The Ringing of Trees

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Source: *Bulletin of Miscellaneous Information (Royal Botanic Gardens, Kew)*, Vol. 1914, No. 6 (1914), pp. 222-225

Published by: Springer on behalf of Royal Botanic Gardens, Kew

Stable URL: <http://www.jstor.org/stable/4119506>

Accessed: 27-06-2016 10:43 UTC

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Eucheuma Schrammii, J. Ag.

Hb. Bot. Mus. Lund.

Guadeloupe specimen
only. det. J. Agardh.

"The following other more or less doubtful references to the plant occur in the literature or herbaria. A name *Tosakanoria japonica* is mentioned in a list of Japanese plants compiled by K. Saida (1910) without description, but with little doubt proposed for this same plant. Being a *nomen nudum*, however, it is not valid. The alga distributed by Collins, Setchell and Holdens in Phyc. Bor. Amer. No. 745 under *Eucheuma echinocarpum*, Aresch. has some resemblance to Tosaka, but it differs in several particulars. It should be further noted that in the copies of Phyc. Bor. Amer., which I have seen, the Florida plant is distinct from the original *E. echinocarpum* of Areschoug. The alga hinted at as gen.? sp.? in Okamura's Nippon Sorui Mei-i (Enumeration of the Algae of Japan, 1902) certainly refers to our Tosaka. The nearest ally is *Eucheuma Schrammii*, J. Ag., which was originally distributed by Mazé as *Mychodea Schrammii*, Orn. I have examined specimens at Kew, Dublin and Lund, all of which are fragmentary, and though they agree in possessing horned cystocarps it is impossible to say from the specimens whether or not they are identical with *E. papulosa*. The colour and texture do not support such a view."

Habitat and Economic Importance.—The following notes have also been supplied by Prof. Yendo. Tosaka is often collected by divers in a depth of 10–12 fathoms in open coasts in the middle and southern part of the country. Large quantities of the plant are, however, obtained by picking up the floating fronds with scoop-nets after rough weather in early spring. It is found on the Pacific side of Japan up to about 36° N., and is supposed to grow in much deeper water than the above-mentioned depth.

The collected weed is dried in the sun and sold in the markets, where several varieties, according to the colour, substance and shape, are distinguished by dealers. It is prepared into isinglass and is used as food. A certain amount is also exported annually to China where the plant is known as Hong-tsay (crimson-weed).

XL.—THE RINGING OF TREES.

L. A. BOODLE.

The injuries sometimes inflicted on trees by squirrels were described a few years ago in the case of young trees of *Thuja* and *Cupressus*, specimens of which had been sent to Kew by Mr. R. B. Rogers, of Hexworthy, Launceston, Cornwall.* The immediate injury is to the bark,† which is stripped off the trunk in places, sometimes on one side, sometimes all round. That is, in the latter case the stem is completely ringed, and an experiment

* A. W. Hill, Conifers damaged by squirrels. New Phytologist, vol. 10, pp. 340–342, Pl. 7.

† The word "bark" is used here for convenience in the vernacular sense to include all the tissues outside the wood (or outside the cambium).

in plant-physiology is the outcome of the squirrels' labour. In the examples referred to the damage had been very severe; long strips of bark had been removed, so that in one case a considerable portion of the trunk appeared as a pole of bare wood with islands of bark upon it. Branches of the stem inserted within some of these islands were still living, and bore healthy foliage, although their isolation by the removal of the bark from around the islands had taken place more than two years previously.

Some further specimens injured in a similar manner have recently been received from the same donor. In one of these the bark had been ringed, and the tree had eventually died, but it was found by examining the annual rings that the part above the wound had lived for at least four years after the ringing-operation. Other specimens examined showed from three to five years' growth above the ring-gap.*

In these cases the wood exposed by the injury is perfectly bare, and of course no new layers of wood have been formed on its surface, as the stripping of the bark involves the removal or death of the cambial layer. The outer layers of the wood exposed to the air soon become dry and useless for conduction, hence it is clear that the older layers of wood must be capable of continued fairly rapid transference upwards of water coming from the roots, as evidenced by the continued life of the parts above the ring-gap. In the case of the specimens previously examined, though some of the branches remained fresh, the water supply had proved insufficient to keep the tops of the trees healthy.

The effect of ringing differs in different kind of trees. Various experiments have been made, and a study of the results of the operation proved useful in the early days of plant physiology in leading to a knowledge of the route of conduction of water and of elaborated food-substances in plants. Experiments in ringing were made by Malpighi and Ray, of whom the latter† mentions that a holly tree lived for several years after a ring of bark of a hand's breadth had been removed from the stem so as to leave the wood bare. Since this early observation numerous experiments have been made on several kinds of trees, and form two classes, viz.:—(1) bark-ringing, *i.e.*, the stripping off of a ring of bark as in the cases mentioned above; and (2) wood-ringing, *i.e.*, making an annular cut into the stem through both bark and part of the wood.

Bark-ringing.—The effects of bark-ringing depend upon the interruption of the bark and the exposure of the wood. The break in the continuity of the bark prevents the normal conduction of elaborated food-substances (albuminous and carbohydrate) from the parts above the ring-gap to those below, since these bodies are ordinarily conveyed through the bark‡ (or more precisely the

* By this is meant the annular gap in the bark, made by the operation of bark-ringing.

