

# HOARY CRESS BIOLOGICAL CONTROL CONSORTIUM

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## INFO UPDATE 3

7 May 2003

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Dear hoary cress controllers,

First of all, I apologize to all of you for providing you so late during the year with the information on the hoary cress consortium. The folks at CABI Bioscience provided me with already 2 months ago with their 2002 Annual Report. Therefore, the delay is entirely my fault. 2002 was a very successful year for the hoary cress consortium. We got a lot of work done, found new research and sponsor partners, and initiated additional activities. Since it is a while ago that you received the last Info Update, this issue is going to be a little longer than usual. However, for those of you who do not have the time and/or patience to read the 73pp. CABI Bioscience report or the 11pp. U. of I. Report, I will try to summarize the main points in this Info Update.

To come straight to the point, funding for foreign exploration at CABI Bioscience is still not entirely secured for 2003 because the Idaho State Department of Agriculture may not be able to provide the total requested \$35,000 and because the exchange rates between the \$U.S. and the Swiss Franc has dropped from 1.5 to 1.3. Thus, I do encourage potential new partners (who receive this Info Update) to join the consortium. Every \$ will help to achieve our ambitious goals for 2003!

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### 1. CABI Bioscience Work 2002

CABI Bioscience completed the literature survey during 2002. The survey revealed 211 plant feeding organisms to be associated with hoary cress, and 289 when adding

organisms recorded from other *Lepidium* species including perennial pepperweed, *Lepidium latifolium* and dyers woad, *Isatis tinctoria*. Eight species of beetles (Coleoptera) were recorded as very host-specific, and four of these were selected as potential biological control agents, 1) the shoot-mining weevil *Ceutorhynchus merkli*, 2) the gall-forming weevil *C. cardariae*, 3) the seed-feeding weevil *C. turbatus*, and 4) the weevil *Baris semistriata*, the larvae of which mine in the root-crown of hoary cress. During field surveys conducted in 2001-02, approximately 80 insect species, one mite, and at least two fungal pathogens were sampled or reared from *Lepidium draba* and *L. latifolium*.

In 2002, investigations on the biology and host-specificity of the four preliminary selected biological control agents were started. Preliminary host-specificity data for the three *Ceutorhynchus* weevil species are very encouraging. In addition, the biology of these three species seems to be well adapted to the phenology of heart-podded hoary cress, which starts to bolt early in spring, reproduces and senesces in early summer and regrows rosettes later during the summer.

Unfortunately it was not possible to collect data on the fourth potential biocontrol agent, the weevil *Baris semistriata* during 2002. Only few adults were collected and they died during summer. However, preliminary tests conducted by a research group at the Zoological Institute in St. Petersburg suggest that the species might not be sufficiently host-specific to be considered for further consideration. A final decision will be made after the 2003 field season.

In addition to the existing candidate species, two flea beetle species, *Psylliodes wrazei* and an as yet undetermined *Psylliodes* sp. from Romania, as well as two recently described gall midges, *Contarinia cardariae* and *Dasyneura cardariae* were added to the list of potential biocontrol agents. Collections of individuals of these four insect species will be conducted in 2003. Thus, the number of potential biocontrol agents for hoary cress studied by CABI Bioscience has increased to eight insect species (*For detailed information refer to the CABI Bioscience 2002 Annual Report*).

## **2. U. of I. Work 2002**

Work at U. of I. focused in 2002 on the comparison of hoary cress growth vigor and insect feeding between populations in Europe and the U.S. Two graduate students are working on this project. Jessica McKenney studied hoary cress populations in North America and Michael Cripps used the exact same research methods to investigate hoary cress populations in central and Eastern Europe. In the U.S., 17 sites were studied in Idaho, Oregon, Washington and Wyoming during 2002 and a similar number of sites were surveyed in Europe. Results from the first field season indicate that hoary cress cover was lower at sites in Europe compared to the U.S. There is more plant competition and less bare ground at European hoary cress sites

Hoary cress shoot density and biomass were much smaller in Europe compared to the U.S., confirming that *L. draba* is growing more vigorously in its introduced range. The diversity of internally feeding species was higher in Europe than in the U.S., where mites, thrips, and plant bugs accounted for the majority of insects collected, sometimes in large numbers. In the U.S., hoary cress is used as early season food source for insect pest species of alfalfa and CANOLA.

