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Prevalence and severity of different citrus diseases in Sylhet region

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ABSTRACT

Citrus is the World's premiere fruit crop infected by a large number of diseases and caused huge economic losses. A study was conducted from November to December 2014 at several citrus orchards of Sylhet, Bangladesh to find out the prevalence and intensity of diseases affecting different citrus species. In this study, 560 plants from seventeen citrus species were critically observed to collect data on the infection of diseases. Different citrus diseases were found among the studied population where greening, die-back, scab and canker of citrus were mostly prevailing diseases in this region. A significant variation in the disease incidence and severity was found among different species. Rough lemon demonstrated the highest susceptibility (95%) to citrus greening. But, die-back in combination with scab of citrus exhibited the maximum greening incidence in BARI satkara-1 (55%), followed by Mandarin (46.66%). The incidence of die-back was the highest in BARI kamala-1 followed by lime (93.3%). The scab of citrus showed the maximum incidence in BARI satkara-1 (50%). Alachilemon was found highly infected by canker of citrus showing 65% and 36% of incidence and severity respectively. Among all the studied citrus species, the overall disease incidence was found to be the lowest in Chinalemon. The study is a valued addition to the literature of citrus research and contributed significantly to the management of citrus disease.

Keywords: Citrus, Prevalence, Severity, Disease and Incidence

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I. Introduction

Citrus (*Citrus spp.*) genus belongs to the family Rutaceae, is popular all over the world due to their superior quality as food. It is a non-climacteric, perennial, woody plant, being cultivated for its unique berry-like fruit (Kader, 1992 and Rieger, 2006). Citrus originated from south-east Asia and was cultivated in China by 2500 BC (Nicolosi et al., 2008). It is cultivated over a vast area of tropical and subtropical countries of the world (Piccinelli et al., 2008). They have good flavor and taste, high nutritional value and vitamin C, healthy properties with functional bioactive phytochemicals like

terpenoids, triterpenes, flavonoids, amino acids, phenolic acids, mineral constituents, and polysaccharides, being beneficial to human health (Ye et al., 2017). Citrus contains flavanones and other polyphenolic compounds, which are helpful in preventing different cardiovascular diseases; also possess enormous therapeutic qualities (Chanet et al., 2012).

The climate of Bangladesh is very congenial to the year-round production of citrus. In addition, it favors disease development if proper control measures are not taking on time (Seif, 1994). Therefore, citrus plant is attacked by many diseases like citrus canker, scab, gummosis, dieback, Citrus Tristeza Virus (CTV) and greening etc. In general, greening, die-back and scab were considered as major diseases for almost all citrus fruits, but in some cases, canker, gummosis, and rot-knot were important and caused severe damages. Economic development of Bangladesh is directly proportionated to the development of our Agriculture. Crop loss hampers the agricultural production of Bangladesh. Generally, 30-50% yield decline and about 80 million taka are lost due to the disease (Khan, 1999). Among 25 diseases of citrus in the world, 14 diseases were found in Bangladesh with medium to higher incidence and severity (Uddin et al., 2014). However, the impact of fungal diseases (sweet orange scab, citrus black spot, powdery mildew), bacterial diseases (pierce's disease, citrus variegated chlorosis, citrus greening, citrus canker) and viral diseases (citrus tristeza, citrus ringspot, etc.) as well as a complex of nematodes limits citrus production, nutritional value and market qualities (Etebu et al., 2014). Sylhet region of Bangladesh has a variety of land topography including hilly areas with a suitable climatic condition to citrus cultivation. Hence, many citrus gardens including national citrus research centers have been developed. However, very little information is available about the incidence of citrus diseases of Sylhet region as well as Bangladesh. Therefore, the present study was conducted to reveal the per-cent of disease incidence and disease index of Citrus (*Citrus spp.*) in citrus orchards of Sylhet region.

II. Materials and Methods

The study was conduct at different citrus orchards of Sylhet, Bangladesh from November to December 2014. These are Regional Agricultural Research Station (RARS) and some other farmer fields near RARS (Figure 01). All the gardens are located in 24°24'N and 91°37'E with the same soil taxonomy and the physiographic unit that is Haplaquepts and Northern and Eastern Piedmont Plain respectively, but different in their soil series. RARS is situated in the soil series of Gowainghat while the other farmer's fields are in the soil series of Balagonj.

