gangotri,
Mysore 570 006, India

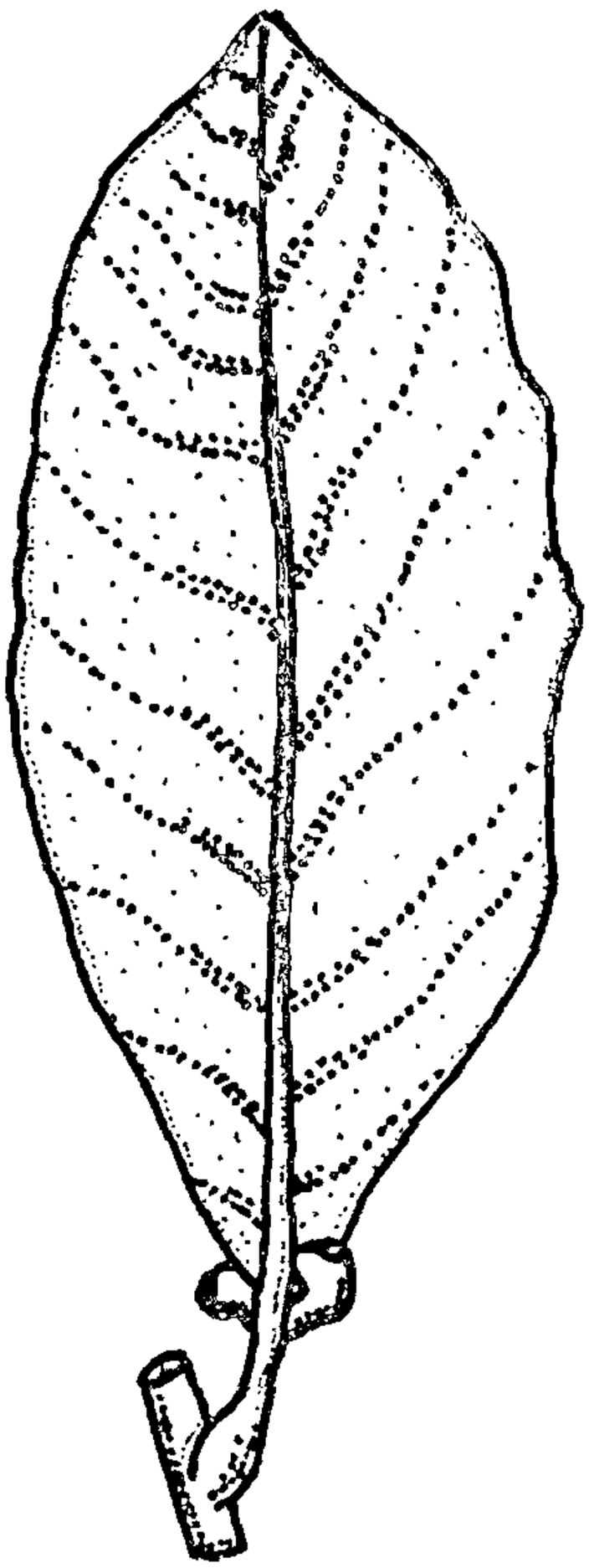
THE earlier taxonomists have recorded the occurrence of foliar 'glands' in the majority of the Angiosperms. These foliar 'glands' occurring at the base of the midrib or on the petiole are the foliar nectaries, often referred as extrafloral nectaries. These foliar nectaries also secrete nectar just as the floral nectaries. The studies with regard to the role of extrafloral nectaries in the economy of the plants, structure and morphology have not received adequate attention. But of late, there are stray reports especially in families, Bignoniaceae, Convolvulaceae, Fabaceae, Acanthaceae and Iridaceae.

Rao[1] described the structure and development of extrafloral nectaries in *Spathodea stipulata*, a member of Bignoniaceae. He also established beyond doubt that the products of secretion of these nectaries contain reducing sugars. Similar studies were made by Inamdar[2], Elias[3], Elias and Gelband[4].

