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extraction was performed on the boiled water-bath in the ratio of 1:20 (comminuted dried rhizome material: distilled water) for 30 min. The viability of yeast cells by long-term cultivation was determined by methylene blue staining and by counting the number of colonies generated onto agar plates. Activity of antioxidant enzymes and level of oxidized proteins were measured by spectrophotometric methods.

Concentration-dependent effects of aqueous extract from *R. rosea* root on long-term survival and stress resistance of budding yeast *Saccharomyces cerevisiae* were studied. At low concentrations, *R. rosea* aqueous extract extended yeast chronological lifespan, enhanced oxidative stress resistance of stationary-phase cells and exponentially growing yeast cultures. At high concentrations, *R. rosea* extract sensitized yeast cells to stresses and shortened yeast lifespan. These biphasic concentration-responses describe a common hormetic phenomenon characterized by low-dose stimulation and high-dose inhibition. Yeast pretreatment with low doses of *R. rosea* extract enhanced yeast survival and prevented protein oxidation under H_2O_2-induced oxidative stress. Positive effect of *R. rosea* extract on yeast survival under heat shock exposure was not accompanied with changes in antioxidant enzyme activities and levels of oxidized proteins.

POTENTIAL MECHANISMS OF SOIL NITRIC OXIDE PRODUCTION

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Nitric oxide is a precursor of tropospheric ozone (Cameides et al., 1994; Laville et al., 2011), which is one of the most important high reactive gaseous pollutant impacting human health and plant productivity (Staffelbach et al., 1997; Ludwig et al., 2001).

Revealing and figuring out possible NO production mechanisms in soils to mitigate nitric oxide influence on ozone formation in sensitive areas was the main goal of our study. Google Scholar and Web of Knowledge interactive data bases were used for review investigation of recent studies.

Biological N transformation processes are usually considered as potential sourced of NO productions, at the same time chemically N transformation should not be neglected. Chemodenitrification is a non-enzymatic chemically transformation of nitrite or nitrate to different gas compounds, including NO (Skiba, 2008). It was shown (Zumft, 1997; Skiba, 2008) that this process normally could occur at pH < 5 in soils with high concentration of organic matter and at presence of iron, ammonium or amines, whilst high NO_2^- concentration level (Ludwig et al., 2011) and temperature (Kesik et al., 2006) influenced on conversion rate as well. High rates of NO emission, associated with chemodenitrification, were reported by Cheng et al. (2004) for agricultural and Kesik et al. (2006) for temperate forest acidic soils. Dissimilatory nitrate reduction (DNRA) to ammonium is a microbial enzymatic process of nitrate transformation into ammonium via nitrite (Cole and Brown, 1980; Cole, 1990) and could be performed by different group of bacteria: obligatory anaerobes, facultative anaerobes and aerobes. It was demonstrated that DNRA was favored at intensively reduced and C-rich soils (Tiedje, 1988; Schmidt et al., 2011). Since N_2O production was found during DNRA (Baggs, 2011), hypothetically nitric oxide could be produced as an obligatory precursor (Russow et al., 2009), but nothing was reported until present time. Urgent and intensively investigations of DNRA as a potential process for NO production/emission are needed to estimate rate of this process.

The detailed discussion of these findings point and demonstrate undiscovered, poorly investigated issues, regarding NO production, which urgently should be taken into account and investigated.

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THE ROLE OF NITRIFICATION AND DENITRIFICATION IN SOIL NITRIC OXIDE PRODUCTION

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Nitric oxide is highly reactive compound in near ground atmosphere (Fowler et al., 2009) and is considered as the main precursor of tropospheric ozone in rural areas (Cameides et al., 1994; Laville et al., 2011).

The main purpose of our survey study is an understanding of NO production/emission mechanisms in soils allow to develop the mitigation strategy for its reduction, leading to O_3 level declining. Published data were obtained using Web of Knowledge and Google Scholar research article data bases.

The basic soil biological N transformation processes could be considered as potential sourced of NO productions. Nitrification is stepwise conversion of NH_4^+ via hydroxylamine (HA) into NO_2^- and to final product – NO_3^- (Zumft, 1997; Wrage et al., 2001). NO production is considered as an intermediate in a step of HA transformation into NO_2^- (Hooper and Terry, 1979; Ludwig et al., 2001). Nitrification is affected by NH_4^+ availability, soil O_2 level, soil moisture content, pH and temperature (e. g. Zumft et al., 1997; Ludwig et al., 2001). Significance of nitrification for NO emission was shown by many researchers (e. g. Gasche and Papen, 1999; Venterea and Rolson,