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Review

A Systematic Review of Major Entomological Work on Tea, Coffee and Cardamom Crops in Nepal

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ABSTRACT

Tea, Large cardamom and coffee are the major commercial crops of Nepal having large export potential. These crops are regarded as most important commercial crops of Nepal as these can improve the livelihood of farmers thus the overall economy of the country. This review revealed that major insects pests of tea in Nepal are stem borers, tea mosquito and mites. Likewise, white stem borer, mealy bugs and scale are major damaging insects of coffee; similarly aphid, thrips, hairy caterpillar and stem borer are serious on large cardamom. Reviewing the literature, the most problem is seen to identify the insects by farmers and available literature regarding the management aspects of these insects are less in Nepal. Hence it is recommended that future researches should focus on the identification and management aspects of these insects to solve and avoid loss from these commercial crops.

Keywords: Tea; Coffee; Cardamo; Export; Pest; Pest management

INTRODUCTION

Tea (*Cammelia sinensis*), coffee (*Coffea arabica*) and large cardamom (*Amomum subulatum*) are key high value commercial crops of Nepal having huge export potential. These crops are important component of Nepalese farming system and have potential to improve livelihood of the farmers. Among these crops, tea is highly profitable and one of the major exported commodity in Nepal. The contribution of tea to agriculture domestic product (AGDP) and agricultural export is 0.17% and 6.48% respectively [1]. The total area covered by tea garden in Nepal is 28732 ha with production of 25206 Mt having productivity 877 kg/ha [2]. The average productivity of tea in Nepal is too low due to various factors. Plant protection factor plays an important role in having low productivity.

Coffee is another high value commercial crop having huge export potential. The total area of coffee production in Nepal is 2761 ha with production of 530 Mt having productivity 192 kg/ha [2]. Coffee has contributed 0.01% and 0.65% to AGDP and agricultural export respectively. Similarly, large cardamom contributes 0.70% and 7.03% to AGDP and agricultural export respectively [1]. It is the major cash crops of eastern hilly regions of Nepal grown as perennial cash crops under agroforestry system. The area of production of large cardamom in Nepal is 15,055 ha and production is 7954 Mt having productivity 528 kg/ha [2].

As the productivity of these crops is low as compared to area of production, insect pest damage should be minimized to increase the productivity. This paper has reviewed on major entomological work done in tea, large cardamom and coffee. Mainly, research activities on these crops are carried out by commodity specific programs. So aim of this paper is to review and collect the research activity done in above these crops and set future strategies which would be the guidelines for the further research and development of these crops.

LITERATURE REVIEW

This review was done by referring many research articles, proceedings, annual reports, agriculture related websites and diaries.

RESULTS AND DISCUSSION

Major entomological research works on tea (*Cammelia sinensis*)

Entomology Division of Nepal Agriculture Research Council conducted key informant survey and focus group discussion in

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three important tea cultivating district of Nepal *viz*. Ilam, Jhapa and Terathum to findout its status [3].This survey mentioned the farmers' ideas regarding the attack of insect pest which are becoming threat to tea gardening. The major insect pests causing more economic damage in these three districts were identified as thrips, white grubs, stem borer, cutworm, and leaf roller, leaf eating caterpilllar, aphids, bugs, red ant, semi-looper and tea mosquito. White grubs and stem borer damage was more severe than other insect pest. The yield loss reported as assessed by respondents was 10%-15%. For controlling these pests, farmer used some non-chemical methods such as use of ash and hand picking. Likewise, overuse and misuse of many pesticides such as thiodan, cypermethrin, choloropyrifos, ethion, metacid, phorate etc.

A survey conducted by Ministry of Agriculture and Livestock development [4]. As mentioned by Bajracharya et.al [5]. At three different villages of Jhapa (Anarmani, Gaurigunj and Garmani), Ilam (Panchakanya, Shreeantu and Phikkal) and Panchathar (Phidim, Yangam and Ranitar) districts showed the presence of different insect pests such as caterpillar (*Latoia sp, Andraca bipunctata* and *Gracilaria theivora*), leaf roller(*Gracilaria theivora, Stringlina glareola*, Hamona coffearia), tea mosquito (*Heolipeltis febriculosa*), aphids (*Toxopetra aurantii*), jassids (*Halopeltis spp.*), flush worm (*Lasperesia bipunctata*) and other pests. Pink, purple and red mites were also reported by them. According to them, several insecticides were used by farmers for controlling these insect pests. Farmers used some organophosphates such as quinalphos, ethion, Malathion, monocrotophus, dicholorovous, cholopyriphos etc. and other insecticides such as alfamethryene, cypermethryene and pyrethroid. They also found overuse and misuse of insecticides in these districts. Likewise, white grub damage (75.9%) was more severe than aphid (62.9%) and stem borer (62.3%) damage in Ilam districts [6] as mentioned by Bajracharya,et.al [5] recorded grasshopper and white grub as major in tea in an experiment conducted during FY 2061/62 at Regional Agricultural Research station(RARS), Tarahara.