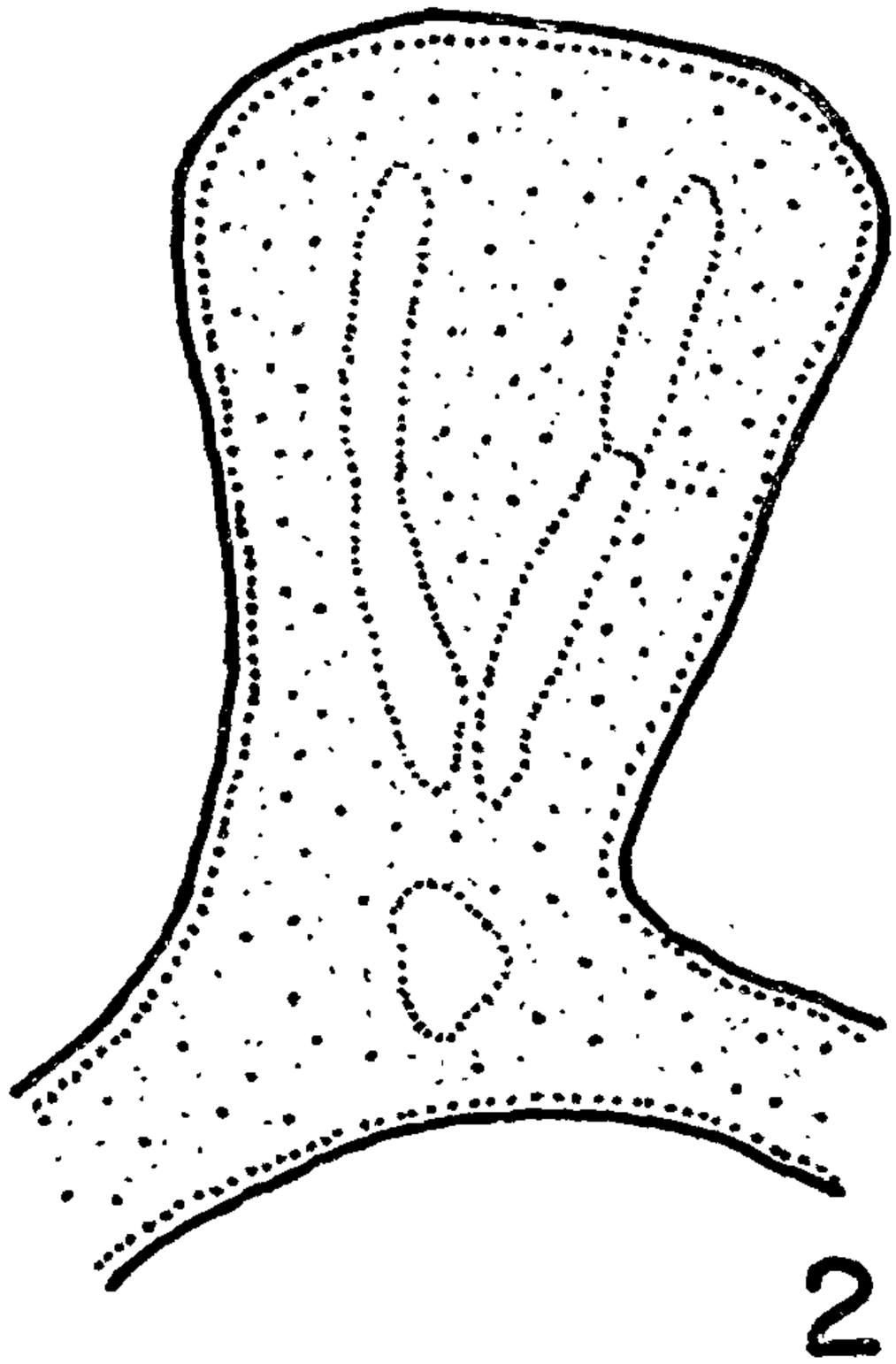
The present study deals with the structure, morphology and functions of foliar nectaries of a member of Combretaceae *Terminalia arjuna* Wt. and Arn.

The foliar nectaries along with a portion of the petiole were cut and fixed in 1:3 acetic alcohol and later preserved in 70% alcohol. Customary methods of dehydration infiltration and embedding were followed. The sections were cut at 10–12 μm thick and stained with safranin and light green. In addition several fresh nectaries were used to detect the presence of reducing sugars.

A single or a pair of foliar nectaries develop at the base of the midrib and they are present on either side of the petiole (Fig. 1). Each nectary is subsessile, cone-like (Fig. 2) in outline, with a depression at the top in the matured nectaries. The epidermis of the nectary becomes epithelial (Fig. 3) particularly within the depressions of the nectary, while on the outside, the epidermis remains normal. The mature nectaries in addition to showing disintegration of cells within, vascular traces are also present (Fig. 4). A careful watch on the nectaries revealed that myriads of ants feed on the nectar. The secreted nectar contains reducing sugars as has been revealed by Fehling's test.

