

# ON THE STRUCTURE AND AFFINITIES OF *SAHNIPUSHPAM* *GLANDULOSUM* SP. NOV. FROM THE DECCAN INTERTRAPPEAN SERIES

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## ABSTRACT

A new species of *Sahnipushpam*, *S. glandulosum* is described here in detail from the Intertrappean beds of Madhya Pradesh. A number of specimens probably representing young fruit stage of *Sahnipushpam glandulosum* have also been described. The flowers and young fruits described here are sufficiently well preserved to reveal all their anatomical details. A comparison with the modern families reveals that this dicotyledonous flower shows a near approach to the family Myrtaceae.

## INTRODUCTION

RECENTLY a small petrified flower, *Sahnipushpam*, was reported by Shukla (1948, 1950) from Mohgaon Kalan, the well-known locality of the Deccan Intertrappean Series, but no detailed description of the flowers has appeared so far.

The only dicot flower which has been described in detail from the Deccan Intertrappean Series is *Sahnianthus Parijai* by Shukla (SHUKLA, 1942, 1944; CHITALEY, 1955), which he regards as belonging to the family Lythraceae. In 1943, Sahni described the fruit of *Sahnianthus Parijai* in great detail under the name *Enigmocarpon Parijai*. These two are reported from the same locality, Mohgaon Kalan.

Recently the author was able to collect about hundred specimens of flowers and young fruits of *Sahnipushpam* belonging to a single species from Mohgaon Kalan (22°1'N. 79°11'E.) and also from Bharatwada (21°14'N. 79°1'E.), which is another important fossil locality in Madhya Pradesh. Most of the specimens were obtained from one block of chert which, when broken, exposed fruits and flowers cut in various planes. The flowers are in their late stages and the fruits are young. Both are excellently preserved showing good structural details in thin sections. Only a few specimens yielded good peel sections. Since the flowers and the fruits are very small in size, their structure was followed through by gradual

grinding and serial sketching at regular intervals.

## DESCRIPTION

### *Sahnipushpam glandulosum* sp. nov.

Information as regards the structure of the flower and its young fruit has been drawn from a number of specimens.

The flower of *Sahnipushpam glandulosum* (PL. 1, FIG. 1) is 5.5-5 mm. in length and 2.5-2.8 mm. in diameter. It is sessile, ? bracteate, actinomorphic, hermaphrodite, cyclic, and perigynous with a calyx tube.

*Bract*—What appears to be a bract is seen in two specimens. It is about 6 mm. long (PL. 1, FIG. 2; TEXT-FIG. 1) and composed of thin-walled, rectangular cells (TEXT-FIG. 2). One oval cavity is present in the middle which is probably a secretory cavity.

*Calyx*—The calyx is tubular and composed of 4-5 sepals. In transverse section, the calyx shows a squarish outline (PL. 2, FIGS. 13, 15). In one specimen, however, two opposite sepals form spatulate structure (PL. 1, FIG. 5). The squarish calyx tube is narrow at the base, measuring about 1.8 mm. in diameter, and follows the contours of the ovary, slightly expanding near the middle part (2.7-2.8 mm. in diameter) and again converging at the apex (2.5-2.7 mm. in diameter). The lobes of the calyx are rather thick (0.24 mm.) at the base, thins out in the middle (PL. 2, FIG. 6) and are swollen and fleshy (0.7 mm. thick) at the apex (PL. 2, FIG. 13).

The calyx tube is squarish in cross-section in most of the specimens, but in some it appears to be five-sided (PL. 2, FIG. 11). As the members are united, it is not possible to distinguish individual sepals. It is quite likely that each angle of the calyx, which is pointed (PL. 2, FIG. 15), represents the central part of a sepal. It has not been possible to observe in cross-sections any regularity in the position of the sepals in relation to the gynaecium.

In cross-section of a sepal, the epidermis on the inner (upper) side as well as on the outer side consists of thin-walled, tangentially elongated parenchymatous cells, which possess hairs or trichomes all over the calyx. The mesophyll (PL. 1, FIG. 3) is made up of only spongy tissue. The cells of the spongy tissue near the base of the calyx (TEXT-FIG. 3) are small and round to oval, but in the upper part perhaps they become shrunk and have irregular outline (TEXT-FIG. 4). In the fleshy apical part, the cells (TEXT-FIG. 5) are bigger and have irregular outline. Round to oval secretory cavities are very common in the thick and fleshy parts of the calyx, especially near the apex (PL. 2, FIGS. 7, 13) and base (TEXT-FIG. 11). In the middle region, where the sepals become thin, the secretory cavities are very few in number, or even absent. These cavities are mostly empty, but often show some spiny crystalline deposits. Stomata are not seen.

The vascular supply of the calyx is usually well preserved. There appears to be 4-5 big and equal traces, one trace per sepal, at the base of the calyx tube (TEXT-FIG. 6). At a higher level the number of traces increases and they become eight or ten in all with two traces per sepal (TEXT-FIG. 7). At the apex of the calyx (TEXT-FIG. 8) the number still increases and there are either twelve or fifteen traces, some of them large and others small with only a few vessels. There are two alternatives which can explain the increase in the number of traces from base upwards. Firstly, there may be one trace in each sepal at the base, which further up divides into two to give rise to eight or ten traces in all. At the apex one trace in each sepal again divides and gives rise to three traces in each sepal, thus making up a total of twelve or fifteen traces in all. Second explanation is that each sepal may

have three traces as seen at the apex, one big midrib trace and the other two small traces, one on its either side. Due to cohesion of the sepals, the small side traces of the two adjacent sepals unite, giving rise to eight or ten traces in the middle region of the calyx tube. Still further down towards the base, the midrib traces are lost, and there remains only 4-5 traces. Considering the size of the traces and the gamosepalous condition second possibility seems to be more plausible.

