Trapping coffee beetles with natural baits

RIU

Validated RNRRS Output.

Natural chemical extracts—pheromones—that attract female coffee stemborers are now being commercially manufactured in India. This new bait, together with specially designed traps, means that females can be caught and destroyed. The coffee white stemborer is a beetle that seriously damages coffee crops in India, Sri Lanka, China, Vietnam and Thailand. In India, coffee growing, as well as providing a living for over half-a-million workers and their families in remote rural areas, checks soil erosion on hillsides. Farmers in all the main coffee-growing areas of India, Karnataka, Kerala, Tamil Nadu and Andhra Pradesh, now use over 40,000 pheromone traps. Since the only pesticide effective on stemborer has been withdrawn from use in India, there is major potential for these traps to help control this major pest of coffee.

Project Ref: **CPP77:**
Topic: **1. Improving Farmers Livelihoods: Better Crops, Systems & Pest Management**
Lead Organisation: **Natural Resources Institute (NRI), UK**
Source: **Crop Protection Programme**

Document Contents:

Description

CPP77

Research into Use
NR International
Park House
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UK

Geographical regions included:

India,

Target Audiences for this content:

Crop farmers,

A. Description of the research output(s)

1. Working title of output or cluster of outputs. *In addition, you are free to suggest a shorter more imaginative working title/acronym of 20 words or less.*

DEVELOPMENT OF PHEROMONES FOR MANAGEMENT OF COFFEE STEMBORER
(Coffee borer pheromone)

2. Name of relevant RNRRS Programme(s) commissioning supporting research *and also indicate other funding sources, if applicable.*

Crop Protection Programme (1996-1998)

Common Fund for Commodities (CFC) / International Coffee Organisation (ICO) (CFC/ICO 18; 2003-2006)

3. Provide relevant R numbers *(and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities. As with the question above, this is primarily to allow for the legacy of the RNRRS to be acknowledged during the RIUP activities.*

R6928: Development of pheromones for management of coffee stemborer in India (1997-8)

R7246: Development of pheromones for management of coffee stemborer in India (1998-9)

4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? *This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database (max. 400 words).*

In **India**, **coffee** cultivation provides livelihoods for more than 140,000 growers and 500,000 workers and their families (Database on Coffee, Economic and Market Intelligence Unit, coffee Board of India, September 2006). Ninetyeight percent of the growers own less than 10 ha and produce 60% of total production. In addition to its socioeconomic importance in remote, rural areas, coffee growing makes a major contribution to maintaining an **ecological balance** in **poor hillsides**, the coffee and shade trees preventing **erosion** and preserving **biodiversity**.

Coffee white stemborer (CWSB), *Xylotrechus quadripes* Chevrolat (Coleoptera: Cerambycidae), is the most serious insect pest of **arabica** coffee in India, as well as **Sri Lanka, China, Vietnam, Thailand**. Loss of production due to *X. quadripes* on arabica is a capital loss caused by the need to uproot and replace infested plants, and it is estimated that the national loss due to this pest is 130m rupees per year (£2m). There are no effective control measures against this pest following the withdrawal of BHC for agricultural use in India.

The male CWSB beetle was previously shown to produce a **pheromone** that attracted female beetles for mating. In the two projects funded by DFID, the pheromone was isolated, identified and synthesised and shown to attract

female beetles in laboratory bioassays. Slow release dispensers for the synthetic pheromone were developed and an effective design of **trap** established during field trials in India.

In the subsequent CFC/ICO project, the lure and traps have been developed further, commercial manufacture established in India, and evaluation by growers is in progress.

5. What is the type of output(s) being described here?
Please tick one or more of the following options.

Product	*Technology*	*Service*	*Process or Methodology*	*Policy*	*Other Please specify*
X	X				

6. What is the main commodity (ies) upon which the output(s) focussed? *Could this output be applied to other commodities, if so, please comment*

The outputs are focussed on coffee.

The principle of use of pheromones in management of insect pests is applied to pests on many commodities, but the specific output described here is applicable only to this species which, although it may use other host plants, is only a pest on Arabica coffee.

7. What production system(s) does/could the output(s) focus upon? *Please tick one or more of the following options. Leave blank if not applicable*

Semi-Arid	*High potential*	*Hillsides*	*Forest-Agriculture*	*Peri-urban*	*Land water*	*Tropical moist forest*	*Cross-cutting*
		X	X				

8. What farming system(s) does the output(s) focus upon? *Please tick one or more of the following options (see Annex B for definitions). Leave blank if not applicable.*

Smallholder rainfed humid	*Irrigated*	*Wetland rice based*	*Smallholder rainfed highland*	*Smallholder rainfed dry/cold*	*Dualistic*	*Coastal artisanal fishing*
			X			

9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? *Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared. (max. 300 words).*

The projects “ICPM for smallholder coffee in Malawi” (R8423, R8203) and “Coffee in East Africa” (R8513)

address constraints due to pests and diseases on coffee in Africa. Related coffee stemborers are also a major problem in Africa, but these are different species to that in India, and work carried out in the CFC/ICO project has shown that the pheromone technology is probably not applicable there. However, other approaches to management of coffee stemborers developed during the CFC/ICO project might be applicable in Africa and *vice versa.*

The project "Support to SME supplying pheromone control technologies and promoting policy change for commercial production" (R8413, 8304, 7465D) deals with issues related to commercialisation of pheromone-based technologies in S E Asia. Commercialisation of the traps for coffee stemborer in India provides an example for this, and lessons learnt during the "support for SME" projects could prove useful for further development of the traps in India and other countries of SE Asia.

