

STUDY ON COFFEE DISEASES IN KAVREPALANCHOK AND SYANGJA DISTRICTS

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ABSTRACT

*This study is concerned about the survey and identification of major diseases of coffee and their infestation level in Syangja and KAVREPALANCHOK districts of Nepal. The study was carried out during September 2003 to August 2004. Key informant survey (KIS) and focus group discussion (FGD) along with field observations were carried out for this purpose. Twenty-three coffee orchard in Syangja and 20 orchards in Kavrepalanchok were observed thrice in different locations of each district covering low to high altitudes, small to big farmers, various geographical settings as well as all vulnerable stages of coffee plants from disease infestation point of view. Disease assessment on coffee plants were done in each selected orchards and disease samples were taken for identification. Based on the symptoms and isolated pathogens in the laboratory, the major diseases identified and confirmed were anthracnose (*Collectotricum gloeosporioides* Penz.), brown eye spot (*Cercospora coffeicola*), damping off (*Rhizoctonia solani*) and wilt (*Fusarium* spp). Minor diseases like sooty mould and algal spots were also identified. Anthracnose was the most serious problem that affected leaves, twigs and berries of coffee plants. The fungus manifested three different disease conditions of coffee i.e. twig die back, stalk rot of berries and leaves and brown blight of leaves. All three conditions were found in many orchards. Brown eye spot was observed in many nurseries, particularly in poorly managed ones and in many young orchards. *C. coffeicola* also caused berry blotch, which was observed in many orchards.*

INTRODUCTION

Coffee is a potential and an emerging commercial crop in the hilly districts of western and central region of Nepal. At present, available statistics indicate that coffee is being cultivated commercially in 21 districts of Nepal. The crop is grown at an altitude from 150 to 1500 masl (meters above sea level) where the rainfall is moderate (between 1500 to 2200 mm). There are three species of coffee grown commercially in the world, *Arabica*, *Robusta* and *Liberica*. Only *Arabica* species is being cultivated in the hilly region of Nepal.

Coffee plant is attacked by many diseases and pests. Some of the diseases are leaf rust (*Hemileia vastatrix*), brown eye spot (*Cercospora coffeicola*), damping off (*Rhizoctonia solani*), leaf spot/dieback/blight (*Colletotrichum gloeosporioides*) and root-knot (*Meloidogyna* spp.). The leaf rust is a classical example of epidemic of plant diseases, which wiped out coffee cultivation from Srilanka and converted it from coffee growing state to tea growing state. In Hawaii, the newly identified local nematode became a big nuisance to the introduced coffee in Hawaii, which reduced its yield and quality.

Identification of major diseases and their prevention and/or control measures could be helpful to improve the quality as well as productivity of coffee. Since majority of the coffee

consumers in the domestic market are tourists, expatriate residents and elite people who go for quality. Improving its quality will not only create access to the international market, but also will increase the demand in the domestic market. With the creation/expansion of domestic as well as international market, the livelihood of the producers in the mid-hills will be improved, ultimately addressing the problem of poverty reduction.

There is a great scope of developing coffee in Nepal, which is importing it worth of Rs. 30 million each year. There are five coffee processing units/mills in Nepal. All of them are running far below their full capacity because of shortage of coffee beans. The annual production is about 187.5 mt (MOAC, 2002). There are about 500 coffee growers scattered all over 40 districts. Coffee is best grown in the districts of mid and western development regions of Nepal. The area under this crop is increasing year by year because of high demand of coffee in the local market. Last year, there was slump on the demand of coffee in the local market, probably because of slump in tourist arrival. The coffee dealers realized that they should not just depend on the local market. Rather, we should improve the quality of coffee and should target both local and international market. Nepal will have hard time to compete in the already gloated international coffee market with big coffee producers of Africa and other countries. The only way to compete in the international market is to take Nepalese coffee as a special high quality coffee. The competitive advantage to the coffee growers of Nepal is that it is grown in the hills, which has special good quality and flavor that lowland grown coffee does not have.

Coffee growers are facing many problems including diseases and pests. So far there is no recommended IPM technology developed for coffee. To increase coffee production and quality, it is necessary to manage diseases and pests. To develop an IPM technology, we need to know the problems first. The project initiates important preliminary research work on coffee disease, which identified the problems. This will open the avenue for further research work to develop IPM for coffee cultivation.