The vascular bundles are more or less circular and collateral in transverse sections. The midrib bundles (TEXT-FIG. 9) are bigger in size and possess a number of vessels and a parenchymatous sheath all round the bundle. In small bundles (TEXT-FIG. 10), there are only a few xylem vessels and phloem elements but no bundle sheath is present. The pitting of the protoxylem vessels is of spiral type. The cells of the phloem tissue are thin-walled.

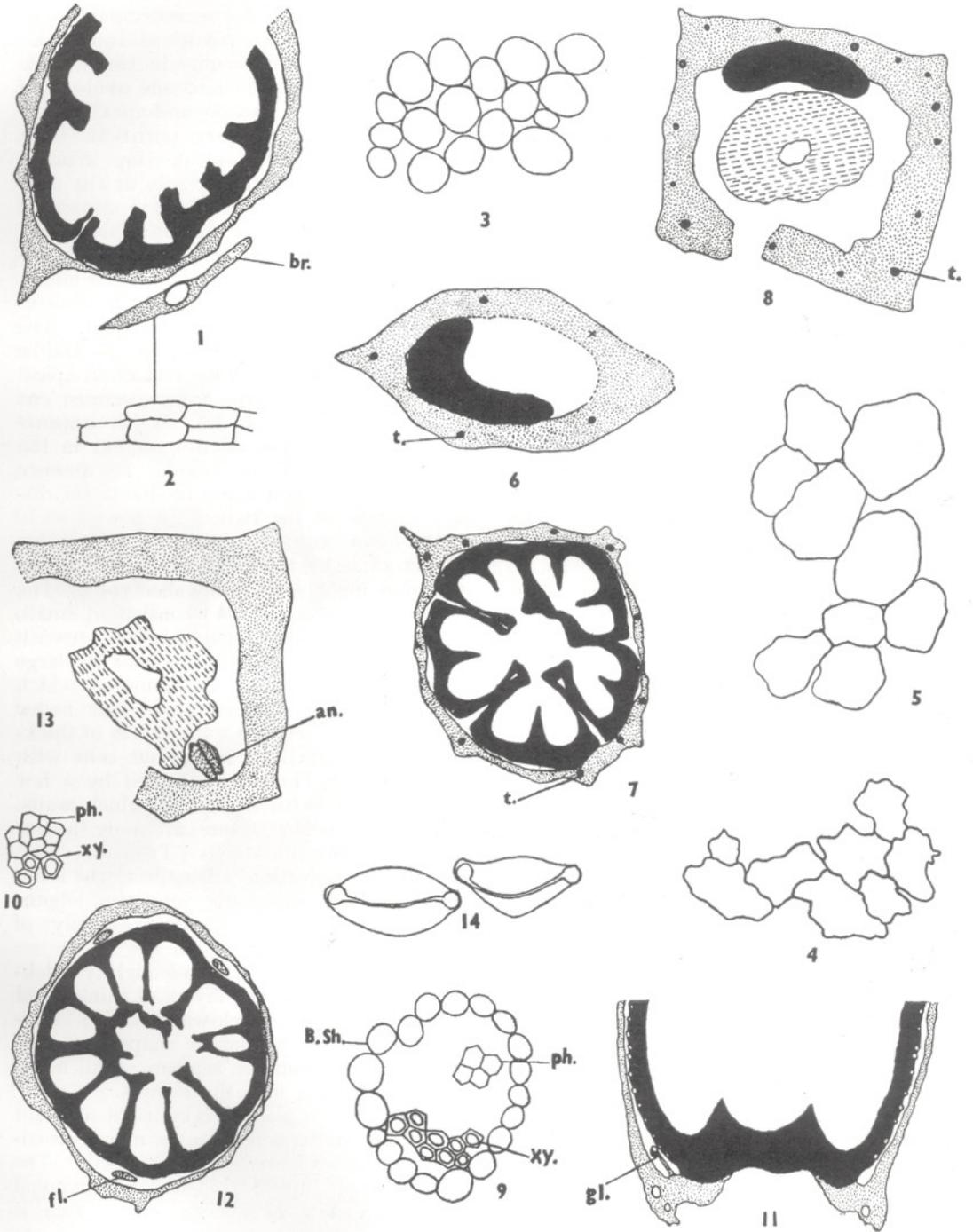
The presence of *corolla* in the flowers could not be detected. Either it may be altogether absent or it has fallen off in the specimens which represent the late stages of the flowers.

*Gland* — In one longitudinal section (TEXT-FIG. 11) a stalked gland-like body is seen arising at the base of the flower between the calyx tube and the ovary wall. It is formed of a multicellular stalk and oval head with a cavity probably of secretory nature. In longitudinal section, the cells of the stalk are rectangular and thin-walled. The cells of the head are not preserved. This gland may represent a glandular trichome.

*Androecium* — Of all the specimens examined only four give evidence of the presence of stamens. The exact number of stamens could not be ascertained. In one specimen the stamens appear to be inserted on the inside of the calyx tube. They are about 2 mm. long and reach up to the style

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TEXT-FIGS. 1-14 — *Sahnipushpam glandulosum* sp. nov. 1, T.S. of a flower from specimen 38 showing a bract (*br.*) with a secretory cavity.  $\times 13.5$ . 2, magnified cells of the bract.  $\times 160$ . 3, highly magnified cells of the calyx from near its base.  $\times 320$ . 4, highly magnified cells of the calyx from its upper part.  $\times 320$ . 5, highly magnified cells of the calyx from its fleshy apical region.  $\times 320$ . 6, T.S. from the base of a flower (specimen 43) showing 4-5 vascular traces (*t.*) in the calyx lobes.  $\times 13.5$ . 7, T.S. of a flower (specimen 5) at a higher level showing ten traces (*t.*) in the calyx.  $\times 13.5$ . 8, T.S. of a flower (specimen 7) through its styler region showing fifteen traces (*t.*) in the calyx.  $\times 13.5$ . 9, highly magnified midrib bundle from a sepal showing xylem (*xy.*), phloem (*ph.*) and a bundle sheath (*B.Sh.*).  $\times 320$ . 10, highly magnified side trace showing xylem (*xy.*) and phloem (*ph.*) tissues.  $\times 320$ . 11, L.S. at the base of a flower showing a gland (*gl.*) between the calyx and ovary wall.  $\times 13.5$ . 12, T.S. of a flower (specimen 27) slightly above its middle region showing the tissue of three filaments (*fl.*).  $\times 13.5$ . 13, T.S. from the apex of a flower showing an anther (*an.*).  $\times 13.5$ . 14, pollen grains highly magnified.  $\times 630$ .



