Reports

Parasitic Conifer Found in New Caledonia

Abstract. A rare and unusual species of *Podocarpus* from New Caledonia was collected and discovered to be parasitic on another conifer. The attachment is by modified roots imbedded between the cork cambium and the vascular cambium. A parasitic gymnosperm is something new to science.

The interesting species, *Podocarpus ustus,* has always occupied a unique position in its genus and family, and among conifers in general. It grows in remote, densely forested highland parts of New Caledonia. It has rarely been collected and has probably never been studied in the field by any competent scientist. The closest to field study was achieved by J. B. Hair of New Zealand, who succeeded in having fresh specimens brought to a field laboratory where he was making chromosome determinations. Its uniqueness has derived from the fleshy deep red or purple scale-leaved branches that have the uncooperative habit of disintegrating into minute fragments when preservation is attempted. *Podocarpus ustus* is the single member of the section *microcarpus* of the over-sized genus *Podocarpus.* In reproductive structure it is a reasonably typical member of the family Podocarpaceae.

Because of the special interest which *P. ustus* has aroused, a special effort was made during a December 1957 visit to New Caledonia to collect the elusive plant. One of its areas of occurrence was visited, and several plants were seen. This report derives from the fact that one of these plants was growing out of the base of a tree of *Dacrydium taxoides.* As might be suspected from the fleshy red nature of *P. ustus,* it is a parasite, certainly sometimes, probably always. The parasitic specimen was collected and has been the subject of a careful study.

Podocarpus ustus is a woody shrub. In the case of its attachment to *D. taxoides,* the largest of two emerging stems had a diameter of about ½ inch and the host had a diameter of about 3 inches. The parasitic stem curves sharply so that the root zone is oriented upward. Most of the woody roots travel up the trunk of the host, probably for several feet; a few grow downward for several inches. The modified roots are imbedded in the bark between the cork cambium and the vascular cambium. General stimulation of the vascular cambium has occurred, producing a thickening in both wood and bark tissue. The cambium of the slightly anastomosing roots, significantly, is on the outside toward the cork cambium. No normal phloem is produced, although a tissue full of sclerids opposite the xylem may represent modified phloem tissue. Around the parasitic roots, the host tissue is somewhat disorganized and forms a sheath of abnormally large cells.

In several ways the specimen of *P. ustus* reported here is not typical. No other specimen has been seen growing from the trunk of another plant. Typically *P. ustus* grows on the open forest floor under rather shady conditions (chlorophyll is present in the leaves). Probably most individuals are root parasites. Several attempts by foresters in New Caledonia to dig up small specimens for transplanting resulted in immediate death of the specimens. It was noticed that removing the specimens involved cutting out various tree roots, but, because a parasitic attachment was not expected, it was not looked for. Although *D. taxoides* is closely related to *P. ustus,* it may not be the preferred host. *Dacrydium taxoides* is common throughout the highlands of New Caledonia, and the rareness of *P. ustus* might seem puzzling. Lumbermen say that the densest stands of this peculiar species occur in association with an undetermined plant which, by its description, may belong to the Cupressaceae. Thus the preferred host of *P. ustus* may possibly be a rare and perhaps unnamed conifer.

It must be remembered that *P. ustus* is not necessarily always parasitic. The possibility of root grafting, a common phenomenon among conifers, may explain the entanglement of roots that has been observed. However, the single specimen upon which this report is based shows unmistakable parasitic modifications. There is no fusion of tissues as in grafting. The xylem strands run through the host phloem. These modified root strands do not show radial symmetry, but do show polarity with respect to the host. That parasitism may well be normal in this species, then, is inferred from the definite modifications that have been made for parasitic attachment, together with the general habit of this species which strongly resembles that of known root parasites. In the observed specimen, a seed has lodged against a trunk instead of over a root.

Until now, all conifers were known to be independent trees, bushes, or trailing shrubs. *Podocarpus ustus,* in being parasitic, thus differs from all other conifers. In fact no gymnosperm of any kind has previously been discovered in a parasitic relationship to other plants.

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Instructions for preparing reports. Begin the report with an abstract of from 45 to 55 words. The abstract should *not* repeat phrases employed in the title. It should work with the title to give the reader a summary of the results presented in the report proper.

Type manuscripts double-spaced and submit one ribbon copy and one carbon copy.

Limit the report proper to the equivalent of 1200 words. This space includes that occupied by illustrative material as well as by the references and notes.

Limit illustrative material to *one* 2-column figure (that is, a figure whose width equals two columns of text) or to *one* 2-column table or to *two* 1-column illustrations, which may consist of two figures or two tables or one of each.

For further details see "Suggestions to Contributors" [*Science* 125, 16 (1957)].

Origin of Tektites

Barnes, Kopal, and Urey (*1*) have recently criticized the idea originally advanced by Nininger (*2*) and later discussed by Gold, Varsavsky, and me (*3*), that tektites originated as secondary bodies from the infall of meteorites on the moon.

The principal criticism of Nininger's hypothesis was one stated earlier by Urey (*4*), who argued that the tektites could not have arrived at the vicinity of the earth as a swarm, since a swarm of the necessary size and density would be gravitationally unstable at the earth's distance from the sun. Urey considered that the tektites could not have arrived as a compact mass, since this mass would be distributed over an area a few tens of kilometers in diameter, while the australite fall covers an area thousands of kilometers in diameter.

If, however, we admit the possibility that the tektites fell from nearly circular orbits around the earth, as suggested by O'Keefe (*3*) and La Paz (*5*), then this difficulty largely disappears. The tektites were conceived as spiraling into the