MATERIALS AND METHODS

Syangja and KAVREPALANCHOK district were selected for the study. Key informant survey and focus group discussions were conducted in major coffee growing areas of the districts. Questionnaire for key informant survey was developed in consultation with socio-economist and biometricians. A checklist was also prepared for focus group discussion. The questionnaires and checklist were finalized in consultation with Coffee Promotion Project (CoPP) Helvetas-Nepal before survey. Site selection for the survey was done in consultation with District Coffee Producer's Association (DCPA) and CoPP. Two key coffee informants from the DCPA Syangja namely Mr. Fani Narayan Aryal and Mr. Lekh Nath Sharma, Chairman and Programme Coordinator respectively were interviewed. Similarly, 2 key coffee informants from DCPA Kavrepalanchok namely Kedar P. Dhungana, Kavre, Panchkhal-8, Tinpile and Govind Timilsina, Kavre, Panchkhal-7, Naya Gaon were also interviewed. The key informant survey (KIS) was done to know the overall situation of coffee cultivation followed by a focus group discussion (FGD) comprised of experienced coffee growers of the districts for in-depth appraisal and cross checking. The KIS was performed using standard format containing list of questions regarding different aspects of coffee cultivation including insect pests and diseases problem in the area.

Three field visits were made in each location for field observation, to interact with the coffee farmers, assess loss and collection of disease samples. Incidence and loss incurred by the

observed diseases were recorded. Incidence of the diseases was determined. Stratified sampling was done based on altitude and farm size. Survey of 23 coffee orchards in Syangja and 20 orchards in KAVREPALANCHOK was done to assess disease situation. Assessment of diseases was done taking incidence and frequency of diseases found in selected orchards. Ten to fifteen of the total population was considered as a sample and the infestation level was recorded and calculated in order to determine the average level of infestation in terms of percentage. Disease samples were collected from each site and brought to laboratory of Plant Pathology Divisions, NARC for identification. The samples were preserved as dry and wet specimens as required for future reference. Soil and root samples were also taken to assess nematodes and root diseases from some orchards. Disease samples were processed in the laboratory. Isolation of the disease causing organisms was done using selective media for different organisms. Diagnosis was done on the basis of symptoms and organisms isolated from the disease samples. Soil samples were processed to extract nematodes. Identification of parasitic and non-parasitic nematodes was done. Root samples were processed to isolate and identify root diseases and beneficial microbes.

RESULT AND DISCUSSIONS

Syangja District

Background

Syangja district is situated at 366 to 2515 masl in western development region of Nepal. The district is comprised of 58 VDCs and 2 municipalities with a total population of 317320, total household number 64746 and average household size 4.9. Of the population, 50.3% are economically active (above 14 years and below 60 years), 9.2% come under aged category (above 60 years) and 40.5% under children category (below 14 years). The district comes under mid mountain topographical zone with a total area of 163687 ha which is comprised of 37718 ha cultivated agricultural land, 22300 ha uncultivated agricultural land, 10265 ha pasture, 31691 ha forest and 1713 ha land utilized for other purpose such as road and building construction etc (Anonymous, 2001b).

Coffee is comparatively new crop in the district though innovative farmers had planted coffee a decade ago. At present, coffee is being cultivated in between 700 masl to 1300 masl but major expansion of its cultivation is focused between 800 to 1000 masl altitude ranges. Coffee is planted in varied agro-ecological sub zones and aspects. We categorized broadly, 40% plantation falls in southwest, 40% in northeast, and 20% in north facing mid hills. Major coffee plantation area has sandy loam soil (40%), followed by clay (20%), coarse soil with small gravels (20%), sandy (7%) and mixed types of soils (13%). Average land holding of coffee growers of the districts ranges from 10-20 *Ropanis*, though very few of them had as much as 80 *Ropanis* and some of them have as low as 1 *Ropani* land. Majority of coffee growers in Syangja have planted 150- 400 plants and highest plantation was up to 4000 plants in a single orchard. Some of the farmers have planted only 5-10 plants in their kitchen garden just to test the adaptability of coffee in their own micro-climatic condition. Some farmers have planted few plants for ornamental purpose.

Coffee Diseases and their Yield Loss as Perceived by the Farmers

Perceptions of coffee growers regarding disease problems were recorded during KIS and FGD are presented in Table 1.

Table 1. Coffee disease problems as perceived by growers in Syangja district

Diseases	Incidence time	Crop stage	Symptoms
A. Foliar diseases			
Blight	Autumn Season	Old plants	Gradual death of cells at young leaf and shoot
Mould formation on leaves (White and black)	Autumn Season	Old plants	Mould mass on leaves
Leaf spot	Autumn Season	Young and old plants	Circular leaf spot, yellowing and defoliation of leaves
B. Stem diseases			
Cracking of bark	Autumn Season	Old plants	Cracking/papery bark type
Black stripes on bark	Autumn Season	Old and young plants	Black stripes on bark
Rotting of bark	Autumn Season	Old plants	Decaying of bark with bad smell.
Twig die back	Autumn Season	Old and young plants	Die-back
C. Disease of berry and flower			
Rotting of fruits	Winter season	Old plants	Dropping of fruits
Drying/wilting and pre-mature dropping of flowers	Summer season	Old plants	Wilting and flower dropping
D. Root diseases			
Root rot disease	Rainy season	Young plants	Rotting of roots, wilting, drying and decaying with bad smell.
E. Disease of nursery			
Leaf spot	Rainy season	Young plants	Grey eye spot on leaves
Damping off	Rainy season	Young plants	Die back starts, whole plant dries