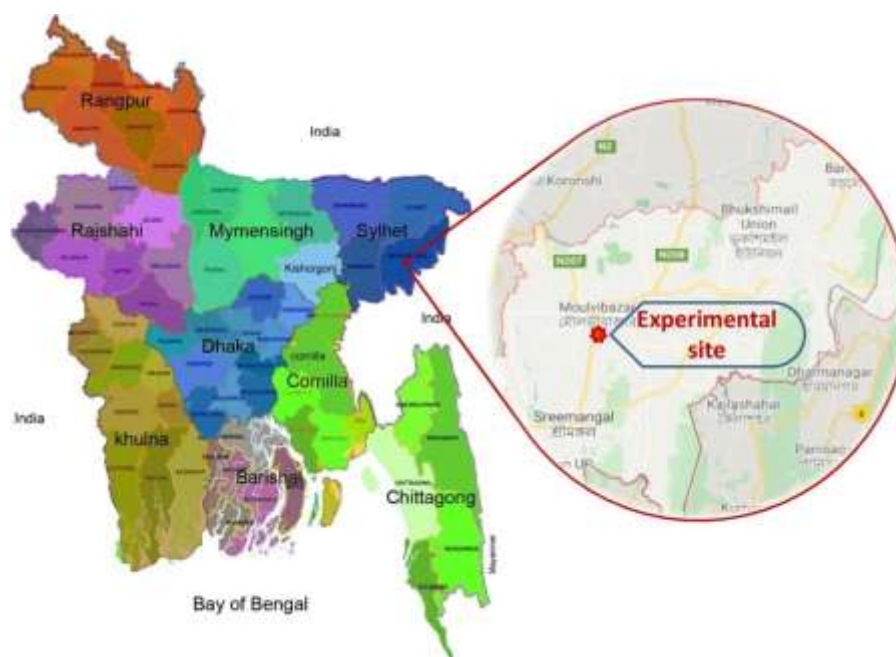


Figure 01. Map showing the site of the experiment.

The soil was sandy to clay loam in its texture and moderate to highly acidic in its reaction with a considerable fertility level (Huq and Shoaib, 2013). The region was subtropical with hot, humid summer and relatively cool winter. It is generally marked with a monsoon climatic zone with the

highest temperature (32°C) in August – October, and the lowest temperature (7°C) in January. Above 80% of the annual rainfall (3372 mm) (Table 01) occurring in May to August favored the easier and faster spread of the pathogens and initiation of diseases.

Table 1. Monthly temperature, rainfall and humidity of the study area

Month	Air temperature (°C)		Relative Humidity (%)	Total rainfall (mm)
	Maximum	Minimum		
January	30	10.56	69	6
February	29.44	13.89	69	34
March	34.44	13.89	59	78
April	38.33	15.56	62	118
May	37.22	20.56	78	520
June	34.44	24.44	84	724
July	35.56	24.44	79	316
August	34.44	23.89	85	797
September	34.44	23.33	85	732
October	35.56	18.89	75	33
November	29.1	16.6	82	9
December	26.4	11.3	81	5

The entire garden was divided into blocks according to their species and sampling was done accordingly. From each block, fifteen to twenty plants of five sample areas were observed for disease infestation. Seventeen species of citrus viz. BARI satkara-1, Pomelo, BARI kamala-1, BARI malta-1, Sweet orange, Jaralemon, Long jaralemon, Alachilemon, Rough lemon, Lime, Ashkorlemon, Citrumelo, Cleopatra mandarin, BARI batabilemon-3, BARI lemon-1, Mandarin and Chinalemon were studied. The data was collected from 560 plants, closely observed through visual inspection to diagnose diseases e.g. citrus greening (Pereira et al., 2011). At that time, trees were in the fruiting stage, which helped to have the data of infected fruits also. Selected trees were inspected by walking around their perimeter and examined the trunks, shoots, leaves, and fruits for the symptoms of diseases. In addition, leaves and fruits falling to the ground with obvious unusual symptoms were observed. A primary data collection sheet was used to record all this information. Finally, these recorded data were analyzed and interpreted to find out variations concerning incidence and severity. Some of the disease symptoms found in different orchards shown in Figure 02.



