INTERNATIONAL BIOHERBICIDE GROUP

IBG NEWS

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THE CHAIRMAN'S COMMENTS

I join Maurizio Vurro in inviting you to attend the next IBG meeting, which will he held on April 27, 2003 in Canberra, Australia, as a satellite workshop of the XI International Symposium on Biological Control of Weeds. Further information about the workshop and the symposium can be found in the official website of the symposium (see page xx of this newsletter). I welcome you to submit one or more abstracts and participate in both the workshop and the symposium. I look forward to seeing you at the workshop and learning about your recent work with bioherbicides. With my best wishes, R. Charudattan.

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MEETINGS

TOP

XI International Symposium on Biological Control of Weeds

The XI International Symposium on Biological Control of Weeds is being held in Canberra, Australia, from Sunday 27 April - Friday 2 May 2003. The importance of ecology as the underpinning displine for biological control is the emphasis for this symposium. Information on the symposium, including cost of registration and deadline for abstracts, can be found at http://www.ento.csiro.au/weeds2003/index.html"

Sharon Corey Sharon.Corey@csiro.au

VI International Bioherbicide Workshop

Sunday 27 April 2003

Description

International Bioherbicide Group, an informal group of bioherbicide researchers and others interested in developing and using plant pathogens as inundative biocontrol agents was formed in 1992 at Orange, NSW, following the VIII International Symposium on the Biological of Weeds held at Canterbury, New Zealand. Since then, the IBG has held bioherbicide workshops at various venues in conjunction with a major international congress or symposium. The sixth workshop in this series will be held as a pre-symposium event during the XI International Symposium on the Biological Control of Weeds in Canberra.

The workshop will be open to anyone interested in the use of plant pathogens for biological control of weeds. Participants wishing to make oral or poster presentations describing their recent works should submit an abstract of not more than 4000 characters (including title, authors, and affiliation) by August 1, 2002 to Maurizio Vurro.

Biocontrol of Weeds with Pathogens
-Workshop -

Lincoln, New Zealand, Saturday 1 February 2003

Call for papers

In association with the *8th International Congress of Plant Pathology "Solving problems in the real world"*, to be held in Christchurch, New Zealand, 2-7 February 2003, a **pre-congress workshop, "Biocontrol of Weeds with Pathogens"** will be held on Saturday 1 February 2003 at Lincoln University.

Get further details, offer a paper and register now for this Workshop (code BIOC) at http://events.lincoln.ac.nz/icpp2003/

The purpose of the workshop is to discuss international progress and constraints in the deployment of plant pathogens in weed control. The format of the workshop remains flexible and will be planned to meet the wishes of contributors. Possible areas for fruitful discussion are:

- Improving the reliability of bioherbicides
- Safety of pathogens used in weed control (classical and inundative)
- New developments/discoveries
- Bioactives versus whole organisms
- Formulation and delivery (a "hands-on" laboratory session is planned)

Programme

Saturday 1 February 2003 – Workshop followed by dinner

Sunday 2 February 2003 - Field trip – weed problems in the South Island high country (e.g. wilding pines, Hieracium, lupins), and some biocontrol successes (ragwort, St John's wort). This whole day event will be offered if there is sufficient interest from workshop participants.

Jane Frohlich FrohlichJ@landcareresearch.co.nz

PEOPLE & PLACES

Biological Control of Forest Weeds & Diseases Research Laboratory "The Shamoun's Research Lab."- Canadian Forest Service, Pacific Forestry Centre, Victoria, BC, Canada

Research Activities:

1. **Visiting Scientists-** Dr. Steven Zhao, an NSERC Visiting Fellow (Post-doctorola Fellow) has recently joined Dr. Shamoun and his research team at CFS-PFC. Dr. Zhao is conducting research on formulation and delivery technologies of the biocontrol agent *Valdensinia heterodoxa* for control of forest weed Salal (*Gaultheria shallon*). On September, 2001, Dr. Susanne Vogelgsang who spent 1.5 years at the "Shamoun's Lab." has accepted a position at the National Centre of Competence in Research "Plant survival" – University of Neuchatel, Switzerland.
2. **Research Assistants/graduate students-** Ms. Cheryl Konoff has recently joined Dr. Shamoun as his Research Technician. Cheryl comes from Nova Scotia where she did her M.Sc. thesis on *Colletotrichum gloeosporioides* as classical biocontrol strategy for control of *Malva* in Nova Scotia. The following graduate students are continuing their research work on different projects:

