

## INFLUENCE OF TOPOGRAPHY, PLANT AGE AND SHADING ON RED RUST (CEPHALEUROS PARASITICUS KARST.) DISEASE OF TEA IN SYLHET REGION

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### Abstract

A survey was conducted in different tea estates of greater Sylhet region and Bangladesh Tea Research Institute during April to July 2013 to assess the relationship of red rust disease of tea with topography (Tillah, hillock and flat) of the estates, plant age and shading conditions. A wide variation in disease incidence and severity was found among various tea estates. Disease incidence and severity were significantly higher in flat areas compared to hillock and tillah areas. Tea plants of tillah, hillock and flat areas were found 49, 59 and 70% disease affected, respectively. Mature plants had more disease incidence compared to younger plants. Shading conditions showed significant impact on disease reaction. Less amount of disease was observed in shaded areas as compared unshaded ones.

**Keywords:** red rust, tea, topography, shade, plant age

### Introduction

Tea (*Camellia sinensis*) is one of the most important economic crops of Bangladesh. Around 144 thousand acres of land is under tea cultivation with an annual production of 64 thousand metric ton (BBS, 2014). Only four percent of it is exported and rest of the amount is used for domestic consumption. There are 163 tea gardens in the country which are mostly owned by private companies (BTB, 2012). Tea is cultivated in three ecological zones namely, Surma valley in greater Sylhet, Halda valley in Chittagong and Karatoa valley in Panchagarh district (Mamun, 2011). Most of the tea gardens are located in the Sylhet region. Tea is affected by many diseases. One algal and eighteen fungal diseases have so far been recorded in Bangladesh (Sana, 1989 and Huq *et al.* 2007). Red rust is an algal disease caused by *Cephaluros parasiticus* Karst. Reddish hairy spots are often found on the upper surface of the leaf extending to the stem. Sometimes affected leaves become variegated. The spores are dispersed by wind or rain. The algae spread from leaves to branches. Older infections become greenish gray and look like lichen (Keith *et al.* 2006). Red rust can attack both young and older tea plants. The disease can be severe or minor depending on the climate and ecological conditions. Under highly severe conditions the whole plant may be fully damaged. In general it is not very destructive. In Bangladesh around 25% tea estates are known to be affected by this disease (Sana, 1989). The present study was conducted to know and evaluate the influence of topography, plant age and shading conditions on red rust disease incidence of tea plants in Sylhet region.

### Materials and Methods

The survey was conducted in nine different tea estates namely Lackatoorah tea estate, Malnicherra tea estate and Burjan tea estate adjacent to Sylhet town, Ghazipore tea estate, Marina tea estate and Bejoya tea estate in Kulaura upazila of Moulvibazar district, Moomincherra tea estate in Fenchuganj upzila, Chundeeche tea estate in Luskerpore upazila of Habiganj district, Baraora tea estate in Srimangal upazila and Bangladesh Tea Research Institute (BTRI) in Srimangal, Moulvibazar during April to July 2013. The landscape of a particular tea garden was divided into 'Tillah', 'Hillock' and 'Flat' area. Tillah was defined as a land form that extended above the terrain; hillock meant slope area and flat was defined as the plain land form. Plants were categorized as 'young' (0-5 years) and 'mature' (>5 years). The area under shade tree was considered as 'Shade'. From each location three samples were selected randomly and for each sample 50 bushes were selected for data collection. Disease was scored on a 0 to 5 scale (0 = no infection, 1 = 1 to 20%, 2 = 21 to 40%, 3 = 41 to 60%, 4 = 61 to 80% and 5 = 81-100% infected plants) (Islam and Ali, 2011). Disease incidence and percent disease index (PDI) was calculated according to the following formula:

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$$\text{Disease incidence} = \frac{\text{No. of infected plants}}{\text{Total no. of plants observed}} \times 100$$

$$\text{PDI} = \frac{\text{Sum of total rating}}{\text{Total no. observation} \times \text{the highest grade}} \times 100$$

Statistical analysis was done by MSTAT-C.

