

FINAL REPORT CDF on Sustainable Pest Management for Coffee Small-holders in Laos and Vietnam



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1. OBJECTIVES

- To evaluate the problems posed by coffee berry borer (CBB) in Lao PDR and Vietnam
- To evaluate the current management programs being adopted including the constraints faced in their implementation
- To formulate guidelines for the development of location-specific IPM programs for CBB in Lao PDR and Vietnam for sustainable production of coffee and market access security
- To engage with key agencies in the target countries, including potential donors, to further develop follow-up project activities concerning CBB

2. PARTNERS

- Research Institute of Agriculture Environment (IAE), Vietnam Academy of Agricultural Sciences, Vietnam
- The Western Highlands Agro-forestry Science & Technical Institute (WASI)
- Plant Protection Centre (PPC), Department of Agriculture, Lao PDR
- Provincial Agriculture and Forestry Office (PAFO), Champasack Province, Lao PDR

3. TRIP TO VIETNAM

3.1. Program from 9-15 November 2008

- Met with Dr. Tran Dinh Pha from IAE in Hanoi airport and travel together to Central Highland (Boun Me Thout city) located at Dak Lak province.
- Discussions with WASI staffs on CBB
 - a. Dr. Hoang Thanh Tiem, Director
 - b. Dr. Truong Hong, Deputy Director
 - c. Dr. Tran Kim Loang, Head of Plant Protection Department
- Visited coffee plantation in Central Highland.
- Return to Hanoi and travel to Son La province on the next day.
- Met with Son La provincial DoA staffs and visited coffee plantation
- Return to Hanoi city and had discussions with Dr. Nguyen Hong Son (Director of Institute of Agricultural Environment-VAAS)
- Travel to Viantiane, Laos

3.2. General Information

In Vietnam coffee was firstly introduced by the French in 1980s, and this remained relatively unimportant until the 1980s. In the decade between 1990-2000, Vietnamese farmers planted more than one million Ha of Robusta coffee, enabling Vietnam to surpass Columbia as the world's second largest coffee producer, with about 80% of them are small-holders (with < 2 Ha land). In the 1990s the coffee production increased at an annual average rate of 30% and by the end of 2000 coffee was providing as much as 10% of Vietnam's annual export earnings. A number of factors help to explain the rapid growth of the coffee industry/sector in Vietnam, e.g. Government's policy of privatization and economic liberalization

(known as *Doi-Moi*), state sponsored migration into the Central Highlands, and the increased of coffee price generated by low production of coffee in Brazil. During the mid-1990s the economic benefits of Vietnam's "coffee boom" has spread rapidly and were far reaching. By mid-2000 more than one million Vietnamese were participating directly or indirectly in the country's coffee economy.

The collapse of coffee prices in three consecutive years beginning in late of 1999, has reversed the fortunes of Vietnamese smallholders. The production prices were insufficient for most farmers to cover their cost of production. One of the most acutely affected areas has been the largest coffee-producing area in Vietnam, i.e. Dak Lak province. Although coffee prices recovered modestly in the 2000-2003 production year, many smallholders in Dak Lak and elsewhere continue to struggle with low prices.



Table 1. Vietnam's coffee production over 10 market years

Source: FAS estimate

Vietnam's coffee production forecast for 2007/2008 is set at 1.05 million metric tons or 17.5 million 60 kg bags due to unfavourable weather conditions in the main coffee growing areas and anticipated lower yields than the previous crop year (See Table 1). This represent a decline in production of 17.6% from last year, though still 28% more than 13.7 million bags of the 2005/2006 year. Despite government efforts encouraging farmers to switch from coffee to other crops in marginal growing areas, coffee farmers continue to expand their production area in response to high coffee prices. The demand for Robusta and Arabica coffee seedlings remains strong, though Arabica coffee (mostly in Son La province) still accounts for only 2.3% of the total coffee production. Government and the industry are currently engaged in the efforts to improve Vietnam's coffee quality with the objective of increasing their global market share. Coffee growers and trading companies are given instruction to harvest only ripe beans (95%) in order to improve export quality. Currently the farmer practice is to mix the immature and mature beans by using total harvest method. To

increase local consumption is also being promoted. The domestic consumption for 2007/2008 is estimated to be 870 thousand bags or 52.2 thousand metric tons green been equivalent. Per capita consumption is still very low, i.e. 0.6 kg/year and local consumption is only accounted for about 5% of the total production.

