PROJECT COMPLETION SUMMARY SHEET

DATE Sheet Completed: 12 March 2002

Project Title:	**Development of Mycopesticides and Pheromones for Cocoa Mirids**	
DFID Project Reference No:	R 7249	
Programme:	Crop Protection Programme	
Programme Manager (Institution):	Dr Simon Eden-Green (NRIL)	
Sub-Contractor (project leader's institution)	Natural Resources Institute/CABI African Regional Centre	
Production System:	Forest Agriculture Interface	
Programme Purpose:	Benefits for poor people generated by application of new knowledge on crop protection to cultivation of tree crops at the forest/agriculture interface.	
Commodity Base:	Cocoa	
Beneficiaries:	Small-scale cocoa growers in Ghana and neighbouring countries of West Africa	
Target Institutions:	Cocoa Research Institute of Ghana	
Geographic Focus:	West Africa	
Total Cost:	£203,079	
	Planned	**Actual**
Start Date:	1 October 1998	1 October 1998
Finish Date:	30 September 2001	31 March 2002

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1. Project Purpose:

The Purpose of the project is to develop and promote improved methods for control of insect pests of cocoa. The project will contribute to this Purpose by developing effective mycoinsecticides against the two main mirid pests of cocoa in Ghana and identifying the sex pheromones of these species. These project outputs will make possible evaluation of new, environmentally acceptable approaches to monitoring and control of cocoa mirids that are appropriate for use in Ghana and elsewhere.

2. Outputs:

Three major surveys for pathogens of cocoa mirids were carried out by CRIG and CABI staff in Ghana. The entomopathogenic fungus, *Beauvaria bassiana*, was isolated from one cocoa mirid species. This was bioassayed in the laboratories in Kenya and Ghana along with four isolates collected from cocoa mirids in Papua New Guinea, and all were active against the Ghana mirids. The isolates were characterised according to rate of growth, sporulation rate and long-term viability at different temperatures. Large-scale culture of the fungus was carried out on rice and spores were harvested with a novel cyclone extractor to provide sufficient material for laboratory and field experiments.

Five oil formulations of the entomopathogen were evaluated against an aqueous control. Ondina oil (a lubricant) gave the best initial viability and long-term stability, but this is expensive. Sunflower oil also gave satisfactory results and is cheaper and locally available.

Production of a sex pheromone by one of the mirid species, *Distantiella theobroma,* had been demonstrated previously. Trapping experiments carried out in this project showed for the first time that the other species, *Sahlbergella singularis*, also produces a pheromone. Pheromone collection equipment was set up at CRIG and collection from both mirid species carried out over two seasons by CRIG staff. Collections were analysed at NRI. Contrary to results with other mirid species, amounts of pheromone produced were tiny and very variable. Two components were detected in collections from virgin female mirids which elicited electroantennographic responses from the males. After careful analysis of mass spectral and chromatographic data and synthesis of over 50 reference compounds, the chemical structures of these were determined as a novel type of compound not previously found as pheromone components. The compounds were synthesised and the synthetic compounds shown to have identical physicochemical and electrophysiological properties to the natural materials.

Trapping experiments carried out in and around CRIG station showed that blends of the two synthetic compounds are attractive to *S. singularis* males. Populations of *D. theobroma* were too low to obtain significant results in these tests. Experiments to optimise the release rate and blend have been carried out and are still in progress. Lures remain active for at least one month in the field. Simple traps have been developed which are easy to construct and deploy.

Two CRIG staff attended formal training courses in the UK in 1999. Dr Ackonor attended a four-week training course on insect pathology at CABI, and Mr Lowor was trained in pheromone isolation and analysis at NRI. On-the-job-training to CRIG staff was given during 12 field visits to CRIG by CABI and NRI staff.

3. Contribution of Outputs to Project Goal:

The planned outputs of the project have been achieved. A local isolate of an entomopathogenic fungus active against cocoa mirids has been isolated and characterised, produced on pilot scale and formulated so that it is now available for field evaluation. Pheromone components for both species of mirids have been isolated, identified and synthesised. Blends have been shown to attract one of the mirid species in the field and effective traps and dispensers are available for further evaluation.

Progress has been slower than expected. Entomopathogens were much more difficult to find than anticipated from work on related species in other countries. The Ghana mirid species still cannot be reared in large numbers and they are very difficult to maintain and transfer between laboratories without heavy mortality. Prior to the project, *D. theobroma* was thought to be the dominant species, but now it is difficult to find compared with *S. singularis.* The pheromone work was hampered by the very small amounts of pheromone produced and the novel structures involved as well as by the factors above. The whole project suffered to some extent from the failure to agree contractual terms with CRIG, and this will be even more important in any future collaborative work.

