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Pathogenic Potential and Location of *Macrophomina phaseolina* in Jute Seed Grown at West Bengal, India

S. K. Sarkar, S. Satpathy, H. Chowdhury

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ABSTRACT

Macrophomina phaseolina (Tassi) Goid, the causal agent of stem rot of jute is mostly externally seed borne pathogen. Under natural condition, infection of *M. phaseolina* in jute seeds grown at ICAR-CRIJAF Research Farm, Barrackpore varies from 1.4–2.1% whereas under artificial inoculation at flowering and pod setting stage seed infection varies from 4.0%, 5.1–6.2% respectively. Pathogenic potential of *M. phaseolina* in terms of germination and emergence rotting of jute seeds were tested by sterilized sand-soil method. The germination of seeds inoculated with *M. phaseolina* culture reduced to about 38% which is mainly due to pre-emergence rotting (46.45%) and post-emergence rotting (7%) of seedling. The germination and emergence rotting of naturally grown seeds (not artificially inoculated) even under sterilized sand-soil condition are 86.4, 8.9 and 2.8% respectively. Further, it was also observed that under field condition seed germination is more than 90% which is more than the seed standard (germination ≥80%). Thus it is clear that there is no threat of seed borne infection by *M. phaseolina* if the seed crop is grown at or after mid-August which avoid the risk of high rainfall/humidity as well as reduce the seed crop duration. The location of the pathogen (*M. phaseolina*) were tasted by component plating method, mostly the pathogen is confined to the seed coat.

Keywords *Macrophomina phaseolina*, Pathogenic potential, Jute seed infection, Location of pathogen.

INTRODUCTION

Jute (*Corchorus olitorius* L.) is an important commercial bast fiber crop mostly cultivated in West Bengal (~ 75% of total area in India) followed by Bihar, Odisha, Assam. The seed producing states like Andhra Pradesh, Telangana, Maharashtra and Gujarat are geographically apart which cater the need of jute seed requirement in fiber producing states. With changing climatic situation as well as replacement of jute seed crop with other more remunerative crops, seed production become uncertain in seed producing states which is a great concern for availability of quality seeds in fiber producing states. Considering the

S. K. Sarkar*
Principal Scientist, Division of Crop Protection, Central Research Institute for Jute and Allied Fibers Barrackpore, Kolkata, West Bengal, India

S. Satpathy
Principal Scientist & Head of the Division, Division of Crop Protection, Central Research Institute for Jute and Allied Fibers Barrackpore, Kolkata, West Bengal, India

H. Chowdhury
Principal Scientist, Reservoir & Wetland Fisheries Division, Central Inland Fishery Research Institute Barrackpore, Kolkata, West Bengal, India
Email : surjapath@gmail.com
*Corresponding author

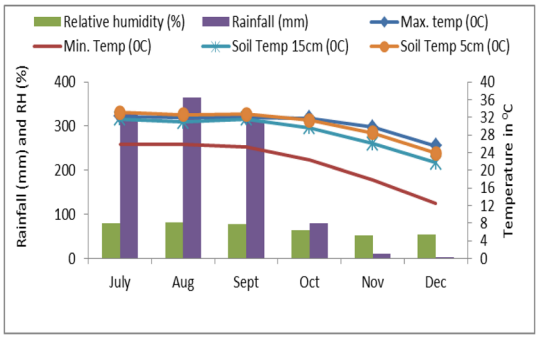

Fig. 1. Meteriological variables at ICAR-CRIJAF, Barrackpore.

need for seed production at local level ICAR-CRIJAF, Barrackpore successfully explored seed production by adopting proper technologies in West Bengal (Sarkar *et al.* 2016). Earlier it was thought that it is difficult to produce jute seed in West Bengal because of high rainfall and humidity which increases the seed borne infection by *M. phaseolina* causing seedling blight, stem rot and root rot of jute (Ghosh *et al.* 2018). Reports on levels of jute seed infection by *M. phaseolina* in West Bengal condition and location of pathogen inside the seeds are not properly studied which are very essential for epidemiological as well as management point of view (Talukdar *et al.* 2021, Fakir 1998). In the present investigations different aspects of seed borne infection by *M. phaseolina* were studied to ascertain the possibility of seed production in West Bengal.

