

**Annual/Interim Project Report - Financial Year**

**2003/4**

(Not to be used for LINK projects)

**Section 1 : Project details**

1. (a) DEFRA Project Code

**HH3118TPC**

(b) Project Title

**Protected herbs: Best practice guidelines for integrated pest and disease control**

(c) Project start date

**01/10/2003**

(d) Project end date

**30/09/2006**

(e) DEFRA Project Officer

**Dr Robert Bradburne**

(f) Name and address of contractor

**ADAS Boxworth & grower holdings**

(g) Contractor's Project Officer

**Rosemary Collier**

**Section 2 : Scientific objectives**

2. Please list the scientific objectives as set out in CSG 7 (ROAME B). If necessary these can be expressed in an abbreviated form. Indicate where amendments have been agreed with the DEFRA Project Officer, giving the date of amendment.

1.

## Section 3 : Summary of progress

3. Please summarise, in layperson's terms, scientific progress since the last report/start of the project and how this relates to policy objectives set out in ROAME A. Please provide information on actual results where possible rather than merely a description of activities.

This project, funded by both Defra and HDC, aims to provide integrated solutions for pest and disease control in protected herbs through dissemination of appropriate information available from current strategies used on both protected herbs and other protected cropping systems. The project addresses Defra's policy objectives of minimising pesticide usage and promoting sustainable, adaptable and cost-effective production methods which meet consumer requirements for a safe food supply chain and environmentally-responsible growing systems.

**Objective 1:** A knowledge review is being carried out to identify control options for priority pests and diseases of the most widely grown protected herbs (selected by steering committee members). The review process has included consulting the scientific literature, other scientists and industry contacts, and case-studies collated from project visits to six herb nurseries during 2004. The six nurseries represented different production systems (propagator, cut herbs, pot herbs and all year round (AYR) production) and the case studies identified pest and disease problems experienced and management strategies currently used. Grey mould (*Botrytis*) on basil, mint rust and powdery mildew on parsley and mint, were the most common diseases occurring across a range of production systems and strategies for control varied between nurseries. The main pest problems were shore flies and aphids on AYR pot herbs, leafhoppers, thrips, whitefly and caterpillars on seasonal pot herbs and leafhoppers, thrips and flea beetles on cut herbs. The knowledge review will form the basis for the development of Best Practice guidelines for management of priority pests and diseases.

**Objective 2:** For certain priority pest and disease problems, alternative management options are available but have not been validated for use on protected herbs. Following discussion at the first steering group meeting (December 2003), experimental work in project year 1 focussed on evaluating options for the control of shore flies and powdery mildew.

An experiment on mint on a commercial pot herb nursery evaluated biological control agents against shore flies, as individual and combined treatments. None of the individual treatments (the predatory beetle, *Atheta coriaria*, the predatory mite, *Hypoaspis aculeifer* and the entomopathogenic nematodes, *Steinernema feltiae*) reduced numbers of shore flies at the end of the five-week cropping period. The combination of the three biological control agents significantly reduced numbers of shore flies (a mean of 0.4 per pot, compared with a mean of 2.3 per pot in the untreated controls), but only when the insect-proof mesh used for preventing migration of *Atheta* between the different treatments was removed during the final two weeks of production. This result indicated that either shore flies flew out of these pots, or additional natural enemies (such as immigrating *Atheta* or a natural shore fly parasitoid, *Aphaereta debilitata*) entered the pots when the mesh was removed. Naturally-occurring *A. debilitata* were found in large numbers on the nursery and the potential role of this parasitoid needs to be determined.

Inoculated glasshouse experiments were carried out at ADAS Arthur Rickwood, Cambs to evaluate alternative foliar treatments for the control of powdery mildew on parsley and apple mint. Treatments included approved fungicides and a range of other products/chemicals reported to be effective against powdery mildew on horticultural crops. Powdery mildew developed rapidly on the untreated control treatments for both parsley and apple mint, and at the first assessment all spray treatments had significantly reduced percentage leaf area affected by powdery mildew. By the third assessment it was evident that treatment efficacy varied with crop. On parsley, Thiovit Jet and K50 + wetter (50 % potassium bicarbonate) were the most effective, both reducing leaf area affected to 35 % compared with 91 % in the untreated control. Under the high inoculum pressure conditions of this experiment, two treatments currently used by growers on parsley, Amistar and potassium bicarbonate (as commodity substance), were ineffective in controlling powdery mildew beyond the first assessment date. On apple mint, Thiovit Jet, Amistar and Milsana were the most effective treatments reducing leaf area affected to <8 % compared with 40 % in the untreated control. Milsana (extract of giant knotweed) is produced and registered in Germany as a 'plant enhancer', with published reports of efficacy against powdery mildew. A second experiment will be carried out in project year 2 to further evaluate sequences and combinations of promising products for powdery mildew control on protected herbs.

**Objective 3:** A steering committee including representatives from different sectors of the protected herb industry (seed production, propagation, cut herbs, seasonal and AYR pot herbs) met together with project scientists, Defra and HDC in December 2003. The meeting provided a forum for members to agree on priority pests and disease to be included in the Best-Practice guidelines and validation experiments, appropriate format and content of the guidelines, and other technology transfer issues. A project website was launched ([www.protectedherbs.org.uk](http://www.protectedherbs.org.uk)) at the end of year 1. In addition to project information and relevant links, the website currently provides guidelines and photographs for recognition of selected pests and diseases of protected herbs. Experiment results and Best Practice guidelines for integrated control strategies will be added during the rest of the project. Other technology transfer activities have included presentations to the industry, articles in the Defra 'Plant-It' publication and in ADAS technical notes, and visits and advice to herb growers.

