

# STUDIES ON THE UPPER GONDWANA OF KUTCH— 2. ISOETACEAE

M. N. BOSE & S. K. ROY

Birbal Sahni Institute of Palaeobotany, Lucknow

## ABSTRACT

Two species of *Isoetites* Muenster form the subject of this paper. One of them, *I. serratifolius* n. sp., is based on impressions of detached leaves with prominent serrations and is devoid of spore. The other *I. indicus* is preserved in the form of incrustation having only the basal regions of the sporophylls forming a sort of rosette, each sporophyll with numerous megaspores.

## INTRODUCTION

IN the Upper Gondwana of Kutch Isoetaceae is represented by two species of *Isoetites*—*I. serratifolius* n. sp. and *I. indicus* n. sp. The specimens of the former species were collected from about two and a half miles S.W. of Ghuneri in Kutch by Drs. U. Prakash and S. K. Srivastava of Birbal Sahni Institute of Palaeobotany in 1958. The later species was collected by one of us (ROY) from Trambau also in Kutch during 1960-61.

*Isoetites serratifolius* n. sp.

Pl. 1, Figs. 1-5

*Diagnosis*—Detached leaves, 2.7-6.6 cm. long. Base (sporangial region) broad, somewhat spoon-shaped, obovate, 1.7-2.1 cm. long, broadest region about 0.5-0.7 cm. Upper part flattened, thin, showing a prominent vascular trace in the middle. Margin for a short distance near the base entire, major portion being serrated, mostly the serrations curved inwards, about 1 mm. long. Sporangial region obovoid, about 1.2 cm. long, broadest region 3 mm.

*Locality*—About 2½ miles S.W. of Ghuneri, Kutch.

*Horizon*—Umia stage.

*Collection*—Syntype Nos. 32717, 32718, and 32672 of Birbal Sahni Institute of Palaeobotany, Lucknow.

*Description*—The collection includes 5 specimens. Except one all are in counterparts. The most complete specimen is shown in Pl. 1, Fig. 3, here too both the apical

and the basal region is not complete. In none of the specimen neither ligule nor velum is clearly marked, however, one specimen No. 32718 (Pl. 1, Fig. 1) shows a faint triangular impression suggestive of a ligule. In each (where the base is preserved) the sporangial region is marked by an elongated oval impression at the centre of the expanded base.

*Comparison*—*Isoetites serratifolius* resembles most *Isoetites choffati* Saporta described by Teixeira (1948) from the Mesozoic of Portugal. However, unlike the later species, the present specimens have leaves with serrated margin. In this character they are also distinct from *I. choffati* reported by Teixeira (1952) from the Cretaceous of Leiria. *I. serratus*, described by Brown (1939), have leaves also with serrated margins. But in this species the serrations are present only around the spatulate ends of the leaves. In *I. serratifolius* the leaves do not have spatulate ends and moreover, except at the basal region almost the entire margin is serrated.

*Isoetites indicus* n. sp.

Pl. 1, Figs. 6-17

*Diagnosis*—Only basal region of sporophylls with megaspores preserved. Sporophylls numerous forming rosettes. Rosettes 2.5-4.5 cm. in diameter. Preserved portion of sporophylls mostly oval with entire margin, broadest region measuring 4.6 mm. Each sporophyll with numerous megaspores, more than 1,500 in number. Megaspores trilete, anispolar, radiosymmetric, triangular to sub-triangular in equatorial outline; equatorial diameter 285-430  $\mu$ . Inner body  $\pm$  oval, equatorial zona or flange 30-45  $\mu$  broad, widest opposite the ray-ends, membranous; Y-mark (laminated) membranous, sometimes undulating, extends up to the margin of the zone. Exine 4.5 to 7  $\mu$  thick, reticulate formed by the anastomosing ridges both on the proximal and distal sides, muri

about 6-10  $\mu$  wide, lumina  $\pm$  polygonal, 16-26  $\mu$  in size, infragranulate.

*Locality* — Trambau, Kutch.

*Horizon* — Umia stage.

*Collection* — Syntype Nos. 32220, 32219, 32221 and 32227 of Birbal Sahni Institute of Palaeobotany, Lucknow.

*Description* — The above diagnosis is based on eight carbonized specimens. In each only the basal portion of the sporophylls are preserved. So nothing is known regarding the upper sterile portion. In none of them the central axis is preserved. Each rosette shows a central hollow region 0.8-2.4 cm. in diameter, perhaps this region was once occupied by the 'Corm', or the central axis. In none ligule is visible. None of the transfers indicated the nature of the sporangial wall, trabaculae and velum. Under reflected light transfer preparations showed a somewhat compact group of megaspores in each sporophyll. When individual sporophylls were macerated in HNO<sub>3</sub> the megaspores got separated from each other and nothing was left of the sporangial wall or the sporophyll.

