

LIDGETTONIA MUCRONATA SP. NOV. A FEMALE FRUCTIFICATION FROM THE LOWER GONDWANA OF INDIA

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ABSTRACT

A new species of *Lidgettonia*, *Lidgettonia mucronata* has been described. It consists of a spatulate fertile leaf with veins spreading out from the base, dichotomise and form meshes. Eight short pedicels, each carrying one cupulate disc at its apex are attached on the basal part of the fertile leaf, 4 on either side. Cupulate disc is almost circular, carrying small seeds on its underside.

INTRODUCTION

THOMAS (1958) described from a place called Lidgetton in Natal, South Africa a collection of fossil plants which consisted of sterile leaves of *Glossopteris*, some fertile leaves, a few sporangium-like organs and isolated seeds. Under a new generic name, *Lidgettonia*, he included these sterile leaves of *Glossopteris* found in association with the fertile leaves, bearing two rows of 4-6 small, disc-like cupules. The type species is *Lidgettonia africana*. Thomas's idea of *Lidgettonia* was that the plant had foliage leaves of *Glossopteris* type which were accompanied by smaller fertile leaves bearing cupules. In these plants the reproduction was probably effected through the agency of structures produced in small and delicate cupules, borne on stalks of the fertile leaves. He further observed that while there is no direct and, indisputable evidence as to the nature of the bodies borne in the "cupules", there is considerable likelihood that the cupules contained small elongated sporangia and also small seeds in some of them. Both these were occurring in considerable abundance in the matrix with fertile leaves. Therefore, the idea of Thomas was that these fertile leaves carried sporangia as well as seeds.

Surange and Maheshwari (1970) instituted from India another species, *Lidgettonia indica* and regarded it as only a female fructification. The fertile leaf of *L. indica* possessed spatulate lamina with dichotomising veins, but the anastomosing was not clear. From the long stalk of the fertile

leaf sprang 2-4 (mostly 4) pedicels in a single row, bearing what looked like ovules; each pedicel carried one ovule at its apex. What Thomas described as cupules in *L. africana* were regarded as ovules or seeds in *L. indica* by Surange and Maheshwari. Furthermore, Surange and Maheshwari's *Lidgettonia* had only a single row of so called ovules, whereas Thomas's *Lidgettonia* had two rows of cupulate discs. Recently Surange and Shaila Chandra placed *Lidgettonia indica* under a new name, *Partha indica*

White (1964) described *Lidgettonia australis* from Australia. It consisted of supposedly seed-bearing scale leaves, which do not have the arrangement characteristic of *Lidgettonia*. The type specimen of *Lidgettonia* is a fertile leaf and it may be better to restrict only fertile organs to this genus as suggested by Surange and Maheshwari (1970). White's specimen should therefore, be excluded from *Lidgettonia*.

The material for the present paper comes from a thick bed of hard, compact, clayey shale, exposed in a road cutting at Hinjrida Ghati, north of Handappa in Orissa. The age is probably Upper Raniganj. There is only one specimen, fairly well preserved in the form of impression in our collection.

DESCRIPTION

Genus — *Lidgettonia* Thomas

Emended diagnosis — Fertile leaves short, spatulate lanceolate with broadly round apex; veins spreading from base, forking and anastomosing; lower portion of the leaf or petiole with two longitudinal rows of disc-like cupules; cupules 3-4 in each row, carried on short stalks, flat, almost circular, disc-like; margin undulating.

Lidgettonia mucronata n. sp.

Diagnosis — Fertile leaf 7 cm. long, spatulate, apex broadly rounded with mucronate tip; lamina 1.6 cm. broad at the broadest part; no midrib, veins spread out from the base, dichotomise, form

meshes; eight short pedicels attached on basal portion of the leaf, four on either side, pedicels 6-7 cm. long, 1 mm. broad; cupulate discs 8 mm. in diameter, almost circular but circle incomplete, margins undulating; small, unwinged seeds probably on the under side of the cupulate discs.

Holotype — B.S.I.P. No. 35035

Age — Raniganj Stage.

Locality — Handappa, Orissa, India.

The one specimen in our collection occurs on a fine grained, grey shale and the fossil also is grey in colour. It is, therefore, difficult to photograph because of the lack of contrast with the matrix. The holotype and its counter part are shown in Pls. 1, 2, Figs. 1, 2, 6; Text-Figs. 1, 2. Fertile leaf is almost complete and it is 7 cm. long and 1.6 cm. broad at the broadest part. The leaf is spatulate in shape with broadly rounded apex, which is drawn out in the middle into a mucronate tip (Pl. 2, Fig. 6; Text-Figs. 1, 2). The lamina is contracted towards the base into a long petiole, measuring about 6 mm. in breadth. The



TEXT-FIG. 1 — Holotype of *Lidgettonia mucronata* B.S.I.P. No. 35035 showing seven cupular discs attached by their stalks to the basal portion of the fertile leaf. The fourth cupular disc on the right side is missing. $\times 2$.