	2006/2007	2007/2008		2008/2009	
Marketing year begins	10/2006	10/2007		10/2008	
		Old	Revised	Forecast	
Sown Area (thousand ha)	515	517	517	520	
Area Harvested (thousand ha)	495	495	490	495	
Beginning Stock (thousand tons)	17.1	50.8	50.8	28.6	
Production (green bean, thousand tons)	1275	1084	1050	1290	
Average coffee yield (ton/ha)	2.58	2.19	2.14	2.61	

Source: Trade, FAS estimate

Table 3. Top ten markets for green coffee from Vietnam (2006-2007)

Rank	Countries	2006		2007		% Change 2006 - 2007		Share of Exports (%)	
		Volume (MT)	Value (\$1,000)	Volume (MT)	Value (\$1,000)	Volume (%)	Value (%)	2006	2007
	Green coffee	980,878	1,217,167	1,229,233	1,911,463	25.3	57	100	100
1	Germany	150,660	192,674	177,015	278,180	17.5	44.4	15.4	14.4
2	United States	130,889	166,428	134,966	212,666	3.1	27.7	13.3	11.0
3	Spain	75,440	90,085	95,662	150,832	26.8	67.4	7.7	7.8
4	Italy	53,409	66,567	90,922	143,788	70.2	116	5.4	7.4
5	Switzerland	42,632	55,399	80,321	115,769	88.4	109	4.3	6.5
6	Japan	35,234	44,923	46,606	76,422	32.3	70	3.6	3.8
7	Belgium	22,072	28,176	45,523	72,317	6.2	56.7	2.3	3.7
8	Indonesia	4,377	5,854	41,390	60,692	845.6	936.7	0.4	3.4
9	Netherlands	27,058	32,451	32,440	51,303	19.9	58.1	2.8	2.6
10	United Kingdom	41,725	51,554	32,130	47,758	-23	-7.4	4.3	2.6

Sources: MARD, General Customs Office

The Ministry of Agriculture and Rural Development (MARD) has issued a directive to local governments (provinces) calling for a halt on expansion of coffee growing areas until 2010. MARD aims to improve quality and yields of Vietnam's coffee to enhance its competitiveness in the global market. The average coffee yield per Ha for 2007/2008 crop is 2.14 ton (Table 2). The total plantation areas for coffee production would be kept at 500,000 Ha. Farmers are being encouraged to replace old coffee trees or replant old areas to other economic crops, e.g. cocoa or cashew in the areas not suitable for production.

Vietnam currently exports coffee to about 74 countries with Germany and USA as the two largest buyers of green coffee exports (Table 3).

3.3. Coffee industry and processing in Central Highlands

Additional information collected from briefing and discussions with officers from WASI and directly from farmers:

- There are approximately 473,000 ha of Robusta and 27,000 ha of Arabica coffee plantation.
- More than 80% plantation belongs to small farmer (with area less than 1ha).
- Mainly planted with Robusta (5% Arabica).
- Planting density: 1100 trees per ha for Robusta and 5000 trees per ha for Arabica.
- 4 kg of Robusta fresh berries were needed to produce 1 kg of dried/green bean and in Arabica, 6-7 kg of fresh berries were needed to produce 1 kg of dried/green bean.
- Pruning of coffee was done 2 times a year.
- 12-13 % of water content in the bean is the optimum drying. Fungi and CBB can't survive in this level of moisture content.
- Freshly harvested berries need to be dried under the sun for 10-15 days to achieve the optimum moisture level (12-13%) and 30 days during raining season.
- Rate of chemical fertilizer application: 3 tonnes/ha with 3 times a year.
- For production of 3 tonnes of coffee bean, 800-900 labour is needed for 1 ha.
- WASI consist of 5 major departments: Industrial Crops, Plant Protection, Agro-food System, Forest & Fruit trees, and Livestock & Pasture.
- National research and development related to coffee industry is under the preview of WASI.
- The main objective related to coffee is to increase the quality and quantity of the coffee production and at the same time to protect the environment.
- There was no IPM training for farmer has been organised. However, activities related to the introduction of new clones and new agronomic techniques were regularly organized by WASI, at least once a year.
- WASI has published a manual on coffee planting and management to be used by farmers and extension workers (in Vietnamese).
- Services like soil analysis and disease diagnostic were provided farmers.