Respondents estimated 30% yield reduction of coffee due to diseases and insect pests in which major (20%) loss was due to disease infection and insect pests caused low yield reduction (10%). Generally, farmers estimated coffee yield loss by observing visual damage caused by insect pests and diseases. Regarding infestation trends of insect pests and diseases, farmers reported that these problems were in increasing trend and they were trying to combat them by using plant based organic pesticides which were locally available. Among the numerous diseases and insect pests problem, die back, and blight diseases as well as stem borers and foliar insects were considered very serious and economically important.

Coffee Diseases and their Infestation Level as Observed During Field Observation

Three field visits were done during the study period. The first (2nd to 3rd week of October 2003) visit was done during early fruiting (green cherry formation) stage followed by second (2nd to 3rd week of December 2003) visit at fruit ripening stage and the third (2nd week of July 2004) visit was done at last flowering stage. Field observations were done critically in each visit and disease samples were taken for laboratory identification in first visit and for further conformation in second and third visits. Stalk rot of berries and leaves, brown leaves blight, brown eyespot, damping off of nursery plants and algal spots were the major diseases during the first visit. Stalk rot and brown eye spot were observed in many orchards and the latter was in many nurseries too. The incidence of brown eye spot was found in almost all orchards visited. Nurseries of Karendada were found highly infested with this disease. The incidence of brown leaf blight was observed severe in Barja and Chitikunna. Berry blotch was more severe in old orchards. There were no diseases in south facing aspect at high altitudes (Bakot), but brown leaf blight symptoms were seen in the north facing aspect in the same altitudes range. Algal spot was seen only in Bhagabati Shah's orchard in Latrepipal. Disease incidence was found decreasing during second and third visit. Stalk rot and berry blotch were observed severe in the second visit. Less disease was found in the third visit. Brown eye spot was observed in almost all places but the severity pattern was less.

Table 2. Detail of incidence and infestation level of diseases in the areas up to 1000 masl

Diseases	October 2003		December 2003		July 2004	
	Incidence	Infestation Level (%)	Incidence	Infestation Level (%)	Incidence	Infestation Level (%)
Berry blotch	-	-	√	10	-	-
Stalk rot of berries	√	10	√	30	-	-
Brown eye spot	√	50	√	20	√	5
Algal spot	√	1	√	1	-	-
Twig dieback	√	10	√	5	-	-
Damping off of nursery	√	5	-	-	-	-
Brown leaf spot	√	10	√	3	-	-

Table 3. Detail of incidence and infestation level of diseases in the areas above 1000 masl

Diseases	October 2003		December 2003		July 2004	
	Incidence	Infestation Level (%)	Incidence	Infestation Level (%)	Incidence	Infestation Level (%)
Berry blotch	-	-	-	-	-	-
Stalk rot of berries	√	<5	√	5	-	-
Brown eye spot					√	2
Algal spot	-	-	-	-	-	-
Twig dieback	√	5	√	2	-	-
Damping off of nursery	√	2	-	-	-	-
Brown leaf spot	√	15	√	5	-	-

Kavrepalanchok District

Background

Kabhrepalnchowk district is situated at 865 to 3018 masl in the central development region of Nepal. It is comprised of 83 VDCs and 3 municipalities with a total population of 385672. Total household number is 70509 and average household size is 5. Of the total population, 53% are economically active (below 60 and above 14). Thirty-nine percent are children (below 14 year) and 8% are aged (above 60 years). Topographically, the whole area of this district is categorized under mid mountain and Siwalik. Total area under mid mountain is 136460 ha and 4026 ha is under Siwalik range. Of the total land, 36442 ha is under cultivation, 25157 ha is uncultivated agricultural land, 3746 ha is pasture, 73801 ha is under forest and 1340 ha is utilized for other purpose (Anonymous, 2001b).