TEXT-FIGS. 1-14.

of the flower. At the apex it bends and curves towards the style so as to follow the contour of the ovary. The filaments being badly preserved, their cellular details could not be seen. In a transverse section of another specimen, three small patches of tissue could be seen inside the calyx tube, which might be the remnants of filaments (TEXT-FIG. 12). In the third specimen, which is a transverse section from the apex of a flower, there is present a tissue which looks like an anther (TEXT-FIG. 13).

The *anther* is composed of two lobes, which are plano-convex in shape, connected to each other. It is about 0.48 mm. long and 0.3 mm. broad. The attachment of the anther to the filament seems to be dorsifixed and the connective is attached to the back of the anther. The anther wall is composed of thick-walled, polygonal cells. The dehiscence of the anther seems to be by longitudinal slit.

*Pollen grains* have also been found scattered in the apical part of the calyx tube of the same specimen. They are (PL. 2, FIG. 10; TEXT-FIG. 14) small,  $22-28 \times 22-16 \mu$ , oblong to somewhat boat-shaped, dicolporate, syncolpate with smooth exine.

*Gynaecium* — It is pentacarpellary and syncarpous, 4.8-5.2 mm. in length and 2-2.5 mm. in diameter.

The *ovary* is superior in nature and more or less oblong, 2-2.5 mm. in diameter and about 3.5 mm. in length. In a few cases it appears to be more or less square in cross-sections. It is narrow at the base (1.65 mm. in diameter) and expanded towards the apex (2.5 mm. in diameter). The ovary wall is moderately thick, about 0.13-0.15 mm., and lined marginally by a number of spherical sacs (PL. 1, FIG. 1), which might have contained oil, tannin or resin.

The ovary is pentalocular with 5-6 secondary partitions. The secondary partitions are complete at the base (TEXT-FIG. 21) and apex (PL. 2, FIG. 14) but incomplete in the middle region of the ovary (PL. 2, FIG. 11). Thus at the base and apex a single ovule in each loculus is seen, whereas in the middle region of the ovary, the secondary partitions being incomplete, there are two ovules in each of the four loculi and

three ovules in the fifth loculus. In some specimens, however, the pentalocular ovary has only five secondary partitions, containing two ovules in each loculus in the middle region (PL. 2, FIG. 6) and one ovule each at the base (PL. 2, FIG. 9) and apex (PL. 2, FIG. 15). The secondary partitions arise from the ovary wall and develop inwards meeting the axile placenta only at the base and apex (TEXT-FIGS. 15-22), remaining incomplete in the middle region of the ovary for about 1.5 mm. The secondary partitions never decrease beyond half the length of the primary septum. This condition of secondary partitions is rather unusual. The central axis could not be seen in the middle region but is present at the basal and apical regions. However, from one specimen cut longitudinally (PL. 1, FIG. 4) it appears that the central axis is also present in the middle region but is hollow. Its absence in the middle region might be due to the disorganization of the tissue.

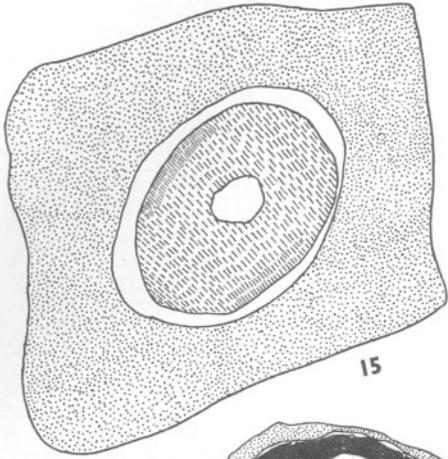
The ovary wall is divided into two regions (TEXT-FIG. 23), the outer with thick-walled cells and inner with thin-walled cells. The epidermis (TEXT-FIG. 24) consists of small, somewhat tangentially elongated to squarish cells interrupted at short intervals by large spherical sacs, 35-60  $\mu$  in diameter, which remains partially bulged out. Just below the epidermis there are a few layers of thick-walled pentagonal to hexagonal cells with short lumen. These are followed by a few layers of cells with moderately thick walls. Lining the loculus, there are only a few layers of thin-walled cells (TEXT-FIG. 25). Small hairy projections arising from the inner lining of the wall hang into the loculus (TEXT-FIG. 23). The vascular supply of the ovary could not be seen.

The *septum* is made up of slightly thick-walled cells with a few layers of thin-walled cells lining it. The thick-walled cells (TEXT-FIG. 26) are polygonal in shape with big lumen. Also from the septum, small hairy projections hang into the loculus.

