

Influences of ground moss cover and summer precipitation on the occurrence of tar spot disease of polar willow in Ny-Ålesund, Spitsbergen Is., Norway

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Introduction and Objectives

Plant pathogens commonly occur on mosses and vascular plant species in the polar regions (Tojo and Newsham 2012). Tar spot disease caused by *Rhytisma polare* is commonly found on leaves of polar willow (*Salix polaris*) in Ny-Ålesund, Spitsbergen Is., Norway (Masumoto et al. 2014). *R. polare* has been known to have a large impact on the host carbon balance under the natural polar ecosystem (Masumoto et al. 2018a). Since *R. polare* requires the wet conditions of the host plant leaves for the dispersion of the ascospores (Masumoto et al. 2018b), keeping the wet leaves is important for the occurrence and development of the disease. During the long-term field surveys of plant pathogens in Ny-Ålesund (Tojo and Nishitani 2005; Tojo et al. 2021), we found that tar spot disease highly occurred when the host plant was grown on the ground covered with mosses which can keep the wet condition required for the disease occurrence. The objective of this study was to clarify the influences of ground moss cover on the occurrence of tar spot disease of polar willow. Summer precipitation which provides wetting of the host plant leaves was also evaluated on the influence of the disease occurrence.

Materials and Methods

The experiment was conducted at the north side cliff in Ny-Ålesund, Spitsbergen Is. from July to August of 2008, 2010, 2012, 2013, 2016, 2018, and 2022. Fifteen plots, each consisting of a 15 x 15 cm square containing up to 223 shoots of polar willow, were examined for the number of plant shoots that had diseased leaves. The ground covering mosses were examined for each plot on the percentage of ground area covered by moss colonies consisting mainly of *Sanionia uncinata* and *Orthothecium* sp.

Results

Positive correlations were observed between tar spot occurrence and the moss-covered area in all three observation years with coefficients of 0.85, 0.59, 0.68, and 0.54 for 2008, 2010, 2012, and 2018 respectively. The disease occurrence increased with increasing the moss-covered area in the other years investigated, although the positive correlations were unclear in these years. The disease showed high occurrence when the summer precipitation was increased.

Conclusion

The results demonstrated that the ground moss cover and summer precipitation influenced the occurrence of tar spot disease of polar willow in Ny-Ålesund, Spitsbergen Is. The ground moss cover was thought to keep the wet condition required for the disease occurrence. Since the distribution of moss communities and precipitation patterns are changing year by year in Ny-Ålesund (Ren et al. 2021), more long-term monitoring is needed to have a better understanding of the occurrence factors of tar spot disease.

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