THE OCHREOLE IN *EQUISETUM RAMOSISSIMUM* DESF.

B. D. SHARMA

Department of Botany, University of Jodhpur, Jodhpur 342001, India

Abstract

Ontogeny and structure of ochreoles produced during origin of lateral branch in *Equisetum ramosissimum* is described. The ochreole is correlated with the integument of a seed bearing plant. It may or may not have vascular system and stomata.

Introduction

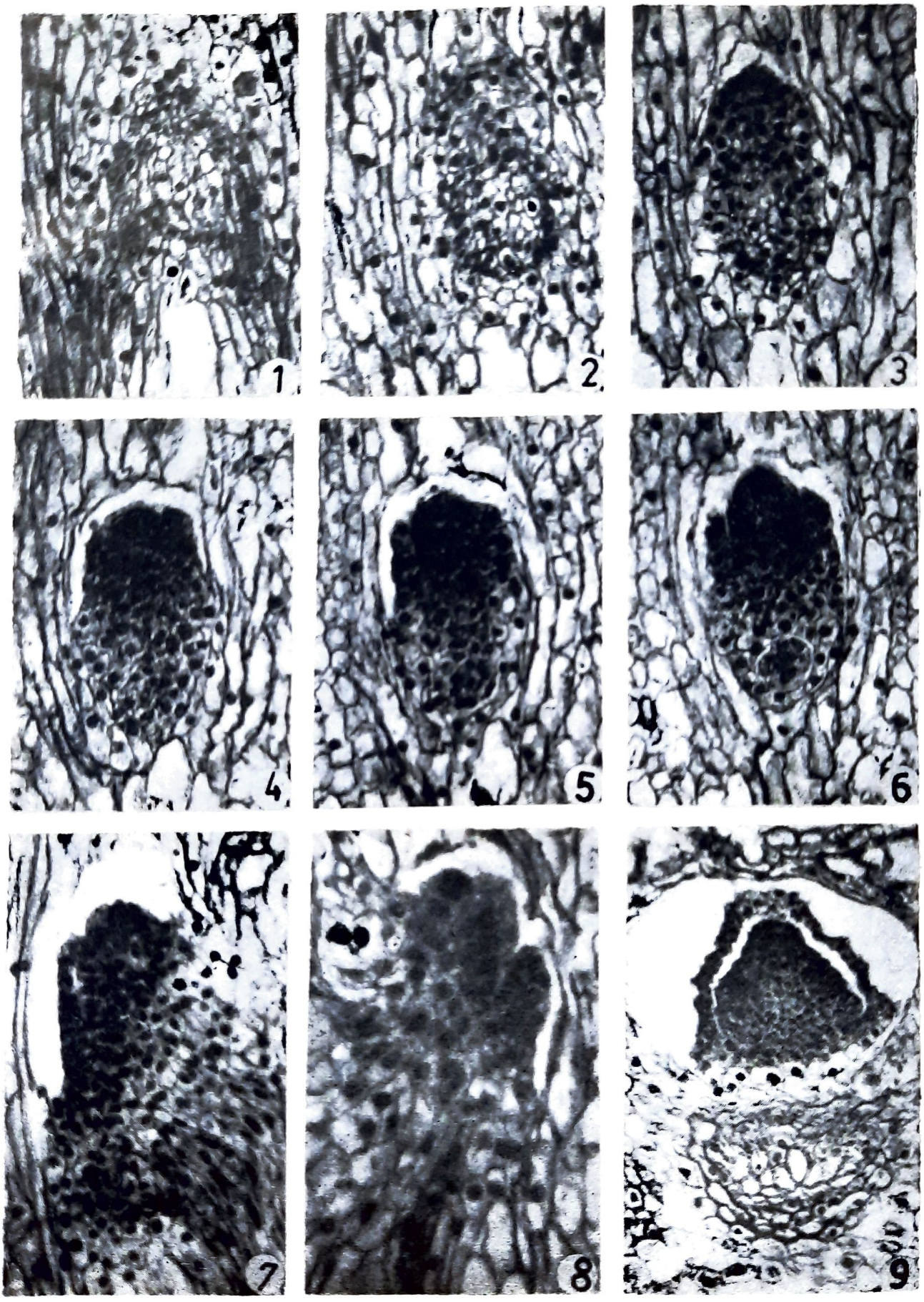
The genus *Equisetum* is peculiar in its mode of branching. The branches originate in whorls below the nodes and in between the leaves. In other words, the branches are associated with the node below them, rather than the node above (Hauke, 1987). The leaves are reduced to scales which are fused by their bases and form distinct leaf sheath at each node. However, the basal sheath of the branch differs from all other nodal sheaths in colour, absence of vascular strand, stomata and subjacent internode. This basal sheath is called the ochreole and has been interpreted differently by various workers (Vaucher, 1821; Duval-Jouve, 1864; Milde, 1867; De Block, 1923; Johnson, 1937; Golub & Wetmore, 1948). Hauke (1987) has discussed the history in detail and describes the presence of stomata (*E. sylvaticum*) and vascular strand (*E. diffusum*) in he ochreole and calls it a prophyllar sheath, equivalent to the first leaf (Cotyledon) formed from the embryo in seed bearing plants (Arber, 1925). In the present paper the origin and development of ochreole in *E. ramosissimum* is described.