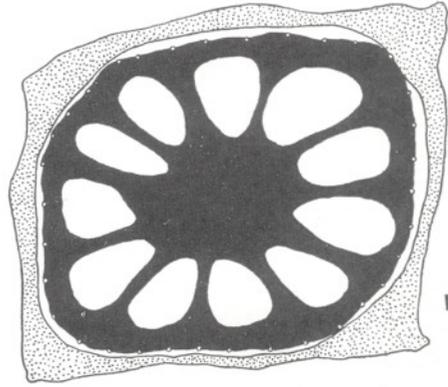
The *axis of the placenta* is cylindrical, about 0.5-1 mm. in diameter, consisting of a cortical zone and a parenchymatous pith. The pith is made up of thin-walled polygonal cells (TEXT-FIG. 27). The cortical zone is

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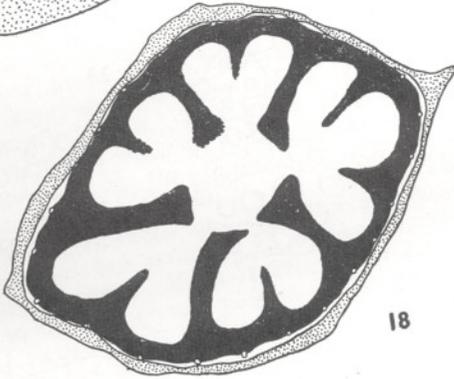
TEXT-FIGS. 15-22 — *Sahnipushpam glandulosum* sp. nov. Serial cross-sections of the flower from the apex to base showing different stages of secondary partitions in the ovary. Camera lucida sketches of Figs. 15-21 are from specimen 34, and Fig. 22 is from specimen 3. All.  $\times 17$ .



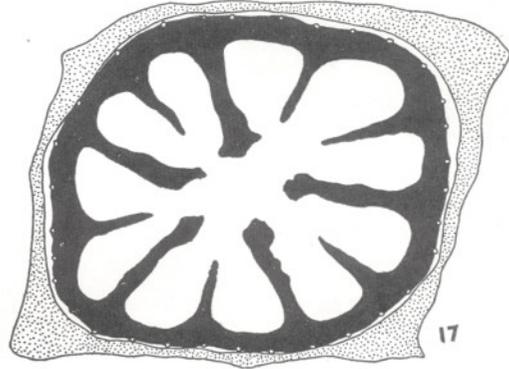
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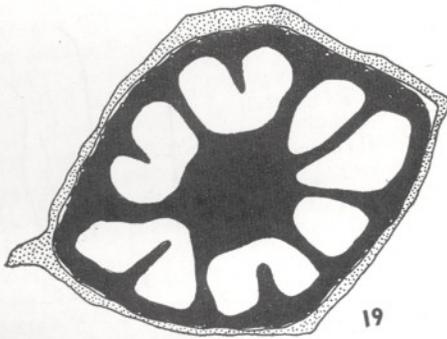
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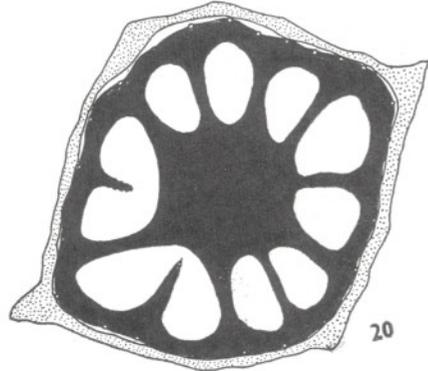
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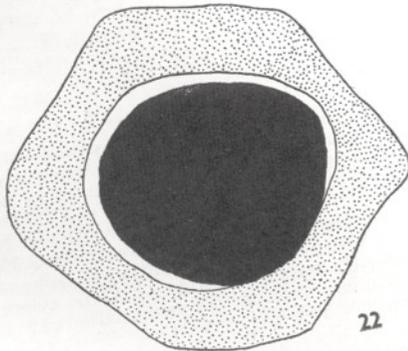
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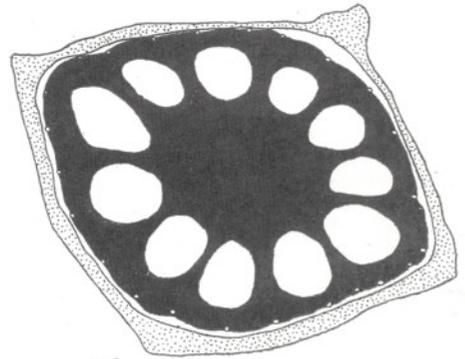
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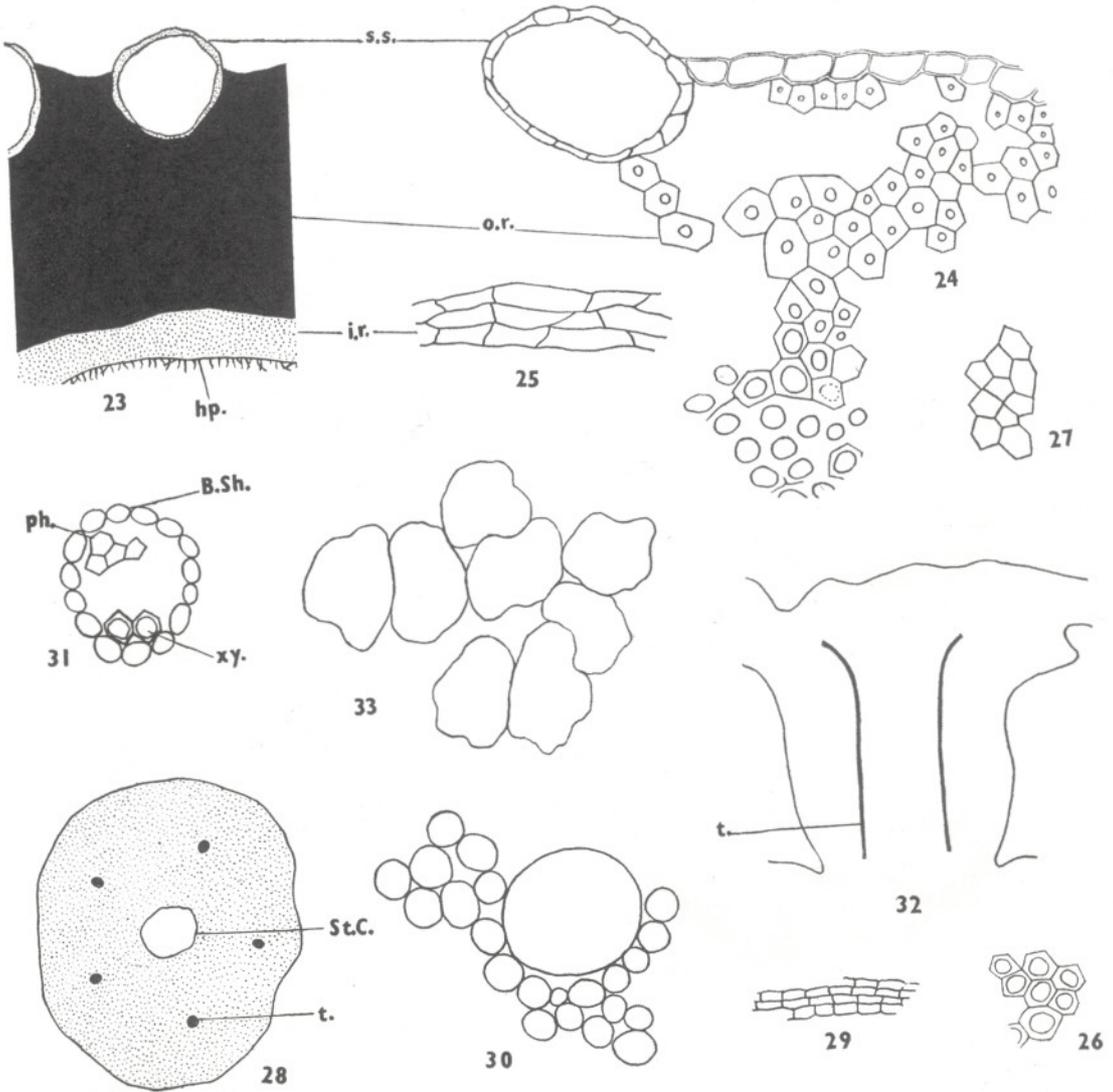


