# On the Distribution, Structure, and Function of the Tentacles of Roridula.

BY

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**With Plates XX.-XXI.**

The genus *Roridula*[1] is usually included in the family of the Droseraceæ, although doubts are now prevalent as to its right to this position. It is confined to South Africa. It includes two species of small shrubby plants, *R. Gorgonias*, Planch., and *R. dentata*, Linn. These resemble each other closely in outward appearance, particularly in the possession of numerous tentacles distributed over their leaves and stem. The arrangement, structure, and function of these tentacles has not been as yet fully investigated, and the following brief account of them is the result of the examination of (and experiments upon) living plants grown in the Royal Botanic Garden, Edinburgh, and of material preserved from these.

## Leaf of Roridula gorgonias.

The leaves of *Roridula Gorgonias* are closely set along the stem.

The leaf is long and narrow; its maximum length about 6 cm., its greatest width, just above the base, is about ·25 cm. This width remains fairly constant through about the lower third above which the leaf begins to taper to the apex, where it ends in a single large tentacle. In its lower part dorsiventral it becomes radial and quite cylindric before it passes imperceptibly into the tentacle (Fig. 1). The surface is covered by numerous

[1] From *ros*, *roris*, dew, after the glistening drops of secretion found on the ends of the tentacles.

[Notes, R.B.G., Edin., No. XVII., April 1907.]

stalked glands or tentacles, which vary in length from small ones which require the aid of a lens to be distinctly seen, to large ones about 3·5 mm. in length. For a short distance behind the leaf-apex, the tentacles do not show any very definite arrangement, but occur at irregular intervals all round the leaf (Fig. 2). Behind this, however, the tentacles are restricted to two definite areas—the under side of the leaf along the mid-rib, and the margin of the leaf.

The tentacles arise in greatest number either on or near the margin of the leaf. Tentacles showing all the variations in size mentioned above occur over this area, but the taller ones form four well-marked rows—two along each margin, one row along its upper, and the other along its lower edge (Fig. 3).

There is an alternation in size between the tentacles in each of these rows; between each pair of taller ones there is an intercalated one (or it may be two) of about one-third less length, and between these in turn is a variable number (six to eight) of still smaller ones. These smaller tentacles occur also on the margin of the leaf between the rows of longer ones, but they never appear on the upper or lower surfaces of the leaf; they are much more numerous than the taller ones, and are fairly evenly distributed over the specified area in the lower two-thirds of the leaf, but above this they diminish in number, while the taller tentacles are more numerous and closer to one another, until for a short distance behind the apex tall tentacles only are present.

No definite relationship exists between the relative positions of the longer and shorter tentacles of the two rows on the same leaf-margin; a long tentacle of one row being sometimes situated opposite a long tentacle of the opposite row, but quite as often there is no correspondence in position of the long tentacles, or there may be one or two small ones opposite a long one. There is also no correspondence between the position of the long and short tentacles on one margin in relation to those on the opposite margin of the leaf.

A fifth row of tentacles is found on the mid-rib of the under side of the leaf (Fig. 3). The tentacles here show variations and alternations in size similar to those of the marginal rows, but the tallest tentacles are only half (a few may be almost two-

thirds) of the length of the tallest marginal tentacles, and have thicker heads and stalks. The glands of these tentacles seem to have greater activity than the marginal ones, at least the amount of secretion present is larger, and in all herbarium specimens the greater proportion of insects caught are found adhering to them.

The tallest tentacles are always situated on the central part of the mid-rib, the smaller ones occur not only on the central part but on each side of it.

Between this central row of tentacles and the marginal rows there is an area of leaf-surface devoid of tentacles (Figs. 3, 5).

The upper side of the leaf bears a number of long narrow unicellular hairs directed upwards parallel with the leaf-surface (Fig. 4). These hairs have thick walls and are present in largest number at the base of the leaf. They decrease in number and in size upwards and are wanting in the upper two-thirds or half of the leaf. The under surface has no hairs (Fig. 5).

The venation is typically droseraceous. There is a well-developed mid-rib, and a marginal vein. This marginal vein receives branches from the mid-rib at intervals of about a centimeter and these give a general appearance of symmetry to the leaf (Fig. 6).

Stomata are present on both the upper and under surfaces. The guard-cells are raised slightly above the level of the surrounding tissue of the leaf, and there are no subsidiary cells (Figs. 7, 8).