The material was collected from Jaipur and fixed in F. A. A. Microtome sections were cut at 10 μm through the stem in cross section as well as longitudinal planes. A combination of safranin and haematoxylin was used for staining and sections were mounted in canada balsam.

Description

Serial sections in longitudinal plane (Figs. 1-6) show the origin of branch and differentiation of ochreole from the central dome-shaped structure. The origin of branch is exogenous (Hauke, 1987), but its differentiation starts quite deep in the cortex and in between the ridges (leaves). The branch initials (Pl. 1, fig. 1) divide rapidly and a mass of small cells is produced (Pl. 1, fig. 2). This mass of cells differentiates into two zones, i. e., the basal portion and the upper (outer) portion (Pl. 1, fig. 3). In the latter, the cells are regularly arranged and have taken deep stain with haematoxylin. Surrounding this dome-shaped structure originate the outgrowth, the ochreole (Pl. 1, figs. 4-8). It becomes a 2-3 cells thick covering over the 'dome' (Pl. 1, figs. 9, 11). The cells of the ochreole look quite distinct from that of the 'dome' in presence of larger, deep staining nuclei in cells (Pl. 1. figs. 7,8). In the 'dome' shaped central portion there develops an apical cell which divides by three oblique walls and produces a radial branch similar to the main stem (Sharma *et al.*, 1986). In the lower portion of the branch initials (Pl.1, fig. 2), there develops a circular structure the root tissue (Pl. 1, figs. 5, 6). It is a nonfunctional structure as the roots do not come out from the bases of the branches in the genus *Equisetum*.