Another Ph.D. graduate student, Jim Tansey, started his research at the U. of I. in August 2002. Jim will study the impact of different types and amounts of insect feeding on

hoary cress growth. He will also study the combined effects of grass competition and insect feeding on hoary cress growth. (*For detailed information refer to the U. of I. 2002 Annual Report*).

### **3. Funding Request for CABI Bioscience 2003**

Please review the *CABI Bioscience Workplan and Budget 2003* document for detailed information on the funding requirements for this year. In short, the funding request for foreign exploration at CABI Bioscience for 2003-04 is \$88,100. The increase is largely due to the weak exchange rate of the dollar (1\$U.S.=1.3SFr in 2003, in contrast to 1.5SFr in 2002). The work program comprises studies on the biology of the biocontrol agents and host-specificity tests. In addition, funds will be used to acquire material of the recently identified additional biocontrol agents. Currently, the best-case scenario would leave us \$6,500 short. In the worst-case we still have to find more than \$26,000. We are, however optimistic to find new sponsors this spring that may start to contribute small amounts so that our goals for the 3<sup>rd</sup> year of this program can be met.

### **4. RC&D Consortium Account**

The consortium has now an account for financial contributions. The northern Idaho based Panhandle Lakes Resource Conservation and Development (RC&D) Council, Inc. is an organization whose mission is to enhance the quality of life by maintaining and improving the economic, social and environmental conditions within this region. The RC&D has assisted the Hawkweed Biocontrol Consortium since many years with the administration of financial contributions. We are very grateful that the Panhandle Lake RC&D also agreed to administer an account for funds used for foreign exploration. The address for contributions is as follows:

HOARY CRESS BIOLOGICAL CONTROL CONSORTIUM  
c/o Dave Johnson, Chairman  
Panhandle Lakes RC & D  
7830 Meadowlark Way, Suite C-1  
Coeur d'Alene, ID 83815

### **5. TAG Meeting and Hoary Cress Workshop September 2003, Spokane, WA**

The Technical Advisory Group (TAG), a interagency committee that reviews petitions for releases of biological control agents is following an invitation of Dr. Linda Wilson and myself to held their 2003 Annual Meeting in Spokane, WA. The meeting is currently scheduled **9-11 September 2003**. The meeting provides not only a unique opportunity to discuss regional and national weed biocontrol issues with representatives from all federal agencies, it also provides a perfect opportunity to present and review our consortium work after 30 months. Drs Hariet Hinz from the CABI-Bioscience Centre and John Gaskin from the USDA ARS NPARL will attend the meeting as well as the major consortium sponsors and graduate students. We plan to have an informal workshop and I will send the TAG meeting agenda and information to all of you once finalized. For now, I encourage you to mark these days in your calendar and to plan to come to Spokane

## 6. Test Plant List

Just in time for this fall's TAG meeting in Spokane, we have completed a draft version of the test plant species list for host-specificity tests with biocontrol insects. The preparation of the list took longer than anticipated, in part because of a name change: The genus *Cardaria* does not exist any longer. Hoary cress species are now in the genus *Lepidium* (together with perennial pepperweed). In addition, there are only two and not any longer three hoary cress species. *Cardaria draba* (heart-podded hoary cress) is now *Lepidium draba* and *Cardaria pubescens* (globe-podded hoary cress) is now *Lepidium appelianum*. *Cardaria chalepensis* (lens-podded hoary cress) is no longer an own species. It is considered a subspecies of heart-podded hoary cress. These name changes affected the selection of the test plant species. The document has become quite large and includes almost 100 test plant species. The advantage of this long list is that we hope to receive approval from TAG and the U.S. Fish and Wildlife Service to use the same list for biocontrol programs against dyers woad and perennial pepperweed. Let me know, if you are interested to receive a copy of the draft list. Thanks to Linda Wilson and Jeff Littlefield for doing such a great job (*For detailed information about the name changes refer to p.6 of the CABI Bioscience 2002 Annual Report*).

## 7. Genetic Studies

Dr John Gaskin at the USDA ARS Northern Plains Agricultural Research Laboratory in Sidney, MT, has started work on the genetic relationship of hoary cress population collected in Europe and North America. While he is still developing the most suitable genetic markers for the research he has already provided preliminary results that are impressive. The ultimate goal is to understand from which area in Europe or Asia Minor hoary cress has been introduced to North America and whether there was one or many introductions.