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TEXT-FIGS. 15-22.

composed of closely packed, hexagonal, parenchymatous cells (PL. 2, FIG. 12). The vascular supply in the cortex is not recognizable.

There are 10-11 ovules in all, which seem to be attached (PL. 1, FIG. 1) to the central axis at the apex of the loculi. As regards its structure nothing could be said because



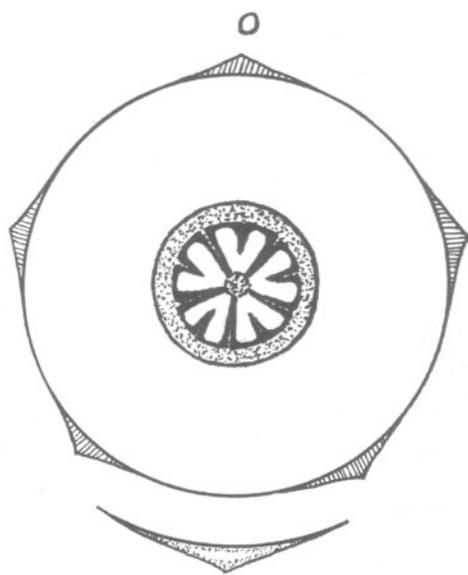
TEXT-FIGS. 23-33 — *Sahnipushpam glandulosum* sp. nov. 23, a line drawing of the ovary wall showing bulged out spherical sacs (s.s.), an outer region (o.r.) an inner region (i.r.) and hairy projections (h.p.). × 270. 24, T.S. of ovary wall with spherical sacs, epidermis and outer region (o.r.) of thick-walled cells. × 420. 25, highly magnified thin-walled cells from the inner region (i.r.) of the ovary wall. × 950. 26, highly magnified cells of a septum. × 420. 27, magnified cells of pith. × 220. 28, T.S. of the style showing five vascular traces (t.) and styler canal (st.c.) in the centre. × 25. 29, highly magnified cells of horizontal partitions of styler canal. × 320. 30, highly magnified cells of style. × 320. 31, a magnified vascular bundle of the style showing bundle sheath (B.Sh.), xylem (xy.), and phloem (ph.). × 320. 32, L.S. from a style and stigma showing longitudinally cut vascular traces (t.). × 23·5. 33, highly magnified cells of stigma. × 500.

the tissue of the ovules has been completely replaced by the inorganic matter.

The *style* is very short, about 0.96-1.12 mm. in length and 1.4 mm. in average diameter, with a collar-like protrusion at its base (PL. 1, FIG. 1). It is more or less circular to roundly angular in cross-section (TEXT-FIGS. 13, 28). In the centre there is a stylar canal about 0.28 mm. in diameter. This canal possesses horizontal partitions clearly seen in its lower part (PL. 2, FIG. 8). These partitions are composed of only a few layers of elongated, thin-walled cells (TEXT-FIG. 29). No lining of the stylar canal could be observed. The style consists of loose, thin-walled, round to oval cells (TEXT-FIG. 30). Some big cells are also seen scattered in the stylar tissue. The epidermis of the style is composed of thin-walled, tangentially elongated cells. The basal region of the style, from where it breaks off, is very well indicated in the fossils. As regards the vascular tissue, 5-6 (PL. 2, FIG. 13; TEXT-FIG. 28), more or less circular vascular bundles are arranged in a ring round the stylar canal. Each bundle has 1-2 vessels on the outside and phloem on the inner side (TEXT-FIG. 31). In one longitudinal section two vascular strands are seen running parallel to the margins of the style and curve out at the apex (TEXT-FIG. 32).