A cross section through the node of the stem shows the origin of a number of young branches. The ochreole, surrounds the basal portion in a young branch and it is 2-3 cells thick layer (Pl. 1, figs. 9, 10) without any trace of vascular strand and stomata (Pl. 1, fig. 11). The ochreole is adhered with the branch only in basal region otherwise it remains separate from the branch and the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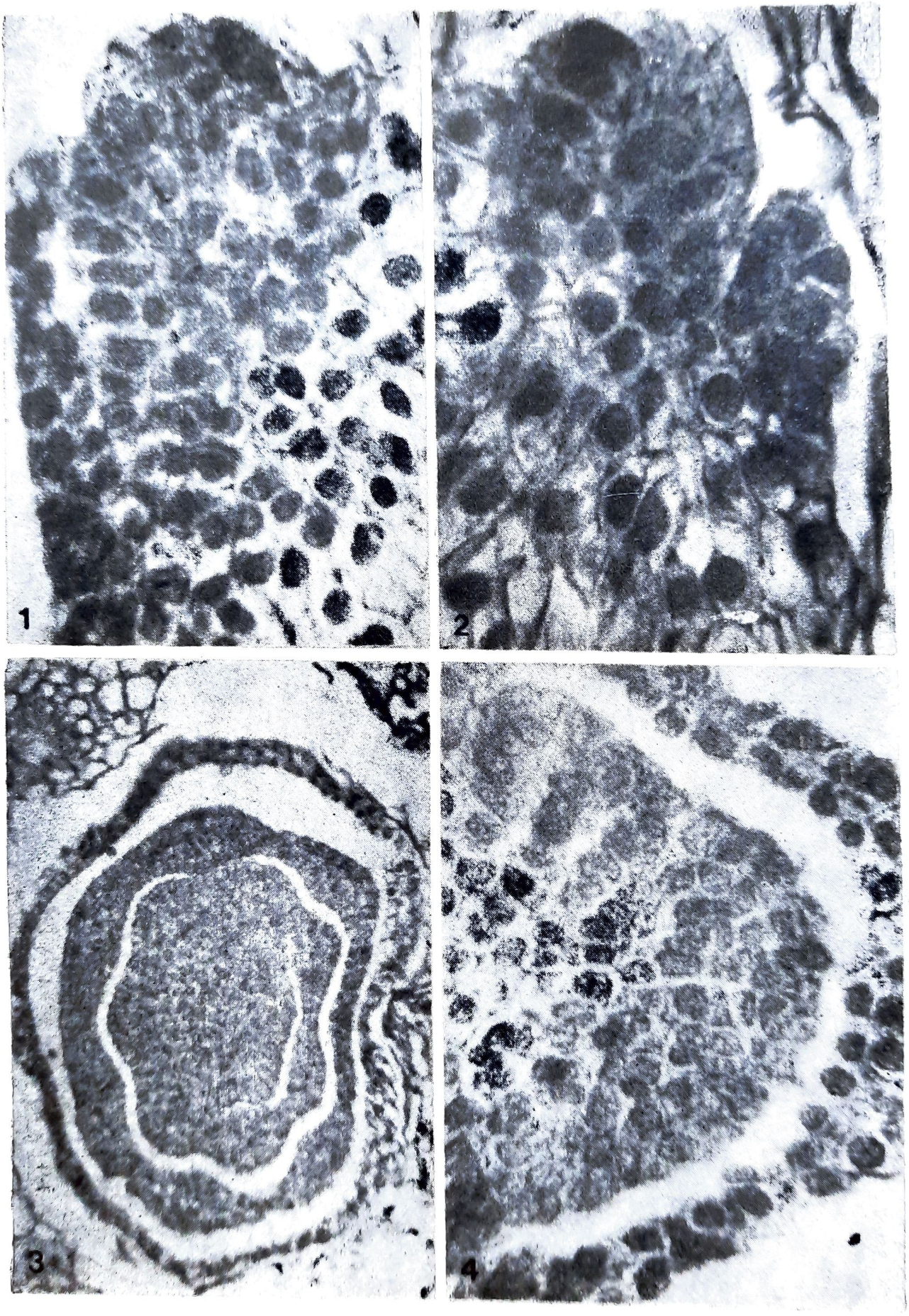

Sharma—Plate 2

surrounding leaf sheaths of the nodes above i.e., a gap is present between the ochreole and the branch (Pl. 1, figs. 9, 10, 11).

Discussion

Hauke (1987) describes the presence of vascular strand and stomata in the ochreole of few species of *Equisetum* and calls it a prophyllar sheath, identical to the first formed embryonal leaf (cotyledon) of seed-bearing plants. This description does not hold good for all the species of *Equisetum*. In addition to *E. ramosissimum* probably a few more species of this genus *E. diffusum* and *E. sylvaticum* do not have vascular strands and stomata in their ochreoles. The ochreole covers completely the young branch and acts as a protective layer for the branch bud in early stages of development. The dome shaped portion of the bud comes out piercing through the ochreole. It cannot be compared with the prophyll of a monocot angiosperm plant which "has a two keeled form, with vascular strands running in the keels" (Arber, 1925, p. 131). The ochreole differentiates from the same tissue which forms the central dome (branch bud). In other words, in ontogeny the ochreole is identical to the integument of seed bearing plants. It may or may not have vascular system and stomata (Bierhorst, 1971; Foster & Gifford, 1974).

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Explanation of plates

Plate 1

(All figs. × 72)

Equisetum ramosissium :

1—9.

1—6. Origin of branch bud and ochreole. Root tissue present in the basal portion of branch bud in figs. 5 and 6.

7, 8. Differentiation of ochreole from central tissue of branch bud.

9. Ochreole covering branch bud (cross section).

Plate 2

Equisetum ramosissimum.

10. Ochreole surrounding young branch (cross section). ×144.

11. Ochreoleprotecting 'dome'. Ochreole cells distinct from that of 'dome'. ×116.