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SURVEY ON CASSAVA DISEASES IN SOME SELECTED AREAS OF BANGLADESH

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Abstract

The preliminary survey of cassava diseases was made in March to October, 2005 in three thanas namely Muktagacha and Mymensingh Sadar of Mymensingh district as well as Modhupur under Tangail district. A total of eleven locations in different areas under these districts were surveyed to investigate the incidence and severity of cassava diseases. In field condition, only the African cassava mosaic disease of cassava has been found. The highest infection was found in Modhupur, medium in Muktagacha and low in Mymensingh Sadar. The plant infection, leaf infection and leaf area diseased of African cassava mosaic disease in Modhupur was found in 82.38%, 20.95% and 32.57%, respectively. Less disease infection was recorded in Muktagacha thana.

Key words: Cassava, Fungal microflora, Muktagacha. Mymensingh Sadar and Modhupur

1.Introduction

Cassava, *Manihot esculents* Crantz (Euphorbiaceae) is one of the most important starchy root crop among the tropical food crops (Cock, 1985). Cassava will be appeared one of the earliest crops that have been domesticated and was widespread throughout the new world tropics by the late fifteenth century (FAO, 1995). Growing food deficit is a great concern to all who are interested in the welfare of millions of people who's living under poverty level in Bangladesh. Attempts to resolve the problems of food production have placed great emphasis on increasing the production and productivity of grain/cereal crops but little attention has been given to crops such as cassava which are produced mainly in the tropics.

Cassava constitutes the principal carbohydrate source for more than 800 million people in developing countries. About 80% of the cassava produced was consumed by human, while the remaining 20% was used for an agro-industrial purposes as animal feeds (Mc Cann, 1976; IITA, 1992). Cassava is grown under very broad climatic and edaphic conditions.

Increasing world population in some countries has prompted a recent surge of interest in

cassava not only for its traditional forms as human food and for specialized starches but also for animal feed stuffs and other industrial uses. This crop has been produced as food crop for more than 500 million people in tropical and sub-tropical Africa, Asia and Latin America (EI-Sharkawy, 2004). Total world production was estimated as 155.3 million tons of dry root weight (FAO, 1993). The leading Cassava producing countries in Africa includes, Zaire, Nigeria, Mozambique, Angola, Tanzania, Uganda, Central African Republic, Madagascar, Ghana and Ivory Coast (FAO, 1991).Cassava is grown on around 17 million hectares with an annual yield of 172 million tons. More than 50% of cassava produced is grown in Africa with an annual yield of 91 million tons, 48.2 million tones are produced in Asia and 31.6 million tons in North and South America. In Brazil, the annual production of cassava was 23.3 million tons, and the average yield per hectare was 13.5 tons (Fukuda, 2002). In northern Brazil, most of the cassava produced was used for human consumption, but in the Central, Western and Southern areas it was mainly used in the manufacture of textiles, paper, glue, medicine and food (Fukuda, 2002).

Plants are completely domesticated and show a high degree of local adaptation mainly in tropical countries. Cassava is a perennial crop and is mostly propagated by woody stem cuttings (CIAT, 1983; IITA, 1990). The large swollen true roots may be harvested 7 months after planting in warm areas, the multiplication of cassava through true seed is becoming important because of increasing breeding research for resistance to major diseases and other agronomic characters, which requires parent true seeds. On dry matter basis, cassava roots contain 92.5% carbohydrate and 3.2% protein; starch and sugar predominate, comprising about 90% (Kawano, 1978; Hahn et al., 1989). The leaves contain 7% and 20-35% protein on a fresh weight and dry weight basis, respectively (IITA, 1992). Cassava leaves protein quality compare to soybeans are considerably higher in lysine, although deficient in methionine and tryptophane (Jalloh and Dahniga, 1994).

