Proceedings of the Iowa Academy of Science

Volume 69 | Annual Issue Article 23

1962

The Latex System of Some Native Spurges

Robert C. Lommasson
University of Nebraska

bore predominantly pistillate inflorescences in comparable positions. Further comparison with other types that produce many long, leafy tillers will be needed to determine whether the extent of elongation of an axillary shoot is correlated with the shift of inflorescence primordia to either staminate or pistillate flowering. It is possible that environmental condiitons, especially conditions of stress, may influence the type of terminal inflorescence that is produced on tillers.

Literature Cited

Bonnett, O. T. 1948. Ear and tassel development in maize. Ann. Mo. Bot. Gard. 35:269-287.

Kiesselbach, T. A. 1949. The structure and reproduction of corn. Nebraska Agr. Exp. Sta. Bul. 161.

Sass, J. E. and Frank A. Loeffel. 1959. Development of axillary buds of maize in relation to barrenness. Agronomy Journal 51:484-486.

Sass, John E. 1960. The development of ear primordia of *Zea* in relation to position on the plant. Proc. Iowa Acad. Sci. Vol. 67, pp. 83-85.

The Latex System of Some Native Spurges

ROBERT C. LOMMASSON[1]

Abstract. Eight species of *Euphorbia* in the subgenus *Chamaesyce* were investigated anatomically from collections made in Kansas. The latex system is composed of branched nonarticulated laticiferous cells. These laticifers are distributed regularly or apparently at random through the cortex of root and stem depending upon the species. When the outer cortex is destroyed by periderm as in the root or the inner cortex by crushing as in the stem, there are still laticiferous cells apparent in these two organs. The most extensive branching network of laticifers is developed in the leaf. No anastomoses were found. The commonest latex system in the leaf was found to be the subepidermal system.

The latex system of plants was one of the features subjected to investigations of various sorts during the 19th century. By the middle of that century sufficient research on the structure of the latex system had been completed to get a fairly accurate idea of the elements composing those systems in a few of the more common families.

During the latter part of that century investigations as to the function of the latex system had produced some theories which were in disagreement (De Barry, 1884; Groom, 1889). Not much progress in the understanding of the function of latex has been made even until today. Textbooks in plant physiology generally omit any discussion of latex.

[1] Department of Botany, University of Nebraska, Lincoln 8, Nebraska

Recent studies and reviews of the structure of the latex system (Esau, 1953) have given satisfactory coverage of the general characteristics. Morphologically there are two kinds of laticifers. Laticiferous vessels are articulated, and laticiferous cells are nonarticulated. Laticiferous vessels originate from rows of meristematic cells in which the transverse septa become absorbed at an early stage of development. These laticifers resemble xylem vessels to this extent. However, they are living and coencytic in nature. In the mature plant they may exist as nonanastomosing systems, or they may form a much branched anastomosing system by the joining of more or less parallel ducts through connecting living cells. Among the families having laticiferous vessels are the Papaveraceae, Caricaceae, Musaceae and the genera *Hevea* and *Manihot* in the Euphorbiaceae.

Laticiferous cells are structurally coenocytes developed from a single cell. Initial cells may be distinguished in the young embryo at the inner margin of the primary cortex in the cotyledonary node. As the plant grows the laticiferous cells develop into a branching system ramifying throughout the entire plant body. This type of growth has been referred to as intrusive growth. Also a considerable amount of growth is symplastic growth. In laticiferous cells there are no anastomoses. This type of laticifer is found in most genera of the Euphorbiaceae and the Asclepiadaceae.

The scope of this paper includes a description of the latex system composed of branched nonarticulated laticiferous cells as it exists in the roots, stems, and leaves of eight species of *Euphorbia* subgenus *Cramaesyce*.

Materials and Methods

The materials used in this study were collected at various places in Kansas. Identification of the specimens and histological samples from them were made from fresh material or from plants preserved in 30% ethyl alcohol. The nomenclature follows that of Wheeler (1941). The following species and varieties were investigated.

Euphorbia missurica Raf. var. *typica*.
E. missurica Raf. var. *intermedia* (Engelm.) L. C. Wheeler
E. maculata L.
E. serpens HBK.
E. Fendleri T. & G. var. *typica*.
E. glyptosperma Engelm.
E. supina Raf.
E. humistrata Engelm.
E. stictospora Engelm.

Sections used in this study were made free hand or with the sliding microtone and rotary microtone. Permanent slides were made of each of the three main vegetative parts of the plant. Scarlet R or Sudan IV was used to stain free hand sections to identify the laticiferous cells.

Observations

The laticiferous cells in the roots of these species occur most frequently in the cortex. Since the development of cork usually destroys the cortex of the older roots, most of the evidence of latex cells has gone too. However, in such cases certain cells of the phloem seem to be differentiated as laticifers. In some roots, such as in *E. macalata*, the laticiferous cells in the cortex are large and oval (27 x 45 microns). They are thus easily distingushed from other cortical cells. In other roots, such as those of *E. supina*, only a few of the cells bearing latex are conspicuous by being of larger size.

