Exploration for Organisms for Biological Control of Weeds

by

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ABSTRACT

The fundamental requirements of an exploratory program for biological control of weeds are outlined and discussed. Emphasis is placed on thorough exploration which includes the detection of all potential control agents and on their sampling throughout their range, and also on experimental investigations into weed growth and development in relation to potential control organisms and other plants. The importance of genetic variation within candidates agents are discussed. Strategies to meet these requirements are proposed.

INTRODUCTION

Effective exploration for suitable host specific organisms is vital to the success of programs for the biological control of weeds. This paper discusses fundamental requirements which an exploratory program should meet and proposes strategies which may satisfy these requirements.

Many useful organisms for biological control of weeds have been collected by entomologists making exploratory, short term sweeps through the native range of the target weed. Usually these men were skilled observers able to make value-judgements regarding the organisms they encountered, but a serious short-coming of this type of exploratory work was its transient and local nature. Many potentially useful organisms were undoubtedly overlooked simply because the observations did not extend to all seasons of the year and were often limited in their geographic coverage. Many of these short-comings are of course, now overcome by establishing research stations in the region of exploration.

Recently then has been a tendency for exploratory entomologists to concentrate their attention on the centre of evolution, or diversification, of the genus and sub-genus of the target weed (see

Goeden 1974, Wapshere 1975). It has been argued that this region will be the richest source of potentially useful control organisms. Certainly results have shown that this strategy can result in the discovery of effective control agents (Wapshere 1974). However, organisms occurring in this region where coadaptation has been in progress for the longest period, will be highly adapted to their host plant and, therefore, may not be effective in restricting its abundance, i.e. they may be too well adapted to their host plant to be an effective control agent. We would question whether concentration of effort near the centre of evolution is the most efficient strategy for exploration for biological control agents.

There has also been emphasis on collection of agents from ecoclimatic situations similar to those occupied by the target weed (Wapshere et al. 1974; Wapshere 1975). While we agree that agents from ecoclimatically homologous regions may be more likely to become established and, under certain circumstances, may be effective control agents, we believe that there are many other factors influencing the effectiveness of a control agent and that undue emphasis should not be placed on ecoclimatic homology. One factor which often receives scant attention is the relative competitiveness of the weed with other components of the plant community. Invariably these relationships vary between the native range of the weed and its country of adoption (Anon 1968). Biological control of a weed may, in fact, often be achieved through a control agent reducing the competitive ability of the weed rather than through it causing direct mortality.

FUNDAMENTAL REQUIREMENTS OF AN EXPLORATORY PROGRAM

It is generally recognized that the following basic information on a weed should be considered prior to beginning the actual search for biological control agents: (1) taxonomic position, biology, ecology, and economic importance; (2) native geographic distribution; (3) total present distribution; (4) probable center of its origin and that of

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