Figure 02. Symptom of different citrus diseases observed in this study: a) greening, b) scab, c) dieback, d) sooty mold, e) canker

Plants were observed individually and the percent Disease Index (PDI) was assessed following the numerical rating shown below (Anon, 2006).

Grade	Leaf area infected (%)	Grade	Leaf area infected (%)
0	No sign or symptoms	3	41-60% infection
1	1-20% infection	4	61-80% infection
2	21-40% infection	5	81-100% infection

The visible symptoms that were considered as the scale of percentage disease infection in citrus are shown in Figure 03.

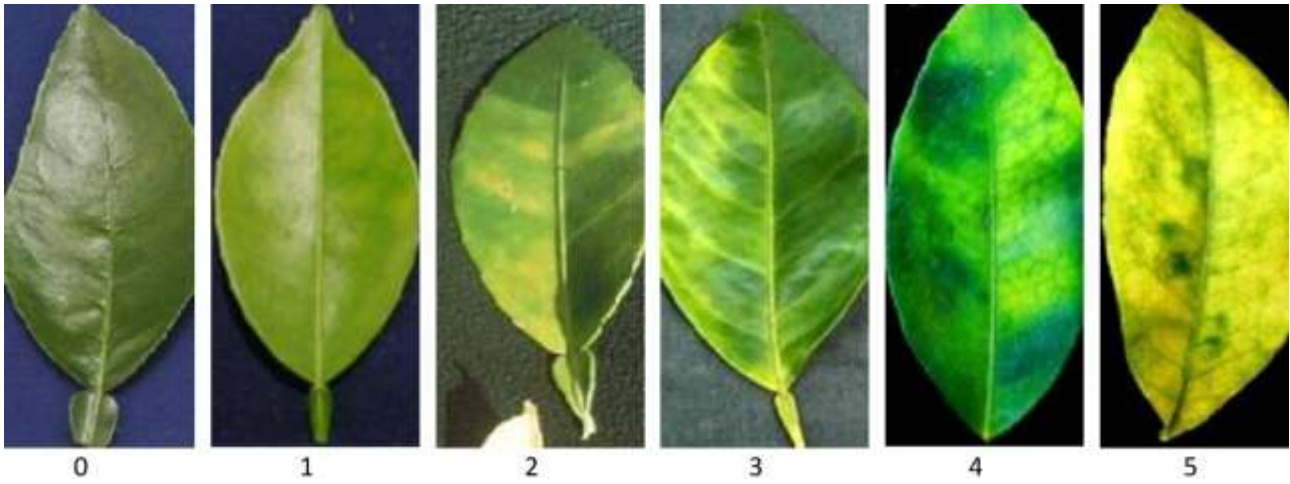


Figure 03. Grading of citrus greening affected leaf sample

Disease incidence was calculated according to the following formulae (Islam and Ali, 2010).

$$\text{Disease Incidence (DI)} = \frac{\text{No. of infected plants}}{\text{Total no. of plants}} \times 100\%$$

The percent disease index was worked out as described by (Mc-Kinney's, 1923).

$$\text{Disease Severity index (SDI)} = \frac{\text{Sum of total rating}}{\text{Total no. of plants observed} \times \text{highest grade}} \times 100\%$$

III. Results and Discussion

The study represented *Citrus spp.* that was susceptible to many citrus diseases (Table 02) in the studied locations. Among the diseases greening, dieback, scab, canker, gummosis and sooty mold were highly devastating and continuously emerging. Similar results were reported by Uddin et al. (2014). We have described the incidence and severity of major citrus diseases of studied locations.