There are many constraints for low production of cassava in which diseases are a great problem. Among the diseases bacterial, fungal and viral are important. Cassava is grown at small scale in Bangladesh. Cassava is attacked by huge number of diseases such as bacterial diseases (Bacterial blight: *Xanthomonas campestris* pv. *manihotis*, Bacterial angular leaf spot: *Xanthomonas campestris* pv. *cassava*, Bacterial wilt: *Erwinia herbicola*); fungal diseases (Anthracnose: *Colletotrichum gloeosporioides f.sp. manihotis*, Blight leaf spot: *Cercospora vicosae*, Cassava ash: *Oidium manihotis*,Fusarium root rot: *Fusarium oxysporum/solani*, Phytophthora root rot: *Phytophthora cryptoge*, Pythium root rot: *Pythiumspp*, Sclerotium root rot: *Sclerotium rolfsii*, Verticillium root and stem rot: *Verticillium dahliae*); virus diseases (African cassava mosaic: African cassava mosaic virus, Cassava common mosaic: Cassava common mosaic virus, Cassava common mosaic: Cassava

vein mosaic virus, Indian cassava mosaic: Indian cassava mosaic virus). Accurate assessment of yield loss has not been quantified especially due to the problem of multiple disease complexes in Bangladesh.On the view point of the above facts the following objective has been undertaken to study the incidence and severity of cassava diseases.

2. Materials and Methods

2.1. Survey on incidence and severity of Cassava diseases in some selected areas in Bangladesh

2.1.1. Survey area

Survey was conducted on standing crop in three Thanas under two districts as shown in the Table 1.

Table 1. List of different Districts and Thanas of Bangladesh were surveyed to investigate the incidence and severity of Cassava diseases

Name of the variety	Location	Thanas	District
Nagra	Crop Botany Field Laboratory, BAU	Sadar	Mymensingh
	Kalibari Bazar, Garo Bazar	Muktagacha Modhupur	Mymensingh Tangail
Phillipine	Crop Botany Field Laboratory, BAU	Sadar	Mymensingh
	Kalibari Bazar, Garo Bazar	Muktagacha Modhupur	Mymensingh Tangail

2.1.2 Soils and Topography of Experimental Places

The experimental place fallls under the Agroecological Zone AEZ-9 (Old Brahmaputra Floodplain) and AEZ-28 (ModhupurTract).

a) Soils and Topography of mymensingh

Soils of the area are predominantly silt loams to silty clay loams on the ridges and clay in the basins. General soil types predominantly include Dark Green and Floodplain soil. Organic matter content is low on the ridges and moderate in the basins, topsoils moderately acidic but subsoils neutral in reaction. General fertility level is low. However, the status of P and CEC is medium and K status is low on highlands and medium on lowlands (Anonymous, 1997).

b) Soils and Topography of Tangail

Eleven general soil types exist in the area in which Deep Red Brown Terrace, Shallow Red Brown Terrace soils and Acid Basin Clays are the major ones. These soils on the terrace are better drained, friable clay loamy to clays overlying friable clay substratum at varying depths.

Soil in the valleys are dark grey with heavy clays. They are strongly acidic in reaction with low status of organic matter, low moisture holding capacity and low fertility level. Soils are mainly phosphate fixing, and low in K, S and Ca (Anonymous, 1997).

2.1.3 Climate

The experimental area was set up under subtropical climate. The average temperature, rainfall, humidity, dew point, wind speed, sunshine and evaporation of Mymensingh district during experimental time were 27.75^{0}C, 328.39 cm, 83.91%, 24.39°C, 8.99 kmph, 153.99 hrs and 125.04 mm respectively (Weather Year: Department of Irrigation and Water Management, BAU campus, Mymensingh, 2005). The average temperature and rainfall of Tangail district during experimental time were 28.68°C and 286.56 cm, respectively (Bangladesh Meteorological Department, Weather Building, Agargoan, Dhaka-1207, 1stMarch to 31th October, 2005).

2.2. Field Study

2.2.1. Period of Survey

Survey work was started in the first week of March, 2005 and completed by the first week of October, 2005.

2.2.2. Variety selected

Two varieties were selected for the purpose of survey namely Nagra and Phillipine.

