THE ANATOMY OF AN ABNORMALLY ENLARGED STEM OF WILD FOUR O'CLOCK

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An abnormally enlarged stem of a wild four o'clock plant [Oxybaphus nyctagineus (Michx.) Sweet.] was discovered last fall. The enlarged part of the stem was near the top of the plant and was located at one internode. On the entire plant there was only this one enlargement.

Microscopic sections of both the normally sized and abnormally enlarged stems were stained and mounted on slides. In mounting these sections the normally sized and abnormally enlarged sections were placed side by side on the same slides. This simplified the microscopic study of the tissues in the two types of stems, and enabled one to make a more accurate comparison.

The first data obtained from these slides were the average diameters and average areas of both the normally sized and abnormally enlarged stems. The areas were computed from twelve sections of each. The actual measurements in millimeters were obtained by the use of a stage micrometer which is a mechanical apparatus that is constructed for this purpose. The diameters on each section varied slightly, possibly due to the manner in which the specimens were handled while being prepared for mounting. Therefore, in order to obtain a more accurate diameter, the longest and the shortest diameters were measured for each section, and an average was obtained. The diameter of the abnormal stem was found to be more than twice that of the normal stem or exactly 120 per cent larger.

From these average diameters of the normal and abnormal stems, average areas of each were obtained mathematically. The area of the abnormal stem was almost five times as large as the area of the normal stem or exactly an increase of 386 per cent (Table I).

Table I

Average diameters and average areas of both normal and abnormal stems computed from twelve sections of each (actual measurements in mm. by stage micrometer).

	Normal	Abnormal
Average diameters	3.017 sq. mm.	4.32 mm.
Average areas	1.96 mm.	14.658 sq. mm.
Average diameters in %	100%	220.4%
Average area in %	100%	485.84%

Next the sections of the normal and abnormal stems were compared when enlarged eighty times. This enlargement was obtained by projecting the sections on a screen with a lantern and a special micro-projection attachment. The data are averages from six enlarged sections of both the normal and abnormal stems. From the projections, sketches were made of the entire sections together with their included vascular tissues. Then the areas desired were computed, from these sketches, by a planimeter. The planimeter is a mechanical integrator used to calculate areas of irregular figures. From the data thus obtained it was learned that the total areas of the vascular tissues of the normal and abnormal stem were approximately the same, but due to the much larger total area of the abnormal stem, its total vascular tissue area consisted of only 5.28 per cent of the total area of the stem while the normal had 25 per cent vascular tissue. Vascular tissues are made up of xylem and phloem. Xylem is the water-conducting tissue and the chief supporting structure of vascular plants. The phloem is the food-conducting tissue and also has a minor function in supporting the stem.

Table II

Comparison of sections of normal and abnormal stems magnified 79.22 times. (The following data are an average from six enlarged sections).

Condition of stem	Total area in square inches	Area of vascular tissue with its percentage of total area in parentheses			Number of separate vascular bundles
		Total area of vascular tissue	In separate bundles	In vascular cylinder	
Abnormal	141.73	7.48 (5.28%)	7.48 (5.28%)		43
Normal	29.35	7.34 (25%)	3.12 (10.4%)	4.22 (14.6%)	25

The number of vascular bundles was twenty-five in the normal stem and forty-three in the abnormal stem. This at first would cause one to think that the vascular bundles in the abnormal stem increased with the increase in size, but this was not true because there was a circle of small vascular bundles in the abnormal stem, next to the cambium which corresponds with the vaguely visible bundles lying in the secondary vascular cylinder of the normal stem; therefore if these small bundles in the abnormal stem are excluded from the count, the number of bundles in both the normal and abnormal stems are approximately the same.

The large thin walled cells surrounding the vascular bundles are called parenchyma cells. Their function is to store food and to hold the stem erect by means of the turgor pressure existing within the cells. In comparing these cells which were in the normal and abnormal stems it was learned that there was some difference in the size of the cells and a considerable difference in cell number. The abnormally enlarged stem had parenchyma cells which were somewhat larger than those in the normal stem and had approximately three times as many. The normal stem had a cylinder of vascular tissue adjacent to the cambium whereas the abnormally enlarged stem had no cylinder of vascular tissue adjacent to the cambium. Instead there were parenchyma cells in that location. This condition accounted for most of

the additional parenchyma cells which existed on the abnormal stem, but did not account for all of them. Table II presents a summary of the data collected.

Professor Miller (1938), after studying the development of the stem from the seedling stage, has evidence to conclude that much of the diameter of the stem is caused by meristematic activity in the pericycle. The abnormally enlarged stem probably developed in the same way from a meristematic pericycle, except that the growth in diameter was far more extensive, with the formation of more parenchyma cells and less vascular tissue adjacent to the cambium, than in a normal stem. The reason for increased and altered meristematic activity is not known.

Literature Cited

Miller, Ward L. (1938)—Anomalous Secondary Growth in the Wild Four O'Clock. Read at meeting of Academy, 1938.