Evaluation of Genetic Relationships and Waterlogging Tolerance on Sesame (*Sesamum indicum* L.) and its Wild Relative *Sesamum radiatum* (Schum. and Thonn.) DC. ex Meisn.

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SUMMARY

The genus *Sesamum*, the Pedaliaceae family, comprises about 20 species, most of which are indigenous to tropics and subtropics. A few species in the genus are occasionally cultivated for their edible seeds and leaves. The species of *Sesamum* have wide adaptability and environmental flexibility. These wild relatives and landraces are the backbones of agricultural production since they are an essential source of genetic diversity for breeders. The goal of sesame breeding is to obtain high yielding genotypes having tolerance to environmental stresses. The wild relatives of cultivated sesame have been proven to be useful for crop improvement since they possess desirable traits such as non-shattering, determinate growth with uniform ripening, and resistance to biotic and abiotic stress.

Wild type *Sesamum radiatum* (Schum. and Thonn.) DC. ex Meisn. originated from Africa is widely consumed as vegetable and grows as a common roadside weed. *Sesamum indicum* L., the cultivated one, thrives well in the harsh environments and provides an income for small-scale farmers in developing countries. Although global sesame production is increasing, productivity is still low because of the adverse effects of abiotic stresses. Waterlogging is the major threat for sesame production in the South and East Asia. When the crop suffers this stress at the crop establishment and reproductive stage, the yield could be decreased by 77% and 47%, respectively.

Myanmar is one of the rich genetic diversity zones of sesame; however, there is a lack of systematic study regarding this issue. *Sesamum* sp. (accession 01-11-27) collected in Kyaito township, Mon State in Myanmar, looks phenotypically similar to *S. radiatum*. Artificial sexual hybridization was performed with three *S. radiatum* accessions (94-27-1, 94-28 and 94-28-1) collected from Africa to produce F_1 hybrids to prove this claim. Their germination pattern, pollen fertility, and seed setting rate were evaluated and compared to parent accessions. Besides that, the germination rate of F_2 generations was tested *in vitro.* It was observed that F_1 hybrids possess high pollen fertility, normal germination, and seed set except those F_1 hybrids crossed with accession 94-28-1, which showed low germination, but high pollen fertility and normal seed set. The result confirmed that accession 01-11-27 is an *S. radiatum* since it could easily cross to produce completely fertile hybrids.

Fifty-eight sesame accessions including *S. radiatum* were screened under different waterlogging days *in vitro*. Germination rate, the radicle length, hypocotyl length, seedling fresh weight, and the waterlogging index were determined. Sesame

genotypes showed different responses to waterlogging stress. Germination rate and the seedling length significantly declined at 7 days of waterlogging. Therefore, the critical time point for the response of sesame to waterlogging stress is 7 days. Based on the waterlogging index, 40 accessions were found tolerant, 11 moderately tolerant, 4 moderately susceptible, and 2 susceptible to waterlogging. Based on the result of laboratory studies, 40 accessions were further evaluated for their tolerance at early seedling stage in the greenhouse. Survival rate and seedling growth were significantly reduced under waterlogging conditions as compared to the control. Based on the survival rate, sesame accessions No. 259156 (cultivar Sinyadanar-1) were found to be moderately tolerant of waterlogging at the early seedling stage. This material can be used as waterlogging tolerance resource for further studies.

The obtained result confirmed the status of accession 01-11-27, which is a fertile cross hybrid of *S. radiatum* collected from Africa, and nowadays distributed in Myanmar of the Southeast Asia. Myanmar sesame accessions have different tolerant levels depending on the period of waterlogging stress. The present study could provide useful information not only for farmers but also for the future sesame improvement program.