John has received samples for all populations sampled by our graduate students for their hoary cress biology research in Europe and North America and CABI Bioscience will continue to collect hoary cress samples for John during 2003. We hopefully will be able to correlate growth vigor in Europe and North America to particular genotypes. Thus far, all but one North American hoary cress populations seem to be *L. draba*, heart-podded hoary cress. Only one population collected in Wyoming turned out to be *L. appelianum*, globe-podded hoary cress.

Since we also want to understand which genotype is growing most aggressively, Jessica McKenney will grow 15 identified hoary cress genotypes from Europe and North America under standardized conditions in a greenhouse. This experiment will show whether the increased growth vigor of North American hoary cresses is genetically based.

We also found a research partner in Europe, Dr. Caroline Mueller at the University of Wuerzburg in Bavaria, Germany, who has agreed to analyze the amount and composition of plant toxins in hoary cress genotypes, that is, the chemical substances that make the plant toxic to cattle. We hope to find that North American hoary cress populations contain smaller amounts of chemical defense substances, which would increase the chances of successful establishment of biocontrol agents.

## 8. Website

Thanks to John Gaskin the Hoary Cress Consortium will soon have a website. In fact John has already developed the entire website, which will be hosted by USDA ARS NPARL in Sidney. The website will inform about the ongoing research projects on hoary cress but hopefully also be a resource for images of the weed, potential biocontrol agents, Info Updates, the 5-year strategic plan, etc. We may even consider uploading a simple powerpoint training session that can be downloaded and used for public awareness projects. We will keep you updated about the website address once available.

## 9. Economic Analysis Study

Is still the only element of the 5-year strategic plan that has not been implemented. We have, however, established contacts with faculty in the Agricultural Economics Department at the University of Idaho and there may be interest to conduct a respective study as a graduate research project. This is a very demanding project because traditional economic cost-benefit and/or risk-benefit models that are usually used to address a research question like ours aren't working too well for noxious weeds. The major problem is to develop \$ values for things like the safety or loss of a plant or insect species. Feasibility discussions are ongoing.

## 10. CABI Goes East: Notes From a Field Trip to Romania (by Harriet Hinz)

From 27-31 March, I went on a field trip to eastern Romania to meet with our collaborator, Dr. Alecu Diaconu at the Institute of Biological Research in Iasi, Romania. I wanted to visit field sites of *Lepidium draba* and take plant and insect samples. Although Romania did not seem that far away on the map, the trip took me nearly 20 hours. Alecu has been involved in the foreign exploration for hoary cress biological control agents since the beginning of the program in 2001. He has been indispensable as a local contact, in taking samples, sending insects, and making observations.

Separated by the Carpathian Mountains, Eastern Romania is nearer to the center of origin of *L. draba* than Western Europe, and therefore assumed to harbor a greater number of arthropods closely associated with the weed. Its continental climate is also more comparable with the Western United States. One of our potential agents, the gall-forming weevil, *Ceutorhynchus cardariae*, has only been found in the Caucasus and Romania. At the time I arrived, the last snow had just melted, and plants were still very small, starting to sprout, which gave us the opportunity to check whether there are insects that attack the plant at this early stage. We were able to collect *C. cardariae* adults that were already active. We also found galls containing eggs but also young larvae. Weevils might start to lay their eggs still in fall. We also found young flea beetle larvae mining the growing point of young, developing shoots. Probably these larvae were *Psylliodes* sp. flea beetles, one of the new potential candidates. Alecu had previously observed these beetles killing shoots. We collected individuals for identification, rearing, and hopefully first host-specificity tests.

I also had the opportunity to meet two of Alecu's students. We agreed that because of their local expertise both should spend a summer in Switzerland during the coming years working on the hoary cress project.

This was my first but hopefully not last trip to Romania. Living in Switzerland, I have to say that it is a little culture shock. Romania is a poor country, still suffering from 25 years communistic dictatorship, evident in lacking infrastructure, high unemployment rates, etc. In spite of their desolate economic situation, people are very friendly and extremely hospitable. I was offered several local dishes, which were delicious. In order to not insult your hosts, I was also obliged to try several varieties of locally distilled liquors called 'Horinca' and 'Tsvica'. My trip was quite productive, but more importantly, I was able to establish personal contacts, which is essential for successful foreign exploration and survey programs.

