Part III. The assessment of the biological control potential of organisms for controlling weeds

INTRODUCTION TO THE SUBJECT

A.J. WAPSHERE

As Chairman of the section on assessment of biological control potential I will use my recent work with Xanthium pungens L. in Queensland, Australia, and with Chondrilla juncea in Mediterranean Europe to indicate and illustrate ways in which the potentialities of the various organisms may be estimated.

Assuming that the problem of specificity to particular host forms and the host preferences of a candidate organism are sufficiently restricted then one is at the stage of considering the likely effects of a given introduction. These researches have indicated that plant populations are controlled by a descending order of importance of factors. Of first importance are the physical factors, e.g. climate, soil and cultivation methods. Secondly, other competing plant species, and finally the plant attacking organisms.

By making a continuous comparison between areas where the organisms attacking the weed are present and the areas where biological control is required, estimates are obtained of the controlling effects of the various factors. There are two important differences between the two areas. These are: a greater density of the weed species where biological control is absent, reflected in the extreme intra-specific competition which takes place compared with its absence in areas where biological control is effective. And secondly, a greater habitat range in terms of soil, climate, cultivation, etc. infested in the areas where the weed is not biologically controlled compared with areas where it is under such control. Thus, by comparing field situations as regards density and habitat range, it is possible to get a reasonable indication of the likely effects of a biological control introduction. There are however three important difficulties, the first is that under field conditions, there is always a multiplicity of organisms attacking a given weed and the separation of the effects of each organism can only be achieved by observations at many sites. Secondly, comparison must be made between situations which are as close as possible since small differences in climate, in plant competition levels, in cultivation practices, have extremely important effects
on population levels and habitat range of weeds. Thirdly, and perhaps the most difficult problem to solve, is to estimate the effect of the various predators and parasites on the populations of the candidate biological control organisms. The effect of these parasites and predators can be partly understood by laboratory rearing and semi-natural cage rearing but these always involve the difficulty that the natural immigration of prey, predators and parasites is restricted. This immigration often depends on various density dependent mechanisms which in themselves limit population build-up and which are often masked by laboratory experimentation. As an important corollary therefore of the method of comparison outlined above, there needs to be developed methods of experimentation which allow the separation of the various effects of the parasites and predators without the disadvantages of laboratory experimentation.