Nevertheless, the project outputs provide new technologies that can now be evaluated for use in control of cocoa mirids in Ghana and neighbouring countries. Mirids were unanimously rated as one of the two main pest and disease constraints on cocoa production throughout West Africa at the recent workshop “West African Regional Cocoa IPM”. These biorational approaches will help minimise use of conventional pesticides and should be more appropriate for use in developing countries and more sustainable. Cost-effective improvements in productivity of cocoa will benefit the livelihoods of over six million people in Ghana alone who depend directly or indirectly on cocoa.

4. Publications:

PADI, B., D. HALL, D. FARMAN., M. DOWNHAM, S. LOWOR, J. E. SARFO (2000). Evidence of sex attractants in the cocoa mirids *Distantiella theobroma* (Dist.) and *Sahlbergella singularis* Hagl. (Heteroptera: Miridae) in field-trapping experiments. Proceedings of 13th International Cocoa Research Conference, Kota Kinabalu, Sabah, Malaysia, 9-14 October 2000, 6 pp. (presentation given and proceedings in press)

5. Internal Reports:

HALL, D.R. & FARMAN, D.I. (1998). VISIT TO Ghana to initiate project on biorationals for control of cocoa mirids, 3-17 November 1998.

HALL, D.R. (1999). Visit to niger and Ghana, 8-18 June 1999.

ODUOR, G.I. (1999) Report on a survey of cocoa growing regions in Ghana for pathogens of cocoa mirids, Ghana, September 1999. Report No. 1. CAB International – Africa Regional Centre, Kenya. 2 pp. (BTOR)

DOWNHAM, M.C.A. & FARMAN, D.I. (1999). Visit to Ghana to undertake collaborative work on pheromones of cocoa mirids 13/10/1999 to 23/10/1999

ODUOR, G.I. (2000) Report on a visit to Ghana to conduct surveys for pathogens of cocoa mirids and discuss future activities, Ghana, July 2000. Report No. 2. CAB International – Africa Regional Centre, Kenya. 2 pp.

HALL, D.R. (2000). Report on visit to Ghana to develop pheromone trapping for cocoa mirids, 9-17 July 2000.

HALL, D.R. (2000). Visit to Cocoa Research Institute of Ghana, 29/10/2000 to 06/11/2000

DOWNHAM, M.C.A. (2001). Report on a visit to the Cocoa Research Institute, Ghana 02/02/2001 to 03/02/2001

ODUOR, G.I. and GODONOU, I. (2001) Report on a visit to Ghana to conduct surveys for pathogens of cocoa mirids and initiate bioassay experiments, Ghana, July 2001. Report No. 3. CAB International – Africa Regional Centre, Kenya. 2 pp.

ODUOR, G.I. (2001) Trip to IITA, Ibadan, to attend the Sustainable Tree Crops Programme's Regional Implementation: Assessment Workshop, Nigeria, September 2001. Report No. 4. CAB International – Africa Regional Centre, Kenya. 2 pp.

GODONOU, I. (2001) Trip to Ghana to test the potential of Beauveria bassiana isolates for the management of cocoa mirid (Sahlbergella singularis), Ghana, November 2001. Report No. 5. CAB International – Africa Regional Centre, Kenya. 2 pp.

HALL, D.R. (2001). Visit to Benin and Ghana 11/11/2001 to 24/11/2001

HALL, D.R. (2001) West Africa Regional Cocoa IPM Workshop, November 13 – 15, 2001, Cotonou, Benin

6. Other Dissemination of Results:

Presentation given by D R Hall on behalf of NRIL to "West African Regional Cocoa IPM" Workshop, November 13 – 15, 2001, Cotonou, Benin: "Cocoa Research funded by DFID CPP".

7. Listing and reference to key datasets generated:

None

8. Follow-up indicated/planned:

As indicated above, this project has provided new biorational technologies that can now be evaluated for control of cocoa mirids in West Africa. In discussion with the Manager of the CPP and Programme Advisor, it has been proposed to hold a workshop in Ghana to disseminate the outputs of this project and a parallel CPP project on control of *Phytophthora megakarya* (R7326). Participants will be invited from all cocoa-producing countries and organisations in West Africa, and this will also provide the opportunity to consider how best to take the two projects forward in a single cocoa IPM project aimed at the two main pest and disease constraints to cocoa production in West Africa.

9. Name of author of this report: David Hall (NRI) & George Oduor (CABI)
Date: 12 March 2002