A) Tod Ramsfield- Ph.D. candidate- UBC/ Forest Sciences working under the direction of Drs. Simon Shamoun and Bart van der Kamphas most recently (May 24, 2002) defended his Ph.D. thesis on "Investigation into biological control strategy for lodgepole pine dwarf mistletoe- *Arceuthobium americanum*". Tod has already accepted a Research Scientist postion "Forest Pathologist" with Forest Research Institute- Forest Health & Biosecurity Research Group, in New Zealand;

B) Under the direction of Drs. Simon Shamoun and Bart van der Kamp, Sue Askew and Lea Rietman- M.Sc. candidates at UBC/Forest Sciences are continuing their research work on development of *Colletotrichum gloeosporioides* and *Nectria neomacrospora* for control of western hemlock dwarf mistletoe (*Arceuthobium tsugense*);

C) Under the direction of Drs. Simon Shamoun and Zamir Punja, Grace Sumampong- M. Sc. Candidate, Simon Fraser University- Biological Sciences is continuing her research work on development of a biological control agents for management of Salmonberry (*Rubus spectabilis*). In addition, Grace is investigating the genetic diversity and population structure of *Rubus spectabilis* populations by using PCR-DNA technology.

D) Under the direction of Drs. Simon Shamoun and Yousry El-Kassaby, Jennifer Wilkin, M.Sc. Candidate at UBC- Forest Sciences is conducting her research on the genetic diversity and population structure approach for "Salal- Gaultheria shallon" and the biocontrol agent *Valdensinia heterodoxa"* by using "PCR- DNA-AFLP markers".

3. On June 17-21, 2002, Dr. Simon Francis Shamoun attended the 4th International Conference on Forest Vegetation Management- Technical, Environmental and Economic Challenges " meeting in Nancy, FRANCE. Simon presented a scientific paper in the "Plenary Session" on "Comparative Efficacy of *Chondrostereum purpureum* on Red Alder and Big Leaf Maple in British Columbia, Canada". In addition, Simon acted as a "Moderator" for a scientific session on "Socially Acceptable Forest Vegetation Management Tools".
4. A Patent was developed by Drs. Shamoun and Vogelgsang on " Culture, formulation and application techniques of *Valdensinia heterodoxa* for use as a biological control agent of salal. The final submission of the patent was filed on May 28, 2002 with US Patent Office in Washington, D.C. and the Canadian Patent Office- Ottawa.
5. **Encouraging News for the "Biological Control of Weeds" Research Community**: we are pleased to announce that **Myco-Forestis Corporation** - a private company in Quebec, Canada has most recently registered *Chondrostereum purpureum* as "Myco-Tech™" in Canada- Eastern Canadian Provinces ONLY. On the other hand, efforts are underway by MycoLogic Inc., UVIC, Victoria, BC to register *Chondrostereum purpureum* as "Chontrol™" in Western Provinces of Canada and the USA. This is the second product for forestry use after "StumpOut™" which was developed in South Africa. A well deserved congratulations to all who have contributed in the development of these 2 products (so far!!) for forestry use.

Shamoun, Simon" sshamoun@PFC.Forestry.CA

From witchweeds biocontrol to bindweeds biocontrol

Monday O. Ahonsi, a Nigerian, in December 2000, obtained his Ph.D. on the Biological Control of the giant witchweed (*Striga hermonthica*) through enhancement of natural soil suppressiveness and periodic release of rhizosphere bacteria from Ahmadu Bello University, Zaria, Nigeria. During the period of his Ph.D., he was a Graduate Research Fellow at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, where he carried out his thesis research. He was supervised at IITA by Dr. Dana K. Berner (now at USDA), and at the University by Profs. Alphonse M. Emechebe and Segun T. Lagoke now at IITA, and University of Agriculture, Abeokuta (UNAAB), Nigeria, respectively. M.O. Ahonsi who after his Ph.D. became a consultant at IITA and Plant Pathology lecturer at UNAAB, recently (March 2002) joined the Biological Control group of the Swiss Federal Institute of Technology (ETH), under the leadership of Prof. (Dr.) Genevieve Defago as a Postdoctoral Researcher. Employed under the project, Risk Assessment of Fungal Biological Control Agents, he is presently working on the Biological Control of field and heldge bindweeds using the toxin producing fungus, *Stagonospora* sp.