Crystals of calcium oxalate are abundant, especially along the mid-rib. They also occur in smaller number along the marginal veins and on the branches passing from the mid-rib to the marginal veins (Figs. 9, 10), where they are often arranged close together in rows. They are present in the epidermis of the upper and under surfaces, in the chlorenchyma, and even in the large empty cells, to be afterwards described, situated below the mid-rib. These crystals are composed of a number of needles all pointing outwards from a centre.

The epidermis is a single layer of cells without chlorophyll. The cuticle is not very thick, the outer, radial, and inner walls of the epidermis are all thin. The mesophyll of the leaf is not divided up into palisade and spongy parenchyma, but consists simply of small round cells, sometimes polygonal, separated by

numerous intercellular spaces. Just underneath the vascular bundle of the mid-rib is a group of large cells which do not seem to have protoplasmic contents. The vascular bundle is surrounded by an endodermis of polygonal and rounded cells.

On the upper side of the vascular bundle and above the endodermis, and separated from the epidermis by a single layer of chlorenchyma, is a crescent-shaped group of sclerenchyma ; and between the endodermis and the large loose tissue underneath the vascular bundle is another similar group. The xylem is situated in the centre of the bundle, and at the two lower corners there is a single phloem-group. These two phloem-groups are quite separate from one another, and are not united to each other in the middle line under the xylem.

The above description of the anatomy of the leaf applies to a section about its base or middle. Towards the apex the structure changes. At the base it is dorsiventral and swollen near the mid-rib, with the sides of the lamina nearly horizontal (Fig. 11). Upward the laminar sides become smaller (Fig. 12), more raised from the horizontal (Fig. 13) and thicker, until the outline of the leaf on transverse section appears like a thick flattened U (Fig 14). Close to the apex the laminar sides disappear, so that the outline becomes circular. The vascular bundle is here situated in the centre, surrounded by a ring of chlorenchyma, outside of which is the epidermis in the outline of a circle (Fig. 15). The large loose cells situated underneath the vascular bundle at the base of the leaf are less developed towards the apex, where they entirely disappear. At the base they are separated from the epidermis by a single layer of small cells which do not bear chlorophyll. About the upper third of the leaf they become fewer in number and smaller in size, and form a small group separated from the upper epidermis by two layers of chlorenchyma. At the apex they gradually merge into the bundle-sheath. This circular apical part of the leaf gradually passes into the terminal tentacle, so that it is quite impossible to say where the leaf ends and the pedicel of the tentacle begins.

The structure of the marginal vascular bundles is similar to that of the large central one, only on a smaller scale.

## LEAF OF RORIDULA DENTATA.

The leaf is much larger than that of *R. Gorgonias*. The longest which I was able to examine measured about 10 cm. while the width at the base was scarcely 1 cm. As in *R. Gorgonias*, the leaf is broadest for the lower third of its length, above which it gradually narrows to a point. It differs from that of *R. Gorgonias* in being pinnatifido-dentate, the side teeth being about 1 to 1·5 cm. in length (Fig. 16). These teeth make an angle of about 30° with the mid-rib, but where the teeth are not long the angle may be about 90°. The teeth on opposite margins of the leaf have no relation to each other; at the base of a leaf they are often opposite, at the apex alternate. Each tooth ends in a tentacle, as does the apex of the leaf itself.

The leaf is more thickly clothed with tentacles than is that of *R. Gorgonias*, and the tentacles are not arranged in definite rows but are scattered indefinitely over the leaf, the taller ones being most abundant on the side branches, while the smaller ones are most frequent on the margin and upper surface of the leaf (Fig. 17).

The side branches increase in size and distance from each other from the base to the apex, the largest branches being found just a little distance behind the apex. Each branch has a terminal tentacle, behind which are several irregularly-placed long tentacles. The smaller tentacles are as a rule absent from the upper half of the leaflet, but are usually well developed on the lower half, especially at the base. The longer tentacles project from the leaflet in all directions, but, although they show a tendency to be distributed in rows, there is no definite arrangement which will hold for all the branches of any one leaf.

It is along the margin of the leaf, however, that the greatest development of tentacles is found. These are mostly of the smaller sizes, but scattered irregularly amongst them is a number of the larger tentacles such as occur on the side branches, as well as others intermediate in size between them and the very numerous small ones. There is also a development of small thick-walled unicellular hairs (Figs. 32, 33), which are only about a quarter of the length of those found on the

upper leaf-surface of *R. Gorgonias*, and they are not only well developed on the upper surface, but equally so on the margins and under surface.

