Status and Prospects for Biological Control of Weeds in the U.S.A.

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Introduction

Approximately one half of the 540 major species of weeds in the United States are introduced (USDA, 1965). This means that from the biological control viewpoint some 270 of the major weeds in the United States are growing without the restraints imposed upon them by their native natural enemies. Many of these weeds were introduced from Europe or Eurasia by early immigrants. We would like to reopen these immigration routes to the natural enemies of these plants so they can be of help in correcting our present imbalance between weeds and natural enemies. This is precisely the purpose of our meeting—to arrange and effect the exchange and study of beneficial organisms between the U.S.S.R. and the United States. We are looking forward to the outcome with considerable anticipation. It will determine to a large extent how efficiently we are able to control many of our weed pests in the United States and the New World.

Work on the biological control of weeds in the United States has expanded greatly within the past 15 years. Today we want to present a general overview of this effort in the hope that it will increase the understanding of our program. We will briefly summarize information concerning the personnel and facilities presently devoted to various aspects of this work in the United States and will describe the procedures and constraints under which American scientists operate in developing a biological control of weeds project. Finally, we will note the current status of several projects.

Resources Devoted to the Biological Control of Weeds

Although efforts to use insects in the control of *Lantana camara* L. and *Cyperus rotundus* L. in Hawaii early in this century represent the first attempts at biological control of weeds in the United States (Goeden, 1978), it was the success in controlling the poisonous weed of rangelands, *Hypericum perforatum* L., in the Pacific Northwest in the 1940's and 1950's that sparked increasing interest at both state and federal levels. Since 1965, the number of projects has increased dramatically, and more than 55 weed species have been, or are now, studied or considered for biological control. By 1978, a survey of the persons known to be working on biological control of weeds showed that approximately 51 person-years (21 federal and 30 state) were being devoted to this work annually. A summary of the scientific disciplines and the time directed to this work in the United States in 1978 is given in Table 1. Today still more persons are devoting at least a part of their time toward biological control of weeds.

During the *Hypericum* project and into the mid-1960's, work on the biological control of weeds in the United States was centered principally at laboratories of the University of California at Riverside and Albany, including USDA personnel stationed at Albany, and of the Hawaii State Department of Agriculture. Work is now conducted at 30 facilities or departments throughout the United States. The scientist/person-years devoted to the biological control of weeds, the location of each facility, and the principal contact persons are listed in Table 2.

In addition, three Cooperative Research (SEA-CR) Regional Research Projects extend the number of scientists and facilities devoting at least some effort to biological control of weeds. Project S-136, "Biological Control of Weeds with Fungal Pathogens" (Southern Region), involves 22 scientists, principally plant pathologists, in ten states; Regional Research Project NC-116, "Biological Control Agents" (North Central Region), involves 12 scientists (pathologists, entomologists, and weed scientists) in 12 states; and Regional Research Project W-84, "Establish, Improve and Evaluate Biological Control in Pest Management Systems" (Western Region), involves at least ten states and scientists, some of which work on both insect and weed pests. (Several of the states and scientists participating in the regional projects are listed in Tables 1 and 2.)

Expanded Approach to Biological Control

Two approaches can be followed in developing biological control. One, the "classical" approach, involves the introduction of natural enemies of pests into areas where they did not previously occur and then allowing the organisms to increase and seek their own level of control. The other approach, which we refer to as "manipulative," is an effort to increase the effectiveness of natural enemies in an area once it has been observed that they cannot achieve effective pest control on their own. This can involve either cultural manipulation of the environment or reduction of factors

Table 1. Time Devoted by Federal and State Persons toward the Biological Control of Weeds in the United States (1978)

Discipline	Federal (SY)[1]	State (PY)[2]	Total
Entomology	15.8	18.21	34.0
Plant Pathology	2.7	9.25	11.95
Nematology	0.2	0.0	0.2
Weed Science	1.6	1.55	3.15
Aquatic Biology	1.0	1.0	2.0
Total	21.3	30.01	51.30

[1]SY - a scientist year includes up to one full-time technician per scientist.
[2]PY - includes the time spent by scientists, technicians, graduate students and state employees at both state and university facilities.