

STUDIES ON *ISOETES SAHYADRIENSIS* MAHABALÉ I. ONTOGENY OF STOMATA

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ABSTRACT

In this, the first of a series on *Isoetes sahyadriensis* Mahabalé, the investigation on the ontogeny of stomata is reported. The stomata generally conform to the Perigenous type of PANT (1965).

INTRODUCTION

Genus *Isoetes* is represented in South India by three species; *I. coromandelina* L. (EKAMBARAM & VENKATANATHAN, 1963), *I. sahyadriensis* Mahabalé (MAHABALÉ, 1938) and *I. sampathkumaranii* Rao (RAO, 1944). *I. sahyadriensis* was described by MAHABALÉ (1938) from the mountain lakes on the table land at Panchagani (Maharashtra) and from the ponds on the grassy tops of the Kalhattigiri, Baba Budangiri and other peaks of Sahyadri in Mysore (Karnataka) State. PANT AND SRIVASTAVA (1962) in their studies on the genus *Isoetes* have drawn a comparison between *I. dixitei* and *I. sahyadriensis*. GOSWAMI AND ARYA (1970) while giving a comparative account of the megaspores of five species of *Isoetes* have described the megaspores of *I. sahyadriensis*. But, unfortunately no further information on the morphology of this species is available. Hence, a detailed study of this species is undertaken and the present paper describes the development of stomata.

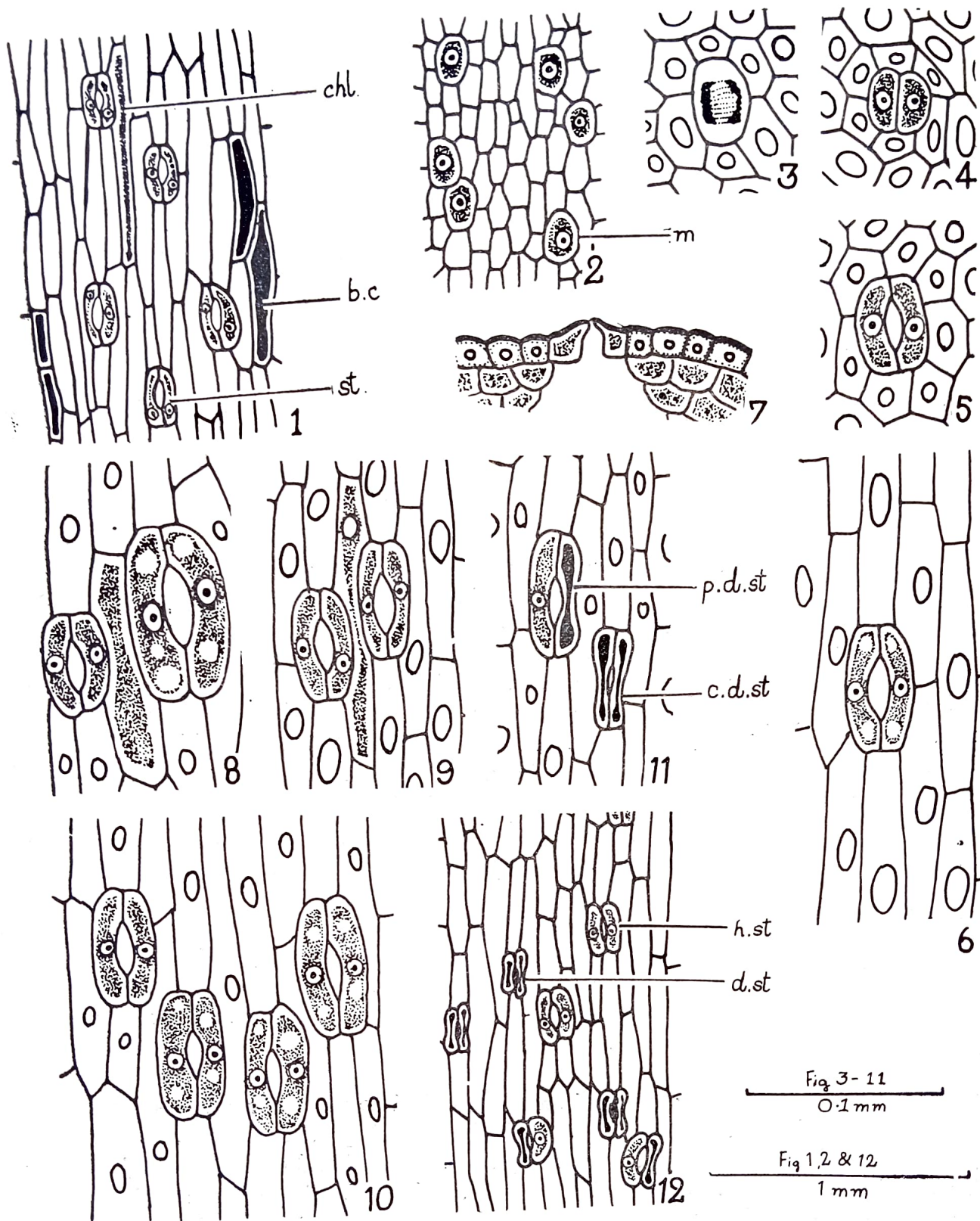
MATERIAL AND METHOD

I. sahyadriensis, an amphibious species, was collected from the ponds at Kalhattigiri, Kemmangundi Hills (1887 km), Karnataka and fixed in F. A. A. Epidermal peels were stained with 1% aqueous Safranin, Iron-haematoxyline and aceto-carmine stains.