The upper surface of the leaf is thickly covered, especially at the basal part, with these unicellular hairs, which gradually decrease in number and size upwards, being almost entirely wanting from the upper half of the leaf. Scattered amongst these hairs is a number of very small tentacles either equalling or about double the size of the hairs themselves (Figs. 18, 19). These hairs and, in many cases, also the small tentacles stand out from the leaf at right angles.

There is no distinct row of tentacles developed on the under side of the mid-rib, but only a few scattered medium-sized tentacles, mostly situated at some distance from each other. The small tentacles are very poorly developed along the mid-rib, but occur to a slight extent on the surface of the leaf between the mid-rib and the margins along with the unicellular hairs.

The droseraceous venation is present showing a well-developed mid-rib (Fig. 20) and marginal vein from which a single branch is given off opposite each of the teeth. This branch passes up the centre of the tooth and ends at the base of the terminal tentacle. The central vein and the marginal veins unite together close to the apex. At the base of each tooth a single vein arises from the marginal vein, and runs inwards to meet the central vein at about the level of the next tooth.

There are stomata on both the upper and under epidermis. These are similar to those of *R. Gorgonias*, and show as in that species beak-like projections of the cuticle.

Calcium-oxalate crystals are abundant, especially along the mid-rib. They also occur along the other veins, and, to a less extent, in the tissue between. They are found both in the epidermis and in the mesophyll of the leaf.

On transverse section the leaf appears much swollen about the mid-rib, and from this the laminar sides extend out almost horizontally (Fig. 21). The cuticle is not specially thickly developed. The epidermis is a single row of cells without chlorophyll; their outer, inner, and radial walls are thin. The mesophyll shows, as in Droseraceæ, no differentiation into

palisade and spongy parenchyma, but only elongated chlorenchyma cells united together at their extremities and forming irregular rows between which are large intercellular spaces. Underneath the vascular bundle there are numerous large loose cells of irregular outline, and small intercellular spaces. Outside this is a crescentic group of pitted sclerenchyma-elements, and there is a similar group occurring above the bundle, and separated from the epidermis by a single row of cells. The central vascular bundle itself is surrounded by a sheath, one or two cells thick on the flanks and on the lower side but much thicker on the upper. A gradual passage may be traced between them and the sclerenchymatous cells. The xylem is well developed. The phloem is divided into two groups, which approach each other closely in the middle line though they do not meet.

The structure of the teeth resembles that of the apex leaf (Fig. 22). The vascular bundle runs up the centre as far as the pedicel of the terminal tentacle which it enters. In structure it resembles that of the mid-rib except that the large loose cells are absent. Stomata are fairly numerous, and the epidermis bears no chlorophyll. The chlorenchyma consists of elongated cells resembling those of the mesophyll of the leaf, and form a ring around the vascular bundle.

## STRUCTURE OF TENTACLES OF RORIDULA.

Although the arrangement of the tentacles is different in the two species, their structure is similar, and one description will suffice, therefore, for both.

The glands of *Roridula* are pedicellate, and vary in size from small ones, which require the aid of a lens to be visible, to large ones about 1 cm. in length.

They all have essentially the same construction, which is typically seen in one of the larger glands, namely, a pluricellular *pedicel* bearing at its extremity an ovoid swelling, the *glandular head* (Fig. 23).

THE PEDICEL.—This is usually slightly swollen at its point of origin from the epidermis of the leaf, but above the base is of uniform thickness. It agrees with the corresponding structure in *Drosera* and *Drosophyllum* in being pluricellular, but differs

in the absence of a vascular strand traversing its centre. It has three layers (Fig. 24) of which the outermost consists of about twenty parallel cell-rows. The cells of these rows are elongated in the long direction of the pedicel, being about two to three times as long as they are broad. They have thin outer walls and thin radial walls, and are firmly united together laterally. The second or intermediate layer consists of from six to eight parallel cell-rows, and surrounds the third or innermost layer, which usually consists of one cell-row occupying the centre of the pedicel.

THE GLANDULAR HEAD.—This is seated on the end of the pedicel and appears as an ovoid swelling, circular on transverse section (Fig. 26). In structure it resembles the pedicel. In the centre is a single cell-row, not digestive, a continuation of the central row of the pedicel. The intermediate layer forms a dome-shaped cover over the central row (Fig. 25). The cells of the outermost layers are *gland-cells*, and are a continuation of the outermost layer of the pedicel. If any one row of cells is traced from the pedicel into the glandular head its cells, which are elongated in the stalk, will become shorter, then square, and finally flattened.