† Ray, *Hist. Plant.*, T. 1, p. 9.

‡ Any conduction of food-substances that may take place through the wood in the downward direction would be against the transpiration current, and might be expected to be slight. That it is slight or non-existent is suggested by the fact that growth in thickness of the stem practically ceases below the ring-gap.

phloem). Hence, if there are no leaf-bearing branches on the stem below the point of ringing, starvation of the roots ensues. This may be slow, seeing that there is a store of food in the bark of the roots and of the base of the trunk to draw upon, but the growth and absorptive powers of the roots will eventually be checked, and in some cases the functional failure of the roots may be the final cause of the death of the tree.

The exposure of the wood, where the bark has been removed, introduces other factors endangering the life of the tree. The supply of water for the upper part of the tree has all to pass through the wood at the level of the ring-gap, and from several causes the conducting power of this wood tends to become more and more curtailed until the requisite amount of water can no longer pass through it. Owing to the surface of the wood being in contact with the air, the outer layers of wood become dry and useless for conduction. This alone may soon render the water-supply insufficient in species with only a thin zone of sapwood, since true heart-wood is incapable of conducting the transpiration stream. On the other hand "sap-wood trees" (*i.e.*, those which form little or no heart-wood) can usually survive the operation of ringing for a long time, *e.g.*, several years. Among these the progressive drying of the wood from without inwards may finally restrict the area of functional wood until it reaches the critical point, or this result may be accelerated by a fungal disease attacking the wood and rendering some of it useless. Again, in trees which form heart-wood, the production of this accounts for the loss of a certain proportion of the wood available for conduction. While no new wood is added at the level of ringing, and functional wood is lost externally by drying, there is a further loss internally owing to the yearly conversion of some sap-wood into heart-wood.

To summarise, bark-ringing eventually causes the death of the upper part of the tree, because the water supply becomes inadequate, either through loss of conductivity in the wood at the level of the wound, or through deficiency of absorption by the roots.

An interesting example of bark-ringing may be quoted here. A forked pine-tree was chosen by Hartig* for an experiment. The tree was 118 years old, and the trunk was forked at $4\frac{1}{2}$ m. above the soil into two approximately equal stems. The bark was peeled off all round one of these stems at about 3 m. above the point of forking. When the tree was felled 18 years after this ringing operation had been performed, it was seen that the crowns of both stems were still sound, but that the foliage of the ringed stem was thinner and weaker than that of the other stem. It was also found that growth in thickness had practically ceased after ringing on the side of the trunk situated below the ringed branch. The reason for the long-continued life of the ringed stem is that the roots attached to the base of the trunk on the side below the intact stem had received normal nourishment, and therefore, having remained healthy, had been able to supply the trunk with a good supply of water.

* Hartig, *Lehrbuch d. Anat. u. Phys. d. Pflanzen*, p. 234.

Wood-ringing.—The experiments in wood-ringing made by Strasburger and others* show that, though the inner (older) layers of sap-wood can conduct water for the transpiration current, the heart-wood cannot do so. The first of the following cases serves as an example of a sap-wood tree, the remainder being “heart-wood trees” (*i.e.*, trees which form heart-wood).

Two beech-trees 150 years old had trunks 32 cm. in diameter. These were ring-cut to a depth of 8 cm., and the trees still bore foliage a year and a half later.

The trunk of an oak 50 years old was ring-cut into the heart-wood, and its foliage withered in a few days. Another oak of the same age, which was cut similarly but not quite through the sap-wood, did not wither for some weeks.

The trunk having been cut to the heart-wood in a tree of *Prunus avium*, and in a *Robinia*, wilting of the leaves took place in two days in the first case, and in a few hours in the second.

Various other experiments and observations have been made in bark- and wood-ringing, but enough has been quoted to illustrate the nature of the results obtained in this way.

XLI.—THE BOTANIC GARDEN, UNIVERSITY COLLEGE, CORK.

The following short article on the Botanic Garden of University College, Cork, has been kindly sent by request for publication in the *Bulletin* by MAJOR H. A. CUMMINS, Professor of Botany and Agriculture in the College. Some photographs of the garden sent with this article have been added to the collection of photographs of Botanic Gardens in the Museums of the Royal Botanic Gardens, Kew.

The University College, Cork, is situated to the West of Cork City. The College was opened in 1849, and up to the establishment of the National University of Ireland in 1908, it was known as the Queen's College.

The original building is in the Collegiate Architectural style of the 15th century.

The existing college grounds comprise a park of about 25 acres, the south branch of the river Lee flowing through the lower part. From the river the land rises, in some parts precipitously to a height of about eighty feet, and the College is situated on the elevated ground. The northern entrance is on the Western road across a bridge spanning the river, and an avenue leads up a gentle slope to the college.

The avenue is bordered on each side by specimen trees and ornamental shrubs. Ascending the avenue, the river and lower grounds are to be seen on the right hand, the latter planted with trees, shrubs, bamboos, and other decorative plants. The central portion has been cleared and tennis courts made for the use of

* Strasburger, *Bau und Verrichtungen der Leitungsbahnen* (Histolog. Beiträge, 3), p. 515.