3.4. Pests and Diseases of Coffee in Central Highlands

Insect Pests

Mealy bugs

- There are 2 different species of Planococcous in coffee areas. One is feeding on the berry while another on root system.
- Control by chemical insecticides.
- Not as serious pests



Coffee Berry Borer (CBB)

- They attack on both Arabica and Robusta coffee.
- It was the main problem in 1980's, and damage can reached up to 40%.
- Due to the better market price of coffee, most farmers practiced a good sanitation of their plants, i.e. to harvest all berries (including the dropped berries) from the fields. This eventually interrupted the lifecycle of the CBB.
- Sanitation could reduce the damage by about 50% (from 10% to 5% damaged in beans)
- The use of chemical insecticides to control CBB is very minimal.
- Farmers used of locally produced biocontrol agent (Beauvaria sp.).
- In some cases CBB also attacked beans in the storage. Major problem in post-harvest warehouse (about 13% infection).
- Serious problems and need to control.
- Potential species for collaboration with CABI.



Adult CBB



Berries infected by CBB

Coffee Branch Borer (Xyleborus spp.)

- Infected young trees with 1-3 years old.
- Not a serious problem in the field



Coffee Stem Borer (Zeuzera coffea)

- Not serious problem
- Farmers managed to control it by plugging cotton bud soaked with insecticides into the bore holes.



Green Scale

• Not a major problem



Cicadas

• Although damaged by larvae occurred in some areas, this is not a major problem.

<u>Diseases</u>

Leaf rust (Hemileia vastatrix)

- Damaging up 70% of Robusta coffee in Vietnam
- New variety of dwarf Arabica (Catimor) is resistant to this disease.
- Difficult to control
- Potential species for collaboration with CABI



Nematodes

- Mainly caused by two species i.e., *Platylenchus* spp. and *Meloidogyne* spp.
- As a major problem in this area but very little research has been done.
- It caused losses to more than 1000 Ha of coffee plantation.

• Management by cultural methods. Farmer will remove infected trees and will replant with leguminous crop for 2-3 years. Root debris must be thoroughly clean from the soil.

Potential subjects for collaboration

- Biological control and IPM of coffee berry borer as the top priority.
- Management of leaf rust and nematodes in coffee plantation.

3.5. Coffee industry and processing in Son La Province

- There are about 4000 ha coffee plantation in Son La Province.
- More than 80% of the plantation belongs to small farmer (0.5-1 ha)
- Mainly Arabica variety Catimor being planted. Coffee variety is provided by Vinacafe.
- Although the average production (mt/ha per season) is lower if compared to coffee from the Central Highlands, coffee quality from Son La is better as the farmer only harvest the ripe berries.
- They have found new markets in Europe (France & Germany) in year 2006 and currently the acreage of coffee plantation is expanding. Majority of the coffee bean produced is for export due to higher price.
- The provincial government is planning to increase the acreage to 10,000 ha in 2015.
- Farmer is allowed to expand their land or convert their existing land (with other crops) to plant coffee.
- The average production is 12 tonnes of fresh berries per ha.
- 80% of the total production is for export and 20% is consumed locally.
- During harvesting, small farmer will help each other by exchanging labours. Only big farm will employ labour during harvesting which will cost 50-70,000 VND/day.
- The current price of fresh berry is about 8000 VND per kilogram.
- There is a private "Coffee & Fruit Company" which will buy dried coffee bean from farmers and exported these to Europe. Some of the farmers have been contracted to produce and sell the dried bean to the company.
- There are a few cycles of harvesting in each season. The difference between each cycle is 10 days and every harvesting season last for 3 months.
- Main production cost is on the labour for harvesting and weeding. Less than 1% of the total cost is used for pesticide.
- Water availability is the major constraint in coffee production.
- No irrigation system has been established in Son La due to the financial constraint.
- To date, no farmer training on IPM has been conducted as WASI lacks of financial support. However, officers from PPD would be sent to field if there is pest outbreak.
- Lack of technologies and information to manage the pests and diseases.
- Alternative methods on pest management are being sought instead of using chemicals.

3.6. Pests and Diseases of Coffee in Son La Province

Insect pests

Coffee Berry Borer (CBB)

- Main concerned and top priority for management.
- The infestation is about 15-20% and is increasing.
- No effective method to control this pest.
- Some farmer cannot recognize the sign of CBB attack on berries.

Stem borer

• Only managed by chemical control using Padan. However, this method is laborious as the insecticide need to be mixed with dust and brush on the tree stems.

Green Scale and Mealybug

• Only chemical control being applied but the effectiveness is low and the chemical is harmful to human.