The gland-cells themselves are united to those of the intermediate row by their inner surfaces, but there is no connection between adjacent gland-cells, that is to say, the lateral walls of the gland-cells do not touch, and each gland-cell is therefore free along its sides (Figs. 25, 26).

As in *Drosera* and *Drosophyllum* there are no pores on the gland-cells for the extrusion of secretion.

The smaller tentacles differ from the larger ones only in simplification of the construction. A section through the head of one of the smaller tentacles (Fig. 27) shows only a single central cell-row to which the gland-cells are attached and the intermediate cell-layer is wanting (Fig. 28). In a still similar tentacle (Fig. 29) the head is composed of the layer of gland-cells alone, and even here the gland-cells are not united to each other laterally (Fig. 30). In the simplest form of all, the tentacle consists of one cell-row, the lower cells of which are elongated and form the pedicel, while the upper cells are flattened and form the glandular head.

All the tentacles of *R. Gorgonias* and *R. dentata* are formed on one common plan of construction; and it is possible to trace a series of gradually increasing complexity, beginning with the smallest tentacles and ending with the tallest.

## EVOLUTION OF THE DROSERACEOUS TENTACLE.

In general microscopic structure as well as in the type of construction of the tentacles *Roridula* is droseraceous and the tentacles show more primitive features than do those of other genera of the family, with the possible exception of *Byblis*, the systematic position of which is at present doubtful.

In order to bring out the relationship, I may start from the simplest tentacles of *Roridula* and thence trace a series of gradually increasing complexity up to the tentacles of *Drosera* itself.

The simplest gland I have seen was on a young stem of *Roridula dentata*. It consisted of a pedicel of a single row of three or four elongated cells continued at the extremity into a row of five or six flattened cells. The whole appeared as if it might have been formed by the repeated division of a single epidermal cell. Such glands are not common and are also to be found on the leaf. They are difficult to detect owing to their small size.

More complex are those tentacles in which the pedicel consists of two rows of cells, and then of three rows of cells, ending in a head containing a similar number of secreting gland-cells which, although originally united, have become separated laterally, so that they are connected with each other at their outer and inner extremities only. The three rows of cells of the pedicel are of the same thickness throughout, but the basal part may be thicker than the upper, more of the epidermal cells having been brought into the formation.

A further advance is shown in tentacles composed of four or five rows of cells with base of the pedicel thicker than the upper part.

By continued increase in the number of cell-rows more complex tentacles are developed. One row of cells may become enclosed by the others which form a ring round it. In the head of such a tentacle we see on transverse section a circle of

secreting gland-cells separated from each other laterally, but united by their inner walls to a single central cell, which does not secrete, but gives a support to the secreting cells.

More complex still is the condition where a third layer of cells has been developed between the outer gland-cells and the central row. This is the stage which most of the taller tentacles of *Roridula* have reached.

All these tentacles are simply epidermal out-growths of the nature of hairs. In none of them is there a central carrying-group of tracheids. But at the base of some of the longer tentacles, which are found just behind the apex of the leaf, there is sometimes a slight development of tracheid-tissue which passes into the pedicel for barely a quarter of its length, and into the tentacle terminating the leaf (and each of its side-branches in the case of *Roridula dentata*), a tracheid-strand is continued from the mid-rib into the centre of the stalk in its lower half or two-thirds (Fig. 30). It never reaches the head.

These terminal tentacles are the most highly developed of all the tentacles found either on the leaf or stem, and may be compared directly with the tentacles found on the leaves of *Drosera*.

The tentacle of *Drosera* may be considered to be derived from a type resembling that of *Roridula*. The tentacles in the two genera agree closely in length of pedicel and in length and diameter of head, but the vascular strand which traverses the pedicel and ends in a number of tracheid-cells occupying the centre of the head of the tentacle of *Drosera* is only foreshadowed in the tentacle of *Roridula*. The tracheid-cells in the centre of the head of *Drosera* represent the innermost row of cells and its surrounding layer in *Roridula*.

The outer layer of gland-cells of the tentacle of *Drosera* arranged in two rows. an outer and an inner, are continuous with one cell-row of the pedicel, not with two, and correspond to the single row of gland-cells in *Roridula*.

The most striking structural difference between the tentacles is the presence in *Drosera* of the so-called *middle layer*.