MATERIALS AND METHODS

Assessment of seed borne infection : In one set of experiment, the jute seed crop (cv JRC 212 and JRO 8432) are grown under artificial conditions. The plants raised in 12" earthen pot were sprayed with homogenized mycelial bit of *M. phaseolina* (from 7 day old culture) at flowering and pod formation stage and kept under natural condition. Another set of experiment was conducted under field conditions during July–December where no artificial inoculation with *M. phaseolina* was made. From both set of experiments, seed borne infection by *M. phaseolina* was determined by blotter paper method (ISTA 2017) after harvesting and cleaning of seeds using the standard manual. The weather parameters during seed growing period (July to December) are presented in Fig. 1.

Transmission : Transmission of inoculum (*M. phaseolina*) through seed to seedlings was determined by sterilized sand-soil method. Sand-soil in PVC bag was sterilized by autoclaving at 20 lbs pressure for 30 min for consecutive two days. Prior to filling this sand-soil, earthen pots were sterilized by 0.1% mercuric chloride solution. Freshly harvested seeds were sown at the rate of 100 seeds per pot and maintained for 15 days in a glasshouse. Observation on germination, pre-emergence and post emergence rotting was recorded. In another set of experiment healthy seeds were treated with active culture (10 days old) of *M. phaseolina* isolated from discolored seeds and these seeds were kept for 7 days in an incubator for establishment of fungi. After 15 days of sowing germination, pre-emergence and post emergence rotting. Vigour index (VI) was calculated as [(root length+ shoot length) × germination]. In third set of experiment freshly harvested seeds are sown under field condition and performance viz. germination, pre-emergence and post emergence rotting was calculated after 15 days.

Location of fungi : Seed component plating method was used to locate *M. phaseolina* in seed coat, cotyledon and embryo. Different parts of freshly harvested seeds viz. seed coat, cotyledon and embryo were surface sterilized and plated on PDA and incubated at 28+1°C for 10 days and examined under microscope for the presence of *M. phaseolina* and other fungi. Fungi isolated from each part were identified on the basis of fungal colony, characteristic fruiting bodies and sporulation using standard identification manual (Frank 2017).

RESULTS AND DISCUSSION

Assessment of seed borne infection : Under natural condition infection of *M. phaseolina* in jute seeds grown at ICAR-CRIJAF Research Farm, Barrackpore varies from 1.4–2.1% whereas under artificial inoculation at flowering and pod setting stage it varies from 4.0%, 5.1–6.2% respectively.

Transmission of pathogen : The transmission studies under artificial condition revealed that the

Table 1. Pathogenic potential of *Macrophomina phaseolina* on jute seed.

Treatment	Germination (%)	Pre-emergence rotting (%)	Post-emergence rotting (%)	Vigour index
Sterilized soil-soil + inoculated seed	38.0	46.4	7.0	504
Sterilized sand-soil + un-inoculated seed	86.4	8.9	2.8	591
Normal field soil + inoculated seed	92.0	4.8	1.5	599
CD (P= 0.05)	4.37	4.1	1.7	23.6

germination of inoculated seed reduced to around 38% which is mainly due to pre-emergence rotting (46.4%) of seedling. Post-emergence rotting of seedling (about 7% was also high in inoculated seed. Symptoms are mostly confined to the root and stem of the plants. Germination, pre-emergence and post-emergence rotting of un-inoculated seeds under laboratory (86.4%, 8.9% and 2.8%) as well as field conditions (92%, 4.8% and 1.5%) are not so affected. Seedling vigour expressed as vigor index is also significantly less (504) in inoculated seed as comparison to un-inoculated seed grown in pot as well as in field condition (591 and 599) (Table 1).

The location of the pathogen (*M. phaseolina*) were tasted by component plating method, mostly the pathogen is confined to the seed coat (Seed Coat- 5.0%, Cotyledon - 2.0%, Embryo- 0.0%, discolored seed –25.0%). Thus discolored seed must be discarded and seed treatment is essential to reduce seed borne infection. The findings are in corroboration with Sultana *et al.* (2009) and Thippeswamy *et al.* (2011).