Cicadas

- Usually infect on 1-year-old plant.
- Can reach up to 30 larvae on one plant and eventually will kill the plant.

Diseases

Coffee Berry Disease (CBD)/Helminthosporium disease

- As the main concern disease in the areas.
- Infected berries and caused the berries to dry up
- Incidence is about 10-12% and 50% in some areas.
- Farmer will increase fertilizer application in order to increase the plant vitality against the disease.



Leaf rust (Hemileia vastatrix)

• Not much has been reported as the Catimor variety is resistant to this disease.

Leaf spot

- Only a few leaves in the field that were infested by the disease
- Not an important disease in Son La.



Pink Disease (Corticium salmonicolor)

- A few trees were observed with the disease symptoms.
- Not as an important disease.

Potential subjects for collaboration

- IPM on Coffee pest and diseases and more specifically on CBB. The lesson learnt from IPM on rice should be used in the coffee IPM.
- Sub PPD will assist in the training implementation (IPM coffee).
- Language is the main constraint among farmers. Therefore, it was suggested that training materials should be prepared in the forms of pictures, presentations, movies or even VCD/DVD.
- In addition Dr. Hoang, Director of WASI has specifically requested CABI to assist his institute in managing "pod-rot" and *Helopelthis* on cocoa.

4. TRIP TO LAOS

4.1. Program from 15-22 November 2008

- Met by Mr. K. Thadavong, Director of PPC at the Vientiane Airport
- Together with Mr. T. Vongsabouth, Deputy Director PPC, travel to Pakse, Champasack Province
- To meet Mr. K. Inthalath, Deputy Head of Agriculture, PAFO (Provincial Agric. & Forest. Office)
- To meet Mr. S. Siriphokha, Deputy Director, PAFO
- To meet Mr. B. Chounthavong, National Director PCADR-PAB

- To meet Mr. B. Sallee, Technical Advisor/Coffee Expert of PCADR- PAB
- To meet Mr. Bouaron Saimunthy, Deputy Director, DAFO, Paksong
- To meet Mr. K. Phaengkhaophone, NAFRI Coffee Experimental Station, Paksong

4.2. General Information

Coffee in Laos is cultivated almost exclusively in the Bolaven Plateau, located in the southern part of the country. This Plateau is of volcanic origin and covers approximately 1.000 km2 at a height of between 300 and 1.500 meters above the sea level. Coffee is grown by about 20.000 families who live in 250 villages. Each family cultivate between 0.5 to 3 Ha of coffee plants therefore, making it an important source of income for many people in the area. The first coffee plants were introduced into Laos between 1913 and 1916 but the experiment failed very quickly. In 1917, coffee plants (Arabica and Robusta) selected from Saigon's botanical garden, were planted by the French at Thateng, a small village situated in the northern part of the Bolaven Plateau. These plants adapted well to the climate of the south Laotian province but, mainly due to lack of care, most of them did not survive.

Coffee production did not really develop until 1930 when an annual production of 5.000 tons of Arabica coffee was harvested. Twenty years later, in 1950, most of the coffee plants were destroyed by a combination of orange rust disease (*Hemilia vastatrix*) and severe frost. Production fell to less than 1.500 tons and farmers gradually replaced the Arabica plants with Robusta, by nature a more resistant variety to disease and low temperature. In 1970, Laos had produced about 7.000 tons of coffee but production dropped sharply again during the war to 3.000 tons a year.

During the early 1980's, farmers' interest in coffee production had renewed and nowadays about 15.000 tons of coffee is produced in Laos, 95% of which is Robusta. In 1993, a new variety of Arabica, i.e. Catimor, resistant to the rust, was introduced on the Bolaven Plateau and more specifically into Champasak's province. The experiment was very successful.

The production of Lao coffee is projected to decline in 2007/2008 due to irregular rainfall, but exporters will focus on creating value added products and seek out foreign niche markets for roasted Lao coffee. In 2006/2007 crop, 18,500 tonnes of coffee beans were grown, the highest yield ever in the history of the industry in Laos, with an export value of US\$30 million. Coffee production would decline to about 16,000 tonnes in 2007/2008 due to inconsistent rainfall when the trees were in bloom and the resultant small beans (Table 4).