OBSERVATION

8-15 leaves are spirally arranged on the tri-lobed corm. Leaves are 7-12 cms long, cylindrical and ligulate. The non-chlorophyllous basal portion bears an oval sporangium. An epidermal cell is $26 \times 5 \mu\text{m}$, straight, thin-walled and elongated longitudinally. A cuticle is present which gets stained brown with Sudan IV. Some of the epidermal cells are chlorophyllous and commonly occur near the stomata. Thick-walled brown cells are found scattered in between thin-walled epidermal cells. Similar brown cells have been reported less frequently in the epidermis of *I. sampathkumaranii* (PANT & SRIVASTAVA, 1962).

Stomata are oriented in distinct rows (Text-fig. 1). At the base of a young leaf, meristemoid is well distinguished from the neighbouring cells by its larger size and darker stain (Text-fig. 2). This cell divides by a wall parallel to the long axis of the leaf to produce two guard cells (Text-fig. 3). These are at first hemispherical but later elongate and a lenticular pore appears in between them (Text-fig. 4). Epidermal cells surrounding a young stoma undergo transverse and longitudinal divisions to form the subsidiary cells



Text-figs. 1-12

1. Surface view of epidermis with rows of stomata, 2. Meristemoid, 3. Meristemoid dividing, 4. Two guard cells formed, 5. Young stoma surrounded by subsidiary cells, 6. An adult stoma, 7. V. S. A larger stoma lying close to a smaller stoma showing the median beak-like projection of the guard cells, 8. A larger stoma lying close to a smaller stoma, 9. Twin stomata, 10. Contiguous stomata, 11. Partially and completely degenerated stomata, 12. Surface view of epidermis showing healthy and degenerated stomata.

St—stoma, *chl*—chlorophyllous epidermal cell, *b.c.*—brown cell, *m*—meristemoid, *h. st*—healthy stoma, *p. d. st*—Partially degenerated stoma, *c. d. st*—completely degenerated stoma, *d. st*—degenerated stoma.

(Text-fig. 5). These subsequently elongate and cannot be well differentiated from the other epidermal cells (Text-fig. 6). An adult stoma is $14 \times 8 \mu\text{m}$ with the pore $6 \times 3 \mu\text{m}$. Each guard cell has a median beak-like projection (Text-fig. 7). Sometimes a larger stoma $18 \times 10 \mu\text{m}$ lies closer to a smaller stoma $12 \times 6 \mu\text{m}$ (Text-fig. 8). Seemingly twin stomata and very closely placed stomata are also found (Text-figs. 9 & 10). Stomata without cell contents in the guard cells are rare, but partial or completely degenerated stomata are common (Text-fig. 11). Non-functioning of stomata may be perhaps due to the submerged condition of leaves of this species. But, in many leaves degenerated stomata are found indiscriminately mixed with healthy functional stomata (Text-fig. 12).

DISCUSSION

Ontogeny of the stomata of *I. sahyadriensis* resembles that described for *I. coromandelina*, *I. indica* and *I. panchananii* (PANT & MEHRA, 1964). The development of the stomata conforms to the Perigenous type of PANT (1965) and Polyperigenous type of FRYNS-CLAESSENS AND VAN COTTHEM (1973). The stomatal index of the present species is 3.5 and the average stomatal frequency is 26. PANT AND SRIVASTAVA (1962, p. 261), based on the stomatal frequency and the stomatal index, divided the Indian species of *Isoetes* into two groups. *I. coromandelina*, *I. indica* and *I. dixitei* show a relatively higher frequency of stomata while lower frequency of stomata is observed in the other group consisting of *I. sampathkumaranii* and *I. panchananii* (Table 1). *I. sahyadriensis* with its stomatal frequency of 26 can be included in the latter group.

Table 1—Frequency of stomata and stomatal indices of various species of *Isoetes* (Pant & Srivastava, 1962)

Name of species	Average Stomatal index	Average Stomatal frequency
<i>I. coromandelina</i>	10.1	65
<i>I. dixitei</i>	8.05	69
<i>I. indica</i>	9.8	73.9
<i>I. sampathkumaranii</i>	5.9	26.7
<i>I. panchananii</i>	4.5	26.7
<i>I. sahyadriensis</i>	3.5 (Present observation)	26 (Present observation)

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