National tea and Coffee Development Board, Hile, Dhankuta district and Fikkal, Ilam district have installed light traps in tea garden for monitoring insects. In these traps, tobacco caterpillar was observed in high frequency followed by white grub and tiger moth [1]. For controlling these insects, they found mixture of amino acid along with NPK (4:4:4) and neem based insecticide most effective Chaudhary,et.al conducted a survey to study insect pest, their nature of incidence and time of occurance in tea garden in Bhadrapur, Barne and Kanyam of eastern Nepal [7]. Information was collected from local tea growing farmers by close observation in the field, collection of species and their identification in the laboratory. It showed terai (Bhadrapur) and foot-hill (Barne) with warmer climate harbored higher number of insect pest than midhills (Kanyam). They found 18 pests (17 insects and 1 mite) harbored in Terai and foot hills. Common looper (*Buzura suppressaria*), red slug caterpillar (*Eterusia magnifica*) and red spider mite (*Oligonichus coffeae*) were absent in tea of mid hills (Table 1).

Sn	Common name	Scientific name	Order	Family
1	Common looper	*Buzura suppressaria Guen*	Lepidoptera	*Geometridae*
2	Red slug caterpilar	*Eterusia magnifica Butl*	Lepidoptera	*Zygaenidae*
3	Bunch Caterpollar	*Andraca bipunctata Walk*	Lepidoptera	*Bombycidae*
4	Flush worm	*Caspeyresia leucostoma Meyor*	Lepidoptera	*Eucosmidae*
5	Tea tortix	*Homona coffearia Nieth*	Lepidoptera	*Tortricidae*
6	Leaf roller	*Gracilaria theivora Walsm*	Lepidoptera	*Gracilariidae*
7	Stem borer	*Zeuzera coffeae Nieth*	Lepidoptera	*Cossidae*
8	Root borer	*Bactocera rubus Lin*	Coleoptera	*Cerambycidae*
9	Cockchaffer	*Holotrichia impressa Burn.*	Coleoptera	*Scarabaeidae*
10	Red ant	*Oecophylla smaragdina Fab*	Hymenoptera	*Formicidae*
11	Brown cricket	*Brachytrypes portentous Lin*	Orthoptera	*Gryllidae*
12	Termites	*Microceroter mes sp*	Isoptera	*Termitidae*
13	Tea mosquito bug	*Helopeltis theivora Wc*	Hemiptera	*Miridae*
14	Tea jassid	*Emposca flavescens Fab*	Homoptera	*jassidae*
15	Tea aphid	*Toxoptera aurantii Boyer*	Homoptera	*Aphididae*
16	Scale insect	*Saissetia coffea Walk*	Homoptera	*Coccidae*
17	Thrips	*Taeniothrips setiventris Bagn*	Thysanoptera	*Thripidae*

18	Red spider mites	*Oligonichus coffeae Niet*	Acarina	*Tetranychidae*

Table 1: Occurrence of insect pests of tea in eastern Nepal [7].

In the surveyed area of eastern Nepal, 2 farmers out of 3 heard about IPM [7]. But no one was adopting IPM in those area [4] (Table 2).

Sn	Common name	Target insect pests
1	Emamectin benzoate	Common looper, Red slug caterpillar
2	Flubendiamide	Bunch caterpillar, Flush worm
3	Imidaclorprid	Tea tortrix, Cockchafer, Stem borer, Root borer Scale insects, thrips
4	Thiamethoxam	Leaf roller
5	Metarhizium +Imidaclorprid	Termites
6	Insecticide+Magic Stick	Scale insects
7	Imidaclorprid +Thiamethoxam +Hexathyzox	mosquito bug, Tea greenfly, Tea aphid, Thrips
8	Dicofol	Tea mites

Table 2: Farmers applying different insecticides for controlling insect pest of tea. Source: PRMS, 2013.

Major entomological research works on Coffee (*Coffea arabica L.*)

Entomology department of NARC during fiscal year 2003-2004 conducted a survey in major coffee growing areas of Syanja and Kavre district and reported that 5 and 10% insect pest loss in Kavre and Syanja respectively [5].white stem borer, red stem borer, grasshopper, aphid, caseworm, scale insect, hairy caterpillar, mealy bug, leaf miner, termite and tortoise beetle were identified as major insects. During fiscal year 2006-2007, Entomology division of NARC conducted another survey in Gulmi district to find out major insect pest of coffee [5]. In Thanapati village, loss by insect was 5-10% in well shade managed and north faced orchard whereas more than 25% in poor shade management condition. Similarly, in Digam village, 5% and 10% production loss in well shade managed and poor shade management condition respectively. Different insect pests reported were Soil insect (White grub), Foliar pest (scale, leaf miner, grasshopper) and stem borers (white stem borer and red stem borer).

