The Occurrence of a Cavity filled with Hairs in the Stem of a Species of Cucurbit.

BY

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With Plate XXV.

The way in which the Hair-Cavity arises.

The stem of this species of Cucurbit, like most of those which I have examined, is a hollow one. The nodes are solid, but the central cavity of the stem extends the whole length of the internode. The cells surrounding this ordinary central cavity differ in no way from the other parenchymatous cells of the stem. They are fairly large thin-walled cells, and are not arranged in any definite manner around the central hollow.

The vascular bundles are of the bicollateral type, with large vasa in the centre, phloem on the outside and also on the inside.

The stem is pentagonal in outline, with five prominent ridges.

The whole surface of the plant is covered with hairs (Fig. 4).

In one part of the stem certain cells form a projection into the central cavity. These projecting cells are at once marked off from the other surrounding cells in being smaller and full of cell-content. The projection appears to have originated as a single cell, and afterwards, in the centre of the projection, there is meristematic tissue.

As this structure is followed along the stem, it increases in size till it gradually fills up the whole of the central cavity.

But before it has altogether done so, in the centre of the projecting portion, that is to say, in the centre of the meristematic tissue, another cavity arises, and this is the cavity which contains the hairs.

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Appearance of the Hair-Cavity (Figs. 1 and 3).

This cavity differs entirely from the original central hollow. It is bounded by a very regular layer of cells, which differ greatly in appearance from the other cells of the pith, being much smaller, and having thicker walls and abundant cell-content. In fact, they are extremely like the ordinary cells of the epidermis.

Two or three rows of cells next to this layer also differ from the cells of the pith in being smaller and having plenty of cell-content. Not only, therefore, does this hair-cavity have a distinct origin apart from the original central cavity, but the cells surrounding the two cavities also differ.

Appearance of the Hairs (Figs. 1, 2, and 3).

From the surrounding layer of cells hairs project outwards into the cavity. These hairs are of two kinds—pluricellulur and glandular.

The former are the more numerous. They are hairs of the kind which De Bary describes as "Conical Multicellulur Hairs"*

The foot-cell differs slightly in appearance from the others. There may be as many as eight or nine cells in a hair, though in most of them there are not quite so many. All the cells are full of protoplasm (Fig. 1).

The glandular hairs are not nearly so numerous. They are similar to those which De Bary calls "Capitate glandular hairs," *i.e.*, the free end is swollen to form a round head, the transverse section of which exceeds that of the stalk.

The stalk is short, 1--3 celled (Fig 2).

In one part of the stem which I examined, in addition to the main hair-cavity, a very much smaller one appeared close to it. This smaller hair-cavity was also filled with hairs of both kinds.

Before discussing the possible significance of this structure, I may here explain that the material which I first examined was among that which had been supplied from the Edinburgh Royal Botanic Garden for the use of students in the Winter Class of Botany. It consisted of short pieces of the stem of several Cucurbits. I was able to find three or four short pieces, probably

* De Bary. Comparative Anatomy of Phanerogams and Ferns, pp. 59-61.

cut from the same plant, which contained this hair-cavity. In one piece I was able to trace its origin as above described. It extended for several inches along the stem, but I was unable to follow it to the end.

It was difficult, too, to say definitely to what species of Cucurbit the little piece of stem belonged. However, I have this year made sections of, and examined carefully, all the species of Cucurbits which are grown in the gardens from which the specimens might have been derived.

These include—*Cucurbita maxima* and var. *turbaniformis*, *C. Pepo* and its varieties *aurantia*, *verrucosa alba*, and *mammeata*, *Lagenaria Sipho*, *L. congourda*, *L. clavata*, *L. pyrotheca*, *L. vulgaris*, *Cucumis Sacleuxii*, and *Benincasa cerifera*.

With the exception of the last named, *Benincasa cerifera*, the stems of all the species differ slightly from that in which I found the hair-cavity, so that now I am sure that it was from *Benincasa* that the pieces which I examined were cut.

The specimens of *Benincasa cerifera* now growing in the houses are not yet full grown.

However, in the young growing plants near the nodes I notice that there are appearances of meristematic tissue similar to that above described. I am unable to say whether the hair-cavity will develop later.

The Nature of the Cavity and Hairs.

De Bary* describes various kinds of Internal Hairs. He divides them into two categories, glandular and non-glandular. The only forms of the first category, he says, are those glandular hairs first noticed by Mettenius, and described later by Schacht, in the air-cavities of the rhizome and base of the petiole of *Aspidium Felix-mas*. These are unicellular capitate hairs, and secrete "a firm greenish brilliant thick layer of resin."

Intercellular hairs of the second category occur in *Pilularia*, *Nymphæaceæ*, *Aroideæ*, *Rhizophora*, and *Limnanthemum*.

In *Pilularia* they are rolled up like watch springs; in *Nymphæaceæ* they are stellate hairs, and in the others they are either stellate or H formed, and according to De Bary they are

* Comparative Anatomy of Phanerogams and Ferns, Sect. 53.

fundamentally related to selerenchymatous fibres in every respect, and are only special cases of the latter, distinguished by their form and distribution.

It is at once obvious that the hairs in this hair-cavity cannot be called "Internal Hairs," according to De Bary's description of such.

I have already said that the whole surface of the plant is covered with hairs. These hairs on the outside of the stem are also of the two kinds, pluricellular and glandular (Fig. 4).

