Eco. Env. & Cons. 29 (3) : 2023; pp. (1115-1117)
Copyright@ EM International
ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i03.015

Assessment of seed quality parameters in Stemphylium blight infected seeds caused by *Stemphylium vesicarium* in onion

[1]Niranjan Prasad H.P.,*[2]Atul Kumar, [2]Vijay Dunna, [3]J.K. Ranjan, [4]Jameel Akhtar and [5]Gyan P. Mishra

[1,2] DSST, ICAR-IARI, New Delhi 110 012, India
[3] Vegetable Science, ICAR- IARI, New Delhi 110 012, India
[4]Plant Quarantine, ICAR- NBPGR, New Delhi 110 012, India
[5]Genetics, ICAR-IARI, New Delhi 110 012, India

(Received 25 January, 2023; Accepted 6 March, 2023)

ABSTRACT

*Stemphylium vesicarium*is an important seed-borne and foliar pathogen and it is highly detrimental to onion crop. Among ten genotypes studied for the effect of Stemphylium blight on the seed quality parameters using infected and healthy seeds,the germination percentage of infected seeds is relatively lower than healthy seeds. The reduction in germination percentage of diseased seeds varied between 14 to 67%. Seed quality parameters like germination and vigour were negatively correlated and the electrical conductivity was positively correlated with *Stemphylium* blight incidence. This shows that a higher incidence of pathogens will lower the viability and vigour of seeds and the infection level is also dependent on genotype and the environmental condition. The seed-borne fungi were found responsible for poor vigour and low seedling emergence in the nursery. The seedling emergence in the seed sample might be low due to the proliferation of pathogenic fungal species on germinating seedlings and resulting in seed and seedling death.

Key words : *Onion, Stemphylium vesicarium, Seed quality, Germination, Vigour.*

Introduction

Onions are affected by many biotic and abiotic stresses during crop production. Among them, fungal diseases such as damping off, Stemphylium blight, downy mildew, basal stem rot and purple blotch are known to cause substantial losses during seed production. Stemphylium blight [*Stemphylium vesicarium* (Wallr.) Simmons] is one of the critical diseases which causes considerable losses in seed as well as bulb crops. The disease is becoming a major concern in recent years, especially in Northern and Eastern India. The initial symptoms appear as small, yellowish-brown to tan, water-soaked lesions at the 3- to 4-leaf stage (Rao and Pavgi, 1975). As the disease progresses, extensive necrosis of infected leaves develops from the tip. After infection, the *S. vesicarium* produces host-specific toxins associated with necrosis (Singh *et al.,* 2000). During the later stage of disease development, desiccation and premature lodging of onion make it more susceptible to secondary and post-harvest infections. The intensity

([1]PhD Scholar, [2] Principal Scientist, [3]Principal Scientist, [4]Principal Scientist, [5]Principal Scientist)
(*Division of Seed Science & Technology, ICAR- IARI, New Delhi 110012)

of disease is greater in seed crops than in bulb crops (Shahanaz *et al.,* 2013). Reduction in germination, vigour and other seed quality parameters result in great loss, as it leads to poor production and productivity of the crop. Control of stemphylium blight by chemicals is easy but dependence on chemical methods of disease management may lead to residue and persistence problems, death of beneficial flora and fauna and evolution of fungicide-resistant pathogen population. The use of biocontrol agents to control plant diseases offers an excellent alternative to chemical control. In the present investigation, seed quality parameters of healthy and infected seeds of various genotypes of onion and their management using biocontrol agents were undertaken under laboratory conditions.

Materials and Methods

Raw material

The seeds of different onion cultivars showing typical Stemphylium blight symptoms were collected from Delhi (cvs., Punjab Naroya, Pusa Red and Pusa Riddhi), Punjab (cvs., PRO 6 and L28), Karnataka (cvs., Rajoli Local, Double Red and Bhima Red) and Maharashtra (cvs., Nasik Red and Pune Fursungi) states during 2020-21.

Seed Quality parameters

The mycelial growth on seeds was observed under the standard blotter paper method. The germination test was conducted according to International seed testing rules, 2021. The percentage of seed germination was recorded using four hundred seeds for each treatment by employing between paper method with four replications. Ten normal seedlings were selected randomly from the germination test, shoot and root lengths of those selected seedlings were recorded for the calculation of seedling length. The mean value of seedling length was calculated and expressed in centimetres. For seedling dry weight, randomly taken ten normal seedlings were placed in butter paper and dried for 24 hours in a hot air oven maintained at 70°C. The dry weight of the seedlings was recorded in an electronic balance and the average weight was computed and expressed in milligrams per ten seedlings. The vigour indices of seeds were calculated according to the method suggested by Abdul-Baki and Anderson (1973) and were expressed as a pure number.

Vigour Index (V I) I = Germination (%) x Total seedling length (cm)

Vigour Index (V I) II = Germination (%) x Seedling dry weight (mg)

Statistics

The analysis of variance was done using a completely randomized design analysis in the OPSTAT sheet. Statistical significance was tested using the "F" test. The critical difference was also used to test the difference between any two means.