Apart from structure, its power of movement at once marks out the tentacle of *Drosera* as an organ showing advance upon that of *Roridula*. Darwin, in "Insectivorous plants," points out that the seat of movement in the tentacle of

*Drosera* is the base of the pedicel, and concludes that the lower part of the tentacle represents a prolongation of the leaf. Confirmation of this view is supplied by the terminal tentacle of *Roridula*, of which the basal part of the pedicel is a portion of the tissue of the leaf, while the upper part is of the nature of a hair. The other tentacles of *Roridula* are obviously hairs, but in some of the taller ones there seems to be a tendency for the tissue of the leaf to become merged in the base of the pedicel. In the case of *Drosera*, all the taller tentacles have undergone this modification, their basal part representing a prolongation of the tissue of the leaf, their upper part being of the nature of hairs, so that movement is limited to the basal part.

I was unable to determine whether all the tentacles of *Roridula* are similar in function or not, but the evidence seems to show that the tall marginal tentacles are losing their digestive function, and becoming of the nature of catching tentacles, and we should have then a foreshadowing of the division of work amongst the tentacles that is characteristic of *Drosophyllum*, with its catching pedicellate tentacles and digestive sessile glands, which are alike, structurally, in the possession of two layers of gland-cells—a middle layer, and a tracheid strand. Sessile glands are absent from the leaves of *Roridula;* there we have smaller tentacles, only simpler in structure. I would suggest, on the basis of this comparison, that the sessile glands of *Drosophyllum* are derived from the pedicellate rather than that the converse development has taken place. The primitive form of the droseraceous tentacle was evidently a hair, and length of pedicel and complexity in the structure of the head have increased equally. When these tentacles were able to attract and capture insects, the insects would ultimately sink down on the surface of the leaf, bearing the tentacles with them, because if these remained standing out from the leaf they would not be able to digest or absorb any nutritive matter; this bending of the tentacles would be apt to break them. This is prevented, in the case of *Drosera*, by the power of movement at the base, which brings about incurving and subsequent re-erection of the tentacle. In *Drosophyllum* this power of movement has not been acquired, and in order that the head of the tentacle may be brought near the insect the pedicel has

become shortened until, ultimately, it has completely disappeared, while those tentacles which have not undergone this shortening have lost the power of digestion, which would be of no use to them, since the head of the tentacle would not be brought in contact with the body of the insect after it had fallen on to the leaf. The glistening drop of secretion formed on these tentacles is, however, advantageous to the plant for attracting insects and capturing them.

### ACTIVITY OF THE GLANDS OF RORIDULA GORGONIAS.

The plant experimented upon was kept in a plant-house in the Royal Botanic Garden, Edinburgh, at a temperature between 50° and 60° C. The experiments were carried out during the months of November and the beginning of December. The plant was, unfortunately, thriving very badly at the time, and died about the middle of December, before the experiments had been concluded.

The plant stood close to several plants of *Byblis gigantea*, and although the glands seemed to all outward appearance to be secreting properly, the number of insects caught was exceedingly small; while the leaves of the active *Byblis* were crowded with insects.

This might be due to the fact that *Roridula* has not the same attraction for insects as *Byblis*, a view, however, which is scarcely consistent with the large number of the glands which in this case were all more or less actively secreting; or, as seems more probable, it might be due to the plant being in bad health at the time.

In order to determine whether the tentacles possess power of movement, I repeatedly irritated them by means of a sharply pointed needle, but was never able to observe any signs of movement, nor after placing small cubes of albumen on the glands did I observe any inflection of the tentacles.

The secretion from the larger tentacles is neutral to litmus paper, but in one or two cases the secretion from the smaller glands was slightly acid.

I placed a small cube of albumen upon one of the glands situated at the back of the mid-rib. After 24 hours the angles and edges of the tube had been rounded off, and, after a further

period of 24 hours it appeared as a small round mass. This, at the end of the third day, had diminished in size, and at the close of the fourth day, *i.e.*, after 96 hours, had entirely disappeared, or, rather, had been digested.

I then placed a drop of solution of $Am_2 CO_3$ upon one of the glands, and found that it became darkened, thus showing that the glands have the power of absorption.

Small cubes of albumen were also placed upon the glands at the margin of the leaf, but these were not disolved after a week, possibly pointing to the fact that these glands are not digestive. I was unable, unfortunately, to conduct sufficient experiments to make certain of this fact.

