Non-Conformist Rhododendrons

by David Rankin

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Growing rhododendrons on limestone is impossible. More or less. Of course, there are one or two lime-tolerant species - the European R. hirsutum is a familiar example - but the vast majority of species become chlorotic and sick if there is lime in the soil. So if you live in a limestone area, don't waste your time on rhododendrons - grow something else instead.

That is what we have been led to believe - but nature has different ideas. In Western China and the Himalaya there are many species of rhododendron which are commonly found growing in limestone regions, sometimes quite close to the rock outcrops. This apparent contravention of the rules has been observed and commented on by the plant explorers from Forrest and Kingdon Ward to the present day. So in keeping with the inclination to argue away the evidence that doesn't agree with our prejudices four theories have been proposed and have gained credence.

Theory Number 1. Although the rhododendrons are growing over or near limestone, they are actually growing in decayed vegetation and the nature of the underlying rock is irrelevant.

Theory Number2. The limestone is dolomitic, with a magnesium content comparable to that of calcium. Plants need magnesium for chlorophyll production, so although there may be competition between calcium and magnesium for uptake by the plant roots, enough magnesium is absorbed. (However, alkalinity can still cause problems by making iron unavailable.)

Theory Number 3. The limestone is hard and effectively insoluble so as with theory number 1, it has no effect on the metals available to the plants.

Theory Number 4. As most of these regions have very high rainfall, the water permeating the soil effectively washes away calcium as it dissolves from the rock, so again it is not available to the plants.

Whenever I discuss this topic, one or more of these theories usually is given as an explanation. Yet so far as I can see, there is very little in the way of hard evidence for (or against) any of them. Such a situation is intolerable to a Rhodophile who happens to earn his bread and butter as a research chemist. So a visit to North-West Yunnan in July 1995 provided the opportunity to investigate what is really going on.

Our aim was to test theories (really hypotheses) to see which one was true, although, of course, there could be different explanations for different species of rhododendrons or different situations. The strategy was to take soil pH readings as a quick and easy way of identifying rhododendrons growing in alkaline or roughly neutral conditions. Samples of the growing medium, subsoil and rock were then taken, and in a few cases it was possible to collect water directly from the soil. This was filtered on the spot - a tediously slow and difficult process, particularly when the monsoon is dripping down your neck. Chemical analyses and inspection by geologists revealed the nature of the rock formations, and we were pleased to find that, without any geological knowledge we had correctly identified limestone locations in the large majority of cases. Soil samples were analysed for organic content, and for calcium, magnesium and iron under several different conditions. these included simply adding water (to represent natural rainfall), extractions with high and low pH buffered solutions, and analysis of the total content of these metals in the soils. Finally, water samples revealed the amounts of the metals present in solution in natural conditions.

Detailed results will be reported elsewhere; here we merely see what happened to those theories.

Theory number 1 is wrong. In most cases the roots were growing in soil which contained large amounts of limestone. At one extreme, lumps could be picked out; at the other, analyses showed the soils to contain large percentages of finely divided calcium carbonate. Sometimes there was so much shattered stone that it was hard to find soil at all, and the plants were effectively growing in stabilised scree. And in the most extreme situation, there were dwarf rhododendrons growing on a flood plain with the ground submerged in a sea of milky white glacier melt carrying a vast amount of finely divided limestone silt and saturated with calcium salts.

Theory number 2 is wrong. In every case, the limestone was effectively pure calcium carbonate with less than 1% magnesium. In natural water samples and in water extracts from soils, the ratio of magnesium to calcium was higher, but at about 1 : 7 still not sufficient to compete with and counter the effects of calcium.

Theory number 3 is wrong. All the limestone samples were described by geologists as being soft. the calcium was readily available under the conditions of all our analyses, and was present in the water samples.

Theory number 4 is wrong. A study of the rate at which calcium dissolved showed that even under the high rainfall conditions found in those mountains, the dissolved calcium concentration will build up in the soil. In any case, the calcium was abundant in water samples.

So we have a dilemma! The lime is there in the soil and it is available to the plants. So we need some more theories or, at least one. My suspicion is that there are in fact many more lime-tolerant species than we had been led to believe, or that at least there are tolerant strains. What we want to do next is to see whether these species growing on limestone are able to avoid absorption of calcium by their roots. If not, we must see where it goes in the plant. Material for these further studies is to be collected on an expedition this summer. We will then have to compare these data with similar observations for supposedly less tolerant species, when fed a lime-rich diet. In the longer term, we would like to see stocks of the species/strains from the limestone mountains in cultivation and tested in limy conditions. If that succeeds, the horticultural implications are considerable. Not least, the potential membership of the Scottish Rhododendron Society could double!

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