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BIOHERBICIDE RESEARCH - STATUS REPORTS

TOP

Report from University of Florida, Gainesville, Florida

We are continuing our efforts to develop *Dactylaria higginsii* as a bioherbicide for *Cyperus rotundus, Phomopsis amaranthicola* for *Amaranthus* spp., *Tobacco mild green mosaic virus (TMGMV)* for *Solanum viarum,* and a fungal cocktail for several weedy grasses. Our team consists of Dr. R. Charudattan, postdocs Dr. S. Chandramohan and Dr. Jose Pablo Morales-Payan, and Senior Biologists Jim DeValerio and Mark Elliott. A new student, Jonathan Horrell, will join our graduate program (M.S.) in the Fall. He will research the genetic basis of the host-virus interaction in the *S. viarum-TMGMV* pathosystem. Jennifer Cook (Ph.D. program) is studying the prospects for integrated control of *Cuscuta* spp. with SMOLDER (*Alternaria destruens,* which is awaiting EPA registration), chemical herbicides, and a foliar desiccant. The following are co-investigators in some or all of the above projects: Dr. William M. Stall, Professor, Horticultural Sciences Department, University of Florida, Gainesville, Dr. Erin Rosskopf, USDA-ARS, Ft. Pierce, FL, and Dr. Thomas Zimmerman, Dr. Elide Valencia, and Dr. Chris Ramcharan, University of the Virgin Islands.

R. Charudattan (Charu) rc@gnv.ifas.ufl.edu

Pacific Forestry Centre, Victoria, BC, Canada

Dr Raj Prasad of the Pacific Forestry Centre, Victoria, BC, Canada has been experimenting with a bioherbicide agent, Chondrostereum purpureum, for contol of profuse resprouting in two exotic and invasive weeds(Cytisus scoparius and Ulex europaeus) in Canada. Laboratory and field trials indicate that this bioherbicide can suppress the resprout growth if applied at the right time and in right formulation.Further experiments are planned on control of other invasive weeds(Daphne laureola and Hedera helix) by Chondrostereum purpreum.
Raj recently attended the 12th Symposium of the European Weed Research Society(EWRS) at Arnhem-Wageningen, NL,during 24-27th June, 2002 and presented a paper on Ecology of Invasive Weeds and Integrated Management of Gorse(Ulex europaeus).

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Dutch biocontrol

We made some significant progress with biocontrol of Ragwort, Hogweed, Giant Hogweed, Californian thistle, and we established a great field experiment of biocontrol of Black Cherry (Prunus serotina), and Willows (Salix). If the latter experiments would turn out very successful (more that 95% dead stubs), the Dutch state forestry centre is willing to negotiate about some continuation as hiring us for production of the mycoherbicide based on *Chondrostereum purpureum* Dutch foresters only. Besides, the Dutch biocontrol firm Koppert might be interested to market our Ragwort, Hogweed, Thistle mycoherbicide.
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CLASSICAL BIOLOGICAL CONTROL OF WEEDS WITH PATHOGENS

TOP

Cooperative Research Centre for Australian Weed Management, CSIRO Entomology, Canberra, ACT, Australia

Bridal creeper rust sets in the Australian environment

Following extensive testing for specificity, the South African rust fungus, *Puccinia myrsiphylli* was approved for release in Australia in June 2000 for the control of the environmental weed, bridal creeper (see IBG News, Vol. 9 No. 1, June 2000). Bridal creeper, *Asparagus asparagoides*, invades native vegetation and establishes in relatively undisturbed vegetation by seed dispersed by birds. The plant establishes a rhizome and tubers which results in most of the biomass being underground. The underground reserves enable the plant to survive over summer (in winter rainfall regions) and to compete against other vegetation. The climbing habit enables establishment in dense vegetation.