Table 4. Coffee production (Arabica and Robusta) in Boloven Plateau, Laos in 2007

boloven i lateau contee productive situation in 2007						
R alta unda	Estimated		Estimated	Young	N	
Kobusta	production	Arabica area	production	unproductive	Inurseries	Potential new
area	(MT of green	(ha)	(MT of green	arabica surfaces	(number of	arabica area (ha)
(na)	(na) coffee)		coffee)	(ha)	plants)	
39,000	15,500	6,000	3,000	6,000	15′000,000	3,300

Boloven Plateau coffee productive situation in 2007

From Report on "Lao Supply Chain Analysis" by GTC, 2007

The cost of Robusta was US\$1,875 per tonne on December 2007, rising to US\$2,544 in February 2008 and falling to US\$2,229 in April. Laos exports almost all of its coffee. In 2006/2007, only 500 of the 20,000 tonnes produced were sold in the country. Producers in Laos mostly export unprocessed coffee beans, which earn less than roasted and instant coffee. For instance, raw coffee sells for only US\$2 per kilogram, but roasted coffee sells for US\$10.

Table 5. Coffee planted areas in Boloven Plateau, Laos from 1990-2007

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Year	Total surface (ha)	Robusta %	Arabica %			
1990	17,066	> 99 %	Residual Typica			
1999	25,000	98,5 %	1,5 %			
2007	45,000	87 %	13 %			

Evolution of coffee surfaces and species share in the Boloven Plateau

From Yearly Statistics of the Ministry of Agriculture, Lao PDR



Figure 1. Coffee acreage and production in Laos from 1976 to 2006

Since 2004, Laos has exported roasted coffee to a number of countries, including America, Japan, Thailand and Vietnam, but does not receive regular orders from these buyers. This is attributed to the fact that Lao coffee companies are small-scale operators and have not built up a global network. They have a small marketing budget and brand recognition remains low. But Lao coffee is building a reputation in many countries for its good quality. The association does not aim to compete with producers in terms of quantity, but will focus on quality, as there are already several Asian nations producing large amounts of coffee.

4.3. Coffee industry and processing in Bolaven Plateau

- Total area: About 40,000 Ha (8,000 Ha non-productive)
- Planted varieties/cultivars: Robusta, Arabica typica and Catimor (dwarf Arabica)
- Varieties preferences:
 - a. 500 800 m a.s.l mainly Robusta coffee
 - b. 800 1200 m a.s.l mainly Arabica
- Planting densities:
 - a. 3,000 plants/ha for Robusta
 - b. 5,000 plants/ha for Catimor
- Flowering times:
 - Arabica January to February
 - Robusta March to April
- Harvesting times:
 - Arabica 15 October to 15 December
 - Robusta January to February
- Ownership:
 - a. >90% belongs to small farmers (< 2-3 Ha)
 - b. 2,000 Ha owned by about 20 companies
- About 20,000 Ha with about 36,000 farmers involved under PCADR-PAB project:
 - a. 53 farmer's groups (each with 20-90 members),
 - b. 38 miller/collection centres have been established



Figure 2: The important of coffee in the household's annual income

From Report on "Lao Supply Chain Analysis" by GTC, 2007

There are three cropping systems in Bolaven Plateau:

- Robusta Most widespread, low intensive with no chemical inputs, very low labour and capital inputs, adapted to cattle grazing
- Arabica typica almost abandoned except for farmer groups that exports Arabica typica niche markets
- Arabica dwarf variety (Catimor) well adopted by farmers and increasing in acreage, labour intensive and high input of fertilizer. Most plantations are still young

Main problems in the coffee industry:

- Socio-economy and culture of the farmers
 - a. No coffee farmers' association/group
 - b. Low incomes and education
 - c. Traditional culture is very strong
 - d. Limited labours
- Soil fertility of the plateau return of the NPK is not sufficient
- Pest and Diseases problems
- High cost for weeding:
 - a. 5-8 times (for young coffee >10 times)
 - b. 20 man-days per weeding
 - c. 30,000 Kip/day/person
 - d. Minimum of 3 million Kip per year
- Harvesting berries
 - a. 400-500 Kip/kg
 - b. One person can harvest 50-90 kg/day
 - c. Dao plantation: 350 Kip/kg
 - d. Dao needed 100,000 man-days to harvest berries from 248 Ha for 2 months

4.4. Pests and Diseases of Coffee in Bolaven Plateau

Insect Pests

Coffee Berry Borer (CBB)