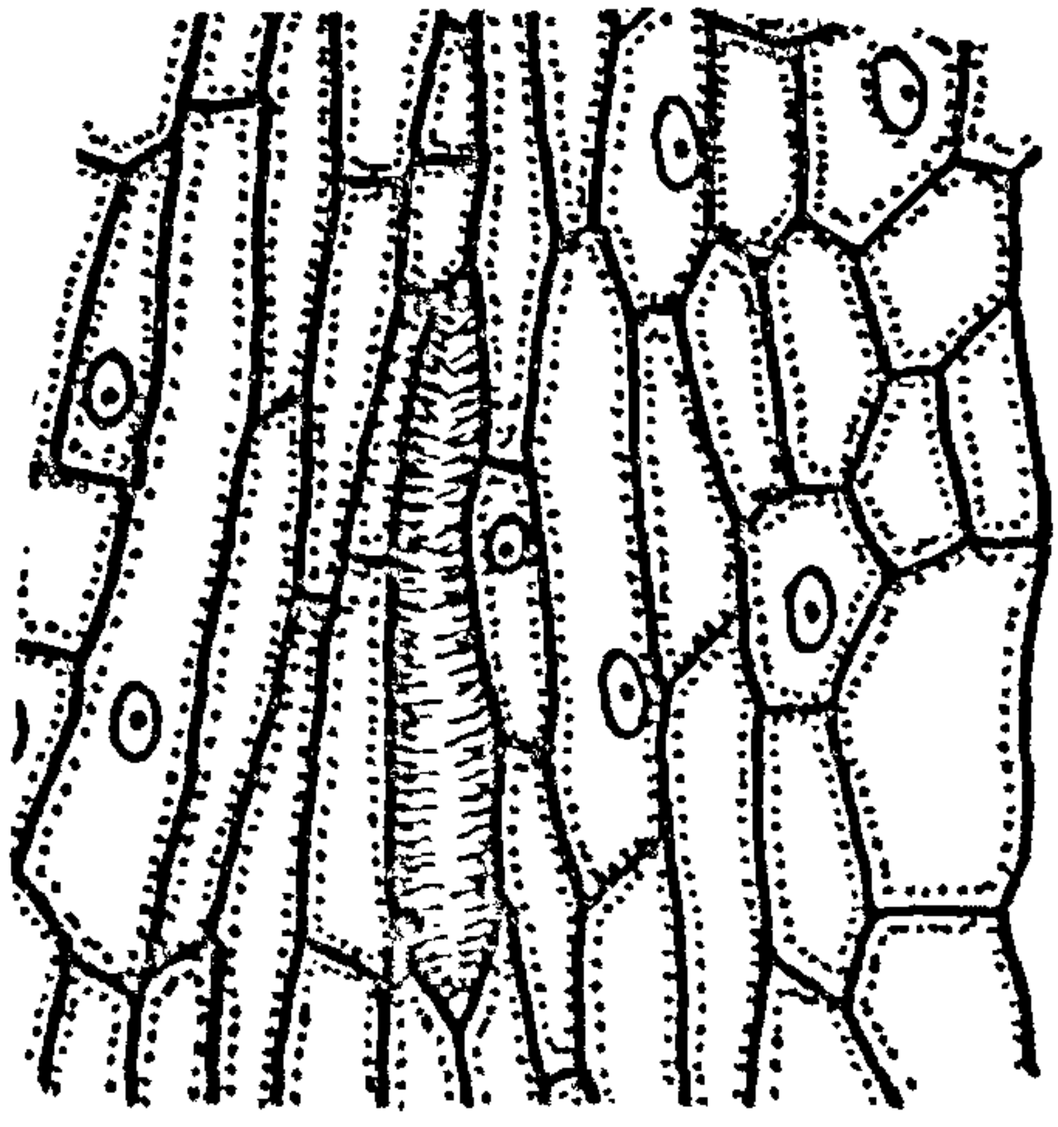


1



2

3



4

FIGS. 1–4. Foliar nectaries of *Terminalia arjuna*. Fig. 1. Surface view of the leaf bearing nectaries at the base of the midrib. Fig. 2. Longitudinal section of a nectary with vacuoles in the centre, × 50. Fig. 3. A portion of a section showing epitholial layer, × 1,000. Fig. 4. A portion of the section showing vascular traces, × 1,000.