*Comparison* — *Isoetites indicus* may be compared with *Isoetites elegans* Walkom (1941-42) from Gingin, Western Australia. In both the sporophylls are arranged in a rosette and both of them bore only megaspores. *I. indicus* can readily be distinguished from *I. elegans* in having broader sporophylls (basal region) and also the megaspores in the former species are much more numerous and are smaller in size. While in *I. indicus* the megaspores are more than 1,500 in number and they are 285-430  $\mu$  in diameter, in *I. elegans* the megaspores are only 40-55 in number and they are 0.5 mm. in diameter. From *I. serratus* Brown (1939) *I. indicus* can readily be distinguished in the absence of corm and roots. Also the leaves of *I. serratus* have

spatulate ends with serrate margin. The character of leaf ends in *I. indicus* is not known. From *Nathorstiana arborea* described by Magdefrau (1932) *I. indicus* can at once be distinguished by its complete absence of the stem. In this character our species is also distinct from *Nathorstianella babbagensis* described by Glaessner & Rao (1955).

## DISCUSSION

The present specimens have been described here under the generic name *Isoetites* Muenster because the sporophylls in both the Kutch species are morphologically similar to *Isoetites choffati* Saporta (1888, 1894), *I. serratus* Brown (1939), *I. horridus* Brown (1939), *I. elegans* Walkom (1941) and *I. choffati* described by Teixiera (1948, 1952). Both *I. serratifolius* and *I. indicus* can readily be distinguished from *Nathorstiana* Richter (1909) and *Nathorstianella* Glaessner and Rao (1955) in the complete absence of the stem or 'Corm'. In this character our species are quite distinct from the modern genus *Stylites* Amstutz (1957) also described by Rauh & Falk (1959). The prominent elongate caudices as is known in *S. andicola* are entirely missing in the Cutch specimens. The leaves of *I. serratifolius* are somewhat different from the modern species of *Isoetes* in having prominent serrations. The megaspores of *I. indicus* are well within the range of those in recent species which is from 250  $\mu$  to 900  $\mu$ . The megaspores resemble most the megaspores of the Sect. *Reticulatae* described by Pfeiffer (1922).

Here, provisionally the Ghuneri and the Trambau specimens have been described under separate species as no megaspores are known from *I. serratifolius* and also as nothing is known regarding the apical regions of the sporophylls of *I. indicus*.

## REFERENCES

- AMSTUTZ, E. (1957). *Stylites*, a new genus of Isoetaceae. *Ann. Mo. bot. Gdn.* **44**: 121-123.
- BROWN, R. W. (1939). Some American fossil plants belonging to the Isoetales. *J. Wash. Acad. Sci.* **29** (6): 261-269.
- GLAESSNER, M. F. & RAO, V. R. (1955). Lower Cretaceous plant remains from the vicinity of Mount Babbage, South Australia. *Trans. roy. Soc. S. Aust.* **78**: 134-140.
- MAGDEFRAU, K. (1932). Über *Nathorstiana*, eine Isoetacee aus dem Neokom von Quedlinburg a. Harz. *Beih. bot. Cent.* **49** (11): 706-718.
- PFEIFFER, N. E. (1922). Monograph of the Isoetaceae. *Ann. Mo. bot. Gdn.* **9**: 79-232.
- RAUH, W. & FALK, H. (1959). *Stylites* E. Amstutz. eine neue Isoetacee den Hochanden Perus. *S.B. heidelberg. Akad. Wiss. Math. Nat. Kl.* **1 & 2**.

- RICHTER, P. B. (1909). Beiträge zur flora der unteren Kreide Quedlinburgs. 11. Die Gattung *Nathorstiana* und *Cylindrites spongioides*. Leipzig: 3-12.
- Idem (1910). Über *Nathorstiana* und *Cylindrites spongioides*. *Z. dtsh. geol. Ges.* **62**: 278-284.
- SAPORTA, G. (1888). Dernières adjonctions à la flore fossile d'Aixen-Provence. *Ann. Sci. Nat.* **7**: 1-104.
- Idem (1894). Flore fossile du Portugal. Lisbon: 133-137.
- SEWARD, A. C. (1910). Fossil plants. **2**. Cambridge.
- TEIXEIRA, C. (1948). Flora Mesozóica Portuguesa. *Serv. Geol. Portugal.* **1**: 1-74.
- Idem (1952). Notes sur quelques gisements de végétaux fossiles du Crétacé des environs de Leiria. *Rev. Fac. Cien. Lisboa.* **2** (2): 133-154.
- WALKOM, A. B. (1941-42). Fossil plants from Gingin, Western Australia. *J. roy. Soc. W. Aust.* **28**: 201-207.

## EXPLANATION OF PLATE 1

- 1, 2. *Isoetes serratifolius* n. sp. Nos. 32718 and 32672. × 1.
3. *I. serratifolius* No. 32717. × 1.
4. *I. serratifolius*, showing serrate margin of sporophyll. No. 32723. × 1.
5. The above magnified. × 3.
- 6-9. *Isoetes indicus* n. sp. Nos. 32219, 32221, 32220 and 32227. × 1.
10. Transfer preparation of specimen No. 32220 shown in Fig. 8. × 1.
11. Magnified view of two sporophylls from the above transfer preparation. × 5.
12. A portion from the above further magnified, showing megaspores. × 10.
13. Dry megaspores as seen on the transfer preparation. × 16.5.
- 14-17. Isolated megaspores of *I. indicus* after HNO<sub>3</sub> acid treatment. Sl. Nos. 32220/1-11, 32220/19-7, 32221/17-4, 32220/19-9. × 100.

