Interfering plants

from Peter D. Moore

In his classification of competitive strategies, Miller (*Adv. ecol. Res.* **4**, 1; 1947; and *Brookhaven Symp. Biol.* **22**, 63; 1969) recognizes two major categories, exploiters and interferers. The interferer has a large body size, a long generation time and is relatively independent of physical environmental factors. Rather than evolving efficient mechanisms for resource exploitation, they substitute space for the resource and succeed by means of their capacity for the physical exclusion of potential competitors from the resource. The concept was developed largely with certain vertebrate animals in mind, especially those exhibiting territorial behaviour.

There are also some members of the plant kingdom which deserve the title 'interferers'. In particular, those which assume dominance in stable ecosystems have characteristics which correspond to those of the interferer. The substitution of space for a resource may be achieved purely by physical growth, or may be achieved by more subtle means. The production of chemical inhibitors which curtail the growth of plant individuals of either the same or another species is one such mechanism. Even more subtle is the process described by Rice and Pancholy (*Am. J. Bot.* **59**, 1033; 1972; see also *Nature* **254**, 184; 1975) in which toxins from litter of grassland climax dominants is considered to inhibit the process of nitrification (the conversion of ammonium ions to nitrate in the soil) by suppressing the activity of the soil microbes *Nitrobacter* and *Nitrosomonas*. Such a strategy would reduce the rate of nitrogen recycling and thereby slow down further ecosystem growth and vegetation succession.

This attractive and sophisticated interference technique has, however, received little supporting evidence over the past few years. It is difficult to distinguish between direct chemical suppression and rather more complex interactions involving the depletion of other necessary resources (for example, phosphorus) or the overall reduction of *p*H, both of which could influence the rate of nitrification. Jordan, Todd and Escalante have tried a technique of manipulative experimentation in the Amazonian rain forest (*Oecologia* **39**, 123; 1979). They added calcium carbonate to the thick root mat on the forest floor and checked the leachate for nitrogen losses. They observed an enhanced loss of nitrogen, but it was mainly in the form of ammonium ions, so the treatment had not stimulated nitrification. They also noted that the *p*H of the drainage water was still as low as 4.5 and thus concluded that it was the low *p*H of the soil which was inhibiting the activity of the nitrifying bacteria. However, they conceded that, since the leachate had the colour and consistency of tea, it could be the tannin from the leachate which was responsible for the suppression.

The deciduous forests of Missouri have provided opportunities for further analysis of the curtailment of nitrification. Here Lodhi (*Am. J. Bot.* **64**, 260; 1977; **65**, 340, 1135; 1978) has shown a heterogeneous pattern in the nitrogen levels of soils under different canopy tree species. Ammonium ion concentrations were invariably higher than nitrate levels, the degree of excess being related to canopy species. Also, there was an inverse relationship between ammonium ion concentration and the density of nitrifying bacteria in the soils. Under some trees, such as American elm (*Ulmus americana*) and sycamore (*Platanus occidentalis*), the soils were of neutral *p*H, so one cannot resort to a low *p*H explanation for the suppression of nitrification at all these sites.

Lodhi has now backed up his contention that polyphenolic compounds can be involved in these woodland inhibition observations by his studies with Killingbeck (*Am. J. Bot.* **67**, 1423; 1980) on the ponderosa pine stands of North Dakota. Here the soil *p*H is neutral to slightly alkaline (mean *p*H 7.25 in the A horizon and 7.75 in the C horizon). Once again, the ammonium ions considerably exceed nitrate ions and the population of *Nitrosomonas* and *Nitrobacter* were low. He then added various extracts of ponderosa pine needles and bark to experimental cultures of these microbes and found that maximum inhibition of their activity (93 per cent) was achieved with aqueous extracts of the needles or with mildly alkaline soil hydrolysates. Both of the extracts were rich in condensed tannins, which probably accounted for the inhibition.

Nothing is known of the mechanism of nitrogen uptake by ponderosa pine but Lodhi speculates that there would be considerable ecological advantages in its taking up ammonium rather than nitrate ions. In this way leaching losses of nitrogen would be reduced, energy would be conserved and the tree would benefit in terms of competition for the soil nitrogen resources. More data is required before such speculations can be confirmed but, should they prove correct, *Pinus ponderosa* will effectively fit the Miller criteria defining an interferer. Whilst satisfying its own requirements, it denies other organisms access to the soil nitrogen resource by allelochemic inhibition of nitrification. □

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100 years ago

THE NEW MUSEUM OF NATURAL HISTORY

The great terra-cotta building facing Cromwell Road, South Kensington, and occupying the site of the old 1862 Exhibition, about which for the past twelve months public curiosity has been raised, is about to draw up its blinds, and offer a part of its extensive galleries for inspection on Easter Monday.

It is no secret that for thirty years past the accommodation in the British Museum, Great Russell Street, Bloomsbury, "both for man and beast," had become too restricted, and the necessity for a larger building was keenly felt. As usually happens in such cases, the most adventurous and energetic officer was the first to obtain for his department what he required, namely, *more room*.

Sir A. Panizzi (then Keeper of Printed Books) projected, shortly after the 1851 Exhibition, his scheme for a great central Reading-room and Library, and some years later on, the Department of Antiquities, represented by Mr. C. T. Newton, C.B., also obtained an addition to its galleries on the western side, and still more recently on the southern side, next to the great Entrance Hall.

Great praise is due to Mr. Bond, the present Principal Librarian, for putting an end to the use made of the fine colonnade in front of the British Museum, which for twenty-five years was blocked by antiquities covered in with a row of extremely unsightly and incongruous wood and glass sheds. These are now happily removed. The Department of Prints and Drawings lacking a gallery, obtained possession of the "King's Library" floor on the east side for an exhibition space; and even the conservative Coin Department likewise laid out for the public a few show-cases here of coins and medals.

But, like the clothes of the rising son, in the old caricature, the collections everywhere had outgrown their receptacle, and none more so than the departments of Natural History. Scientific men were however not unanimous, and a fierce controversy was carried on in 1858-59 as to the relative merits of enlargement on the old site, or dismemberment. Finally, after a Committee of the House of Commons had taken evidence upon the subject, the removal of the Natural History Collections was decided upon by the Government.

But the death of the Prince Consort, the delay of the House of Commons to vote the necessary funds, the retirement of Sir A. Panizzi from the post of Principal Librarian, the discussion of rival plans, the inevitable delays about the completion of any Government building, caused twenty years to pass before the plans of the chosen architect, Mr. Alfred Waterhouse, were realised in a solid and material form.

From *Nature* **23**, 14 April, 549, 1881.

Erratum

In *A tropical Volute shell and the Icarus syndrome* from Jonathan C. Howard (*News and Views* April 9, **290**, 441, 1981) 'simulate' was incorrectly printed as 'stimulate' on p442, column 3, line 37. The correct sentence reads "C.H. Waddington[8] pointed out as long ago as 1942 that genetic modifications to adaptable systems can simulate the inheritance of acquired characters."

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