## 11. Agents in a Nutshell

### The Hoary Cress Stem Weevil (*Ceutorhynchus merkli*)

Females of this weevil species lay their eggs end of March in bolting stems of hoary cress. Larvae mine in the shoots during April and May. Development time from egg to emergence of beetles of the new generation takes 8-9 weeks. After emergence, adults feed for a few weeks on hoary cress foliage. Then they aestivate in the ground until late summer. Feeding recommences in late summer and fall before the weevils overwinter in the leaf litter.



### The Hoary Cress Stem Gall Weevil (*Ceutorhynchus cardariaei*)

The picture shows several *C. cardariaei* larvae in a cut-open shoot base gall. This weevil species forms gall in shoot bases and petioles. A few eggs are laid in fall into leaf petioles. Females lay the majority of their eggs however, in early spring into shoot bases. Galls are formed in growing points of leaf petioles or young shoots. Growth of galled shoots is stunted. Mature larvae leave the galls to pupate in the soil in early summer. The weevils of the new generation emerge during the summer, feed on leaf foliage and aestivate during the hot months in the ground.



### The Hoary Cress Seed Weevil (*Ceutorhynchus turbatus*)

Adults of this weevil species are smaller than those of *C. merkli*. The larvae of the hoary cress seed weevil develop in the ripening seeds of the weed. The picture shows a young damaged seed with a *C. turbatus* egg. Larval feeding will destroy one or both seeds in the fruit capsule. Oviposition starts end of May when pods are formed. Larvae mine in the developing seeds during June. Larvae develop within 30 days. In early July, mature larvae leave the pods to pupate



in the soil. The development is completed in August. Adult weevils remain however, during the winter in their earthen cocoons and start feeding on plants during the following spring.

### **The Hoary Cress Root Weevil (*Baris semistriata*)**

The adults of this species occur on the plants in spring. Weevils lay their eggs in the base parts of developing shoots of hoary cress. Larvae mine in the basal part of the shoots and might mine down into the top part of roots or rhizomes. By the end of June, larvae are mature and likely leave the shoots for pupation in the soil. Adults of the new generation may emerge in late summer to feed on foliage of re-growing hoary cress rosettes before they overwinter in the leaf litter. The biology of this weevil is still not completely understood. Larval feeding causes leaves and shoots to first wilt and then die.



### **The Shiny Hoary Cress Flea beetle (*Psylloides wrasei*)**

The biology of this flea beetle is still unclear. In general, larvae of flea beetles mine in roots, rhizomes, and basal parts of their host plants. Larvae of this flea beetle were found in early spring. The adults may emerge during late spring and lay eggs in late summer and fall into leaf petioles and root crowns of re-growing hoary cress rosettes. The biology of this insect will be studied during the upcoming field season.



### **The Hoary Cress Flea Beetle (*Psylloides* sp.)**

This flea beetle was found in relatively large numbers in Romania. The species needs yet to be identified. The larvae of this flea beetle mine in the root crowns of hoary cress.

### **The Hoary Cress Flower Gall Midge (*Contarinia cardariae*)**

This gall midge occurs in southern Kazakhstan and has been reported to develop in flowers of hoary cress. CABI Bioscience will try to obtain specimen of this insect during the upcoming field season.

## **The Hoary Cress Seed Gall Midge (*Dasineura cardariae*)**

This gall midge also occurs in southern Kazakhstan and has been reported to develop in developing seeds of hoary cress. CABI Bioscience will try to obtain specimen of this insect during the upcoming field season.

Again, please consider providing financial support for the exciting foreign exploration program. As in many other biological weed control programs, active project sponsors will be the first to obtain biological control agents when they become available. 2003 will be an important year for the hoary cress biological control consortium. In fall, we will get together and evaluate what we have accomplished during the first 2½ years. And we will outline what we need to get done during the next 3 years. Part of this process will be a decision as to whether we want to officially include perennial pepperweed and dyers woad into the program.

If you have any question or suggestion, please feel free to contact me any time. I am looking forward to hearing from you.

Best regards to you all,  
Mark

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