Abstract

Title of Ph.D thesis: Modulation of Adventitious Rooting in Sunflower Hypocotyls by Nitric Oxide, Auxin and Other Related Biomolecules

Department: Botany; Candidate: Sunita Yadav; Supervisor: Professor S.C. Bhatla

Adventitious root (AR) formation from the meristematic activity in the predetermined interfascicular region of the stem, has been under investigation in the past, largely for the associated anatomical and physiological aspects. Recently, however, interesting observations on the biochemical and molecular events accompanying the three phases of AR formation (induction, initiation and extension) have also been put forward. On line with these investigations, present work focuses on auxin-modulated AR formation in hypocotyl segments derived from sunflower seedlings. Major attention has been paid to localize differential nitric oxide accumulation at/around the site of AR formation and during different phases of AR development. Based on these investigations, a model has been proposed about auxin-nitric oxide (NO) interaction during specific stages of AR formation. Going deeper into the mechanism of NO action during AR formation, tyrosine nitration of proteins has been investigated as a possible signalling route accompanying the said response. Both spatial distribution in sections and Western blotting analysis of tyrosine nitrated proteins in tissue homogenates, have generated significant new information. Analysis of actin distribution by confocal laser scanning microscopic imaging has emphasized the significance of intact cytoskeleton for polarized distribution of PIN (auxin efflux) proteins, and their modulation by nitric oxide scavenger and auxin efflux blocker in a similar manner. A bundling/debundling of actin network seems to regulate directional auxin movement by regulating the movement of PIN carrying vesicles through the process of endomembrane recycling. Two-dimensional electrophoretic separation of polypeptides has lead to interesting identification of polypeptides unique to specific stages of AR formation. In addition to these investigations, attention has also been paid to observe a possible correlation of this auxin-regulated developmental process, with mechanisms for scavenging reactive oxygen species. Serotonin, a derivative of tryptophan, has been quantified by HPLC and interesting observations on its differential distribution during the different phases of AR formation point towards its noteworthy role in the developmental process (AR) under investigation. The present work has, thus, brought forward new information on auxin-NO interaction and spatial distribution of tyrosine nitrated proteins, in addition to new findings on the involvement of actin, reactive oxygen species and serotonin during specific stages of AR formation.

Sunita Yadav
(Candidate)

Professor S.C. Bhatla
(Supervisor)