From the results it is clear that the *M. phaseolina* is mostly externally seed borne and under natural contrition the seed infection is 1.4–2.1%. The germination and emergence rotting of naturally grown seeds (not artificially inoculated) even under sterilized sand-soil condition are 86.4%, 8.9% and 2.8% respectively. Further, it was observed that under natural condition seed germination is more than 90% which is more than the seed standard (80%) (Tunwar and Singh 2013). The performance of the locally grown seeds in terms of fiber productivity is also more than 30 q/ha in West Bengal condition (Sarkar *et al.* 2021). Therefore, there is no threat of seed borne infection of *M. phaseolina* on productivity of the jute crop under natural condition rather the farmers will get benefitted by getting the seeds timely if it is produced at West Bengal itself. The sowing of jute seed crop during mid-August followed by foliar spraying of carbendazim 50 WP @ 0.2% at pod maturity stage was most effective for maximization of quality jute seed (~13 q/ha) (De 2013, Sarkar *et al.* 2016). Even in mid-September sown crop the yield was as high as 8.8 q/ha with same quality as that of August sown crop. Certain advantage like reduction in crop duration as well as escaping of peak rainfall that hinders different operations is associated with September-sown crop. In September-sown crop also the seed infection as well as seed discoloration reduced significantly and other quality parameter like germination and vigour index remain unaffected as that of August sown crop (Sarkar *et al*. 2016).

REFERENCES

De RK (2013) Effect of date of sowing on the incidence of stem rot of jute (*Corchorus olitorious* L.) caused by *Macrophomina phaseolina*. *J Mycopathol Res* 51 (2) : 251—257.

Fakir GA (1998) Health status of farmers jute seeds: Progress and prospect of seed pathological research in Bangladesh. 1st International Workshop on Seed Pathology, Department of Plant Pathology, BAU, Mymensingh, Bangladesh.

Frank M Dugan (2017) The Identification of Fungi: An Illustrated Introduction with Keys, glossary and guide to Literature. APS Publication, https://doi.org/10.1094/97-80890545041, ISBN:978-0-89054-504-1.

Ghosh T, Biswas MK, Guin C, Roy P (2018) A review on characterization, therapeutic approaches and pathogenesis of *Macrophomina phaseolina*. *Pl Cell Biotech Mol Biol* 19 (3 and 4) : 72—84.

ISTA (2017) Rules Proposals for the International Rules for Seed Testing 2018 edition. International Seed Testing Association (ISTA), Bassersdorf. https://doi.org/10.15258/istarules.2015.f.

Sarkar SK, Chawdhury H, Satpathy S (2016) Disease-free jute seed production in West Bengal. *Bangladesh J Bot* 45 (3) : 561—565.

Sarkar SK, Jha SK, Kar Gouranga, Satpathy S, Mitra J, Saha AR, Mitra S (2021) ICAR-CRIJAF – A Profile, ICAR-Central Research Institute for Jute and Allied Fibers, Barrackpore, Kolkata, pp 36.

Sarkar SK, Satpathy S, Chowdhury H, Kar CS, Bera Amit (2016) Disease free jute seed production in West Bengal. Central Research Institute for Jute and Allied Fibers, Barrackpore, Kolkata 700120. Bull 1/2016.

Sultana Nasreen, Azeem Talha, Ghaffar A (2009) Location of seed-borne inoculum of *Macrophomina phaseolina* and its transmission in seedlings of cucumber. *Pak J Bot* 41 (5) : 2563—2566.

Talukdar FU, Rahman MS, Saleh Mohammad Ashraful Haque, Mohammad, Mia Mukul (2021) Prevalence of seedborne fungal invasion on tossa jute (*Corchorus olitorius*) seeds. *Front Environ Microb* 7 (1) : 15—21.

Thippeswamy B., Sowmya HV, Ramalingappa, Krishnappa M (2011) Location and transmission of *Macrophomina phaseolina* and *Alternaria alternata* in okra. *Int J Pl Prot* 4 (1) : 23—26.

Tunwar NS, Singh SV (2013) Indian Minimum Seed Certification Standards. The Central Seed Certification Board Department of Agriculture and Co-operation Ministry of Agriculture, Government of India, New Delhi.