Rhododendron occidentale on serpentine soils

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Western azalea, *Rhododendron occidentale*, a deciduous shrub native to California and Oregon, occurs on a wide variety of soils throughout its range, with most populations on acidic soils of various origins. Some populations in the coast ranges of California and Oregon are on serpentine soils that tend to be alkaline, with pH values above 7 to 7.8. These soils are generally very infertile, many being low in nitrogen, phosphorus, potassium, and calcium, and high in magnesium. This infertility manifests itself in vegetation that sharply contrasts with adjacent nonserpentine vegetation.

Previous research has identified the ability of the serpentine ecotypes of a particular plant species to accumulate calcium from soil containing low levels of this macronutrient. This ability is indicative of a physiological adaptation not exhibited by nonserpentine counterparts and appears to be one of the main factors enabling species to exist on serpentine soils.

Tracking differences

This project was initiated to determine the differences and similarities between western azalea populations from serpentine and nonserpentine soils, and to determine whether there are edaphic (soil-related), and possible taxonomic, differences among these populations.

Azalea growth rates and uptake of calcium, magnesium, potassium, and nitrogen were compared in pot tests. The hypothesis was: if populations have genetic adaptations favoring survival on serpentine soils, then differences in growth rate, nutrient uptake, or both might be revealed.

Three seed sources, one from serpentine and two from nonserpentine soils, were compared by growing young seedlings of each population in reciprocal pot tests on three media: a serpentine soil, a nonserpentine soil, and an artificial (peat, sand, redwood sawdust) control medium supplied with nutrient solutions. Several growth parameters--height increase, numbers of new shoots, increase in stem size, fresh and dry weight, and percent dry weight--were measured. Tissues were also analyzed for calcium, magnesium, potassium, and, in the first harvest, for nitrogen.

Plants from the serpentine populations had greater height increases on both soils than did the nonserpentine populations. Height growth on the control medium was similar for all seed sources. Numbers of new lateral shoots were not significantly different among seed sources, but numbers of new basal shoots and of total new shoots displayed significant differences. There was a slight increase in the number of shoots per plant in the control medium compared with those in the two soils.

Fresh weight and dry weight yields were similar for all seed sources within each medium, but varied among media. The nonserpentine soil with its greater nutrient reserves gave higher fresh weights than the serpentine soil. The control yielded far greater fresh weights than either of the soils. Dry weight yields between media showed the same trends. The nonserpentine soil yielded about 50 percent more than the serpentine soil, and yields were nearly ten-fold higher on the control medium for all seed sources.

The percent dry weight was lower for all seed sources grown in the control medium compared with those grown in the two soils, as might be expected from the more luxuriant growth in the well-fertilized control medium. In all cases the serpentine seed source had slightly lower percent dry weight than the two nonserpentine sources. This was unexpected, because the serpentine population appeared to have more xeric or "harder" growth.

Lower yields

Yields were considerably lower for the second harvest in the two soils, but higher in the control medium. These results probably reflected dwindling nutrient supply in the native soils.

The largest differences between the seed sources was in the uptake of the base minerals calcium, magnesium, and potassium. The serpentine population showed significantly higher levels of calcium and magnesium than either nonserpentine population on all media, and higher levels of potassium in all but two instances, where levels were about the same as for one nonserpentine seed source. These differences were consistent for each harvest and for means of the two harvests. Overall, the serpentine seed population accumulated much larger quantities of base minerals than either of the nonserpentine populations. Base accumulation by the two nonserpentine seed sources, however, was quite similar.

The serpentine population of western azalea was thus quite distinct from the two nonserpentine populations on the basis of height growth, total numbers of new shoots, and, especially, base mineral accumulation. While there were few differences in yield between the three seed sources, chemical analyses of leaf tissue strongly suggest that the serpentine population is an edaphic ecotype with a more efficient mechanism of mineral accumulation.

Morphological comparisons have not yet been made among these seed sources. The casual observer can readily distinguish the serpentine population on the basis of leaf and other vegetative characteristics, but the two nonserpentine populations are not readily separated.

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