Considering the problem of white stem borer in Nepal, a volunteer, Prof. Jose Carlos Verle Rodrigues, Ph. D., (an expert on coffee white stem borer) from University of Puerto Rico, USA was invited to Nepal through "Farmers to Farmers Program" of Winrock International. In collaboration with Winrock Internationl, Entomology Division of NARC organized six days workshop cum training program on 17-22 December, 2014 for officials of NARC, DOA, Agricultural Universities and other organizations involved in Nepalese coffee development to impart technical knowledge to participant on management of coffee white stem borer and to prepare coffee promotion strategy focusing on white stem borer management in Nepal. This workshop made short term, medium term and long term strategies for the management of white stem borer.

Short term strategies: Implementation of recommended practices

Medium term strategies: Adoption of updated packages based on research findings, publishing manuals for WSB, training, capacity building, exposure to in/ out country

Long term strategies: Adoption of standardized package of practices (But not clearly said).

Major entomological research works on large cardamom (*Amomum subulatum*)

Khatiwada, et al., as cited in Joshi et al. reviewed many literatures and reported 3 main insect pests of large cardamom *viz*. leaf eating caterpillar, aphid(causing Chhirke and Furkey disease) and stem borer [5-8]. Likewise, a survey conducted in Terhathum and Sankhuwasava districts by Joshi,et.al reported that the leaf eating caterpillar was most severe than Chirkey and Foorkey disease [8]. They took perception of farmers against insect damage in cardamom and found that 49.2% respondants reported less than 10% loss whereas 16.6% respondants estimated more than 21% losses. A survey was conducted by National Commercial Agricultural Research Program (NCARP) in cardamom growing areas of Dhankuta, Ilam, Panchathar, Taplejung and Sankhuwasabha districts. During that survey, 30 farmers from each district were selected and data was collected by interviewing them. 90% farmers pointed out the leaf eating caterpillar as the most problematic insect, while 10% farmer said that they don't have any insect problems. Most of the farmers (40%) had used metacid and 10% used thiodan for controlling leaf eating caterpillar, while, rest of the farmers don't use any chemicals. Likewise, a survey of ninty large cardamom growing households Ilam, Panchthar and Taplejung districts of Mechi region was conducted by Nepal Agricultural Research Council to know farmers' perception on disease and insect incidences in large cardamom and found that leaf eating caterpillar damage was more severe than rhizome borer and Aphid [9] found Stem borer (*Glyphipterix sp*.), shoot fly (*Merochlorops dimorphus*) and leaf eating caterpillar (*Artona chorista*) as common pest of large cardamom in Nepal [1]. Among them, leaf eating caterpillar was the major one. The pest causes crop loss due to voraciously feeding on leaves. It is recommended some management practices; for leaf eating caterpillar (destroying of infested leaves with larvae and 2-3 spray of cypermethrin or Nuvan @ 1 ml/L), stem borer (sanitation, two spray of demacron 1 ml/L in 20 days interval), aphid (two spray of Rogor 30 EC or metasystox 20 EC @ 1 ml/liter in 20 days interval) and thrips (like aphid

management). Likewise, Anonymous (2011) also suggested for insect management in large cardamom which was similar to above management practices suggested by Koirala [10]. Shrestha, et al., Suggested control measures for different insect pests of large cardamom which are as follows [7].

i) Leaf caterpillar (*Artona chorista*)-Use mixture of cow urine and tobacco leaf juice on the infected plants, Collect and destroy the hairy caterpillars, light traps can be used to attract and kill the adult moths, Spray insecticides such as Phasalone 35 EC 750 ml in 500-1000 L of water per ha.

ii) Shoot fly (*Merochlorops dimorphus*)-Inspect the infested plants and separate them and then kill the flies, Remove the affected shoots at ground level and destroy them, Spray chemical insecticides such as dimethoate 30 EC or quinalphos 25 EC 1 L.

iii) Stem borer (*Glyphipteris sp.*)-monitor the infected plant and destroy, infected portion of the plant should be separated and disposed, Spray insecticides like quinalphos 25 EC or phosalone 35 EC 1 L during March, April, May, August and September in 500-1000 L per ha.

iv) White grubs (*Holotrichus sp.*)-monitor the plant and kill the insect. Aphids (*Mollitrichosiphum spp.*)-Regularly irrigate the plant and destroy the aphids wherever they appear on the plant. Capsule borer-Spray quinalphos 25 EC 1.5 L or carbaryl 50 WP 1 kg in 500-1000 L of water per ha [11-14].

CONCLUSION

Existing problems

Lack of adequate research works in tea, coffee and cardamom for insect pest identification and their integrated management. Most of the research works on tea, coffee and large cardamom are concentrated on agronomic practices only. In most of the research, insect pest management technique isn't well worked out. Farmers were overusing and misusing chemical pesticides as a medicine.

Future strategies

Crop specific database of insect damage on commercial crops should be prepared. Future research should focuses on identification of pest of commercial crops and their natural enemies. Year round specific insects of commercial crops should be monitored by research institution. Public private Partnership (PPP) should be involved in research and development of commercial crops like tea, cardamom, coffee. Ecological and cultural practices should be followed to control several insect pest.

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