They are absolutely identical in appearance with the hairs that fill the cavity. The pluricellular are again the more numerous, and the proportion of glandular to pluricellular is the same as in the hair-cavity.

The cells surrounding the cavity are exactly like the cells of the epidermis.

These facts point to the conclusion that we have here an internal epidermal structure.

It is not exactly the case, however, that the cells surrounding the central hollow, in response to an air-environment, have started to produce an epidermis with hairs. Such would doubtless be a likely and natural explanation, if it were not for the way in which the hair-cavity arises.

Wounding the surface of a stem has been said to cause an internal epidermis to be produced, but I hardly think that any wound on the surface would cause such a structure as this to arise. And, as far as I could see, there was no wound on the surface of the stem.

Another attempt at an explanation is that this might be an infolding of the epidermis, the infolded loop, as it were, being cut off and forming the cavity. But looking again to the method in which it arises, this explanation seems impossible. No disarrangement of the vascular bundles, nor any other irregularity in the appearance of the stem or distribution of the tissues is apparent, and a vascular bundle lies directly between the point where the hair-cavity begins and the outside of the stem.

The most natural explanation—which, however, is by no means a complete one—is that certain cells in the interior of this plant have taken on themselves the character of meristem and have laid down an epidermis.

This epidermis does not line the central hollow, as would perhaps be expected. Instead of that, the central cavity becomes filled up, and a new cavity is formed which is surrounded by this internal epidermis.

As to the physiological significance of the structure, further investigation will be necessary before anything can be said.

In conclusion, I should like to express my sincerest thanks to Professor Bayley Balfour, under whom these observations were made, and to Mr. W. Edgar Evans, B.Sc., who prepared the microphotographs.

EXPLANATION OF THE FIGURES IN PLATE XXV.

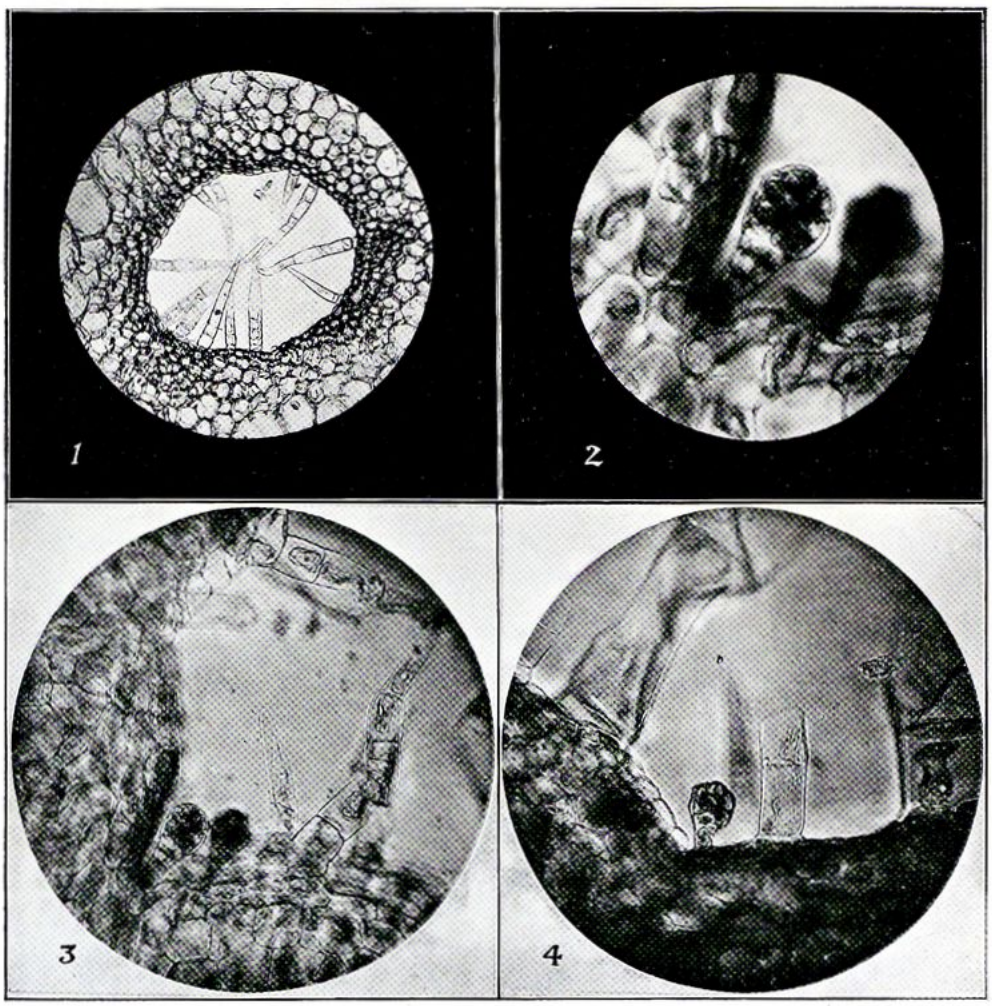
Illustrating Mr. J. W. Bews' paper on "A Cavity Filled with Hairs in the Stem of a Cucurbit."

FIG. 1. The hair-cavity and the pluricellular hairs. General appearance of the cells surrounding the cavity.

FIG. 2. A glandular hair in the hair-cavity with short stalk and round globular head.

FIG. 3. Part of the cavity showing both pluricellular and glandular hairs.

FIG. 4. The ordinary epidermis with pluricellular and glandular hairs similar to those in the cavity.



Bews.—Hair-cavity in Cucurbit.