Table 02. Diseases observed at different citrus orchards

Sl. No.	Disease	Causal agent
1	Canker	<i>Xanthomonas axonopodis pv. Citri</i>
2	Greening	<i>Candidatus Liberobacter asiaticum</i>
3	Die-back	<i>Colletotrichum spp.</i>
4	Gummosis	<i>Phytophthora spp.</i>
5	Sooty mold	<i>Capnodium sp.</i>
6	Scab	<i>Elsinoe fawcettii</i>
7	Leaf spot	Unknown

Infection of citrus greening disease

Citrus greening was first reported in China in the early 1900s but now has spread across the world (Bove, 2006). The bacteria of this disease have three different strains i.e. i. Asiatic, ii. African and iii. American. The African and American strains are present in African countries and Brazil, respectively. The Asiatic strain is prominent in Asia including Bangladesh. From the study, it was found that all the citrus species were infected by greening disease with a moderate to high percentage (Table 03). Rough lemon was found to be highly infected (95%) followed by BARI malta-1 (85%), whereas, the lowest incidence was recorded in Chinalemon (16%) followed by lime and Ashkorlemon (20%). On the other hand, the percent disease index was the highest in BARI malta-1 (49%) followed by Jaralemon (37%) and the lowest was found in Chinalemon (3%), followed by Ashkorlemon and BARI kamla-1 (4%). Our result correlated with the study carried out in the Philippines showing Greening incidence from 60.42 to 100% plants (Ochasan et al., 2014). Most notable, Chinalemon, Ashkorlemon, lime and BARI kamla-1 showed substantial resistance to the greening of citrus. Ullah, (2011) reported the presence of greening disease in Bangladesh but in an earlier survey, this disease was not reported as major (Bakr, 2007). Greening is considering a quarantine disease of citrus for Bangladesh (Uddin et al.,

2014). Gupta (2012) also reported a high incidence of greening in the Punjab province and India. In the world, Greening is nowhere under adequate control and where the disease occurs, it continues to rise in its incidence and severity (Gottwald, 2010). All the species and hybrids of citrus irrespective of their rootstock are susceptible to greening (Bove 2006, Koizumi et al., 1992 and Liu et al., 2011). Economic losses occurred by citrus greening disease has become one of the greatest challenges for citrus growers across the world (Cevallos-Cevallos et al., 2012) because it limits production and debilitates citrus trees (Qureshi and Stansly, 2009).

Table 03. Incidence and Severity of citrus greening disease

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	13	65	34
Pomelo	20	10	50	18
BARI kamala-1	15	3	20	4
BARI malta-1	20	17	85	49
Sweet orange	20	10	50	10
Jaralemon	20	15	75	37
Long jaralemon	20	8	40	12
Alachilemon	20	9	45	14
Rough lemon	20	19	95	24
Lime	15	3	20	5
Ashkorlemon	20	4	20	4
Citrumelo	15	8	53	11
Cleopatra mandarin	15	9	60	12
BARI batabilemon-3	15	7	47	9
BARI lemon-1	20	10	50	22
Mandarin	15	10	67	20
Chinalemon	30	5	17	3

Infection of die-back disease

Dieback of citrus breaks out widely and has become a limiting factor of citrus cultivation in many countries including Bangladesh (Talukdar, 1974; Rawal and Saxana, 1997; Alam, 2003). Three species: *Colletotrichum gloeosporioides*, *Diplodia natalensis*, *Fusarium spp.* are causing die-back disease in Bangladesh. In our study, all the species of citrus were found to be infected with dieback (Table 04). Both the species BARI kamala-1 and Lime were highest in their disease incidence (93%) which is being followed by BARI satkara-1(80%), Sweet orange (75%), Roughlemon (60%) and BARI malta-1(50%). In case of severity, Lime and BARI kamala-1 were mostly infected with a bit different in them that are 66% and 65% respectively. Chinalemon showed the lowest disease incidence (20%) as well as severity (4%) for die-back of citrus. Our results support the findings of (Lashin et al., 2013), where they observed the incidence and severity of dieback is 23-95% and 4-66%, respectively in Egypt. Recently, the organism of dieback, *Colletotrichum spp.* was included in the list of the 10 most important plant pathogenic fungi in the world based on perceived scientific and economic importance (Dean et al., 2012).