Detailed monitoring has been carried out at three sites in south-eastern New South Wales since the release of the rust in July 2000. In the months following release, the rust established and spread at each of the three study sites until bridal creeper began its annual senescence in late November 2000. The rust successfully survived the 2000/2001 summer and naturally reappeared on a few scattered pockets of new shoots at the Bar Beach site (36°20'S 150°13'E) in April 2001 and at the Eurobodalla (35°98'S 150°15'E) and Scheyville (33°58'S 150°90'E) sites in late May 2001.

For example, at Bar Beach the rust had spread to all adjacent study quadrats (each 0.5 m^2) and up to 18 m downwind of the central release quadrat by late September 2000, 76 days after release. By the end of the bridal creeper growing season (November 2000, 139 days after the rust's release at the site) the rust had spread an additional 12 m. In total, the rust had spread about 30 m from the point of release over the four months of the 2000 season. In the 2001 growing season, the rust recolonised bridal creeper in all but one of the 53 permanent study quadrats at Bar Beach. It was also found at least 200 m from the site on plants growing near an adjacent road.

As well as spreading, the intensity of the rust within infected quadrats increased steadily during each of the two growing seasons after the release was made. In the period from July to November 2000, the incidence and severity of the rust in the central release quadrat increased steadily, ultimately killing bridal creeper shoots before the end of the season. In contrast, rust epidemics did not reach such a high level in the surrounding quadrats. Rust epidemics in the core study quadrats reached higher levels of severity in the following growing season in 2001. By the end of this second season, bridal creeper shoots in the central quadrat, and adjacent quadrats up to 1.5 m away, had been killed by the rust. The rust epidemic was also severe in quadrats located 2 – 3.5 m from the central release quadrat.

This monitoring study highlights the relatively slow dispersal capabilities of *P. myrsiphylli* within and between bridal creeper infestations. This contrast with rusts used in other weed biological control programs such as *Puccinia chondrillina* on skeleton weed, which spread 320 km from the point of release in one year. Low wind turbulence and high moisture levels characterize bridal creeper habitats during winter in southern Australia when dispersal of the rust is expected. It is probable that these climatic conditions have prevented long-distance spread of the rust from the central foci of our experimental infections. Nevertheless, these conditions, combined with the cool winter temperatures, have been ideal for the development of severe epidemics of *P. myrsiphylli* in infected patches of bridal creeper. We have set up a national network for the redistribution of the rust across the country in order to overcome its slow dispersal capabilities. During the two growing seasons since its release, the rust has been established at more than 250 sites across southern Australia, in collaboration with State and local government agencies and community groups. Redistribution of the rust and of another biocontrol agent for bridal creeper, the leafhopper *Zygina* sp., by CSIRO and the Weed CRC has been enhanced with National Heritage Trust funding in 2002.

Louise Morin (CSIRO) and Alan Wood (Plant Protection Research Institute, South Africa) observing damage caused by the bridal creeper leafhopper and the rust fungus at the Bar beach release site near Narooma on the south coast of New South Wales (October 2001).

One of the main goals of the classical biological control program against bridal creeper is to reduce populations below the ecological threshold at which infestations of the weed threaten native biodiversity. To achieve this goal, biological control agents for bridal creeper must exert a significant impact on the weed's root system. This is because bridal creeper's extensive system of below-ground rhizomes and tubers can comprise more than 90% of total plant biomass. The root system therefore represents a particularly efficient means of buffering plants from above–ground disturbance, including the action of natural enemies. We have shown in a glasshouse experiment that the size of root tubers, the number of tubers and the length of the rhizome on plants infected with the rust for a period of only 20 weeks were reduced by 31%, 62%, and 61%, respectively. Commensurate with these reductions in root growth, the shoot biomass of infected plants was reduced by 61%.

These results confirm that *P. myrsiphylli* has the potential to drastically reduce the size and regeneration capability of bridal creeper both above, and below-ground. A similar impact of the rust on rhizomes and tubers is likely to occur in the field during the bridal creeper growing season when conditions are ideal for rust epidemics. However, when considering the existing mass and extent of rhizomes and tubers at established infestations of bridal creeper, it will probably take several years for the rust to reduce below-ground biomass to a level that ultimately decreases the number of shoots and, thereby, the weed's ability to compete with native plants for light and space, above-ground.

