There seems to be no doubt but this behavior of the endosperm in *Lilium candidum* is a provision for increasing the absorbing surface of that tissue in the region of greater food supply. These cells of the endosperm may, therefore, be known as *endosperm haustoria*.

A similar behavior of the epidermal cells in certain parts of the embryo, such as the cotyledons, serving as special organs of absorption, is well known, and a few striking illustrations of the same are brought together by Haberlandt in his "Physiologische Pflanzenanatomie."

The narrowed end of the embryo-sac, which extends into the chalazal region in certain *Compositae (Senecio)*, is doubtless associated with a like function. In *Senecio*, however, the antipodal cells not only persist but multiply, while in *Lilium candidum* these disappear early, and the space which they formerly occupied is soon filled by endosperm cells.

THE EFFECT OF CENTRIFUGAL FORCE UPON THE CELL. BY DAVID M. MOTTIER.

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ABSORPTION OF WATER BY DECORTICATED STEMS. BY G. E. RIPLEY.

It is probably known to all students of botany that the sap in a plant rises chiefly through the wood-cells, and not through the cortex-cells. This can be easily demonstrated by securing two similar leafy shoots from a tree or bush. From one, remove all the cortex for about an inch above the cut end, and from the other the wood for about the same distance. Now place the two prepared ends in water, and observe the rate of wilting as shown by the turgescence of the foliage. In a few hours, if transpiration is rapid, the shoot from which the wood has been removed will begin to wilt, and after a time will lose all turgescence, while the decorticated one will appear almost as fresh as at first and will continue so for a considerable time. This proves that the wood-cells and not the cortex-cells supply the water to the shoot.

Last spring, while performing this experiment in the laboratory of vegetable physiology at Purdue University, it was observed that the third unprepared shoot, used as a control on the other two, wilted much sooner than the decorticated one. This observation at once raised the question in what way the removal of the cortex at the cut end of a shoot would delay wilting. In the unprepared shoot used the wood-cells in touch with the water were only those exposed by the cross-section of the stem. but in the decorticated one, besides these. the cells from which the cortex had been removed. were also brought in touch with the water, thereby increasing the number of wood-cells in contact with the water in the decorticated shoot. As it has already been shown that the cortex is a poor conductor of water, we can see that it will prevent the water from reaching the wood-cells beneath, but if removed from the shoot the water is brought in contact with these cells the same as with those exposed at the cut end of the shoot, and as results show, is taken up by them.

The turgescence of a shoot depends upon the amount of water supplied to it in relation to the amount given off by transpiration, and this can be prolonged by providing a greater supply of water, or by decreasing the rate of transpiration. As the latter. however, is dependent upon the condition of the atmosphere, it is beyond our control; but the supply of water is not. Pressure can be used to increase this supply to the cut shoot. and by this guttation can be produced in the vigorous shoot. and turgescence can be restored in the wilted. But this is too inconvenient to be of much practical value in preserving cut shoots in fresh condition. If the supply of water to a cut shoot can be increased by removing the cortex from above the cut end. this will give a very simple method for prolonging turgescence, a method that all may employ who are lovers of cut flowers and delight to preserve them as long as possible.

In the experiment mentioned, as the decorticated did not wilt as soon as the corticated shoot. the former must have received more water than the latter. If the end of a cut shoot that is in water be removed at different intervals so that fresh cells are exposed to the water, the shoot will not wilt as soon as it would if the fresh cells were not exposed. This is due to the fact that as the cells take up the water they act as a filter and stop all foreign matter present in the water. and so in time the cells are choked. and can not take up more water. When the cortex is removed more wood-cells are exposed. and it may be that the water is not taken up any faster by the shoot. but on account of the greater surface of cells exposed they do not choke so soon. But if the cells exposed by the cross-section do not overload the carrying capacity of the shoot, it should take up more water when the cortex is removed.

