

Evaluation of Promising Jute (*Corchorus olitorius*) Germplasm Against Stem Rot Caused by (*Macrophomina phaseolina*) (Tassi) Goid

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Abstract: Jute (*Corchorus* spp) is one of the commercial crops of Nepal and cultivation is mostly confined in Jhapa, Morang, Sunsari, Siraha Saptari and Udaipur districts of eastern region of the country. Among the jute diseases, stem rot (*Macrophomina phaseolina*) is the most important disease of jute equally affecting both the species viz., *Corchorus olitorius* (tossa jute) and *C. capsularis* (white jute). This disease is prevalent in all the jute growing areas of the world. So, considering the importance of this disease, this study was carried out to identify sources of resistance in jute germplasm (*Corchorus olitorius*) against deadly disease of stem rot. For the study six *C. olitorius* jute germplasm including one standard check (Itahari-2) were evaluated against stem rot at Itahari for three consecutive years 2019-2021 under replicated conditions with the plot size of 3×3 m² applied randomized complete block design (RCBD). Out of six germplasm of jute, only JRO-524 was found resistant with disease rating scale (0.73, 0.68, 0.63) against the stem rot disease over the years at Itahari conditions. Rest of the lines also showed resistant to moderately resistant differently over the years. This germplasm line JRO-524 possessed good degree of resistance against stem rot of jute under natural epiphytotic condition at Itahari location which could be further exploited for resistance breeding programme against this deadly disease. Rest of the tested genotypes reacted moderately resistant over the years.

Keywords: *Corchorus Olitorius*, Germplasm, Epiphytotic, Resistance, Moderately Resistance

1. Introduction

Jute is long, soft shiny vegetable fibre that can be spun into coarse, strong threads is an attractive fibre. It belongs to genus *Corchorus* of the Tiliaceae family with two cultivated species, *C. capsularis* L. and *C. olitorius* L. Jute grow under a wide ranges of climatic and stress conditions of the tropic and subtropics it is a natural fiber crop and is second in the world after cotton in terms of global production, consumption and availability.

It is being produced in Bangladesh, India, Nepal, China, Taiwan, Thailand, Vietnam, Cambodia, Brazil and some other countries. At least, 87% of the total jute crop of the world is concentrated in the area of the Indo- Bangladesh region [2]. In Nepal it ranked second in the fiber crop after the cotton and also comes second in the cash crop after the sugarcane. Jute is

one of the most important natural, biodegradable, recyclable and eco-friendly lingo-cellulose fiber crops most commonly grown in the Eastern Terai region of Nepal. Jute is one of the most versatile natural fibers that have been used in raw materials for packaging, textiles, non-textile, and agricultural sectors. Jute is socio- economically and environmentally important crop and is also labor intensive crop that creates huge employment opportunities in the rural areas. Beside these the crop allowed to shed the leaves in the field that decomposed in the soil and serve as a source of manure resulting into the increase in the soil fertility. Basically, the jute fibre is consists of cellulose and lignin that are major part of wood fibre [1]. Currently, two species of jute viz. *C. olitorius* and *C. capsularis* are grown in around 7555 hectare of land with the production of 10123.7 mt. with productivity of 1.34 mt ha⁻¹ [4]. The area, production and productivity of jute

remain more or less stagnant since last several years. The jute crop and its production and productivity is affected by various diseases. The diseases are compelling crop to suffer are seedling blight, stem rot, leaf blight, root rot, anthracnose and leaf mosaic [5]. Among these *Macrophomina phaseolina* is the causal agent of stem-rot disease in hundreds of plant species spanning a wide geographic distribution [6], and is one of the most devastating pathogen to the cultivated species of jute (*C. olitorius* and *C. capsularis*) [7]. The disease favors infection in alluvial and lateritic soils with low pH (5.6-6.5), high level of nitrogen, high rainfall and high humidity [15]. Higher soil temperature and low soil moisture predispose the older plants. March sown crop suffer more than late sown crop. The sclerotia survives in the soil and on infected crop debris (upto three years) serve as the primary source of inoculum. These multicelled sclerotia allow the persistence of the fungus under adverse conditions such as low soil nutrient levels and temperature above 30°C. Germination of the sclerotia occurs throughout the growing season when temperatures are between 28°C and 35°C. Sclerotia germinate on the root surface, germ tubes form appressoria that penetrate the host epidermal cell walls by mechanical pressure and enzymatic digestion or through natural openings. *M. phaseolina* can grow and produce large amounts of sclerotia under relatively low water potentials allowing this disease to be severe under water stress. Population of *M. phaseolina* in soil will increase when susceptible hosts are cropped in successive years. The seed borne inoculum also causes infection in jute leading to damping off or seedling blight [14]. Under favourable conditions viz., cloudy weather, high rainfall and temperature of about 30-35°C secondary spread of the disease takes place through airborne conidia. The pathogen attacks any part of the plant at any stage of growth, right from germination to harvest resulting in decreased quantity and quality of fibre. Average yield loss due to this disease is about 10%, however if disease is in epidemic conditions then loss can go up to 35-40% [5].

The favorable environment for infection is cloudy weather, over rainfall, high atmospheric humidity and soil temperature below 30°C [8]. The disease can be effectively controlled by the use of fungicides but it developed resistance mechanism against them. In recent years due to change in the climatic condition and introducing of new crops which act as an alternate host have resulted shifting of disease status in jute

and allied fibre crops. Therefore, the use of host resistance could be quite appropriate to manage the disease [9]. Keeping above in view, the present study was undertaken to identify more sources of resistance in jute germplasm and the results are reported.