2.2.3. Procedure of Survey

To record the incidence and severity of diseases of cassava, two Thanas were selected from Mymensingh districts namely Muktagacha (Kalibari Bazar) and MymensinghSadar (Crop Botany Field Laboratory, BAU, Mymensingh). In Kalibari Bazar and Garo Bazar four locations (Farmers field) were randomly selected and in Crop Botany Field Laboratory, BAU, Mymensingh three locations were selected. Ten experimental plots or units area were randomly selected from each location. In every unit area, total number of diseased plants along with the corresponding healthy ones were counted. Total healthy leaves and total infected leaves were counted and leaf areas diseased were also recorded. These results were finally expressed as percentage. Data were collected at three stages of plants namely seedling, vegetative and pre-harvest stage but only vegetative stage was vulnerable for African cassava mosaic disease. It was noted that the crops were planted in the field during the period 20th October to 10th November, 2004 in all locations, which were also recorded. Both varieties (Nagra and Phillipine) in Cassava, 10 infected plants were selected at random to determine percent leaf infection and percent leaf area diseased. Percent leaf area diseased was measured based on eye estimation.

2.2.4. Parameters of Data Collection

An area of 2 m x 1.5 m was selected at the middle of each bed for data collection in case of Garo Bazar and Kalibari Bazar and Crop Botany Field Laboratory, BAU, Mymensingh. Data were collected at 30 days intervals in case of Crop Botany Field Laboratory, BAU, Mymensingh on the following parameters:

i) Total number of plants
ii) Total number of infected plants
iii) Total number of leaves

iv) Total number of infected leaves and
v) Percent leaf area diseased

2.2.5. Procedure of recording leaf disease incidence (DI) and disease severity (DS)

Leaf DI (%)=(No. of Infected Leaves/Total No. of Leaves) X100

Leaf DS (%) = (Leaf Area Diseased/Total Leaf Area) X 100

3. Results

3.1. Field Study

No disease was observed in the area surveyed other than African cassava Mosaic Disease (ACMD).

3.1.1. Symptoms of African cassava mosaic disease

Symptoms of African cassava mosaic disease of cassava were appeared on leaflets early in the development of the laminae as light coloured or chlorotic areas, variable in size, often contain small islands of green tissues. Chlorotic areas were well defined and distinct from unaffected leaf tissues and vary in size from small spots to entire leaflets. Affected leaf areas did not enlarge at the same rate as apparently healthy portions of laminae and result in twisted and mishappen laminae with the degree of distortion often related to the sizes of chlorotic area. Reduced size of leaflets was common, and affected plants were generally stunted (Cook, A.A. 1978) as shown in photographs-2-3.

Photograph 2a: African cassava mosaic diseased leaf (left) and healthy leaf (right) detached from standing crop (Modhupur)

Photograph 2b: African cassava mosaic diseased leaf (left) and healthy leaf (right) detached from standing crop (Muktagacha)

Photograph 2c: African cassava mosaic diseased leaf (left) and healthy leaf (right) detached from standing crop (Mymensingh sadar)

Photograph 3a: African cassava mosaic diseased leaf (left) and healthy leaf (right) from standing crop (Modhupur)

Photograph 3b: African cassava mosaic diseased leaf (left) and healthy leaf (right) from standing crop (Muktagacha)

Photograph 3c: African cassava mosaic diseased leaf (bottom) and healthy leaf (above) from standing crop (Mymensingh Sadar)

3.1.2. Incidence and severity of African cassava mosaic disease (ACMD)

In the field, only African Cassava Mosaic Disease (African cassava mosaic geminigirus) of cassava has been found in Garo Bazar of Modhupur Thana. The survery revealed that the cassava plants of this area only suffered from African Cassava Mosaic Disease (ACMD). Local variations of the disease were observed. The mean plant infection (82.38%), leaf infection (20.95%) and leaf area diseased (32.57%) of African Cassava Mosaic Disease (ACMD) were recordedin Garo Bazar under Modhupur Thana (Table-2).

The disease was also found in Kalibari Bazar under Muktagacha Thana. The mean plant infection, leaf infection and leaf area diseased were 75.23%, 18.27% and 26.64%, respectively (Table-3).

The ACMD was also found in Crop Botany Field Laboratory, BAU, Mymensingh. The mean plant infection, leaf infection and leaf area diseased were 58.61%, 16.95% and 24.07%, respectively (Table-4). The incidence and severity of ACMD of Cassava in three locations have been graphically shown in Figure1.