In order to determine if different shoots would give results similar to those observed in the elder shoot used in the experiment mentioned, a number of experiments were carried out last fall. The data. from all but three of these experiments, were very satisfactory and supported the first result.

The three which were not very satisfactory were with the tomato, gladiolus and one of the maples. They will be mentioned later. In these experiments duplicates were carried out with all but the rose, dahlia and gladiolus; but were not carried out at the same time except for two of the experiments. The stems for the duplicates, while of the same species, were not always taken from the same plant from which the first stems were secured. The condition of the stems used was noted, efforts being made to secure the two as near alike as possible. The number and condition of the leaves were taken, but the amount of foliage present did not appear to have any appreciable effect upon the results. If, however, a large surface of foliage was employed and suitable apparatus used, it would undoubtedly be apparent in the data.

The length that the stems were decorticated was measured for each experiment, and the relation between the length of cortex removed and the time of wilting is shown in the table.

In the first of the experiments performed last fall, stems from a catalpa were used. The tree stood in the open on high, dry, gravelly soil, and was about ten inches in diameter. Two stems each having the same number of leaves were secured. From one the cortex was removed for about 2.8 cm. above the cut end, from which, just before it was put in the water. a fresh cross-section was made so as to expose fresh cells to the water. About 3 mm. were cut off so that there was left about 2.5 cm. of decorticated stem. A fresh cross-section was also made on the corticated before it was put in water. Both stems were put in water at the same time, September 20, at 11 a. m., with the air temperature at 18.5°C. The sky was cloudy and transpiration was slow that day, but by 9 a. m. the next day, with a clear sky and the temperature at 22.5°C., the corticated stem had wilted. The decorticated did not wilt until after five that evening. Six days later catalpa stems were tried again. This time the cortex was removed for only 1 cm. The stems, prepared as before, were placed in water at 7 a. m., temperature 21°C. At 4 p. m. that day, temperature 24.5°C.. the corticated had wilted. the decorticated wilting about three hours later.

If we compare the data secured from these two experiments, we find that in the first, with 2.5 cm. of cortex removed, there is a difference of over eight hours in the wilting of the corticated and decorticated stem; and in the second, with only 1 cm. of cortex removed, there is a difference of only about three hours. Now, if we take for granted that the two corticated stems, if under same conditions, would have wilted at about the same time, we have in the decorticated stems for a difference of 1.5 cm. of cortex removed about five hours difference in their wilting.

It is not supposed that this will not vary, nor that stems from other plants will give the same data, for different stems take up water at different rates; but the following, maple, oak, aster cordifolius, wild cherry, Indian mallow, rose, bittersweet, dahlia and chrysanthemum, with which two experiments were tried from all but the rose and dahlia, gave a similar relation between the length of cortex removed and the time of wilting.

With some of the experiments wilting was slow on account of so much moisture being present in the atmosphere, while in others it was rapid, due to the absence of moisture. But in no instance was it evident that the decorticated stem wilted sooner than the corticated one, though with the tomato and gladiolus the time was apparently the same.

Aster cordifolius gave the best results. In the first experiment with it the corticated wilted in about forty-five hours; the decorticated, with 1 cm. of cortex removed, wilted in about sixty-four hours. In the duplicate, the corticated wilted in about fifty-six hours; the decorticated, with 2 cm. of cortex removed, wilted in about ninety hours. It was cloudy all the time that these two experiments were being carried on, and part of the time was raining, so that transpiration was slow.

If we compare these two experiments we find that in the first there is nineteen hours' difference in the wilting of corticated stem, and decorticated with 1 cm. of cortex removed, and in the duplicate there is thirty-four hours' difference in the wilting of corticated stem and decorticated with 2 cm. of cortex removed. The data secured from the other experiments, except those mentioned as giving no results, were not so marked as the aster. The data from the rose were furnished by Dr. Arthur. Only one experiment was tried but the result was good, the decorticated being almost as fresh as at first, when the corticated had wilted.

