LX. THE PECTIN CONTENT OF NORMAL AND "SILVERED" APPLE LEAVES.

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DURING a recent investigation the observation was made that the young bark of the apple contained a very appreciable amount of pectin. The variety of apple examined was Bramley's Seedling. The bark, after mincing, was thoroughly extracted with boiling alcohol and then, after drying, with boiling water. The aqueous extracts, after concentration under diminished pressure, yielded, on precipitation with alcohol, a product which appeared to be essentially identical with the pectin obtained from apple fruit, with the exception that it contained a very small amount of starch. On treatment with alkali it gave methyl alcohol and acetone and on treating its aqueous solution with the enzyme, pectase, a good gel was soon formed, although not quite so quickly as was the case when employing pectin obtained from the fruit.

This discovery of pectin in the young bark suggested that apple leaves might also contain this substance. A quantity of apple leaves was therefore examined for pectin in a manner similar to that employed when investigating the bark. A good yield of pectin was then obtained, but it was not quite so pure as that derived from the bark since it contained rather more starch and did not gel so quickly with pectase.

It was observed, however, that while the leaf fragments, which had been previously exhausted with boiling alcohol, were being deprived of pectin by means of boiling water they developed a silvery appearance precisely resembling that shown by leaves affected by the well-known "Silver Leaf" disease. The possibility of "Silver Leaf" being associated with pectin deficiency was therefore investigated.

As is well known, "Silver Leaf" is a disease particularly affecting plum trees, but other trees, including the apple, may also become infected by it. Leaves of the last mentioned were chosen for the present investigation since material particularly well adapted for this purpose was readily available, and, moreover, the results so obtained would be comparable with the observations already made, which are recorded above.

The tree chosen was an espalier apple of the "Keswick Codlin" variety, the upper branch on one side of which only was affected with "Silver Leaf"

disease. On the morning of July 22nd 40 average leaves, without stalks, were collected from near the end of the diseased branch, and a like number from a similar position on the corresponding branch on the other side of the tree, which was perfectly normal. After weighing, each sample of leaves was cut into narrow strips and thrown into boiling alcohol. After boiling for 15 minutes the extractions were completed in a Soxhlet apparatus with fresh quantities of alcohol. After drying and weighing the material which had been exhausted with alcohol, each sample was extracted a number of times by boiling with large volumes of distilled water for the removal of the pectin. The latter, after concentration of the extracts under diminished pressure, was precipitated by means of alcohol, collected, dried and weighed. The results obtained are given below:

	Original weight of 40 leaves g.	Weight of alcohol- extracted marc g.	Weight of pectin g.	% of pectin in alcohol-extracted marc
Normal leaves	35.15	7.70	1.30	16.89
"Silvered" leaves	29.70	6.50	0.97	14.90

It is thus seen that the leaves affected by "Silver Leaf" disease contain an appreciably smaller amount of pectin than do normal leaves. Moreover, the yield of pectin calculated on the weight of the fresh, normal leaves (3.7 %) seems surprisingly large when compared with the proportion of this substance found by the present author [1921, 1923] to occur in the peel and pulp of the fresh fruit, namely, 2.6 and 1.3 % respectively. The pectin obtained from the leaves, however, is not so pure as that prepared from the fruit, but the amount of impurity present certainly does not seem sufficient to account for the increased yield obtained from the leaves as compared with that from the fruit.

Although the presence of pectin in apple leaves does not appear previously to have been recorded, it is known that they contain the enzyme, pectase. Thus, if fresh apple leaves be well pounded with a little water and the resulting mass strongly pressed, the juice so obtained, if added to a solution of pectin in the presence of chalk, causes the formation of a solid gel of calcium pectate. The expressed juice of the leaves appears, however, to contain little, if any, pectin.

REFERENCES.

- Tutin (1921). *Ann. Rep. Univers. Bristol Agric. Hortic. Res. Station*, p. 135.
 — (1923). *Biochem. J.* 17, 513.