TEXT-FIG. 2 — Counter part of the holotype. Here only six cupular discs are seen. Mucronate tip of the spatulate fertile leaf is clearly seen here. $\times 2$.

venation is clearly preserved in some portions of the leaf (Pl. 2, Fig. 6; Text-Figs. 1, 2). There is no midrib. A number of veins spread out from the base of the lamina, those in the middle running straight upwards. All secondary veins dichotomise a number of times and form short meshes right up to the margin. The meshes are comparatively long, narrow and hexagonal. The meshes mostly occur near the margin.

The disc-like cupules are attached by their stalks on the basal portion of the leaf (Pls. 1, 2, Figs. 1, 3, 6; Text-Figs. 1, 2). The stalked cupules are borne in two rows, four or either side of the leaf. One cupule on the right side (Text-Fig. 1) is missing, thus only seven cupules are present in the specimen, but the total number must have been eight. The stalks or pedicels, measuring 6-7 mm. in length and 1 mm. in breadth, spring from the petiole in a row one below the other on each side. It appears likely that the stalks are attached on the upper side of the petiole. The stalks bear more or less circular, fluted, cupular discs at their apical ends (Text-Fig. 3). It looks as if the stalk has branched into finger-like fashion or broadened at its apical end where it is attached to the disc (Pl. 1, Figs. 3, 4; Text-Fig. 3).

The cupular discs measure about 8 mm. in diameter and are almost circular in outline, but the circle is not complete (Text-Fig. 3). The disc is thus more like a



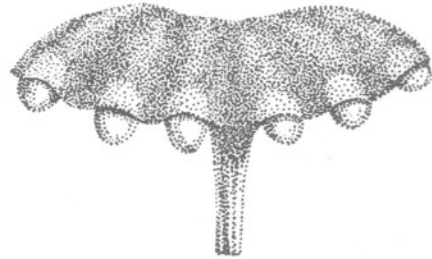
TEXT-FIG. 3—A cupular disc enlarged to show the swellings on its upper surface, probably indicating the positions of the seeds on its under side. $\times 8$.

horse-shoe and appears broken at a place where the stalk is attached with it (Pl. 1; Figs. 3, 4). It appears to us that the incompletely circular cupule is like an umbrella type shallow disc, which has given to it a fluted appearance at the margin. All the cupules in the specimen are preserved in such a way that only their upper sides are visible. Oval to round swellings are seen on this surface and it appears certain that the underside of the disc contain seeds. The swellings indicate the positions of the seeds attached on the undersides of the cupular discs (Pl. 1, Figs. 3, 4; Text-Figs. 3, 4, 5, 6).

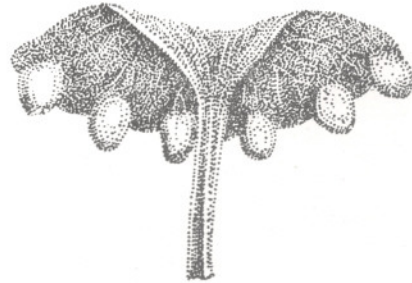
One detached seed, which might have been ejected out of a cupulate disc, is seen lying near the fructification (Pl. 1, Fig. 3;



TEXT-FIG. 4 — An unwinged seed lying close to the specimen shown in Pl. 1, Fig. 3. Such isolated seeds are found in large numbers in the material. $\times 5$.



TEXT-FIG. 5 — A diagrammatic restoration of a stalked cupular disc showing how the seeds might have looked when viewed from the side. $\times 6$.



TEXT-FIG. 6 — A diagrammatic view of the under side of the cupular disc showing the attachment of seeds. $\times 6$.

Text-Fig. 4). The swellings on the cupulate discs are almost of the same size as the detached seed and, therefore, this seed could be assigned with fair amount of certainty to this fructification. The seed is small, unwinged, 3 mm. long and 2 mm. broad (Pl. 1. Fig. 5). A number of such detached seeds are present in our collection.

It is undoubtedly true that the attachment of seeds to the cupulate disc has not been proved by the find of such a specimen

so far. But there appears to be no reason also to suppose that these cupulate disc bore sporangia as Thomas (1958) had suggested. The male fructifications of Glossopteridales known so far are constructed on entirely different patterns (Surange and Maheshwarri, 1970). Moreover the sporangia are too small in size; on the other hand seeds could easily be correlated with the swellings on the cupulate discs. The possibility that the cupules bore seeds is, therefore, much greater.

RECONSTRUCTION

Text-fig. 7 shows a restoration of *Lidgettonia mucronata*. Eight cupular discs, four springing out from each side are shown attached to the upper side of the petiole. The umbrella type cupular discs partly shield small seeds, which are attached on their under surface. Text-figs. 5 and 6 show how the seeds must have been attached on the disc.