- Very serious problem in Lao
- Firstly recognized in 2004 most likely from Vietnam
- Causing significant damage, as high as 20-50% yield loss
- Effective control methods:
 - a. Orchard sanitation (keeping the area clean, removing dropped cherries, removing carry-over fruit from coffee bushes are suggested) is very successful in reducing losses.
 - b. Trapping during the fruiting season by using BROCAP®

BROCAP[®] Demonstration in Farmers' fields

- 2000 traps was imported from Mexico at a price of US\$ 2/trap (US\$ 5 with transportation cost)
- Traps have been used in two seasons (2006-7) in 116 plots in 53 villages
- 25 traps was used per Ha for 120 days after flowering
- Number of infected berries in 30 plants was observed in trap and non-trap areas
- Results:
 - a. 13% of berries infected by CBB in control plots
 - b. 7.5% of berries infested by CBB in plots with traps
- 42% reduction in losses
- Farmers impressed with the result and willing to use widely in their fields
- US\$ 2/trap is the maximum price farmers' can purchase
- Local production of the traps in Laos should be explored



- Traps should be used in:
 - a. January to June for Arabica
 - b. March to August in Robusta
- Proper training on the use of the traps should be done
- Farmer dependent on the traps should be avoided

Green scale

- A common problem in Lao
- Scales suck the plant sap resulting in reduced growth and crop yield. Sooty mould (a black, loose, sooty-like cover) often develops on leaves. It grows on the sweet exudates from the scales (honeydew) that also attracts ants.
- There are a number of natural predators of coffee scale such as wasps, ladybugs and Verticillium fungus. In many instances, these will reduce the level of scale infestation.

Stem borers

Red stemborer (Zeuzera coffeae).

- Not a serious pest
- The adult has white and black spotted wings
- The red coloured larvae tunnel through the coffee branches, normally in the upper part of the coffee trees.
- Branches and the top part of the main stem easily break off, but the tree usually survives.

White stemborer (Xylotrechus quadripes).

- Not a serious pest but can kill plants
- The adult is a black and white banded beetle
- Damage is caused by the white larvae, which hatch from eggs deposited in cracks and crevices and under loose scaly bark of the main stem and thick primary branches, especially on plants exposed to sunlight.
- Adults are active during daylight. Young larvae feed on the corky tissue just under the bark, which splits making the stem appear ridged.

Mealybugs

- Not a serious pest
- Small sucking insects (about 3 mm long) covered with a white mealy wax that feed on young shoots and young roots.
- There are several species similar in appearance to the naked eye.
- They are generally more of a problem in the dry season when water is lacking.

Aphids

- Not a serious pest
- Can occur in large numbers on new shoots in the rainy season.
- Aphids suck sap from young shoots and cause damage to these developing shoots.
- Large numbers of small black aphids (2 to 3 mm long) concentrated on new growth. Often associated with black sooty mould.

Diseases

Cercospora leaf spot (brown eye spot)

- Not serious problem in Lao
- Fungus that occurs on leaves when plants are under stress.
- The fungus can develop both in seedbeds and after plants have been transplanted into bags.
- It is the most common nursery disease and a sign of poor management.

Cercospora (berry blotch & brown eye spot)

- Not serious problem in Lao
- This occurs on the leaf but can also occur on berries where it is known as berry blotch.

5. SUMMARY OF THE PROBLEMS IN VIETNAM & LAOS AND RECOMMENDATIONS

5.1. Coffee berry borer-CBB (Hypothenemus hampei)

- Is a very serious problem in Vietnam and Laos
- Firstly recognized in Laos in 2004 most likely from Vietnam
- Causing significant damage, as high as 20-50% yield loss
- No insecticides effective to control the pest
- Best methods of control:
 - a. Through proper sanitation
 - b. Through trapping by using BROCAP[®]

Suggestion for future collaboration:

- Large scale implementation of IPM on CBB should be done in Vietnam and Lao PDR
- The use of biological control agents of CBB in both countries should be explored
- Available farmers' group established by previous project(s) should be utilized maximally in implementing the IPM program
- External funding sources should be jointly explored between CABI and DOA (for Lao PDR) and for Vietnam between CABI, WASI and IAE-VAAS

5.2. Leaf rust (Hemileia vastatrix)

- Is a serious problem in Robusta coffee in Dak Lak, Vietnam but not on Arabica coffee
- Causing significant damage

Suggestion for future collaboration:

- Integrated disease management of leaf rust should be done in Robusta coffee areas in Vietnam
- External funding sources should be jointly explored between CABI, WASI and IAE-VAAS

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