2. Details of the Experimental Locations

The research site is situated in Sunsari District at ward No. 9 of Itahari sub-metropolitan city, which lies between Biratnagar and Dharan at the distance of 25 a 17 km in the north and south direction respectively. Geographically, the site is located at 26°15' north latitude and 87°20' east longitude with elevation of 175 masl. The climate is sub-tropical with average maximum and minimum temperature ranges from 20° to 36.6°C and 9.1° to 27.7°C, respectively. The rainfall ranges from 1484 to 2263 mm annually.

3. Materials and Methods

Five *C. olitorius* jute germplasm YA-23, JRO-524, YA-41, KEN-DS-058 and O-4 including one standard check (Itahari-2) were evaluated against stem rot disease of jute for three consecutive years 2018-2020 under natural condition at experimental plots of JRP, Itahari, Sunsari. The jute germplasm was sown in June. Each entry was sown in 3×5 m² with four replications in randomized block design (RBD) with row to row spacing of 30 cm and plant to plant spacing with 10 cm maintained with dense plants were thinned at 20-25 days after sowing. The recommended agricultural package and practices were followed except use of any plant protection measures as and when required. The disease reaction was recorded on 0-5 scale as per described by Mandal and De [10]. Genotypes were classified in resistant (0-1%), moderately resistant (1.1-5%), moderately susceptible (5.1-10%), susceptible (10.1-20%), highly susceptible (>20%) categories. The disease severity is based on actual damage in the individual plant that cause loss to the plant and the number of plants observed. The individual damage of plant is based on size of lesion, position of the lesion on the stem and lesion type, but the disease incidence (DI) was done on the basis of percentage of plant infection.

4. Results

Table 1. Reaction of jute germplasm lines against stem rot caused by *M. phaseolina*.

Disease rating scale (%area infected)	Year 2018	Year 2019	Year 2020
R (0-1)	YA-23, JRO-524	JRO-524, YA-41	YA-23, JRO-524
MR (1.1-5)	YA-41, KEN-DS-058, O-4, ITAHARI-2	YA-23, KEN-DS-058, O-4, ITAHARI-2	YA-41, KEN-DS-058, O-4, ITAHARI-2
MS (5.1-10.0)	Nil	Nil	Nil
S (10.1-20.0)	Nil	Nil	Nil
HS (>20.0)	Nil	Nil	Nil

R: Resistant, MR: Moderately resistant, MS: Moderately susceptible, S: Susceptible, HS: Highly susceptible

From the result of three years cropping season 208-2019 revealed that JRO-524 was found resistant against the stem

rot disease over the years (Table 1). Whereas, YA-23 was recorded resistant in the year 2018 and 2020. Among the tested genotypes YA-41 was recorded moderately resistant in the year 2018 and 2020 but was found resistant in the year 2019 against stem rot disease. Whereas, KEN-DS-058, O-4, ITAHARI-2 was moderately resistant and no lines were recorded for moderately susceptible, susceptible and highly susceptible at Itahari conditions. This difference in behavior of germplasms at different years may be due to the prevalence of different weather conditions in different years.

5. Discussion

Bast fibres are basically stem/bark fibres composed of sclerenchyma cells united together into small or large strands or bundles, arranged in the form of layer (s). Fiber extracted from stem having diversified commercial use mostly as hessian, sacking, rope, particle board, paper, bags, decorative, shoes, automobiles, textiles, geotextiles, and many other jute diversified products [3]. In Nepal the most important bast fibre crop is jute (*Corchorus olitorius* and *C. capsularis*). Stem rot (*Macrophomina phaseolina*) is the most important disease of jute equally affecting both the species viz., *Corchorus olitorius* (tossa jute) and *C. capsularis* (white jute). Jute is affected by the several pathogens, of which *Macrophomina phaseolina* (Tassi) Goid is the pivotal devastating soli and seed borne fungal pathogen, that infected more than 500 plant species in more than 100 families [11]. Although this disease is commonly known as stem rot, but any part of the plant may be infected by the pathogen at any stage of growth right from germination to harvest producing various symptoms, like, damping-off, seedling blight, leaf blight at seedling stage, stem rot, collar rot, stem break, root rot at adult plant stage and brown spot on pods especially in seed crop. This disease is prevalent in all the jute growing areas of the world. It causes significant reduction in yield and quality of the fibre. Average yield loss to this disease is about 10%, but it can go up to 35-40% in severe condition [16]. Some accessions of wild species of *Corchorus*, like *C. aestuans*, *C. fascicularis* showed very high degree of tolerance against the disease [12, 13]. The pathogen may cause damping off, seedling blight, collar rot, stem rot and root rot. The disease generally spreads from the infected leaves fall and adhere to stem surface where the infection may occur. The pathogen also may also attack the roots causing wilting and death of the plant and on uprooting, blackish brown discoloration of the roots are seen. In case of seed crop late infection may cause spotting on the capsule and seed [15]. Furthermore, use of resistance germplasm lines are good source for further investigation of mechanism of resistance and for developing of disease resistant varieties for management of stem rot disease [9].

6. Conclusion

Stem rot of jute is caused by *M. phaseolina* is one of the major disease of jute (*C. olitorius*) in Nepal, which results

economic losses. Development of resistant lines is only the effective method to manage this deadly disease in the field. Hence, it may be concluded that the germplasm line JRO-524 was found resistant under natural epiphytotic condition over the three consecutive years against this disease and rest of the germplasm lines also reacted moderately resistant to resistant in different years. So, the resistant germplasm JRO-524 should be exploited for resistance breeding program against this disease.

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