AGRICULTURAL RESEARCH FOUNDATION
INTERIM REPORT
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TITLE: Developing a Risk Index to Guide Regulatory Decisions in Biological Control for Weeds

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SUMMARY:
Biological control in the classical sense involves the introduction of natural enemies from foreign locations with the goal of establishing a permanent population that will suppress the weed or pest population. In order to ensure that the introduced natural enemy (or "agent") will not cause harm to other organisms, classical weed biological control in the United States requires extensive pre-introduction testing, rigorous review by a technical advisory group (the TAG), and further reviews by federal regulatory agencies to comply with the Endangered Species Act, the National Environmental Policy Act, and the Plant Protection Act. The regulatory process, first implemented in 1987, has been very successful in permitting only weed-specific agents. Nonetheless, recent years have seen a drastic reduction in the rate of new biocontrol agents being approved, which may be the result of a combination of turnover in regulatory personnel, shifting agency policies, and reduced tolerance and/or misperception of risks involved. Although there has been a continuous flow of proposed new biocontrol projects with favorable reviews by the TAG, no new agents have been permitted for release into the U.S. since 2011. In the mean time, the weeds targeted by these proposed programs (including Japanese knotweed, gorse, garlic mustard, and perennial pepperweed in Oregon) continue to spread unchecked, imposing greater and greater economic and environmental harm. A sticking point in the review process is the lack of evidence-based guidance for translating laboratory host specificity test results into quantitative risk to non-target plants in the field. Without a standard for assessing risk, regulators may be too risk averse, denying candidates that are actually safe, or they may be too permissive, allowing the release of organisms likely to harm native or economically important plants.

The goal of our proposed research is to aid regulatory decisions in weed biocontrol by providing a system for quantitatively estimating the risk of a lab-tested candidate biocontrol agent based on the observed outcomes of a large number of past biocontrol projects.

OBJECTIVES and PROCEDURES:

(1) Use published records of pre-release host specificity trials to compile a database of agent and non-target plant combinations and compute relative performance measures.

(2) Assess whether and to what degree each at-risk non-target plant is attacked by the biocontrol agent in the field. This will involve a combination of literature review, consultation with experts, and our own field surveys carried out within Oregon.

(3) Carry out logistic regression analysis to determine the extent to which relative performance measures in the lab predict use of a non-target plant in the field. This will provide an index to estimate the risk that future biocontrol agents pose to non-targets and will also suggest safety threshold levels of feeding or development below which field host use has not previously been seen.

(4) Use the index to estimate the risk of new candidate agents that are currently under review, including the knotweed psyllid and the gorse thrips.

(5) Demonstrate and share risk index approach and database with others developing new weed biocontrol projects. Encourage expansion (=improved accuracy) of the database as new data becomes available.

SIGNIFICANT ACCOMPLISHMENTS TO DATE:

We completed a literature review of 73 weed biocontrol agents introduced into the State of Oregon, plus a few that were introduced into other regions of North America, to obtain data for the risk index database. The database is currently stored as a Google spreadsheet accessible by all members of the research team. For each biocontrol system and for each "at-risk" non-target plant species, the following data were recorded: 1. No-choice oviposition; 2. No-choice larval development; 3. No-choice reproduction; 4. Oviposition when given a choice. For each of these, the relative rate was calculated by dividing the value for the non-target plant by the value for the target weed (experimental control). The data was taken from published papers where available. Where published reports were not available, we reviewed reports that were submitted to the TAG as well as other unpublished reports used in the review process which were available from the Oregon Department of Agriculture. These documents were scanned and stored for our future reference. For a few biocontrol projects, neither published nor unpublished reports were available.

For each biocontrol agent, we also searched the literature for documentation of field use of non-target plant species by the biocontrol agent as one of 3 categories: none (no field use); spillover (occasional field use when high densities of the agent deplete their usual food source; or full (in which the agent is frequently found to complete development).

In total we found ~266 non-target plants for which use by the biocontrol agent in the lab tests was not zero. However, there were only 41 cases of at-risk non-target plants for which there were also published follow-up observations in the field. The 41 non-target plants with both lab results and field observations were distributed among 16 biocontrol agent species used against 10 target weed species. In the coming months, we will distribute a survey to biocontrol specialists throughout the western U.S. to obtain additional observations of field use for certain biocontrol agents. This will further increase the size of our dataset prior to applying logistic regression analysis.

During the summer of 2016, we carried out field surveys in the Willamette Valley and Eastern Oregon to add field use records for several biocontrol agents. For two Scotch broom biocontrol insects (*Bruchidius villosus* and *Exapion fuscirostre)*, we surveyed the following related non-target plants: *Robinia pseudoacacia* (black locus), *Laburnum anagryloides* (golden chain tree), and *Lupinus arborius* (tree lupine). Plants at a total of 10 sites were searched. At each site we collected and dissected 50 or more seed pods from each non-target plant species as well as the nearest Scotch broom plants. Both biocontrol agents were found to be present on all Scotch broom populations sampled but were never found using the non-target plants. We also carried out surveys of thistle agents on several at-risk native thistle species in south central Oregon. The seed weevil, *Rhinocyllus conicus*, which was known to have a broad host range when it was introduced in 1965, was found using several native thistles in that region. We also found one instance of the stem mining weevil, *Trichosyrocaulus horridus*, using the native thistle *Cirsium brevistylum*.

In October of 2016, we presented the results to date at the Annual Meeting of the Western Regional Biocontrol Working Group in Grand Junction, Colorado. The biocontrol specialists attending the meeting expressed much interest in the risk index project and in providing future observations for confirming field specificity of their respective biocontrol systems.

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM:

2015-2016. U.S. Forest Service Forest Health Technology Enterprise Team Biocontrol of Invasive Plants Program, "Development of a Risk Index to Guide Regulatory Decisions in Weed Biocontrol", **$22,139** to F. Grevstad and P. McEvoy.

FUTURE FUNDING POSSIBILITIES:

USDA NIFA has programs that may support research related to this project. We may also apply for further funding from the US Forest Service Forest Health Technology Team in the future.