## Results and Discussion

### Influence of topography

Red rust incidence and severity varied considerably in relation to elevation of land (Table 1). The highest disease incidence and severity was found in the flat region followed by hillock and tillah area. In flat area disease incidence varied from 42 to 84% and the PDI varied from 14.68 to 40%. The average disease incidence and PDI in flat region was found to be 70 and 27%, respectively. A wide variation was found in different tea estates. The highest (84%) disease incidence was found in BTRI farm and the lowest (42%) in Baraora tea estate. Islam and Ali (2010) observed higher incidence of red rust in the flat area which was in agreement with the present findings. In the hillock area disease incidence varied from 36.67% in Baraora tea estate to 80.67% in BTRI farm and the PDI varied from 13.33% in Burjan tea estate to 34.13% in BTRI farm. The average disease incidence and PDI in the hillock region was 59 and 21%, respectively. In the tillah region disease incidence and PDI varied from 25.33 to 67.33% and 8.53 to 23.20%, respectively. The highest disease incidence and severity in tillah region was found in Lackatoorah tea estate and the lowest in Malnicherra tea estate. The average disease incidence and PDI in tillah region was 49 and 17%, respectively. The study revealed that in most of the cases disease incidence was significantly higher in flat region than tillah region but the difference between either tillah and hillock or hillock and flat region was insignificant in most of the cases. The algal spores carried away by the air current from higher tillah ultimately settle in the flat region. That might be one of the reasons for greater prevalence of red rust in the flat region as compared to tillah or hillock region. The wide variation in red rust incidence between different tea estates might be due to variation in age of the plants, variety, location and management practices taken to combat pest problems.

**Table 1. Incidence and severity (PDI) of red rust in Tillah, Hillock and Flat area of different tea estates**

Locations/ Tea Estates	Tillah		Hillock		Flat	
	Incidence(%)	PDI (%)	Incidence(%)	PDI (%)	Incidence(%)	PDI (%)
BTRI Farm	61.33 ab*	18.67 bc	80.67 a	34.13 a	84.00 a	40.00 a
Lackatoorah Tea Estate	67.33 a	23.20 a	73.33 b	26.00 b	80.00 ab	32.67 b
Ghazipore Tea Estate	59.33 ab	15.20 cd	72.67 b	25.07 bc	74.67 bc	25.33 c
Marina Tea Estate	58.67 b	21.33 ab	63.33 c	21.47 d	83.33 ab	36.53 ab
Chundeeche Tea Estate	54.67 bc	19.06 bc	56.00 de	20.80 d	81.33 ab	37.20 ab
Bejoya Tea Estate	50.00 cd	16.00 cd	53.33 e	16.26 e	58.00 e	18.67 de
Moomincherra Tea Estate	46.00 d	20.13 ab	60.67 cd	22.13 cd	66.00 de	23.87 c
Baraora Tea Estate	36.67 e	12.27 de	36.67 f	14.13 e	42.67 f	14.68 e
Burjan Tea Estate	34.67 e	12.40 de	40.67 f	13.33 e	62.67 de	18.67 de
Malnicherra Tea Estate	25.33 f	8.53 e	52.67 e	16.13 e	67.33 cd	22.40 cd
Average (%)	49	17	59	21	70	27

\*Data with same letter(s) in a column are not significantly different at 5% level of significance.

### Influence of plant age

Data on disease incidence and severity as affected by plant age are presented in Table 2. Comparatively higher disease incidence and severity was observed in mature plants as compared to younger plants but the difference was insignificant in most of the cases. Significant difference in disease incidence and severity was observed between different tea estates. In younger tea plants disease incidence varied from 66.67 (Bejoya tea estate) to 91.33% (Lackatoorah tea estate) with an average of 81.13%. Severity of red rust ranged from 18.93 to 50.80% with an average of 34.21%. In mature plants disease incidence and severity varied from 74.67 (Bejoya tea estate) to 94.67% (Lackatoorah tea estate) and 22.60 to 51.60%, respectively. The average disease incidence was found to be 86.16% and the severity was 37.97% (Table 2). Results from the present study revealed that variation in disease reaction between young and mature plants was not significantly different. This might be happened due to categorization of only two types in the present investigation (< 5 years: young and > 5 years: mature). If more plant age categories were used as samples then there could have significant differences in disease reaction.

**Table 2. Incidence and disease index of red rust in young and mature plants in different tea estates**

Locations/ Tea Estates	Young plant		Mature plant	
	Incidence (%)	PDI (%)	Incidence (%)	PDI (%)
BTRI Farm	83.67 c*	41.31 c	89.21 c	44.57 c
Lackatoorah Tea Estate	91.33 a	50.80 a	94.67 a	51.60 a
Ghazipore Tea Estate	89.33 b	40.13 c	91.20 bc	44.65 c
Marina Tea Estate	70.67 f	18.93 i	79.33 g	22.60 i
Chundeeche Tea Estate	77.33 d	28.13 f	83.33 f	31.47 f
Bejoya Tea Estate	66.67 g	21.00 h	74.67 h	26.07 h
Moomincherra Tea Estate	89.33 b	45.60 b	92.67 ab	50.27 b
Baraoora Tea Estate	74.00 e	23.93 g	84.00 ef	28.47 g
Burjan Tea Estate	84.33 c	37.93 d	85.51 de	38.96 e
Malnicherra Tea Estate	84.67 c	34.40 e	87.04 d	41.06 d
Average (%)	81.13	34.21	86.16	37.97

\*Data with same letter(s) in a column are not significantly different at 5% level of significance.