COMPARISON AND DISCUSSION

Our specimen compares favourably with the type species of *Lidgettonia africana* figured in Pl. 23, figure 4 by Thomas (1958). In this figure only half of the fertile leaf is preserved, which is about 4 cm. in length but the entire leaf must have been longer than this. The upper part being absent, it is not known what was the shape of the fertile leaf of *L. africana*. The shape of the fertile leaf of *L. mucronata* is as shown in Text-Figs. 1 and 2 and is different from Thomas's fertile leaf of *L. africana* as shown in his Text-fig. 2 (Thomas, 1958). Thomas regarded the contracted lower part of the fertile leaf as a petiole, but in our specimen we do not know if it can be called a true petiole. Further, cupulate discs in our specimens are larger in size than those of *L. africana*. Moreover, *Lidgettonia mucronata* and *L. africana* are found in two different continents and perhaps there may be some difference in age also. We have, therefore, described our specimen under a new specific name.

Surange and Maheshwari's species, *Lidgettonia indica* does not appear to belong to *Lidgettonia* at all. Fertile leaf of *L. indica* Surange and Maheshwari is different in every respect from that of *Lidgettonia africana* and *Lidgettonia mucronata* described here. The so-called ovules or seeds in the former arise in a single row from the stalk, whereas



TEXT-FIG. 7—A restoration of *Lidgettonia indica*. \times Ca. 1.5.

in *L. africana* and *L. mucronata* the cupulate discs arise in two rows. The entire specimen of *L. indica* gives a completely different look from the specimens of *L. africana* and *L. mucronata*. Thus *L. indica* is different in its organization from *Lidgettonia* and, therefore, it has now been transferred to a new genus *Partha*.

Thomas (1958) also included some sterile leaves under the genus *Lidgettonia* which were found associated with the fertile leaves. Such association of sterile and fertile leaves does not prove anything, particularly when, as a rule, diverse types of detached organs and taxa lie close together on a piece of shale in the Gondwana material. The description of the sterile leaves should, therefore, be deleted from the generic diagnosis of *Lidgettonia* as given by Thomas (1958, p. 180) and the genus should be confined to the fertile leaves only. The generic diagnosis has been emended accordingly in the present paper.

Thomas (1958) regarded that some of the cupulate discs of *Lidgettonia* carried sporangia, and some carried small seeds. The male organ bearing sporangia of *Glossopteris* have a different type of organization as is evident from the known male fructifications like *Glossotheca* and *Eretmonia*. It is more likely that these cupulate discs, like those of peltaspermateous pteridosperms, carried only female type of reproductive organs in the form of ovules or seeds.

The structure of the cupulate disc as has been restored in Text-Figs. 5, 6 show

superficial resemblances with the cupulate disc of *Lepidopteris* of the Peltaspermateae. But in size, shape and other structural details *Lidgettonia mucronata* is distinct from *Lepidopteris*. The presence of Mesozoic peltaspermateous type of fructification in the Permian is rather interesting. These might represent blind evolutionary lines culminating into extinct gymnosperm groups.

Thomas (1958) ascribed *Lidgettonia* to *Glossopteris* on the evidence of association. The anastomosing of secondary veins into distinct meshes in the fertile leaf shows similarity to *Glossopteris* as well as *Gangamopteris*. The latter is without midrib, but it may be added that most of the scale leaves in the *Glossopteris* flora (many of them could really be the fertile leaves) do not possess midrib. It is not necessary at all to presume that *Glossopteris* leaves will have fertile scale leaves with midrib. The fertile leaves are specialized types of leaves and, therefore, there is nothing to prevent a normal *Glossopteris* plant to have fertile leaves which are distinct from the sterile leaves. *Lidgettonia mucronata*, therefore, could be regarded as female fructification of either *Glossopteris* or *Gangamopteris* type of leaf genus. However, the possibility of its belonging to *Glossopteris* is more because there is not a single species of *Gangamopteris* present in the fossil locality where *L. mucronata* is found. On the other hand, there are present more than twenty species of *Glossopteris*. In any case *Lidgettonia mucronata* could be assigned to *Glossopteridales* without any doubt.

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EXPLANATION OF PLATES

PLATE 1

1. Holotype of *Lidgettonia mucronata* B.S.I.P. No. 35035. Fertile leaf with four cupules attached on the left side and three cupules on the right side

(see arrows) at its basal portion. The venation is clearly seen. \times Ca. 1.5.

2. Counter part of the holotype with three cupules on either side of the basal portion of fertile leaf. \times Ca. 1.5.

3. Six stalked cupules as seen in Fig. 2. magnified to show their attachment to the basal portion of the leaf. Note an isolated seed (see arrow) on the top left. \times Ca. 3.

Fig. 4. A cupular disc enlarged to show fluted margin and the swellings on the surface. \times 4.

5. The isolated seed seen in Fig. 3 enlarged. \times 6.

6. Holotype of *Lidgettonia mucronata* as shown in Fig. 1. (B.S.I.P. No. 35035) enlarged to show the venation of the fertile leaf and seven cupules attached to its basal portion, four on the left and three on the right side (see arrows). \times 3.



3



5



4



2



1



6