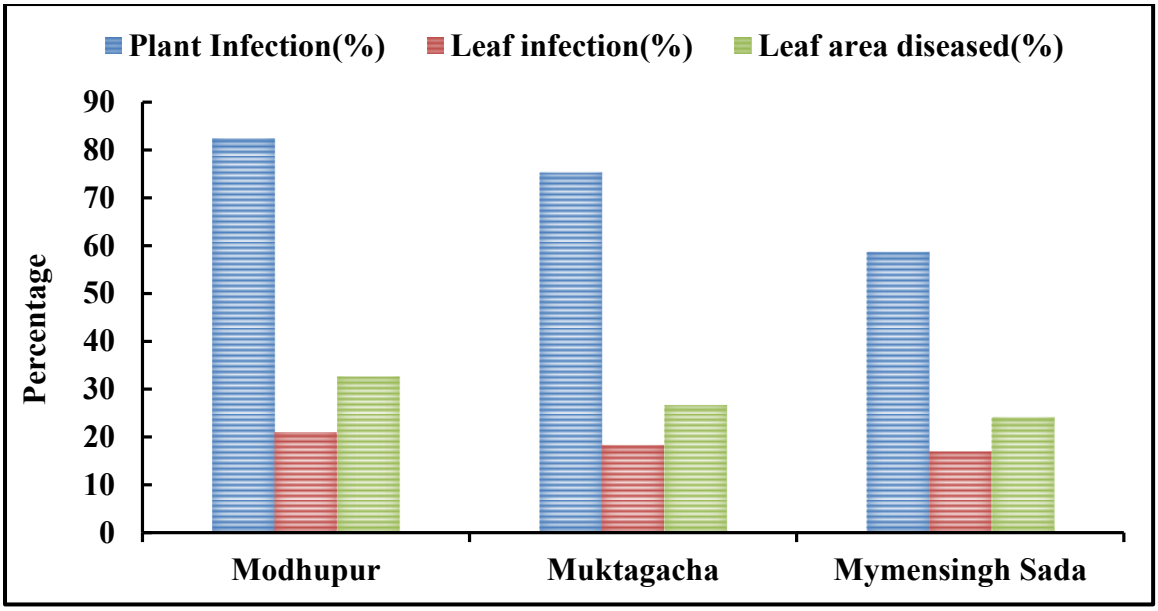

Figure-1. Incidence and severity of African cassava mosaic disease in different areas of Bangladesh.

Table-2: Incidence and severity of African Cassava Mosaic Disease (ACMD) of Cassava in Different areas of Garo Bazar of Modhupur Thana under the Tangail district

Area	Location-1	Location-2	Location-3	Location-4	Mean
Garo Bazar	Plant infection (%)				
	86.87	88.89	78.95	75.00	82.38
	Leaf infection (%)				
	23.56	19.53	20.59	20.12	20.95
	Leaf area diseased (%)				
	37.56	27.64	30.88	34.18	32.57

Table-3: Incidence and severity of African Cassava Mosaic Disease (ACMD) of Cassava in different areas of Kalibari Bazar of Muktagacha Thana under the Mymensing district.

Area	Location-1	Location-2	Location-3	Location-4	Mean
Kalibari Bazar	Plant infection (%)				
	75.00	80.00	72.22	73.68	75.23
	Leaf infection (%)				
	18.72	17.67	18.50	18.17	18.27
	Leaf area diseased (%)				
	26.64	25.23	27.44	27.25	26.64

Table-4: Incidence and severity of African Cassava Mosaic Disease (ACMD) of Cassava in Crop Botany Field Laboratory at BAU campus, Sadar Thana under the Mymensingh district.