Validation

B. Validation of the research output(s)

10. How were the output(s) validated and who validated them? *Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the "who" component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc. This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation (max. 500 words).*

Structure of the pheromone and its biological activity in laboratory and field was established by NRI and the CCRI and published (Hall *et al*., 1998, 2006).

The effectiveness of the pheromone traps for monitoring CWSB emergence was validated by CCRI. Pheromone traps were deployed throughout the coffee growing regions of India during 2003-2006. Season-long monitoring of trap catches demonstrated the emergence pattern and the magnitude of the catch was correlated with the extent of infestation.

The impact of the traps in reducing populations of CWSB was determined by CCRI by trapping areas of from 4-7 ha of coffee with traps at 25 traps per ha. Borer emergence was estimated by counting new emergence holes on all stems in the area. In six studies, the proportion of available beetles trapped was 16-61%.

Grower evaluation was carried out during the October-December flights in 2005 and 2006 and the April-May flight in 2006. Reductions in infestation as measured by the number of infested stems removed are being monitored in selected areas.

Hall, D.R., Cork, A., Phythian, S., Sumathi, Ch., Jayarama, Venkatesha, M.G., Violet D'Souza, M. & Naidu, R. (1998) Studies on the male sex pheromone of the coffee white stemborer, *Xylotrechus quadripes* Chevrolat (Coleoptera: Cerambycidae). *Proceedings of 2nd International Conference on Semiochemicals,* Wageningen.

Hall, D.R., Cork, A., Phythian, S.J., Chittamuru, S,. Jayarama, Venkatesha, M.G., Sreedharan, K., Seetharama, H. G., Vinod Kumar, P.K. and Naidu, R. (2006). Identification of components of male-produced pheromone of coffee white stemborer, *Xylotrechus quadripes* Chevrolat (Coleoptera: Cerambycidae). *Journal of Chemical Ecology*, 32 (1): 213-237.

11. Where and when have the output(s) been validated? *Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above (max 300 words).*

Validation is being carried out in the main coffee growing areas of India – Karnataka, Kerala, Tamil Nadu and Andhra Pradesh.

Growers at all levels from small-scale to estate are involved.

Production system is Hillsides and farming system rainfed highlands.

Current Situation

C. Current situation

12. How and by whom are the outputs currently being used? *Please give a brief description (max. 250 words).*

Pheromone traps are being used by a range of coffee growers from small-scale to large estate as part of a package recommended by the Coffee Board to control CWSB. This currently includes two rounds of "tracing" (removal of infested stems), two applications of insecticide and use of pheromone traps. If the pheromone trapping proves successful it is planned to eliminate the insecticide applications and the number of infested stems required to be removed will decrease.

13. Where are the outputs currently being used? *As with Question 11 please indicate place(s) and countries where the outputs are being used (max. 250 words).*

Pheromone traps are being used in all the main coffee growing areas of India – Karnataka, Kerala, Tamil Nadu and Andhra Pradesh.

14. What is the scale of current use? *Indicating how quickly use was established and whether usage is still spreading (max 250 words).*

In October-December 2005, 10,000 traps were deployed in the first large-scale evaluation. In 2006 this number has increased to 40,000.

15. In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here *and in terms of capacity strengthening what do you see as the key facts of success? (max 350 words).*

The research was carried out in close collaboration with the Central Coffee Research Institute (CCRI) of the Coffee Board of India, which provides effective research and extension in all the coffee growing areas of India. Outputs generated by the UK researchers were taken up, developed and promoted by the CCRI.

Commercial uptake of the traps and lures has been possible in India because of the existence of several companies that now provide pheromone technologies. These have established because of the highly skilled labour force and also government policy promoting "biorational" approaches to pest control which have provided a reliable market for their products.

Furthermore, farmers and growers in India have become increasingly aware of the problems with overuse and misuse of chemical pesticides as a result of government policy and also media reporting of events such as crop failures and suicides due to drinking of pesticides. For a cash crop that is largely exported, such as coffee, elimination of pesticide residues is a major economic issue.

The CFC/ICO project also provided a stimulus to further development and promotion of the trapping technology and funding for involvement of UK experts to assist in this.

Environmental Impact

H. Environmental impact

24. What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)?*. This could include direct benefits from the application of the technology or policy action with local governments or multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex. (max 300 words)*

Direct environmental benefits of adoption of the technology will be reduction in use of conventional pesticides.

Indirect benefits will be promotion of coffee growing in poor hillside regions which makes a major contribution to maintaining an ecological balance, the coffee and shade trees preventing erosion and preserving biodiversity.

25. Are there any adverse environmental impacts related to the output(s) and their outcome(s)? *(max 100 words)*

At present, the traps are constructed from plastic sheet and disposal of these by burying or burning presents an environmental hazard. Current work is aimed at developing re-usable and/or biodegradable traps.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce

the risks of natural disasters and increase their resilience? *(max 200 words)*

As a perennial crop, coffee can act as a form of investment. However, cash returns are typically concentrated in a small part of the year which is why at smallholder level coffee is grown along with other crops which provide a more regular income.