Regional Spread of Moisture in the Wood of Trees.

II.—Moisture-Spread in a Graft-Region.

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With Plate CLXV.

An earlier paper * summarised the results of experiments on the spread of moisture in the wood of deciduous trees throughout the winter and early spring. The moisture present in each of the wood sections examined was expressed in terms of the percentage of the dry weight of the sections. In other words, the percentage represented the absolute amount of moisture present in 100 grms. (dry weight) of the wood of each particular section. This method of calculation has been objected to † on the grounds that a variable factor — specific gravity — is involved. I admit that an ideal result to have achieved would have been the separate estimation of the water of imbibition and the physiologically available or free water per unit volume.

At the commencement of the investigations various schemes were formulated for the purpose of arriving at definite conclusions along these lines. Every such theoretical scheme was in its turn abandoned when the practical details were considered. Some of the schemes involved, for example, the accurate determination of the volume of small, irregularly shaped pieces of dry wood—a process which would almost certainly lead to the introduction of errors. Other schemes, where accurate volumetric calculations were unnecessary, postulated very true cutting of the wood, so that all the ultimate sections should be of absolutely uniform dimensions and consequently of equal volume. The necessity for this accurate cutting of the sections militated against such a course of procedure. But a still greater objection, to my mind, was the consequent neglect of

* Craib in Notes Roy. Bot. Gard. Edin., xi, p. 1 (1918).

† Groom in Trans. Roy. Scot. Arb. Soc., xxxiii, p. 165 (1919).

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the annual ring as the unit structure of the wood. The necessary cutting of the wood into absolutely equal sections would result in many, if not all, of these sections having a disproportionate amount of either spring or summer wood. If the true balance between the two regions of the annual zone be not preserved, then, as has been proved experimentally, distorted results will follow. There is another objection. Uniformity in the wood would be postulated, *e.g.* an occluded dead branch would vitiate the whole results, or, if the branch were cut out, allowance could only be made by accurate volumetric determination.

As confirming the results arrived at by the methods adopted by me, we find that newly felled timber, especially when seen in median longitudinal section, gives a visible demonstration of the distribution of the moisture. An approximate graphic representation of the moisture-distribution can be made from a glance at the newly felled wood. This statement is made on the strength of results of trials during the experiments. On several occasions I constructed graphs of the moisture-distribution from the appearance of the wood in longitudinal section, and these graphs agreed in their main details with the graphs made from the calculations following on the drying of the sections.

That the main details of the moisture-distribution can be gauged from visual examination can be confirmed, I think, by reference to the accompanying plate, which is a reproduction of a photograph through the graft-region of a newly felled tree of which the scion was a form of *Pyrus Aria* and the stock was probably *Pyrus Aria*.

Excluding the dark-coloured heartwood, which occurs only in the stock, we find that both stock and scion have a central pale-coloured area bounded on both sides by darker-coloured areas. The colour-shades are due to the moisture-content, the darker-coloured areas having a much higher moisture-content than the paler-coloured, and the transition between the two areas is not abrupt but gradual. A graph constructed from these details would be low in the central region, rising with some irregularities through the intermediate region to its maximum in the youngest wood. This brief general description would apply to the graph of the lower parts of the trunk of *Acer Pseudoplatanus* for March * if we leave out the very dry youngest wood of the *Acer*. And with the same proviso the two finished graphs correspond in their general outline.

So far I have referred to the accompanying plate as a visible demonstration of moisture-distribution in wood. Of much more interest are the deductions to be drawn from an examination

* Craib in Notes Roy. Bot. Gard. Edin., xi, pl. clix (1919).

and comparison of the conditions found in the stock and in the scion. As a preliminary it will be well to give a fuller description of the plate.

As already stated, the stock was probably *Pyrus Aria*, and the scion was a form of that species. The tree was felled entire on the morning of 9th April 1919, at which time the buds were considerably swollen, though none were yet open. The spread of the moisture radially away from the centre has made considerable progress, the stage reached in this movement being, as noted above, practically that of the March *Acer*.