There are variations in the aspects of coffee orchards. Majority of the orchards faced towards east (35 %) and southeast (30%). Others faced towards northeast (20 %), north (10 %) and west (5 %). Regarding soil types sandy loam (50%) and clay (45%) are the major types of the soils prevalent in the district. Some of the lands also contain sandy and red type of soils. In Kabhrepalnchowk district, coffee farmers have minimum land holding of 2 *Ropani* and maximum of 16 *Ropani*. The average land holding of majority of coffee farmers ranges 5-8 *Ropanis*. Regarding the number of coffee plants planted in the orchard varied according to the farmers' purpose of cultivation. Some farmers who planted coffee to know the adaptability had 4-5 plants and farmers who grew commercially have maximum population of the plants up to 900. Average number of coffee planted by majority of the farmers ranged from 100 to 300 plants per orchard. Around 4-5 % of the total coffee farmers had their own nursery for producing saplings for themselves and to supply other farmers. The saplings were produced in poly bags containing forest soil.

Diseases of Coffee as Perceived by the Farmers

The losses in coffee plants incurred due to damage of diseases and insects were 15% and 5% respectively. Farmers used to assess losses by visual observations and based on the damaged plants due to diseases and insect pests infestation. Perceptions of coffee growers regarding diseases problem had been recorded during KIS and FGD are given in table 4.

Table 4. Coffee disease problems as perceived by growers in Kavrepalanchok district

Diseases	Time of attack	Stage of plant	Symptoms	Problem's Priority
Foliar Diseases				
Blight (Daduwa)	Aswin-Magh	Small plants	Many spots on the leaves, leaf fall and yellowing	2
Leaf spot	Aswin-Mag		Brown leaf spot on the surface of leaves	3
White fungus			White powder can be seen	1
Stem Diseases				
Black fungus	Chaitra-jestha	Old Plants	Blackening of stem	
Root Diseases				
No problem				
Diseases of Nursery				
Leaf blight	Srawan-Bhadra	Nursery	Spots on leaves, leaves dried from margin	
Leaf spot	All season	Nursery	Brown leaf spots on the surface of leaves	

Coffee Diseases Observed during Field Observation

Three visits were made during the study period. During the first (October last week to November 1st week 2003) and Second (1st to 2nd week of December 2003) visits, Coffee crop was in early fruiting (green cherry formation) stage and fruit ripening stage. Third visit was made in the last week of June 2004, when coffee crop was at pre-flowering stage. As in Syanja district, field observations were done critically in each visit and disease samples were taken for laboratory identification in the first visit and for further conformation in the second and third visits. Stalk rot of berries was observed severe in the orchards of Gobinda Timsina and Kedar Dungana at 38 Kilo and Tinpile areas. The incidence was recorded more than 90 %. Almost 80 % of the berries were rotten in Yellow Caturra variety. Erect type plants were found more susceptible to fruit rotting than drooping type plants. Sudden wilt caused by *Fusarium* spp. was also found in Tinpile (Dhan Bdr. Shrestha) and Jaisithok (Ramesh Adikari). This disease was not severe in Tinpile whereas its infestation was found around 10 % in Jaisithok. The incidence of this disease was found less in the third visit as compared to second visit. Brown eye spot was found almost in all places. Diseases incidence was less observed with increased temperature and was found affected by the season. Winter season was observed more favourable than other season for disease development.

Table 5. Incidence and infestation level of diseases in the areas up to 1000 masl

Diseases	October 2003		December 2003		June 2004	
	Incidence	Infestation Level (%)	Incidence	Infestation Level (%)	Incidence	Infestation Level (%)
Berry blotch	-	-	√			
Stalk rot of berries	√	90	√	20	-	-
Brown eye spot	√	50	√		√	5
Algal spot	√	2	√	1	-	-
Twig dieback	√	5	√	2	-	-
Damping off of nursery	√	2	-	-	-	-

Table 6: Incidence and infestation level of diseases in the areas above 1000 masl

Diseases	October 2003		December 2003		June 2004	
	Incidence	Infestation Level (%)	Incidence	Infestation Level (%)	Incidence	Infestation Level (%)
Berry blotch	-	-	√	5	-	-
Stalk rot of berries	√	10	√	15	-	-
Brown eye spot	√	20	√	15	√	2
Root Rot	√	1	-	-	-	-
Twig dieback	√	5	√	3	-	-
Brown blight	√	5	√	2	-	-

CONCLUSION

Based on the field observations, symptoms and isolated pathogens in the laboratory, the important diseases of coffee identified and conformed in both districts were anthracnose (*Collectotrichum gloeosporioides* Penz.), brown eye spot (*Cercospora coffeicola*), damping off (*Rhizoctonia solani*), and wilt (*Fusarium* spp.). Minor diseases like sooty mould and algal spots were also identified. Anthracnose was the most serious problem that affected leaves, twigs and berries of coffee. The fungus manifested three different disease conditions in coffee i.e. twig die back, stalk rot of berries and leaves and brown blight of leaves. All the three conditions were found in many orchards visited. Brown eye spot was observed in many nurseries, particularly in poorly managed ones and in many young orchards. The same pathogen (*C. coffeicola*) also caused berry blotch, which was observed in many orchards.

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