The *stigma* is terminal and somewhat discoid (PL. 1, FIG. 1). The disc appears to be slightly angular (probably five-angled) which could be seen by observing the stigmatic region by gradual grinding. It is about 2.6-3.2 mm. in diameter. The central part of the plate in some specimens appears to be slightly raised (PL. 1, FIG. 1). In only one specimen margin of the plate hangs down so as to form an umbrella-like structure. In some a few projections come out from under the stigmatic plate (TEXT-FIG. 32). The stigma consists of loose, thin-walled cells (TEXT-FIG. 33).

*Fruit* — There are about seven specimens which probably represent the early stages of the fruit. The fruit of *Sahnipushpam glandulosum* (PL. 1, FIG. 4) is an ellipsoidal, woody capsule, about 3 mm. in diameter and 3.8-4 mm. in length, with a persistent calyx tube. There is a depression at the base of the fruit. The fruit possesses septicial dehiscence (PL. 2, FIG. 11). In one fruit only remnants of the calyx tube are seen. It seems that the calyx might have been detached during fossilization. The calyx



⊕ ⊙ K<sub>(4-5)</sub> C<sub>NOT KNOWN</sub> A<sub>NO?</sub> G<sub>(5)</sub>

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TEXT-FIG. 34 — Floral diagram and floral formula of *Sahnipushpam glandulosum*.

tube encircling the fruit is 4.6 mm. in length. It is more or less uniform in diameter, about 3 mm. at the base and 3.2 mm. at the apex. As regards the anatomy of the fruit, it is similar to what has been described in the previous pages for the ovary.

*Diagnosis* — Flowers bracteate?, sessile, actinomorphic, hermaphrodite, cyclic, perigynous with a calyx tube, 5.5-5 mm. length and 2.5-2.8 mm. diameter; *calyx tube*, squarish, 4-5 lobed, slightly thick at the base and fleshy at the apex, secretory cavities present; *corolla* not seen; *gland* present; *stamens* present, probably inserted in the calyx tube, exact number not known, about 2 mm. long; *anther* two-lobed, 0.48 × 0.3 mm., biconvex and attachment dorsi, fixed; *pollen grains* small, oblong to somewhat boat-shaped, smooth, dicoloporate and syncolpate; *gynaecium*, 4.8-5.2 mm. long, 2-2.5 mm. diameter, pentacarpellary and syncarpous; *ovary*, 2-2.5 mm. diameter, 3-5 mm. long, superior, pentalocular, usually with

two ovules in each of the four loculi and three ovules in the fifth loculus, often with two ovules per loculus, secondary partitions present, ovary wall with marginal spherical sacs of oil, tannin or resin; placentation axile, placenta cylindrical, 0.5-1 mm. thick, ovular tissue not preserved; style united, short, 0.96-1.2 mm. long, 1.4 mm. average diameter, stylar canal 0.28 mm. diameter with horizontal partitions; stigma terminal, disc-like, slightly angular. Fruit with persistent calyx tube,  $3 \times 3.8-4$  mm. ellipsoidal, woody capsule, sessile, pentalocular with secondary partitions; dehiscence septical; calyx tube  $4.6 \times 3.2$  mm. encircling the young fruit; spherical sacs embedded partially on the fruit wall; seeds not preserved.

*Locality* — Mohgaon Kalan ( $22^{\circ}1'N.$ ;  $79^{\circ}11'E.$ ) in Chhindwara district and Bharatwada ( $21^{\circ}14'N.$ ;  $79^{\circ}1'E.$ ) in Nagpur district of Madhya Pradesh.

*Horizon* — Deccan Intertrappean Series.

*Age* — Tertiary (probably Eocene).

*Type Specimens* — B.S.I.P. Nos. 5505, 5510, 10372.

#### COMPARISONS AND DISCUSSION

The flower of *Sahnipushpam glandulosum* does not resemble with any of the flowers so far described from India. The flower *Sahnianthus* (SHUKLA, 1942, 1944; CHITALEY, 1955) and the fruit *Enigmocarpon Parijai* (SAHNI, 1943), which are also reported from Mohgaon Kalan, are quite different from the flowers and young fruits of *Sahnipushpam glandulosum*. They belong to different families.

Similarly *Pondicheria ebenaleoidea* (SAHNI, 1933), known from Pondicherry, South India, differs from the young fruit of *Sahnipushpam glandulosum* in the form and size of the fruit and in the presence of a single, large, compressed seed placed vertically in each fertile loculus.

There is no doubt that *Sahnipushpam glandulosum* belongs to dicotyledons. The flower possesses certain distinct characters which afford some clue as regards its affinities with the dicot families. These distinguishing characters are the pentacarpellary and syncarpous gynaecium, the spherical glands or sacs of oil, tannin or resin in the ovary wall and a calyx tube. These characters are found in the following families: Combretaceae, Myrtaceae and Melastomaceae of Myrtales (HUTCHINSON, 1926; RENDLE, 1952; WILLIS, 1948; ENGLER & PRANTL, 1898).

Out of these families only the members of the Myrtaceae possess flowers with short undivided style, a somewhat discoid stigma and a pentalocular ovary with two ovules in each loculus and false septa as is the case in *Sahnipushpam glandulosum*. These characters exclude other families mentioned above except perhaps Melastomaceae, which is closely allied to Myrtaceae.

The important characters which are common to *Sahnipushpam glandulosum* and the family Melastomaceae are the presence of squarish calyx tube with the stamens inserted in it, a five-celled, superior ovary with axile placentation and a short style with a capitate stigma. However, the important differences are the absence of secondary partitions in the ovary and the presence of gland-tipped bristles in the floral parts of Melastomaceae. As such this family can also be eliminated.