Infection of scab disease

Citrus scab is an important disease producing fruit blemish through developing lesions on citrus fruits, leaves, and twigs prevailing in most humid citrus producing areas (Spósito et al., 2011). Three types of scab diseases caused by *Elsione fawcettii*, *S. fawcettii* var. *scabiosa* and *E. australis* (Hyun, 2009). Initial symptoms generally develop one week after tissue infection (USDA, 2010). Leaves are susceptible to infection primarily in the early spring as they emerge from the bud (Timmer et al., 2000). Citrus scab attacks the young shoots and causes the dropping of fruits up to 65.9 to 71.29% (Huang, 1999). The status of Scab disease is represented in Table 05. The findings of our study showed that the intensity of scab disease was moderate in its nature of infection showing 20 to 55% disease incidence and 3 to 22% disease severity. BARI lemon-1 showed the highest susceptibility to scab disease while Sweet orange and Jaralemon showed the lowest susceptibility. Pomelo, Ashkorlemon, BARI satkara-1 and Lime also showed comparatively higher susceptibility. BARI lemon-1 was found highly infected with a disease incidence of 55% and disease severity of 11%, whereas both the species Sweet orange and

Jaralemon were the lowest in infection with a disease incidence of (15%) and severity of (3%). Citrus scab occurs widely in Sylhet region, as citrus scab infection is conducive to high rainfall areas (Hyun, 2001).

Table 04. Incidence and severity of die-back disease of citrus

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	16	80	37
Pomelo	20	8	40	13
BARI kamala-1	15	14	93	65
BARI malta-1	20	10	50	10
Sweet orange	20	15	75	45
Jaralemon	20	5	25	5
Long jaralemon	20	4	20	4
Alachilemon	20	5	25	5
Rough lemon	20	12	60	12
Lime	15	14	93	66
Ashkorlemon	20	4	20	4
Citrumelo	15	8	53	15
Cleopatra mandarin	15	5	33	7
BARI batabilemon-3	15	7	47	9
BARI lemon-1	20	9	45	11
Mandarin	15	7	47	9
Chinalemon	30	6	20	4

Table 05. Incidence and severity of scab disease of citrus

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	10	50	15
Pomelo	20	8	40	14
BARI kamala-1	15	4	27	5
BARI malta-1	20	5	25	5
Sweet orange	20	3	15	3
Jaralemon	20	3	15	3
Long jaralemon	20	4	20	4
Alachilemon	20	5	25	5
Rough lemon	20	4	20	4
Lime	15	6	40	10
Ashkorlemon	20	9	45	22
Citrumelo	15	4	27	5
Cleopatra mandarin	15	5	33	7
BARI batabilemon-3	15	5	33	7
BARI lemon-1	20	11	55	11
Mandarin	15	4	27	5
Chinalemon	30	10	33	7

Infection of canker disease

Citrus canker is a serious bacterial disease of commercial varieties of citrus caused by *Xanthomonas citri* sub sp. *Citri* (Graham et al., 2004). The disease affects the leaves, twigs and fruits causing the leaves and fruits to drop before it ripens. The disease is endemic in many tropical and subtropical citrus growing areas (Goto, 1992). Temperature between 15 to 20° C and 35 to 40° C is conducive to develop canker disease of citrus (Pria et al., 2006). The disease is most prevalent in areas with a yearly rainfall of more than 1000mm (Vernier et al., 2003). The study showed the highest incidence of disease for Alachilemon (65%) followed by Jaralemon (60%), Lime (60%), Sweet orange (55%) and Long jaralemon (45%), whereas the lowest disease incidence was found for chinalemon (17%) (Table 06). In case of disease severity, Alachilemon was found the highest (36%) but the lowest (3%) was found in BARI batabilemon-3.