Results and Discussion

Seed quality parameters

The mean germination percentage of healthy seeds ranged between 79-84%, while infected seeds ranged between 45-56%. The reduction in germination percentage of diseased seeds varied between 14 to 25%. Maximum germination (84%) was recorded in healthy seeds of genotypes P Naroya whereas minimum germination (42%) was recorded in infected seeds of genotypes Rajoli Local (Fig.1).

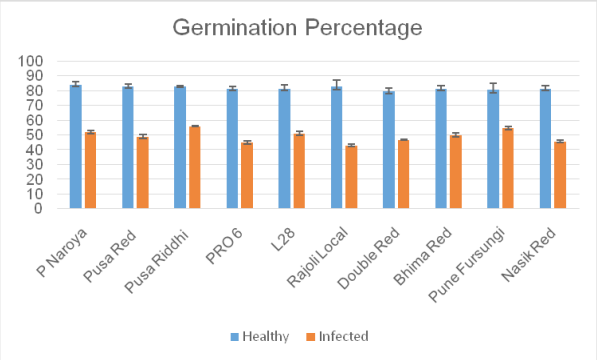

Fig. 1. Mean Germination percentage of healthy and infected seeds

The vigour index I of healthy seeds ranged between 737.97- 809.33, while infected seeds ranged between 299.3-387.8. Maximum vigour of 809.3 was recorded in healthy seeds of genotypes Punjab Naroya which drastically fell down to 342.6 in infected seeds (Fig. 2).

The vigour index II of healthy seeds ranged between 0.3957-0.4358, while infected seeds ranged between 0.1867-0.2298. Maximum vigour of 0.4358 was recorded in healthy seeds of genotypes P.Naroya which drastically fell down to 0.2233 in infected seeds (Fig. 3).

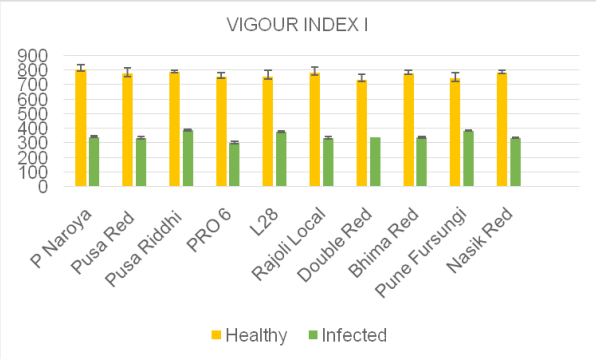

Fig. 2. Mean Vigour index I of healthy and infected seeds

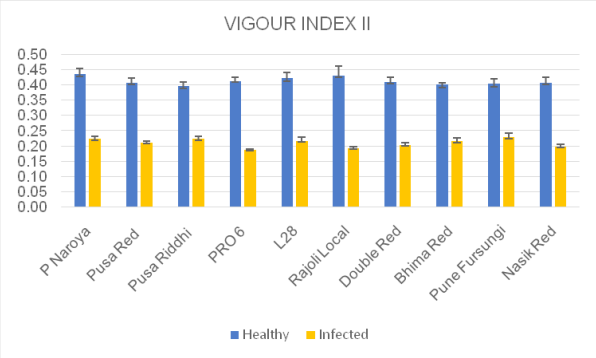

Fig. 3. Mean Vigour index II of healthy and infected seeds

Discussion

The results of our investigations clearly showed that Stemphylium blight caused by S. *vesicarium* has a significant effect on seed germination, seedling length and seedling dry weight. The seeds of the infected varieties showed reduced germination, seedling length and dry weight compared to the healthy seeds of same varieties. The seed-borne fungi were found responsible for poor vigour and low seedling emergence in the nursery. The seedling emergence in the seed sample might be low due to the proliferation of pathogenic fungal species on germinating seedlings and resulting in seed and seedling death. The vigour of seedlings arising from such highly infected seed samples was comparatively low, whereas seed samples showing infection up to 10 per cent gave very good germination and the vigour of seedlings was also very high. So, the results indicated that the seed samples with more than 50 per cent seed infection are poor in germination as well as in vigour. The seed germination and vigour index decreased with an increase in seed infection. This effect may be probably due to fungi which caused more of seed rotting and abnormal seedlings.

Acknowledgement

The authors are thankful to the Head Division of Seed Science and Technology for utilizing the facilities of the division, SERB for chemicals and equipment and ICAR-IARI Fellowship for financial help for conducting research.

Conflict of interest: On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Abdul Baki, A. A. and Anderson, J. P. 1973. Vigour determination in soybean seeds by multiple criteria. *Crop Sci.* 13:630-33.

Raghavendra Rao, N.N. and Pavgi, M.S. 1975. Stemphylium leaf blight of onion. *Mycopathologia*. 56: 113-18.

Shahnaz, E., Razdan, V.K., Rizvi, S.E.H., Rather, T.R., Gupta, S. and Andrabi, M. 2013. Integrated disease management of foliar blight disease of onion: A case study of the application of confounded factorials. *J. Agric. Sci*. 5: 17-22.

Singh, P., Park, P., Bugiani, R., Cavanni, P., Nakajima, H., Kodama, M., Otani, H. and Kohmoto, K. 2000. Effects of host-selective SV-toxin from *Stemphylium vesicarium*, the cause of brown spot of European pear plants, on ultra-structure of leaf cells. *J. Phytopathol*. 148: 87-93.