A PRELIMINARY STUDY OF ALUMINIUM AND THE TEA BUSH

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All bio-geochemical *) studies should include a detailed account of the uptake and physiological effects of the element concerned on at least one plant species. The aluminium relationships of the garden hydrangea, *H. macrophylla*, were explored in this respect to a limited extent by the writer 20 years ago but as a corollary to a comprehensive survey of aluminium in the plant world 4) 6) a more detailed investigation seemed desirable. Since the tea bush, *Camellia sinensis*, is the aluminium-plant with the greatest economic value it was chosen as the species to study. It was believed that its connexions with aluminium might eventually have some bearing on its cultivation. The work described below was largely undertaken at Rothamsted Experimental Station in 1948–50 as part of a Colonial Development and Welfare Research Scheme and was later followed up in Uganda.

HISTORICAL

Bertrand and Levy 2) in 1931 appear to have been the first to record a high aluminium content for tea. They examined 76 species of food and garden plants and found that prepared Ceylon tea contained 465 ppm †) aluminium as against a mean of 11 ppm for the rest. The next year Yoshii and Jimbo 3a)

*) Bio-geochemistry may be simply defined as the natural history of individual chemical elements 27).

†) All analytical data cited in this paper have been recalculated to parts per million (ppm) or milligrams per kilo of oven dried material.
published the results of their survey of the occurrence of aluminium in the plant kingdom. This included old leaves of the tea bush which contained 2370 ppm aluminium. It must be stated here that the tea family (*Theaceae*) had been shown to be aluminium accumulating much earlier in 1922 by Hallier and in 1927 by von Faber but they did not test the tea bush. In 1934 the present writer determined aluminium in old leaves from the tea bush growing in one of the economic greenhouses at the Royal Botanic Gardens, Kew. Only 392 ppm aluminium was found. High figures are cited in American literature by Robinson, as much as 9300 ppm aluminium being found by Hou. McMurtrey and Robinson in a review of neglected soil constituents state that concentrations nearly as high as 20,000 ppm are possible although they give no specific examples. Russian workers have only recently been aware of the ability of the tea bush to take up large amounts of aluminium. The earliest mention of this is by Polynov in 1944 and although he refers to it later he does not quote any figures. Quantitative data for aluminium in Russian tea, as far as can be ascertained, have only very recently been published. Parfenova and Troitskii in 1951 recorded 3220 ppm aluminium for healthy mature tea leaves and 1310 ppm for unhealthy leaves.

**CONSTANCY OF ALUMINIUM IN THE TEA BUSH**

In order to verify the foregoing and to obtain some idea of the constancy of high aluminium uptake by the tea bush a series of samples were taken from Kew Herbarium specimens which had originally grown in countries not included above. The results are tabulated below.

It is evident from Table I and the results of previous workers that considerable variation occurs in the amount of aluminium accumulated by the tea bush but it is a constant feature. This variation may be due to differences in age of leaf, age of tree, genetic constitution, rainfall, altitude or soil. The effect of these factors will now be assessed.

*) Details of the method of analysis are given in the appendix.