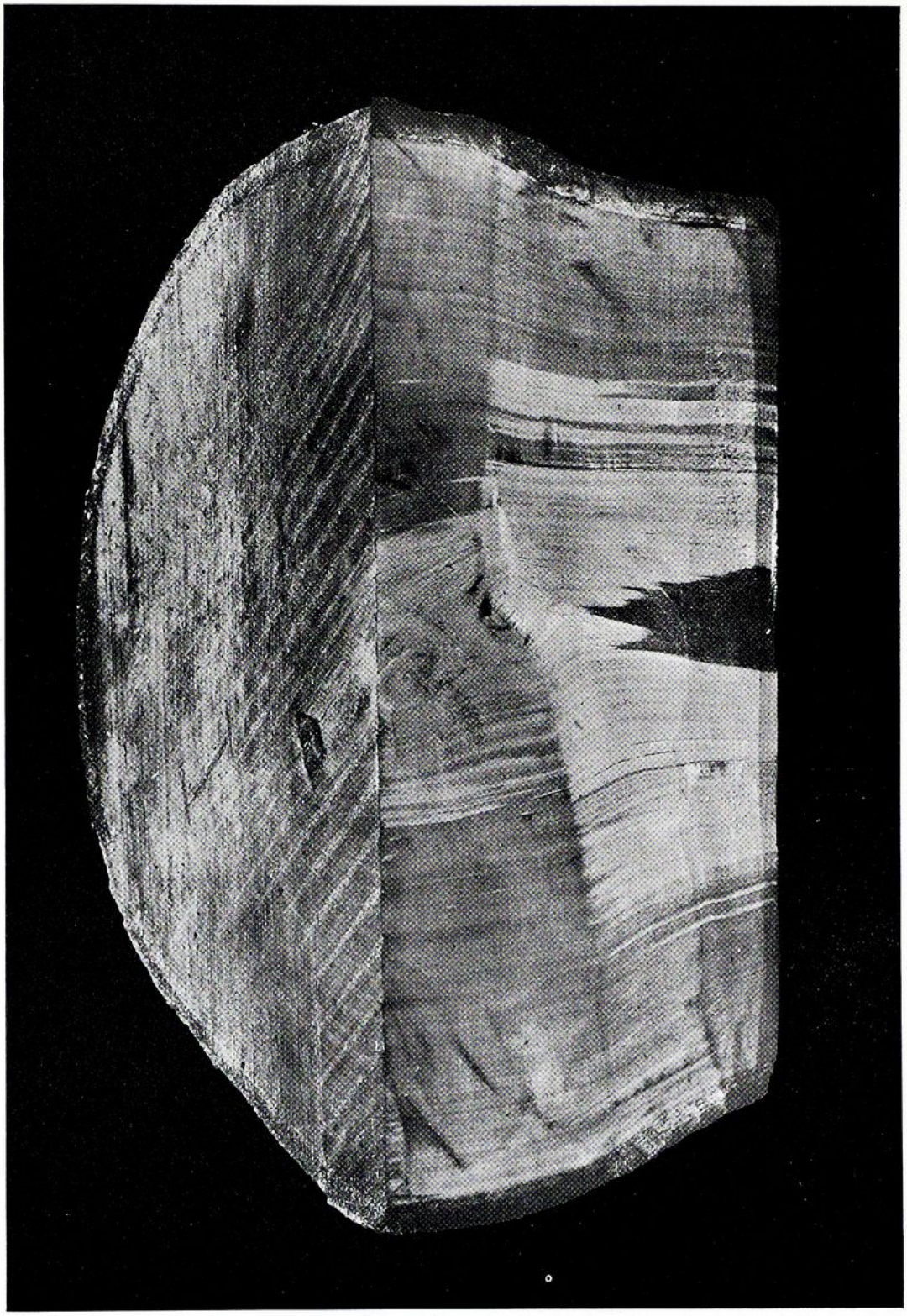
The line of the graft is shown very clearly marking off the stock and the scion as two regions whose physiological activities, at least as regards moisture-spread, do not synchronise. The stock is visibly ahead of that part of the scion immediately above it in the extent to which the radial spread of the moisture has been carried. As a natural consequence of the more advanced stage reached by the stock, we find that a wet part of the scion overlies a dry part of the stock. Without some restraining influence, we should naturally expect the moisture from the wetter region to diffuse downwards along the walls of the drier cells immediately below.

Cannot one deduce from this that the moisture-spread is a controlled or vital phenomenon and not a purely physical one? To all intents and purposes a grafted tree of this age is structurally one tree, and if the moisture-spread were a purely physical happening then there would not be such a marked and sudden difference in the amount of the spread above and below the graft-line. Both stock and scion perform their accustomed cycles independently. This touches many important biological problems, the consideration of which must be dealt with in subsequent papers.

EXPLANATION OF PLATE CLXV.

Illustrating Professor Craib's paper on Regional Spread of Moisture in the Wood of Trees.

PLATE CLXV.—Photograph of graft-region in longitudinal section, showing moisture-distribution above and below the graft-line. Photograph taken immediately after the tree was felled.



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