### Influence of shading

Significant variation in disease incidence and severity was observed in shaded and unshaded conditions in different tea estates (Table 3). Less disease was recorded from shaded area as compared to unshaded area. Average disease incidence and severity in shaded area were found 68.87 and 21.99%, respectively and in unshaded area were 75.60 and 26.72%, respectively. A wide variation in disease reaction was observed among different tea estates. The highest disease incidence (77.33%) was recorded from Chundeeche tea estate and the lowest (63.33%) from Baraoora tea estate under shaded section of the gardens. Under non shaded conditions, the highest (83.33%) and the lowest (68%) incidence of rust were also recorded from Chundeeche and Baraoora tea estates, respectively. Shade management is an important component of tea cultivation. Inadequate or complete absence of shade is favorable for rust disease. Mite and thrips infestations are more in the fields devoid of shade (Anon, 2003, Mamun and Ahmed, 2011). Results of higher disease incidence in non-shaded areas in the present study are in agreement with the findings of the previous authors.

**Table 3. Incidence and severity of red rust in shaded and unshaded conditions**

Locations/ Tea Estates	Shade		Unshade	
	Incidence (%)	PDI (%)	Incidence (%)	PDI (%)
BTRI Farm	74.00 b*	23.93 bc	84.00a	28.47 b
Lackatoorah Tea Estate	66.67 d	23.07 c	75.33 c	26.53 cd
Ghazipore Tea Estate	70.67 c	23.00 c	73.33 c	26.17 d
Marina Tea Estate	70.67 c	18.93 e	79.33 b	22.60 f
Chundeeche Tea Estate	77.33 a	28.13 a	83.33 a	31.47 a
Bejoya Tea Estate	66.67 d	21.00 d	74.67 c	26.07 d
Moomincherra Tea Estate	66.67 d	19.60 de	74.67 c	26.00 d
Baraoora Tea Estate	63.33 e	17.33 f	68.00 e	23.73 e
Burjan Tea Estate	66.00 d	25.20 b	70.67 d	27.20 c
Malnicherra Tea Estate	66.67 d	19.80 de	70.67 d	29.00 b
Average (%)	68.87	21.99	75.60	26.72

\*Data with same letter(s) in a column are not significantly different at 5% level of significance.

Results obtained from the present study in different tea states revealed that red rust incidence was greatly influenced by the topography and shading conditions. In tillah and shaded area disease incidence was significantly lower as compared to flat and unshaded areas. Mature plants had more disease infestation than younger plants, although the difference was not significant in most of the cases. A wide variation in disease incidence and severity of red rust across different tea estates indicated that other factors like location, variety, growing conditions and management practices might play significant role in the development of red rust disease. More studies covering those aspects could give better explanation and clear insight about red rust in tea plants.

### References

- Anonymous. 2003. Protection of tea from red rust disease in the low country. T.R.I. Advisory circular No. DM 4. Tea Research Institute of Srilanka. 2p.
- BBS. 2014. Statistical Pocket Book of Bangladesh. Bangladesh Bureau of Statistics, Ministry of Planning, Dhaka, Bangladesh. 522p.

- BTB. 2012. Annual Report. Bangladesh Tea Board, Chittagong.
- Huq M, Ali M and Islam M S. 2007. Red rust disease of tea and its management. Memorandum No. 1, Bangladesh Tea Research Institute, Srimangal. pp.1-8.
- Islam M S and Ali M. 2011. Efficacy of Sedomil 72 WP and Recozeb 80 WP in controlling red rust of tea. Bangladesh J. Agril. Res. 36(2):279-284.
- Islam M S and Ali M. 2010. Incidence and severity of major tea diseases in Bangladesh. Bangladesh J. Agril. Res. 35(4):605-610.
- Keith L, Ko W H and Sato D M. 2006. Identification guide for diseases of tea (*Camellia sinensis*). Plant Disease (PD)-33. Cooperative Extension Service, University of Hawaii at Manowa, USA. pp.1-4.
- Mamun M S A. 2011. Development of tea science and tea industry in Bangladesh and advances of plant extracts in pest management. Int. J. Sust. Agril. Tech. 7(5):40-46.
- Mamun M S A and Ahmed M. 2011. Integrated pest management in tea: prospects and future strategies in Bangladesh. J. Plant Prot. Sci. 3(2):1-13.
- Sana D L. 1989. Tea Science. Ashrafia Boi Ghar, Dhaka. pp. 224-226. Walmsley A J, Giesecke A H and Lipton J M. 1986. A case of shivering during epidural anaesthesia. Anaesth. Analges. 63:61-64.