

WEED CONTROL AND THE CO-OPERATIVE RESEARCH CENTRE FOR TROPICAL PEST MANAGEMENT

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Summary. The Co-operative Research Centre for Tropical Pest Management (CTPM) in Brisbane is formed from the Entomology Divisions or Departments of the University of Queensland, CSIRO, Queensland Department of Primary Industries and Queensland Department of Lands. CTPM staff are involved in research into all aspects of improved management of tropical pests, with a significant section involved in biological control of weeds. Australia is a world leader in this field, and over 50% of Australian weed biocontrol occurs in 2 of the CTPM participating institutions. The CTPM offers new educational opportunities for weed scientists in the region, with a new intensive 2-week course on Biocontrol of Tropical Weeds, and course-work Diploma and Masters as well as research degrees at the University of Queensland, all taught or supervised by experienced weed biocontrol scientists.

INTRODUCTION

The Co-operative Research Centre for Tropical Pest Management (CTPM) was formed in Brisbane in 1991, one of the first of 50 Co-operative Research Centres funded by the Australian Government for a 5-year period, in a move to increase the links between scientific research, industry and education. The CTPM was formed from 4 participating institutions, CSIRO Division of Entomology at Long Pocket, Queensland Department of Primary Industries Entomology Branch (as it was then), Queensland Department of Lands Alan Fletcher Research Station, and the University of Queensland Department of Entomology. CTPM headquarters are at the University of Queensland and Dr Geoff Norton, well-known for his work at Imperial College on the economics of pest management, is Director.

RESEARCH PROGRAMS

The main thrust of research at the CTPM will be towards improved management of tropical insect pests, but there is also a significant section involved in biological control of weeds. Australia is a world leader in this field, and over 50% of Australian weed biocontrol occurs in Brisbane, at CSIRO Longpocket laboratories and at the Alan Fletcher Research Station, both participating institutions in the CTPM. The existing programs of these institutions will continue, but the CTPM will bring an increased thrust towards basic understanding of the mechanisms governing biological control of weeds.

One core CTPM program aims to improve the accuracy of predicting the effects of potential biological control agents on weeds. The behaviour of the insects involved and the responses of the weeds to their attacks are important factors in determining the level of injury, and therefore of control, inflicted by a given insect population. The core activity of this research will be the development of a generic computer model of plant growth, able to simulate responses of plants, ranging from grasses to trees, to insect attack. Basic data on the growth of the plants and their responses to insect damage are being collected for several plants including the important weeds parthenium *Parthenium hysterophorus* and water hyacinth *Eichhornia crassipes*. This data will provide the basis for developing and testing the model. The generic plant model will eventually be interfaced with the generic insect population model being developed by the Centre, and the

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package then incorporated into decision-support and computer-aided learning software for improved weed management. Dr Peter Room of CSIRO and Dr Jim Hanan, a CTPM Post-doctoral Fellow, are responsible for this program.

Another program investigates the basis of host specificity and host selection by weed biocontrol agents, and the differences in host selection behaviour in cages and in the field.

A PhD student Ms Seemi Khan is investigating host selection in the moth *Epiblema strenuana*, released as a biocontrol agent for parthenium weed. In its native home in north America as well as in Australia, the moth never attacks sunflower, which is closely related to parthenium. Yet both Chinese and Indian biocontrol scientists report significant attack on sunflower and other related plants in cage tests. Seed of sunflower cultivars from India and China have been obtained and field and cage tests are in progress. These will be followed by experiments to determine the chemical basis for host selection in this moth. This work ties in with and will be strengthened by other research within the Centre on the chemical basis of host selection in plant-feeding insects.

A third program is studying eutrophication of water and its effect on biological control of water hyacinth. This is a new Centre initiative, and is the first step towards improving our understanding of biocontrol of serious waterweeds such as salvinia *Salvinia molesta*, water hyacinth *Eichhornia crassipes* and water lettuce *Pistia stratiotes* in eutrophic waters. This program also links with the plant growth model, which will be used to help analyse data from eutrophication experiments. Mr Shaun Witherton (CTPM) will be conducting the experiments with CSIRO scientists Mr Tony Wright and Dr Tim Heard.