The path of the laticiferous cells through the cortex of the root in longitudinal extent as seen in tangential section may be a tortuous pathway; at other places it may be straight. No discontinuity or regular alignment of surrounding cortical cells is apparent to account for the difference. The difference in the nature of the pathway is probably connected with the two types of growth. The tortuous appearance is probably a result of intrusive growth of the laticiferous cells through the tissues and the straight pathways may result from symplastic growth. In the unbranched portion of roots there is apparently almost no branching of the laticiferous cells. In *E. maculata* they are about 100 microns apart.

In the stem regions of these species the laticiferous cells develop in a manner similar to that found in the roots. *E. Fendleri* offers an interesting example of the development, as the occurrence of latex cells may be observed in both perennial and first year stems. In the perennial stems the development of the periderm has destroyed all traces of the cortical cells and sclerenchyma fibers which are found in first year stems. The laticiferous cells found in the perennial stem are all in the phloem, yet in the first year stem they occur in the cortex. Some are situated between the sclerenchyma groups and adjacent to the outermost part of the phloem.

In the stem of *E. stictospora* two systems of branching occur. One composed of larger laticiferous cells within the inner cortex and another of much smaller and more numerous ones in the outer portion of the cortex. The stem of *E. supina* shows an abundance of latex cells in the cortex which, as in the root, are not greatly differentiated from other cortical cells in size and

shape. The cortex of the stem of *E. missurica* var. *intermedia* becomes crushed by the growth of the stem and the failure of the outer two layers of cells to divide. This condition gives the hard glass-like surface to the stem and effectively obscures all the laticifers except those in the innermost part of the cortex. In transverse sections of the stems of *E. serpens* and *E. glyptosperma* the laticiferous cells appear as a single layer of large oval cells with thickened walls about 100 to 150 microns apart and about two cell layers away from the phloem. *E. maculata* likewise shows, generally, the same type of distribution of the laticifers but due to the larger stem size they are about 400 microns apart around the circumference of the stem. The laticifers of *E. humistrata* show a similar orientation in the stem, but they are fewer in number and not as regularly spaced. In *E. missurica* var *typica* the laticifers have no regular arrangement except that they are located within the inner cortex where they are clearly distinguishable by their larger size.

Branching of the laticiferous cells takes place most commonly at the nodes of stems where branches are given off along with the leaf traces to ramify the petiole. In the petiole the laticiferous cells occur close to the vascular tissue latterally and abaxially.

The proliferation of laticiferous cells into the profusely branching network takes place within the leaf blade. In the base of the blade the laticifers are approximately the same size and rather close to the midrib, but they are not intimately associated with the vascular tissue. The branches of these large laticifers are oriented in all directions and are found in any tissue of the leaf blade. Latex cells may come together and lie adjacent to one another for some distance, and one may end while in contact with the other without ever joining it. No anastomosing was observed in any species. Branches may be given off at right angles or they may branch in opposite directions. A prominent network may be observed in almost any layer of the leaf blade. The most easily observed subepidermal system occurred in *E. serpens* where the laticiferous cells are in contact with the upper epidermal cells and the upper ends of adjacent palisade cells. Although *E. supina* possesses a rather poorly developed hypodermis above the lower epidermis, a striking network of laticiferous cells occurs in the spongy parenchyma just above the hypodermis. In leaf cross sections, these larger laticifers occur about every 150 microns of leaf width with smaller ones about twice as frequent. Considering all of the species concerned in this study the commonest latex system in the leaf is that lying just beneath the epidermal cells. No laticifers were observed in a subcuticular position. The next most commonly observed

system is that of the spongy parenchyma as noted in *E. supina*. The least common system is that in which the laticifers are adjacent to the bundle sheath cells.

Conclusions

The latex systems of the root and stem remain active after periderm formation in the root and crushing of the cortex in the stem. The irregularities of the pathways of the laticiferous cells were attributed to intrusive growth and subsequent expansion of surrounding cells. Symplastic growth probably gave rise to straight laticifers. Branching occurred most frequently near the point of origin of lateral structures.

In the leaf the present study was unable to show any frequent connection between the laticiferous cells and the vascular system as was proclaimed so strongly by Haberlandt (1914). There was no copiously branched system of laticiferous cells found just beneath the palisade tissue in any of these species as was reported by Haberlandt for *E. Myrsinites*. There have been no palisade cells inclined in tufts toward laticiferous cells or to funnel shaped connecting cells. The only inclination of palisade cells in these species was their inclination toward vascular bundles. Haberlandt also recorded a diminishing of the efferent parenchyma when there was a well developed latex system. This does not occur in the species considered in this study, for the vascular bundles have a most striking and well developed bundle sheath.

All of the observations are in close agreement with those of Groom (1889). Laticiferous cells may end in the mesophyll or in contact with either epidermis. The ends of laticiferous cells are not associated with any particular leaf tissue.

Literature Cited

De Bary, A. 1884. Comparative Anatomy. Clarendon Press, Oxford. pp. 183-199.

Esau, Katherine. 1953. Plant Anatomy. John Wiley & Sons, New York. pp. 304-323.

Groom, Percy. 1889. On the function of laticiferous tubes. Ann. Bot. 3:157-168.

Haberlandt, G. 1914. Physiological Plant Anatomy. Macmillan. London. pp. 336-345.

Wheeler, L. C. 1941. *Euphorbia* subgenus *Chamaesyce* in Canada and the United States exclusive of Southeran Florida. Rhodora 43:97-154, 168-205, 223-286.