Long-term monitoring of bridal creeper populations in the field is required to document the impact of the rust fully. In collaboration with researchers across the country, we have set up permanent trellises to gather data on vegetative growth and reproduction of bridal creeper populations before and after the release of biocontrol agents. This work is in progress; we currently have three years of pre-release data and one year post-release.

For more information on the bridal creeper biological control program consult our web site established to assist landholders and community groups
http://www.ento.csiro.au/bridalcreeper/index.html

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Detection of *Salvinia molesta* infestation in Mexico

Salvinia molesta (plant native from Brazil), is the second noxious aquatic weed behind waterhyacinth. Excessive growth (plant can double every 2-10 days) can coverage water surface in short time (Photo1). This flotting plant has been introduced in many countries by aquarius or nurseries stores. In a survey made in March 2002 in the south of Mexico (Villahermosa, Tabasco), an infestation of this weed was located at "Laguna de las Ilusiones" and "Tabasco" lake. The area infested was aproximatly 10 ha. Due to the characteristics of this weed, buds and stems are below the water surface and the leaves are virtually unwettable due to air trapped in the numerous hairs that cover their upper surface, chemical control has been used with some success. In Mexico, Mexican Water Technological Institute (IMTA) plans to control this weed by using insects and pathogens in collaboration with USDA and Florida University, USA.

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PUBLICATIONS

R. Ghorbani, P. C. Scheepens, W. V. D. Zweerde, C. Leifert, J.S. McDonald and W. Seel. Effects of nitrogen availability and spore concentrations on the biocontrol activity of *Ascochyta caulina* isolates in common lambsquarters. *Weed Science*, Vol. 50, issue 4, July-August 2002.

de Jong, M.D., G.W. Bourdot, J. Powell & J. Goudriaan (2002). A model of the escape of *Sclerotinia sclerotiorum* ascospores from pasture. Ecological Modelling 150, 83-105.

Last line from the Abstract:
"Combined with information on release rates of *S. sclerotiorum* spores at a biocontrol site, this model will enable a time-series analysis of spore emission, and coupled with a Gaussian plume model, prediction of minimum isolation distances between a biocontrol site and a susceptible crop."
Keywords: *Cirsium arvense; Sclerotinia sclerotiorum; Venturia inaequalis; Lycopodium clavatum*; spore dispersal; Biological control; Risk analysis; Weed
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Ahonsi, MO, Berner DK, Emechebe, AM, Lagoke, ST (2002). Selection of rhizobacterial strains for suppression of germination of *Striga hermonthica* (Del.) Benth. seeds. *Biological Control*, 24: 143-153

Ahonsi, MO, Berner DK, Emechebe, AM, Sanginga, N, Lagoke, ST (2002). Selection of non-pathogenic ethylene-producing rhizobacteria for accelerated depletion of *Striga hermonthica*'s seed bank. *African Crop Science,* 10: 1-8.

COLORADO STATE UNIVERSITY IDENTIFIES NATURAL, PLANT-PRODUCED HERBICIDE

Scientists have speculated for decades that spotted knapweed is able to spread over large areas because of a secret weapon - an ability to release a chemical that kills surrounding plants. Until now, they have never been able to put their thumb on the phenomenon, but recently a Colorado State University horticulture professor identified and isolated the chemical for the first time. What's more, they are using the chemical as a completely natural and environmentally friendly herbicide to kill other weeds.

The discovery and isolation of the chemical, called catechin, within spotted knapweed may revolutionize the war against weeds for homeowners and farmers.

"For years, scientists have talked about spotted knapweed releasing this chemical, but they couldn't find it in the soil because it was almost impossible to separate from all the other compounds that naturally occur in soil," said Jorge Vivanco, assistant professor of horticultural biotechnology at Colorado State. "We looked for it in the plant. Spotted knapweed releases catechin into the soil through its roots."

Now that catechin has been identified and isolated, and scientists can capture the chemical in the Department of Horticulture's laboratory, Vivanco and a team of researchers at Colorado State are investigating a wealth of applications for the chemical. They have discovered that the weed produces two types of catechin that are the same chemical compound but the mirror image of each other in their structure. One has anti-bacterial properties and the other acts as a natural herbicide.