Table 06. Incidence of canker disease at Sylhet

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	5	25	11
Pomelo	20	5	25	8
BARI kamala-1	15	3	20	13
BARI malta-1	20	10	50	23
Sweet orange	20	11	55	25
Jaralemon	20	12	60	25
Long jaralemon	20	9	45	14
Alachilemon	20	13	65	36
Roughlemon	20	4	20	9
Lime	15	9	60	19
Ashkorlemon	20	3	15	4
Citrumelo	15	4	27	9
Cleopatra mandarin	15	3	20	5
BARI batabilemon-3	15	2	13	3
BARI lemon-1	20	6	30	10
Mandarin	15	4	27	5
Chinalemon	30	5	17	5

Infection of sooty mold disease

Sooty mold disease caused by several species of fungi growing on honeydew secreted on plant parts and other surfaces. The fungi's dark, threadlike growth (mycelium) gives plants the appearance of being covered with a layer of soot. It is a black, powdery fungus that grows on branches, leaves and fruit. However, a severe coating of fungus can block light, thus affecting plant growth. The sooty mold was comparatively less prevalent in the studied orchard. It showed lower disease incidence and severity (Table 07). Among the other species, sooty mold showed its highest incidence (33%) in Lime and BARI batabilemon-3 and the lowest (7%) in Chinalemon, whereas the highest disease severity (13%) was found in Pomelo followed by Lime (9%) and BARI batabilemon-3 (9%). Again, Chinalemon was the lowest in its disease severity (2%).

Table 07. Incidence and severity of sooty mold disease of citrus

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	3	15	4
Pomelo	20	6	30	13
BARI kamala-1	15	2	13	4
BARI malta-1	20	2	10	3
Sweet orange	20	3	15	4
Jaralemon	20	3	15	5
Long jaralemon	20	4	20	4
Alachilemon	20	5	20	8
Rough lemon	20	3	15	3
Lime	15	5	33	9
Ashkorlemon	20	2	10	3
Citrumelo	15	4	27	7
Cleopatra mandarin	15	3	20	4
BARI batabilemon-3	15	5	33	9
BARI lemon-1	20	3	15	4
Mandarin	15	2	13	3
Chinalemon	30	2	7	2

Infection of Gummosis disease

An early symptom of gummosis is sap oozing from small cracks in the infected bark, giving the tree a bleeding appearance. Symptoms can be seen in fruit if the disease is severe. Infection may occur from soil or nursery plants due to extended periods of moist and wet conditions. Gummosis is one of the

main diseases that contribute to citrus decline. The study showed the gummosis infection as rare with little or no infection at all. The species Jaralemon, Lime, Citrumelo and Chinalemon were found to be resistant with zero infection, whereas Mandarin (27%), Sweet orange (20%) and Rough lemon (15%) were found susceptible with comparatively higher disease incidence and the highest disease severity for Mandarin (9%) followed by Sweet orange (6%) and Rough lemon (5%) (Table 08).

Table 08. Incidence and severity of gummosis disease of citrus

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	2	10	2
Pomelo	20	1	5	1
BARI kamala-1	15	1	7	1
BARI malta-1	20	1	5	2
Sweet orange	20	3	15	6
Jaralemon	20	0	0	0
Long jaralemon	20	1	5	2
Alachilemon	20	2	10	2
Rough lemon	20	4	20	5
Lime	15	0	0	0
Ashkorlemon	20	3	15	3
Citrumelo	15	0	0	0
Cleopatra mandarin	15	2	13	4
BARI batabilemon-3	15	1	7	3
BARI lemon-1	20	2	10	2
Mandarin	15	4	27	9
Chinalemon	30	0	0	0

Combined infection of greening and die-back disease of citrus

Mixed infections of greening and die-back are presented in Table 09. According to the data collected from the studied location, the highest disease incidence was found in BARI satkara-1 (55%) followed by BARI malta-1 and Sweet orange with similar disease incidence (50%). Also, BARI lemon-1, Pomelo, Citrumelo, Mandarin and BARI batabilemon-3 had identical disease incidence (40%) whereas Chinalemon was the lowest (10%) in infection. In terms of severity, the highest data was found in BARI satkara-1(28%) followed by BARI malta-1(23%) with the lowest in Chinalemon that was only 2% in its disease severity.