It must be remembered that the results given are only approximate, as the eye had to decide when the stems had wilted. With the use of suitable apparatus we might discover a relation between the time of wilting and the length of cortex removed. This, if proven, though it might not be of much value in itself, may bring us a step nearer to the final answer of that great question, How does sap rise in plants?

In the experiments with tomato, gladiolus and one of the maples, no definite results were secured. The tomato stems were very tender and transpiration was so rapid that the stems would wilt in a short time, remain wilted until sundown and then revive only to wilt the next morning. The gladiolus specimens used were secured from a bouquet and were not in a fresh condition, which might account for failure to give results. One of the three maple experiments also gave no difference in time of wilting, but in the evening the decorticated stem revived, while the corticated did not, proving that the former took up water more readily than the latter.

The following table gives the results of the experiments, the average temperature, length of cortex removed, time of wilting of corticated and decorticated, and the difference in time of wilting:

Stems Used.	Length of Stem Decorticated in cm.	Average Temperature in C.	Hours Before Wilting.		Difference in Favor of Decorticated
			Corticated.	Decorticated	
Catalpa	2.5	20.5	22	30+	8+
Duplicate	1.0	22.7	9+	12+	3+
Maple	3.0	21.2	10	36	26
Duplicate	1.5	26.0	20	27.5	7.5
Oak	1.5	29.0	9	13	4
Duplicate	2.0	30.0	7	13.5	6.5
Aster C	1.0	20.2	45	64	19
Duplicate	2.0	18.9	56	90	34
Wild Cherry	1.5	20.1	15	22	7
Duplicate	2.5	22.0	12+	22	10
Indian Mallow	2.0	24.0	7	11	4
Duplicate	1.0	26.7	8	10	2
Rose	3 (about)	....	40	Still fresh.	....
Bittersweet	2.5	19.0	30	37	7
Duplicate	2.5	21.0	36	41	5
Dahlia	2.0	23.0	30	48	18
Chrysanthemum	3.0	26.5	29	46	17
Duplicate	1.5	24.0	33	39	6

Just in what way the removal of cortex delays wilting in the cut shoot is yet to be determined, but that it does is evident from results secured. It seems reasonable to suppose that if the cortex is removed and more wood-cells exposed, the shoots should take up more water, provided the cells exposed by the cross-section are not able to supply all the stem can carry. If they can, however, then the delay in wilting must depend on the fact that the more wood-cells exposed, the more time required for them to choke and break down; and this leaves us with the problem as regards the "absorption of water by decorticated stems," either the supply is greater or the cells do not choke so soon.

Indiana Plant Rusts, Listed in Accordance with Latest Nomenclature.

By J. C. Arthur.

Stability in nomenclature is conceded by all to be important. In botany there should be one recorded name for each plant by which it can be identified, and none other should be valid. If this could be strictly maintained, the study of plants would be simplified, for not only would doubt be removed regarding the true application of a name, but when a name was once learned it would hold good for all time. How different the present status of botanical usage is has been brought to the attention of every one using the successive editions of Gray's Manual, a work that probably has introduced more American students of recent years to an acquaintance with the plants of field and highway than all others combined. Those of us who were brought up botanically on the fifth edition learned to call the pretty little white rue-anemone, so abundant in spring, *Thalictrum anemonoides*, but with the new edition in 1890 we were asked to forget that name—no, not to forget it, but to remember that it is not the right one—and to say, instead, *Anemonella thalictroides*. If one had but to relearn a few hundred names, and feel assured that no further demands would be thrust upon him, the task would seem less wearisome. But the new manual names are scarcely fixed in mind before the valuable work by Britton and Brown comes to us, a work so admirably conceived and executed, and so conveniently devised to assist the learner, that it must be recognized as the foremost manual of our flora, and we are again asked to put away the former names of our little rue-anemone and to rechristen it among our list of acquaintances as *Syndesmon thalictroides*. There are