As might be predicted from their structure and relationships, the uni-cellular hairs of the upper surface of the leaf have no digestive power. Cubes of albumen placed upon them were unchanged after a week. Their function is that probably of the similar hairs of *R. dentata*, to prevent too much transpiration from the surface of the leaf, so that as much water as possible may be available for the tentacles.

The plants upon which the above experiments were carried out were about five inches high. At the end of the stem there were four green leaves which were able to assimilate; below these was a single withered brown leaf, the tentacles of which were, however, covered by drops of secretion, just as if the leaf on which they were situated had been perfectly healthy. I placed two small cubes of albumen upon two of these glands, and found that, after four days had elapsed these small cubes showed no signs of being digested. Shortly after this the upper four leaves also withered, and then, and not till then, did the drops of secretion upon the glands on this fifth leaf disappear. This would seem to point to the fact that the presence of these drops of secretion are simply due to hydrostatic pressure. This is the more remarkable when it is remembered that there is no vascular tissue in the stalk of the tentacles of the *Roridula*. The upper four leaves were able to draw up a sufficient supply of water, and some of this transpiration current passing along the vascular tissue of the withered leaf found its way to the glands, where it appeared in the form of glistening drops, the continual evaporation of which would draw up more water and thus keep the supply constant.

## STRUCTURE OF STEM.

In the largest specimen of *R. dentata* that I was able to examine, the diameter of the stem was about 1 cm. It was bare of tentacles, which had been thrown off with bark. The consistence is hard. On transverse section of an old stem there is visible a poorly-developed pith of small cells, a mass of dense wood composing the bulk of the stem, and traversed by numerous long, narrow medullary rays. On the outside is a small bark.

Young stems show a large central pith, and just outside the phlœm is an endodermis of five or six cells in one layer, but here and there there may be two layers. Outside this is a sheath of sclerenchyma-cells, which may in places be four or five rows thick.

The cortex is composed of large irregular cells with numerous intercellular spaces. The epidermal cells have a thick cuticle and no chlorophyll. The radial walls of the cells are thin, the outer and inner walls thick. Beneath the epidermis is a single row of cells of about the same size as the epidermal cells, with which they alternate in position. Their radial walls are also thin, while the outer and inner walls are thick.

*R. Gorgonias* is like *R. dentata* in stem-structure.

## STRUCTURE OF ROOT.

*R. Gorgonias* has a well-developed root showing a large central axis with numerous lateral rootlets. It is tetrarch. The large root system in *Roridula*, which in its adaptation to insectivorous habit seems to me to show the most primitive construction amongst the Droseraceæ, is of interest as pointing to the conclusion that the acquisition of the insectivorous habit was not due to a difficulty in absorption from the soil through defect in the root-system.

*R. dentata* conforms in root-features to *R. Gorgonias.*

## EXPLANATION OF THE FIGURES IN PLATES XX. and XXI.

Illustrating Mr. A. Ninian Bruce's Paper on the Tentacles of *Roridula*.

The following references apply to all the figures:—A. Sp., Air-spaces; B. S., Bundle-sheath; C. C., Central row of cells; Ch., Chlorenchyma; Cr., Crystals; E.C., Empty cells; Ep., Epidermis; Gl., Gland; L., Leaflet; M., Midrib; M. V., Marginal vein; P., Pedicel; Ph., Phloem; Scl., Sclerenchyma; St., Stoma; S. T., Spiral tracheids; T., Tentacle; T. t., Terminal tentacle; U. h., Unicellular hair; V. B., Vascular bundle; X., Xylem.

### PLATE XX.

FIGS. 1-15.—*Roridula Gorgonias*, Planch.
FIG. 1.—Leaf.
FIG. 2.—Apex of leaf.
FIG. 3.—Scheme of leaf in transverse section to show position of marginal tentacles.
FIG. 4.—Upper surface of base of leaf.
FIG. 5.—Under surface of base of leaf.
FIG. 6.—Portion from middle of leaf to show venation.
FIG. 7.—Stoma of leaf in surface view.
FIG. 8.—Stoma of leaf in vertical section.
FIG. 9.—Under side of leaf showing distribution of lime-oxalate crystals.
FIG. 10.—Upper side of leaf showing distribution of lime-oxalate crystals.
FIGS. 11-15.—Leaf in transverse section at intervals from base to apex.
FIGS. 16-22.—*Roridula dentata*, Linn.
FIG. 16.—Leaf.