The chemical acts as a natural herbicide to most other plants, although grasses and grassy-like plants, such as wheat, display some resistance to it. This discovery alone holds much potential. For example, it may mean that specific amounts of catechin could be used on lawns to kill weeds without killing grass or on wheat without damaging the crop. The chemical also is environmentally friendly and has existed in the soil for decades.

Catechin kills other species of knapweed, such as diffuse knapweed, which also is a noxious weed. It is fatal to spotted knapweed only when manually inserted into its cells in a laboratory. In nature, spotted knapweed cells do not permit catechin to reenter the plant once the chemical is produced and released into the soil.

"It is a clever root to produce, secrete and protect itself from this chemical," Vivanco said. "There are only small amounts of catechin insidethe root at any given time; it secretes it as it produces it." The Colorado State team has found that spraying catechin on plants or adding it to soil is as effective as 2,4-D against pigweed, lambs quarters and other common weeds. Catechin usually kills cells within the plants in an hour and kills the plants in about a week, but the team still is investigating the length of time that it remains active in the soil to prohibit plant growth. The researchers are working with commercial companies to make spotted knapweed catechin spray available to consumers within a year or two.

Colorado State researchers also are working to transfer the genes that produce the natural chemical into other plants to give them a built-in defense mechanism against weeds. Perhaps one of the most promising applications of the discovery is the fact that spotted knapweed has such a complex defense mechanism.

Spotted knapweed immediately begins to produce and release chemicals at the slightest hint ofa threat or stress. Just tapping its leaves automatically activates the plant's chemical response.

The funding for these projects comes from Colorado State University's Invasive Weeds Initiative.

For more information about this story and other related Colorado State projects, visit Colorado State AgNews at www.agnews.colostate.edu.

Spotted knapweed catechin fact sheet

What is catechin? Catechin is a phytotoxin. Scientifically, catechin in spotted knapweed is even more remarkable than just a natural herbicide. Spotted knapweed produces a compound of two different kinds of catechin. The two different types of catechin are produced and secreted by spotted knapweed at the same time and in the same amounts. They are structurally the same, but one is produced as the mirror image of the other. One catechin, called (-)catechin, is the natural herbicide that is toxic to other plants. The other, called (+)catechin, has antibacterial properties and has been commercially available for several years as an antioxidant and anti-aging compound. Until now, (-)catechin was considered a by-product with no commercial value. These mirror-image compounds are called racemic and are very rare in nature. They occur in chemical synthesis in laboratory settings, but the spotted knapweed's catechin is one of the first examples of racemic compounds that occur naturally in plants. It's also particularly interesting, notes Jorge Vivanco, Colorado State University horticulture professor, that each compound has a different activity.

How long have scientists known that spotted knapweed may secrete chemicals? This theory was suggested as early as 1832, but scientists have not been able to identify the chemical secreted by spotted knapweed that is responsible for killing other plants.

How many different kinds of knapweed are there? There are 15 different kinds of knapweed. Spotted knapweed is known as Centaurea maculosa in the scientific community. The common names for some other varieties also found in Colorado are meadow knapweed, yellow starthistle, diffuse knapweed, cornflower, squarrose knapweed and Russian knapweed.

Is spotted knapweed native to Colorado or other parts of the United States? Spotted knapweed (Centaurea maculosa) also is known as Asian native spotted knapweed. It is considered a noxious weed and is one of the most economically destructive exotic weeds because it invades western North America and displaces other weeds and crops with chemical warfare. The chemicals that spotted knapweed produces have less effect on plants native to Asia. This lack of a natural predator or check-and-balance system for plant species is typical of why non-native plants are generally invasive.

Is there evidence that other plants produce chemicals to fight off competition from other vegetation? The soil immediately surrounding a plant root constitutes a unique physical, biochemical and ecological environment. That environment is largely controlled by the root system through chemicals secreted into the surrounding soil. Roots typically secrete compounds such as amino acids, organic acids, sugars and proteins. These compounds help the plant regulate microbes in the soil around their roots.

How was Colorado State University able to identify and isolate catechin secretions from spotted knapweed? The Colorado State University Department of Horticulture laboratory was able to develop a system to grow knapweed roots in vitro, or in a fluid in laboratory beakers. In the laboratory, the roots continue to secrete catechin into a sterile liquid.

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EDITOR'S CORNER

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