## Section 4 : Amendments to project

4. Are the current scientific objectives appropriate for the remainder of this project?

YES

If **NO**, explain the reasons for any changes giving the financial, staff and time implications.

**Contractors cannot alter scientific objectives without the agreement of the DEFRA Project Officer**

## Section 5 : Progress in relation to targets

5. (a) List the primary milestones for the year/period under report as on CSG 7 (ROAME B).

**It is the responsibility of the contractor to check fully that ALL primary milestones have been met and to provide a detailed explanation if this has not proved possible**

Milestones		Target date	Milestones met?	
Number	Title		in full	on time
01/01	Knowledge review completed	30/06/2004	NO	NO
02/01	Protocols for first validation studies prepared	30/04/2004	YES	YES
03/01	Steering committee meeting held	31/12/2003	YES	YES
03/02	Best-practice guidelines for recognition of selected pests, pest damage and diseases available on the project website	30/09/2004	YES	YES

## Section 5 : Progress in relation to targets (continued)

5. (b) Do the remaining primary milestones look realistic?

YES

(c) If you have answered **NO** at (a) or (b), please provide an explanation.

The knowledge review is well underway and completed for several priority pests and diseases, including those selected for the validation experiments in years 1 and 2. The knowledge review is part of the continual process of formulating the Best practice Guidelines during the project, the first section of which will be communicated to the industry at the end of March 2005 (milestone 03/03). Preparation of the best-practice guidelines will be completed by 31 March 2006 (milestone 03/05) and the knowledge review will be completed before this date. The continuous nature of the knowledge review will not delay the achievement of remaining milestones or objectives, indeed it will allow the most up to date information on control measures to be made available to the industry in the Best Practice Guidelines.

## Section 6 : Project costs and staffing input

6. In this reporting period, what was:

(a) the approved expenditure?

£46,391

(b) the actual expenditure?

£49,524

(c) \* the approved staff input?

0.80

(d) \* the actual staff input?

0.5

\* staff years of direct science effort

## Section 7 : Publications and other outputs

7. (a) Please give details of any outputs, e.g. published papers/presentations during this reporting period.

- Jude Bennison presented the aims of the project in a presentation entitled 'Integrated pest management on protected herbs' at the AGM and Annual Conference of the British Herb Trade Association, Norwich, 24 January 2004.
- Jude Bennison and Kim Green submitted an article on project progress for the Defra 'Plant-It' publication in November 2004.
- Jude Bennison presented the results of the project to date at a technical exchange meeting with Certis in November 2004.
- Tim O'Neill presented results from the powdery mildew trial at a training workshop at Findons Nursery, Stratford upon Avon in November 2004.
- An article on the project is currently being prepared by Jude Bennison and Kim Green for ADAS bedding and pot plant notes for growers, for the December 2004 edition.
- Jude Bennison and Kim Green are currently preparing a paper on the project for the published proceedings of the next IOBC meeting of the Working Group 'Integrated control in protected crops, temperate climate' to be held in Finland in May 2005.

## Section 7 : Publications and other outputs (continued)

7. (b) Have opportunities for exploiting Intellectual Property arising out of this work been identified? If you have answered **YES**, please give details.

NO

- (c) Has any other action been taken to initiate Technology Transfer? If you have answered **YES**, please give details.

YES

- Representatives from five sectors of the protected herb industry attended the first project steering committee meeting (December 2003) to ensure project outputs were relevant to industry needs.
- Six herb nurseries were visited to discuss pest and disease problems and management strategies with growers.
- Identification of more than ten pest and disease samples was carried out for growers.
- Telephone/technical advice on aspects of the project was provided to two additional herb nurseries.
- Experiment results were discussed with suppliers of biological and other alternative controls used in the trials.
- The project website was launched, providing the industry with guidelines and photographs for recognition of priority pests and diseases.

## Section 8 : Future work

8. Please comment briefly on any new scientific opportunities which may arise from the project.

The results of the shore fly experiment have indicated that the naturally-occurring parasitoid, *Aphaereta debilitata*, found on both the nursery hosting the experiment and on another herb nursery visited as part of the case studies, warrants investigation as a biological control agent, either as a commercially-produced and released beneficial or as a natural enemy to be conserved and augmented on nurseries where it occurs. Jude Bennison is exchanging information with other researchers and biological control companies both in the UK and in Finland, to identify future research, development and commercial opportunities.

Development work has been done recently in Canada on breeding *Atheta coriaria* on nurseries growing protected ornamentals, using fish pellets as a food source. Some UK growers of pot plants, bedding plants and hardy nursery stock have been experimenting with this technique and one grower has been particularly successful. Jude Bennison visited the Entomologist and growers in Canada who have been developing the technique in October 2004, and is liaising with ADAS colleague John Buxton and with UK growers, to discuss further development and adaptation of the technique for growers of various protected crops including herbs. Industry funding would be appropriate to help to develop and evaluate this technique, as it has the potential to offer effective control of both shore flies and sciarid flies at very little cost to growers.

Promising alternatives to fungicides have been identified for disease control. It will be essential to identify the compatibility of any such products with biological control agents used in IPM programmes.

## Section 9 : Declaration

9. I declare that the information I have given is correct to the best of my knowledge and belief. I understand that the information contained in this form may be held on a computer system.

Signature

Name

Jude Bennison

Date

03/12/2004

Position in Organisation

Senior Research Entomologist