In Myrtaceae an important anatomical feature is the presence of spherical oil sacs or glands, similar to those in *Sahnipushpam glandulosum*, beneath the epidermis of fruits as well as in the floral organs. The author has cut a number of sections of the ovary wall and calyx lobes of *Eucalyptus* sp. and *Psidium guyava* and found that the spherical glands of these genera are almost identical with those of *Sahnipushpam glandulosum*. However, it must be said that it has not been possible to identify *Sahnipushpam glandulosum* with any of the living genera of Myrtaceae so far. If we take into account the presence of secondary partitions, only two genera of Myrtaceae, viz. *Rhodomyrtus* and *Decaspermum* (HOOKER, 1879; NIEDENZU, 1893), are known to possess this character. In *Rhodomyrtus*, however, the ovary is 1-3 celled with secondary partitions or divided into numerous one-ovuled superposed cells. The style is also filiform, unlike that in the fossil.

In the other genus, *Decaspermum*, the calyx tube is persistent, campanulate and made up of 4-5 lobes. The ovary is also five-celled with two or very few ovules per loculus and the cells are divided by spurious dissepiments like that of *Sahnipushpam glandulosum*. But *Decaspermum* differs from *Sahnipushpam glandulosum* in possessing a filiform style, a berry-like fruit and semi-inferior ovary.

In fact, the only difference shown by *Sahnipushpam glandulosum* is in the possession of superior ovary as opposed to inferior or semi-inferior ovary in the Myrtaceae.

Otherwise all the important characters of *Sahnipushpam glandulosum* are to be found in Myrtaceae. Even the evidence afforded by pollen grains points to the same conclusion. Somewhat similar two-colporate pollen grains as found in *Sahnipushpam glandulosum* have been reported in some genera of Myrtaceae (ERDTMAN, 1952; SELLING, 1947).

## ACKNOWLEDGEMENTS

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## EXPLANATION OF PLATES

## PLATE 1

1. Median L.S. of *Sahnipushpam glandulosum* showing tubular calyx tube and spherical sacs partially embedded in the ovary wall.  $\times 16$ .
2. L.S. of the flower with a bract (*br.*).  $\times 19$ .
3. T.S. of a sepal with thin-walled cells. Note the empty secretory cavities (*s.c.*).  $\times 60$ .
4. L.S. of the young fruit of *Sahnipushpam glandulosum*.  $\times 16$ .
5. T.S. from a flower showing two opposite sepals forming spatulate structure.  $\times 21$ .

## PLATE 2

6. T.S. of a flower from the middle region of the ovary showing two ovules per loculus divided in-

completely by secondary partitions. The central axis is not seen.  $\times 13$ .

7. T.S. of a flower through the styler region showing styler canal and fleshy calyx lobes with a number of secretory cavities.  $\times 8$ .

8. Highly magnified styler canal with horizontal partitions.  $\times 34$ .

9. T.S. (slightly oblique) from the base of a flower showing ovary with three loculi possessing two ovules each and incomplete secondary partitions, and the rest two loculi with complete secondary partitions thus making up four loculi with one ovule each.  $\times 13$ .

10. Pollen grains highly magnified.  $\times 400$ .

11. T.S. of a flower from the middle region of the ovary showing two ovules in each of the four loculi and three ovules in the fifth. Each loculus is divided by incomplete secondary partition equal

to half the size of true septum. Note the septicial dehiscence. The central axis is also not seen.  $\times 13$ .

12. Hexagonal parenchymatous cells of cortical zone.  $\times 90$ .

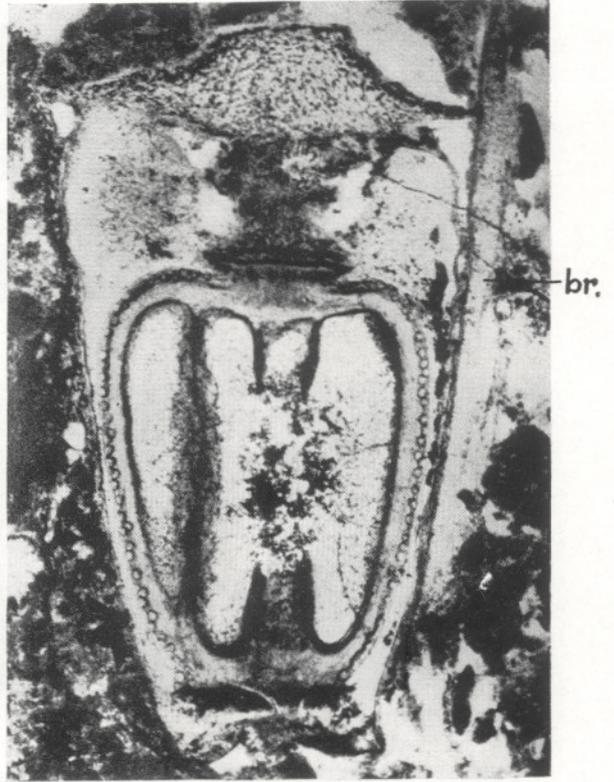
13. T.S. through the stylar region of the flower showing fleshy calyx lobes, with numerous secretory cavities. Note the five vascular traces (*vt.*) of the style.  $\times 15$ .

14. T.S. from the apex of a flower with ovary showing eleven loculi formed by the union of six secondary partitions with the central axis. One ovule is present in each loculus.  $\times 13$ .

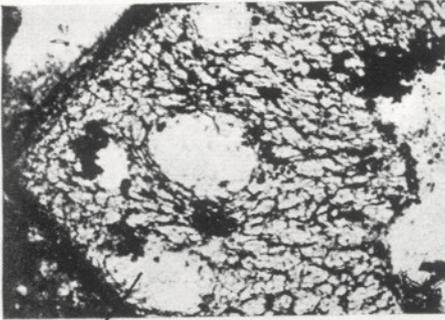
15. T.S. from the apex of another flower with ovary showing ten loculi formed by the union of five secondary partitions with the central axis. One ovule is seen in each loculus.  $\times 13$ .