The large nectary of *Terminalia arjuna* is more or less similar to that of *Pithecellobium macradenium*[3]. Further, the morphology and anatomy of nectaries in *T. arjuna* studied is different from all other reports[1–4]. The vascular traces present within the bigger nectaries suggest that it is a specialized and well-organized nectary. A similar view has been expressed by Frey Wyssling[5]. However, Elias and Gelband[6] and Carlquist[7] surmised that it is the size of the nectary responsible for the vasculature and it is not the specialization.

Haberlandt[8] suggested that they are additional structures of normal floral nectaries; however he has not suggested the function. Faegri and Pijl[9] have demonstrated that the extrafloral nectaries function as an ant-guard in species of *Thunbergia grandiflora* (Acanthaceae), *Canavallia* (Papilionaceae), species of *Iris* (Iridaceae) and *Ipomoea* (Convolvulaceae). The present study also confirms the view arrived at by Faegri and Pijl[9].

February 5, 1981

1. Rao, L. N., *J. Indian Bot. Soc.*, 1926, 5, 113.
2. Inamdar, J. A., *Proc. Indian Acad. Sci.*, 1969, B70, 232.
3. Elias, T. S., *Bot. Gaz.*, 1972, 133, 38.
4. — and Gelband, H., *Science*, 1975, 189, 289.
5. Frey Wyssling, A., *Ber. Schweig. Bot. Ges.*, 1933, 42, 109.
6. Elias, T. S. and Gelband, H., *Amer. J. Bot.*, 1976, 63, 1349.
7. Carlquist, S., *Phytomorphology*, 1969, 19, 332.
8. Haberlandt, G., *Physiological Plant Anatomy*, Macmillan and Co., London, 1914.
9. Faegri, K. and Pijl van der, L., *The Principles of Pollination Ecology*, Pergaman Press, London, New York, 1966.

A PREHISTORIC SITE AT VULLIPATTADI (NEAR SRI PADMAVATHI WOMEN'S COLLEGE, TIRUPATI), CHITTOOR DISTRICT, SOUTH INDIA

S. Bhaskar

Department of Sociology
Sri Venkateswara University, Tirupati 517 502
Andhra Pradesh, India

The village Vullipattadi lies on 13° 38′ north latitude and 79° 19′ east longitude situated one kilometre east by southeast to Sri Venkateswara University Campus, Tirupati, South India.

The village and its surrounding areas are found to be the abode of Early Man in the remote past. To the north and northwest of this village at about four kilometres, Tirupati Hill ranges are situated which consist of geologically 1,500 million year old quartzites and 2000 million year old granites of the Purana and Archean eras. The Eparchean unconformity of 500 million years is prominently present as in other parts of the world. Besides these, trap dykes cutting through the Archeans are also seen. The other Pleistocene formations are recent alluvial deposits and soils.

The observation of the present flora and fauna as well as water resources at and around the site suggest that in the remote past the environmental conditions were to a large extent congenial for the survival and perpetuation of human technology and culture.

During the present explorations (1980) a site belonging to the lower palaeolithic period was discovered at Vullipattadi village. It is located to the north by northwest to the village and is spread over about half-a-square kilometre in area. A random sample of nine handaxes, 12 flakes, five worked nodules (incomplete tools which may be fashioned into handaxes or cleavers) and three cleavers were collected from ten square metre area (Plate I). Apart from this collection, four worked nodules, six flakes and three handaxes were also picked up from their *in situ* position at the depth of 3 to 5 feet in the pebbly-gravel layer. The creek section consists of 1·5 to 2 feet humus, 3·5 to 4·5 feet loosely packed pebbly-gravel which is a cultural layer and below that the distintegrated granite rock (Plate II).

The preliminary examination of the tools reveals that block-on-block and cylinder hammer techniques have been employed for the manufacture of the tools. Basing on the typotechnology of the tools and their stratigraphical position in the section at the site, they can be assigned to the early Acheulian period of Lower Palaeolithic period and they may tentatively dated back to beyond 60,000 years B.C. and it supports the

Plate I. The lower palaeolithic artifacts from Vullipattadi.