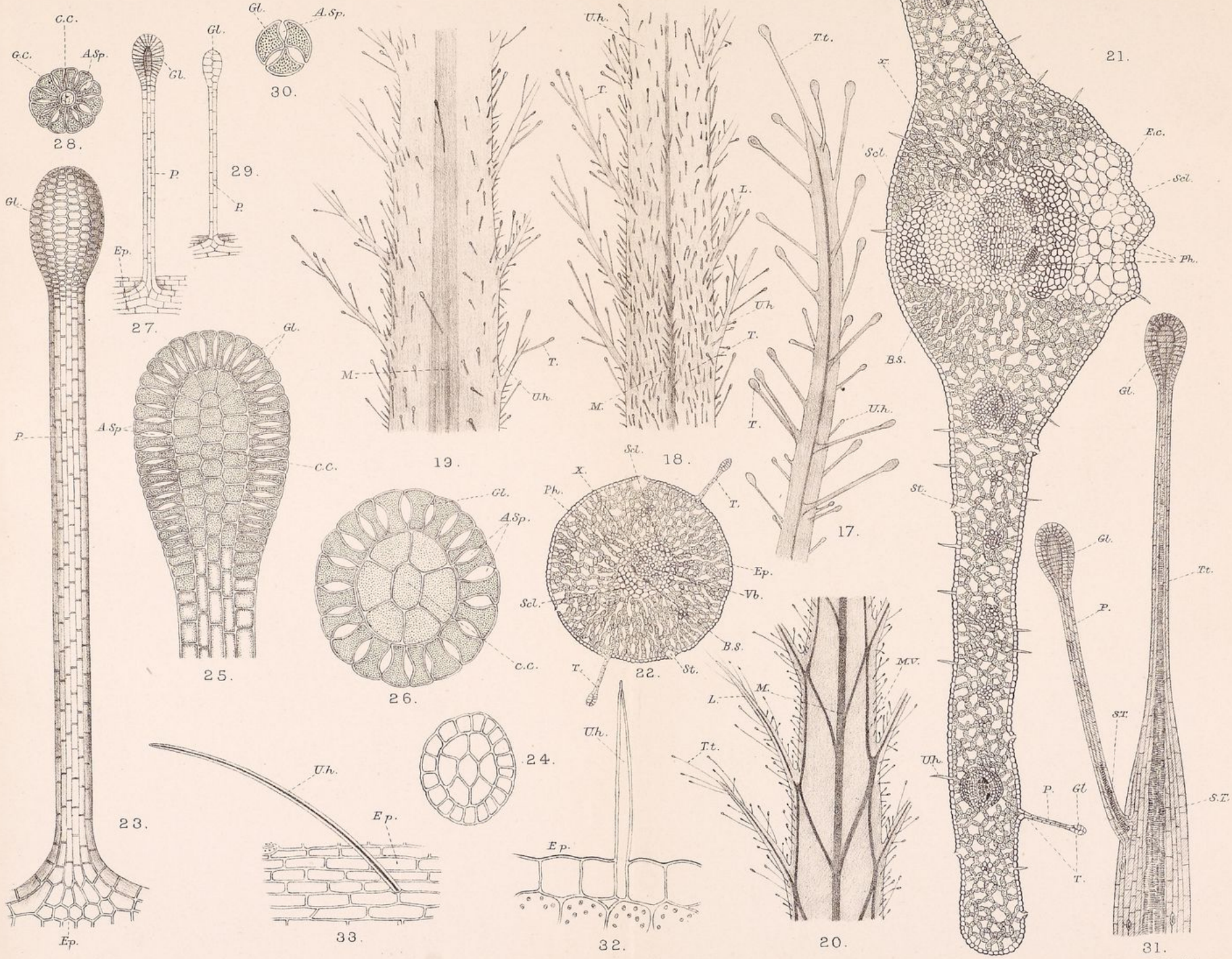
### PLATE XXI.

FIG. 17.—Leaf lobe.
FIG. 18.—Upper surface of leaf.
FIG. 19.—Under surface of leaf.
FIG. 20.—Portion from middle of leaf showing venation.
FIG. 21.—Leaf in transverse section.
FIG. 22.—Lateral leaf-lobe in transverse section.
FIGS. 23-31.—Tentacles of *Roridula*.
FIG. 23.—Large tentacle.
FIG. 24.—Pedicel of large tentacle in transverse section.
FIG. 25.—Head of large tentacle in longitudinal section.
FIG. 26.—Head of large tentacle in transverse section.
FIG. 27.—Medium-sized tentacle.
FIG. 28.—Head of medium-sized tentacle in transverse section.
FIG. 29.—Small tentacle.