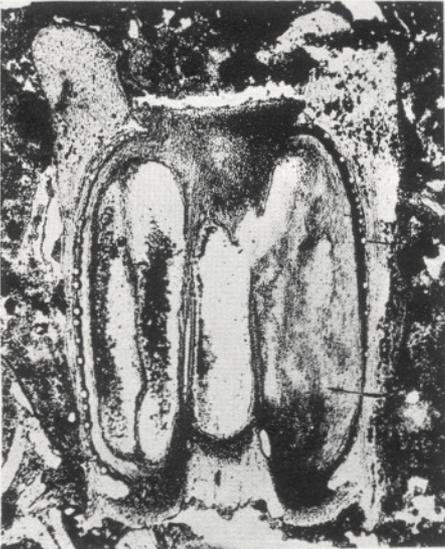
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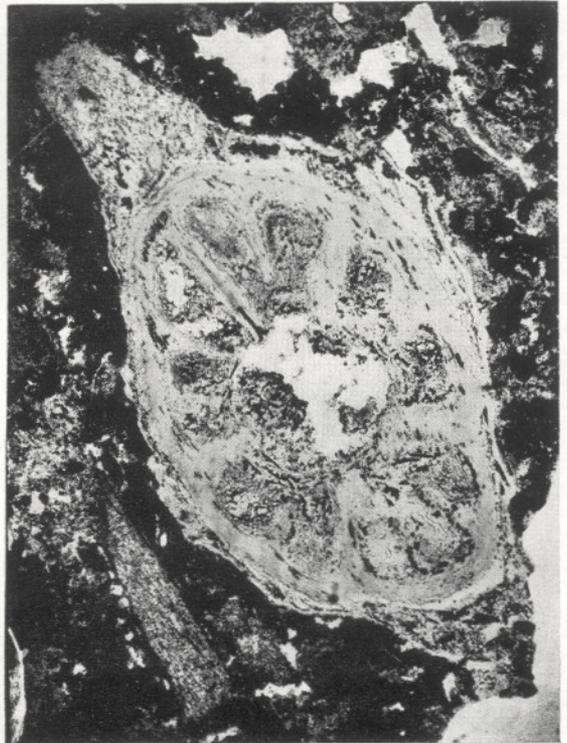
2



s.c. 3



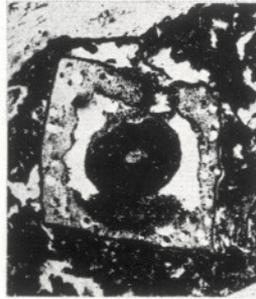
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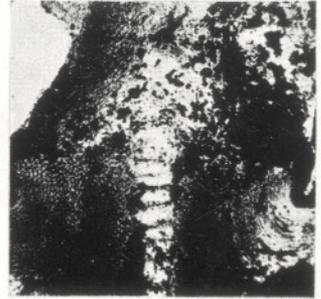
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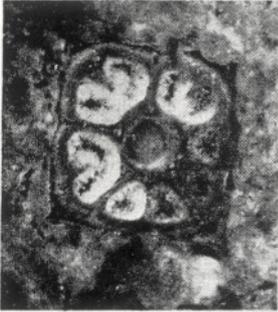
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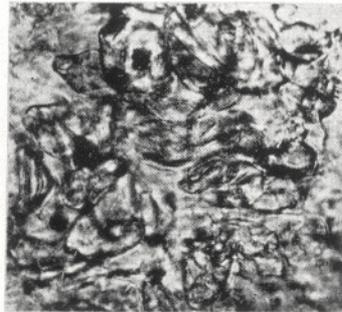
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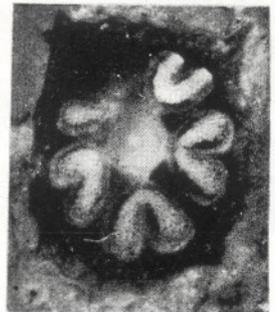
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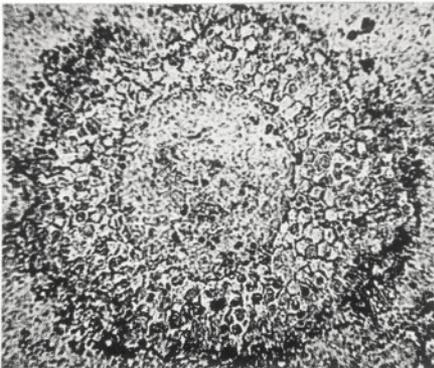
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10



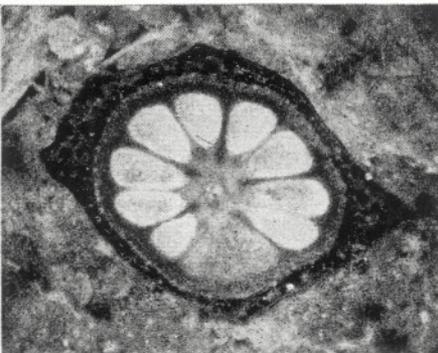
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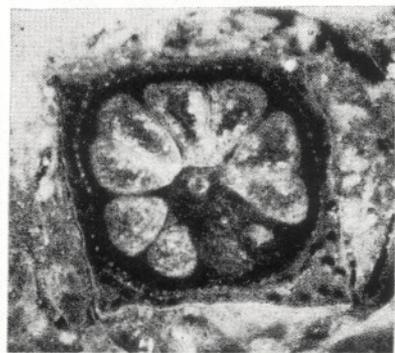
12



13



14



15