Table 09. Combined infection of greening and die-back disease of citrus

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	11	55	28
Pomelo	20	8	40	14
BARI kamala-1	15	2	13	3
BARI malta-1	20	10	50	23
Sweet orange	20	10	50	18
Jaralemon	20	4	20	10
Long jaralemon	20	4	20	4
Alachilemon	20	3	15	5
Rough lemon	20	9	45	11
Lime	15	3	20	8
Ashkorlemon	20	4	20	4
Citrumelo	15	6	40	13
Cleopatra mandarin	15	5	33	6
BARI batabilemon-3	15	6	40	8
BARI lemon-1	20	8	40	20
Mandarin	15	6	40	12
Chinalemon	30	3	10	2

Combined Infection of greening and scab disease at Sylhet

According to the field survey, the combined infection of greening and scab disease was very unusual with lower to moderate disease infection. Mandarin was the highest in its disease incidence (47%) followed by Cleopatra Mandarin (33%), BARI batabilemon-3(33%), BARI satkara-1(33%) and BARI lemon-1(30%). These species showed a harmonious pattern in their disease incidence. Jaralemon (10%) and Chinalemon (10%) showed the lowest disease incidence. But BARI lemon-1 (17%) was found to be the highest in its disease severity followed by Mandarin, BARI satkara-1, BARI malta-1, BARI kamala-1 and Lime with 16%, 15%, 12%, 11%, 11% respectively and the lowest was found for both Ashkorlemon and Chinalemon (3%) (Table 10).

Table 10. Combined infection of greening and scab disease of citrus

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	7	33	15
Pomelo	20	5	25	9
BARI kamala-1	15	3	20	11
BARI malta-1	20	6	30	12
Sweet orange	20	3	15	8
Jaralemon	20	2	10	5
Long jaralemon	20	4	20	6
Alachilemon	20	4	20	6
Rough lemon	20	4	20	8
Lime	15	2	13	11
Ashkorlemon	20	3	15	3
Citrumelo	15	3	20	4
Cleopatra mandarin	15	5	33	7
BARI batabilemon-3	15	5	33	7
BARI lemon-1	20	6	30	17
Mandarin	15	7	47	16
Chinalemon	30	3	10	3

Table 11. Combined infection of die-back and scab disease of citrus

Species	No. of plants observed	No. of plants Infected	Disease Incidence (%)	PDI
BARI satkara-1	20	12	60	31
Pomelo	20	6	30	11
BARI kamala-1	15	4	27	14.66
BARI malta-1	20	5	25	5
Sweet orange	20	3	15	11
Jaralemon	20	3	15	3
Long jaralemon	20	4	20	6
Alachilemon	20	4	20	4
Rough lemon	20	4	20	6
Lime	15	5	33	27
Ashkorlemon	20	3	15	3
Citrumelo	15	4	27	8
Cleopatra mandarin	15	5	33	7
BARI batabilemon-3	15	5	33	7
BARI lemon-1	20	7	35	9
Mandarin	15	4	27	5
Chinalemon	30	3	10	2

Combined infection of die-back and scab disease of citrus at Sylhet

Among all other diseases, scab caused by *Elsinoe fawcettii* and dieback caused by *Colletotrichum gloeosporioides* is considered the major diseases of citrus in our country (Alam, 2003). In case of their combined infection (Table 11), disease incidence was the highest in BARI satkara-1 (60%) followed by Cleopatra mandarin (33%), Lime (33%), BARI batabilemon-3 (33%), Pomelo (30%), Mandarin (27%),

BARI kamala-1 (27%) and Citrumelo (27%). The disease incidence in Sweet orange, Jaralemon and Ashkorlemon was 15% with the lowest in Chinalemon (10%). The highest disease severity was in BARI satkara-1(31%) followed by Lime (27%). In most cases, disease severity was less than 15% with the lowest severity in Chinalemon (2%).

IV. Conclusion

Survey on diseases of citrus species manifested seven diseases on different citrus species at the Sylhet region. The diseases were greening, die-back, scab, canker, gummosis, sooty mold and leaf spot. Among these diseases, citrus greening revealed to be the most prevalent one. Most of the species were seriously infected with considerable greening symptoms. Also, the diseases die-back, canker and scab of citrus were at an increasing trend in their infection. Hence, it is a matter of great concern to control the infection of citrus diseases, most notably citrus greening with proper steps to check the yield loss of citrus. However, BARI satkara-1 and BARI kamala-1 were the most susceptible species and Chinalemon was mostly tolerant of various citrus diseases producing least visible symptoms.

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Conflict of interest

The authors declare that they have no conflict of interest.

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