FIG. 30.—Head of small tentacle in transverse section.

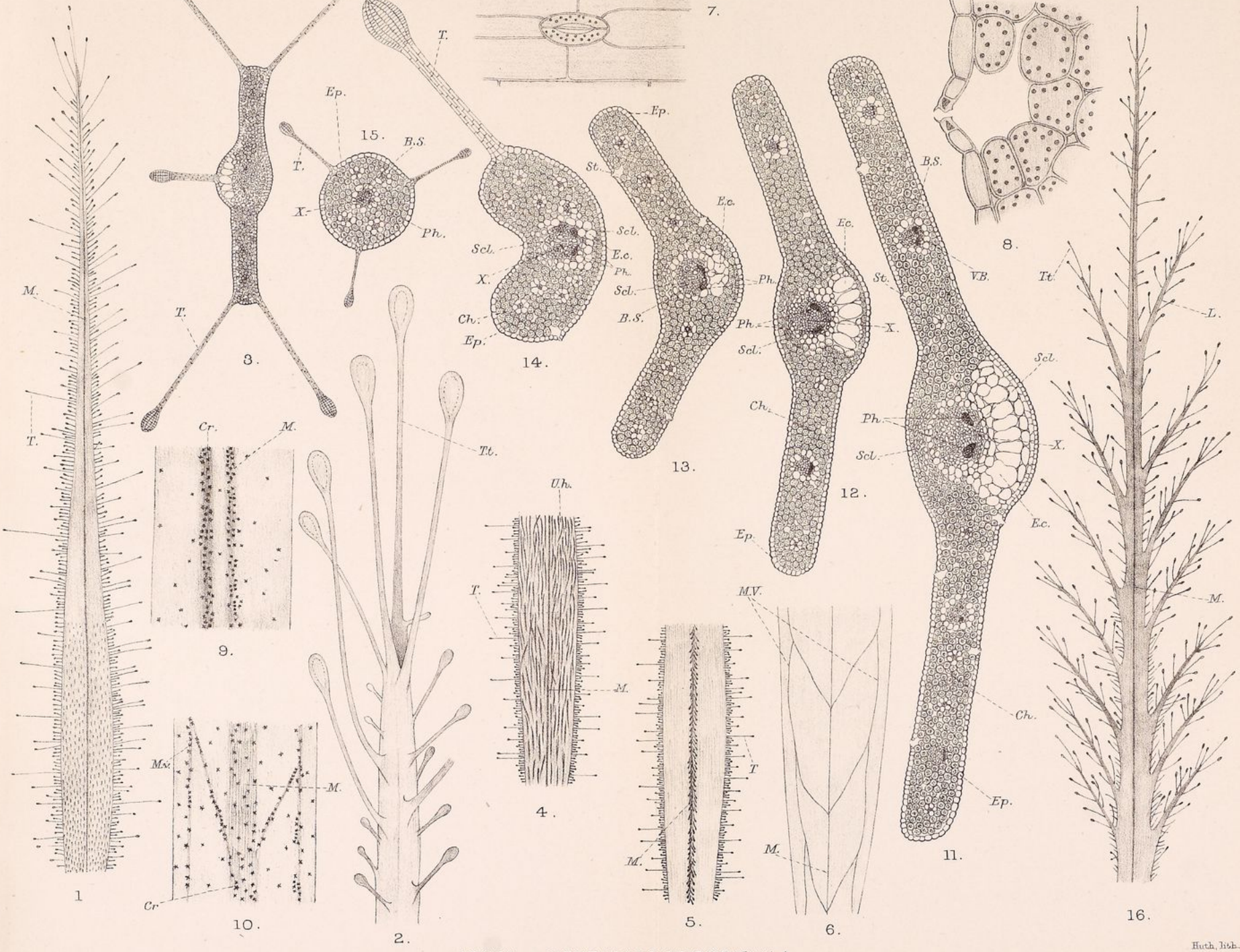
FIG. 31.—Apex of leaf showing vascular bundle passing into base of end tentacles.

FIGS. 32 and 33.—Unicellular hair on upper surface of leaf of *Roridula dentata*, Linn.




BRUCE — TENTACLES OF RORIDULA.

Huth, lith.




BRUCE — TENTACLES OF RORIDULA.

Huth, lith.