EDUCATION

Together with these new research programs, there is an increased emphasis on education. The first intensive 2-week course on Biocontrol of Tropical Weeds was held in May this year, with 10 participants from Uganda, Vietnam, Thailand, Fiji, the Solomon Islands, Indonesia, the Philippines, and Australia. Pressure to reduce use of chemical herbicides and move towards "sustainable" land use is leading to increased interest in biological weed control in many countries, but there are few experienced biocontrol scientists in the region except in Australia. This course provides expert and "hands-on" training for weed scientists and agricultural entomologists, equipping them to run or supervise a weed biocontrol program in their own country. It is also extremely valuable for senior agricultural scientists who may have to make the decisions regarding importation and release of insects as biocontrol agents against weeds, as it equips them with the background knowledge and experience necessary to evaluate weed biocontrol applications. The course will be run again in March 1994, and in future years according to demand.

The education program of the Centre incorporates aspects of all the Centre's research programs. The Centre is enhancing and adding to education in Tropical Pest Management within the University of Queensland through undergraduate lectures, postgraduate research and supervision, and development of innovative teaching methods (eg Computer Assisted Learning, CAL) for use by a range of clients from students through to industry consultants. Through the Centre, there is an increased contribution of non-University research staff to undergraduate courses, which means Agriculture students, for example, learn about weed control programs at the CSIRO and the Alan Fletcher Research Station, and can undertake final-year projects at these laboratories under the supervision of CSIRO and AFRS scientists. Vacation scholarships are offered for projects in

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any of the CTPM's centres, with students able to work on diverse projects including aspects of weed control. Post-graduate students can enrol for Diploma, Masters and PhD degrees at the University of Queensland, based at these participating organisations, and under the supervision of experienced weed scientists. Diplomas and Masters degrees in Tropical Pest Management can include courses in weed control and management, as well as a wide range of other options such as the use of plant growth models, expert systems, or economics of pest and weed management.

PREDICTIVE AND EXPERT SYSTEMS AND COMPUTER ASSISTED LEARNING

CLIMEX, the PC/DOS-based computer package for predicting the effects of climate on plant and animal distributions, has been refined to be more user-friendly. It can be used to predict the potential Australian distribution of new weeds, or the effect climatic change might have on existing weeds. CLIMEX for Windows will be available in 1994, and a Training Course for users of CLIMEX will be run at the University of Queensland in October this year. Short training courses for CLIMEX users can be arranged as required. An educational version of CLIMEX which addresses geographical and ecological issues, is also being developed. Dr Bob Sutherst, Gunter Maywald and Bryce Skarratt are the scientists working on CLIMEX development.

Other CAL initiatives are DIAGNOSIS, a computer program intended to teach crop consultants and undergraduates the process of diagnosis and management of crop-production problems, for example unexplained plant deaths in a crop which could be due to several possible causes. Also for university teaching, a prototype key which uses graphics extensively has been developed for identification of insects to order level. A prototype Expert System on pest-risk analysis has been developed for AQIS; this determines the risk of establishment, reproduction, and spread of a pest organism, combines the factors to give the overall risk associated with the organism, and refers to management options for this risk. This is now being further developed into a functional system. Robert Merlicek and Bruce Blackshaw are the scientists responsible for these projects, and they could readily adapt these CAL and Expert Systems for use with weeds if the demand is there.

WORKSHOPS

An important part of the CTPM approach to pest management is the involvement of the user community from the outset ie at the problem-definition stage. This is achieved partly through close links with industry bodies, through the CTPM Consultative Group of industry representatives, and through the CTPM newsletter Tropical Pest News and other informal direct links. Problem-Definition Workshops are another major way of bringing industry, the users of research, into the process. These Workshops bring scientists, economists, funding body representatives, crop consultants and farmers/graziers, together into a 2 or 3-day workshop to consider a particular research problem. The CTPM has held several such Workshops already and more are scheduled. The CTPM offers support in facilitating the Workshop and producing the report, which allows the scientists to concentrate on reviewing the problem, brainstorming all possible options, and finishing with solid and well-thought-out recommendations.

CONCLUSION

Through its participating organisations, the CTPM is already extensively involved in weed biocontrol in Australia as well as the Asian-Pacific region. It is our hope that the CTPM will result in greater co-ordination and depth to our research as well as a better use of resources. The CTPM offers unique opportunities for university-level education in weed control in the tropics, and we hope these will be increasingly taken up by scientists from the Asian-Pacific region. In particular, the considerable expertise within the CTPM in developing computer models and expert systems for pest management is an enormously valuable resource, and we look forward to developing these systems for use by weed scientists.

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