Area	Location-1	Location-2	Location-3	Mean
Crop Botany Field Laboratory, BAU	Plant infection (%)			
	53.33	62.50	60.00	58.61
	Leaf infection (%)			
	17.00	17.14	16.72	16.95
	Leaf area diseased (%)			
	24.09	25.08	23.04	24.07

4. Discussion

Different locations of three Thanas namely Muktagacha (Kalibari Bazar) and Mymensingh Sadar (Crop Botany Field Laboratory, BAU, Mymensingh) under Mymensingh district and Modhupur (Garo Bazar) under Tangail district were surveyed to investigate percent plants of Cassava infected with African cassava mosaic disease as well as its severity. Only two varieties were surveyed under all locations. Mean percent plant infection was high (82.38%) in Garo Bazar under Modhupur thana. This result was comparatively high than other two thanas. Second highest percent plant infection (75.23%) was found in Kalibari Bazar under Muktagacha thana followed by Mymensingh Sadar thana (58.61%). Percent leaf infection was high (20.95%) in Garo Bazar under Modhupur thana but low in other thanas. The percent leaf infection under Kalibari Bazar and Mymensingh Sadar thana were 18.27 % and 16.95%, respectively. Similarly, percent leaf area diseased was also high (32.57%) in Garo Bazar under Modhupur thana but low in other two thanas. The percent leaf area diseased were 26.64% and 24.07% under Kalibari Bazar of Muktagacha thana and Crop Botany Field Laboratory, BAU, Mymensingh Sadar thana, respectively. All these results indicate that percent plant infection, percent leaf infection and percent leaf area diseased were high in Garo Bazzar under Modhupur thana. African cassava mosaic disease was more severe in Modhupur area than other areas. These three parameters were found medium in Muktagacha thana and were low in Mymensingh Sadar thana. Thus, it reveals that inoculam of African cassava mosaic disease pathogen was available in all locations. Moreover, the results indicate that inoculum potential was high in Modhupur thana than Muktagacha and Mymensingh Sadar thana whereas Muktagacha and Mymensingh Sadar thana ranked second and lowest, respectively. The intensity of leaf damage was more or less uniform in all the areas. In case of percent plant infection as well as percent leaf infection, large variation was recorded among Muktagacha, Modhupur and Mymensingh Sadar thanas.

Variations of plant infection (%), disease incidence and disease severity were confirmed in different locations under Kalibari Bazar, Garo Bazar and crop Botany Laboratory, BAU, Mymensingh. No remarkable variations in case of plant infection recorded among the locations under Garo Bazar. Highest (88.89%) and lowest (75.00%) plant infection observed

in Location 2 and Location 4, respectively. Same observation was true for leaf infection in four locations under Garo Bazar where highest (23.56%) and lowest (19.53%) results were recorded in the Location 1 and 2, respectively. So far as disease severity is concerned, little variation were seen among the Locations under above areas. Here, highest (37.56%) and lowest (27.64%) disease severity was recorded in Location I and Location 2, respectively.

In Kalibari Bazar, highest (80.00%) and lowest (72.22%) plant infection were recorded under Location 2 and Location 3, respectively. Next to highest value (75.00%) plant infection was observed in Location I and was followed by Location 4 (73.68%). More or less similar pattern of disease incidence was distributed in all the four Locations. Here, highest and lowest leaf infection values were 18.72% and 17.67% in Location 1 and Location 2, respectively. In case of disease severity, leaf area diseased was recorded highest (27.44%) in Location 3 whereas lowest (25.23%) severity was observed in Location 2.

In Mymensingh Sadarthana, the highest (62.50%) and lowest (53.33%) plant infection were recorded under Location 2 and Location 1, respectively and medium was recorded (60.00%) in Location 3. Here, the highest and lowest leaf infection values were 17.14% and 16.72% in Location 2 and Location 3, respectively and leaf infection was recorded medium (17.00%) in Location 1. In case of disease severity, leaf area diseased was recorded highest (25.08%) in Location 2 whereas lowest (23.04%) severity was observed in Location 3 and medium (24.09%) leaf area diseased in Location 1.

5. Conclusion

In field condition, only African cassava mosaic disease (African cassava mosaic geminivirus) of cassava has been found. The survey revealed that the cassava plants of these areas only suffered from African cassava mosaic disease. Local variations of the disease were observed. The highest plant infection (82.38%), leaf infection (20.95%) and leaf area diseased (32.57%) of African cassava mosaic disease were recorded in Garo Bazar other than Kalibari Bazar and Crop Botany Field Laboratory, BAU, Mymensingh.

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