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Lotus corniculatus in the roadside verge

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The production of nitrogen based artificial fertilizers is very dependent upon the availability of fossil fuels. Because the resources of these fuels are finite, there has been a resurgence of interest in plants which can improve the nutrient level of arable land. One line of research is aimed at understanding and then harnessing the nitrogen fixing systems of cyanobacteria and of nitrogen fixing bacteria and, although good progress is being made, this is long term biotechnology.

Another method is to improve the efficiency of those plant species that have been used traditionally for the purpose, e.g. grassland members of the Leguminosae. It is very important, therefore, to locate and maintain stocks of the most useful species. Furthermore, there are clear advantages in leaving these stocks in 'natural habitats' where they are subject to the rigours of natural selection and are cheap to maintain.

A very good habitat for many of these grassland legumes is the roadside verge and following the demise of spraying roadsides with selective 'weed-killers' the longterm maintenance of this type of habitat is essentially assured. Roads traverse all types of terrain and soil, and occur at all the heights and latitudes at which plants can grow.

It is clear that any plant species which commonly occurs in the roadside verges of Europe must have a very flexible genetic system capable of generating a large number of physiological and morphological varients.

Lotus corniculatus (L) is one of these highly variable roadside species. The plant has been little used in the agronomy of northern Europe, but it is of importance in the upland regions of southern Europe and, increasingly, in North America (to which continent it has been introduced). Of recent years, the potential of *L. corniculatus* for Europe has greatly increased and we are still at the early stage of assessing this potential.

Alien *Lotus corniculatus* in roadside verges

Since 1945 there have been extensive road building programmes effected over the whole of western Europe and part of the landscaping of these roads has been the sowing of the verges with suitable grasses. Legume seeds are frequently included in mixtures specifically marketed by seed merchants for roadsides. One so called *conservation* mixture for alkaline soils has the following composition:

	%
Birdsfoot Trefoil - *Lotus corniculatus*	6
Yarrow - *Achillea millefolium*	1
Chicory - *Cichorium intybus*	3
Small Salad Burnet - *Poterium sanguisorba*	3
Caraway - *Carum carvi*	3
Tansy - *Chrysanthemum vulgare*	1
Sheeps Parsley - *Petroselinum segetum*	5
Flax - *Linum flavum*	3
Catmint - *Nepeta cataria*	1
Sainfoin - *Onobrychis viciifolia*	7
Wild White Clover - *Trifolium repens*	7
Black Medick - *Medicago lupulina*	3
Red Clover - *Trifolium pratense*	7
Awnless Brome - *Zerna inermis*	14
Crested Dogstail - *Cynosurus cristatus*	14
Rough Stalked Meadow Grass - *Poa trivialis*	14
Tall Fescue - *Festuca arundinacea*	8
	100%

Jones (1977) has reported the occurrence of alien *L. corniculatus* in several locations in western Europe and subsequently I have discovered many more. Two new locations have recently been discovered less than 40 km from Hull and a long term study of these sites has begun.

These alien plants are very distinctive. They are tall (≈ 0.5 m), are invariably cyanogenic, have large leaflets, small flowers (often with more than the usual 5 flowers per umbel) and light keel petals. These plants correspond with var. *sativa* of Chrtková-Žertová (1973). Jones (1973) has shown that the character of height is heritable, obtaining a segregeting family among the progeny of a native prostrate plant (♀) growing among aliens on a roadside in Denmark. The occurrence of these aliens in many different parts of Europe allows us to study some important problems of ecological genetics, conservation and management.

(1) To what extent do the aliens outcross with native plants?

(2) Are the aliens persistent?

(3) Although aliens obtained from different locations appear to be very similar when grown in the glasshouse, are they physiologically distinct?

(4) Are the aliens found in the roadside populations produced from a random sample of seeds in the seed mixture or have the habitats exerted strong selection on the seedlings.

(5) What is the origin of these aliens? Our guess is southern Europe, but seed merchants have not been helpful because they have bought low grade mixtures from wholesalers 'through the trade'.

(6) Are these aliens growing in roadside verges in northern Europe a good source of the heritable variation required for establishing the species among the agronomically important plants of northern Europe and North America. Certainly they are morphologically suitable; the question is whether their growth rate and other physiological components of fitness are satisfactory?

Other questions which arise are about the propriety of introducing alien plants in an uncontrolled way on a very large scale. Apart from the likelihood that insect and fungal pests will have been introduced there is also the effect that aliens may have on the indigenous population. Whereas there is often an outcry when alien individuals of rare species are found in 'natural' habitats, the average field biologist seems to be singularly unconcerned about the large-scale importation of common species.

On the positive side, however, useful genetic stocks are being scattered throughout Europe and outcrossing between the natives and the aliens, together with the resultant recombination, could well give rise to some individuals which would be invaluable in plant breeding programmes.

Some of the characteristics of ***Lotus corniculatus*** which make it a particularly suitable species for both unconscious and deliberate experimentation include:

(1) The plant is almost ubiquitous in short-turf grassland in Europe. It is a perennial with an ability for clonal spread by means of underground stems. (Not all individual plants have this ability). Stem cuttings readily produce roots in a mist propagation unit.

(2) It is also a pioneer species thriving particularly well in dry soils having little structure.

(3) The plant will produce many seeds under good conditions. For example, in a speced plant trial individual plants in their second season have been recorded as producing 18,000+ seeds (Jones, 1970).

(4) The plant has a deep tap root and is capable of surviving droughting conditions severe enough to kill *Trifolium repens* (Foulds, 1973) and even *Vicia sativa* (Jones, original observation).

(5) The plant thrives in alpine pastures, a few centimetres from glaciers in Norway (Compton, 1980), in rock crevices and sand dunes regularly sprayed by sea-water and also on lead/zinc contaminated soils (Jones, original observations).

There are two relevant disadvantages of which I am aware:

(1) ***Lotus corniculatus*** does not grow in persistently wet soils. *L. uliginosus* is found in these places.

(2) ***Lotus corniculatus*** does not grow as quickly as ***Trifolium repens***, ***Medicago sativa*** or ***Vicia sativa*** and it is not as aggressively persistent as ***T. repens***.

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