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Unravelling Urides and Amides in Legumes

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SUMMARY

Ureides are nitrogenous compounds with a special function in some legume under nitrogen fixing conditions, the ureidic legumes. Ureides are the predominant nitrogen transport molecule from nodules to the upper part, whereas amidic legumes use amides as nitrogen transport compounds. Amides and ureids are most important molecules for legumes in nodule fixations.

INTRODUCTION

Ureides are stored and assimilated mainly in the shoot. The precise pathways, localization and regulation of ureide assimilation are poorly understood and require further investigation. Similarities exist between the properties of the enzymes involved in ureide assimilation in higher plants and in micro-organisms. Warm season N2-fixing legumes move fixed N from the nodules to the aerial portions of the plant primarily in the form of ureides, allantoin and allantoate, oxidation products of purines synthesized de novo in the nodule. Ureides are also products of purine turnover in senescing tissues, such as seedling cotyledons. A combination of biochemical and molecular approaches in both crop and model species has shed new light on the metabolic pathways involved in both the synthesis and degradation of allantoin. Improved understanding of ureide biochemistry includes two 'additional' enzymatic steps in the conversion of uric acid to allantoin in the nodule and the mechanism of allantoin and allantoate breakdown in leaf tissue. Ureide accumulation and metabolism in leaves have also been implicated in the feedback inhibition of N_2-fixation under water limitation.

Nitrogen transporting molecule

The ureides have been mostly studied as the predominant nitrogen transport molecules in the xylem of nitrogen fixing tropical legumes. Legumes can fix atmospheric nitrogen through their root nodules and the fixed nitrogen can be exported to the aerial parts in the form of amides, glutamine and asparagine. The advantage of ureides as nitrogen-transporter can be exploited, as well, during other processes that require high mobilization as the seedling development described above, or during the leaf senescence. Seeds represent a crucial stage in the life cycle of higher plants. Seed germination and postgerminative growth are heterotrophic phases in the sense that seedlings completely depend on seed reserves. At the end of these periods, its nutrient reserves became depleted and the seedling must achieve photoautotrophism (Baral *et al.*, 2016)

Biotic and Abiotic stress

Biotic and abiotic stress are the main cause of crop yield loss for the major crops worldwide. The concentration of cellular ROS increases when plants are challenged by both type of stresses. ROS stress can cause oxidative damage to proteins, lipids, nucleic acids or pigments. Damaging effect of ROS can be alleviated by enzymatic and nonenzymatic mechanisms. Enzymatic mechanisms include several antioxidant enzymes such as peroxidases, catalase or superoxide dismutase, whereas the non-enzymatic mechanisms involve the action of antioxidant species such as glutathione, ascorbate or vitamin E. Consequently, ureide metabolism is related to the antioxidant activities in legume seedlings. To contrast this, the antioxidant activities and ureide metabolism of four ureidic and four amidic legumes have been investigated during early seedling development by many reserachers. ureidic and amidic plants can use different strategies to cope with the oxidative stress involved in seedlings development.The accumulation of ureides in plants under abiotic stress might suggest a possible role for ureides protecting plants against the effects of reactive oxygen species, directly acting as ROS protector or mediating the activation of ABA signaling pathways.

Transports of urides and amides

Amides and ureides, respectively are the main long-distance transport forms of organic nitrogen in legumes. Following their synthesis, amides and ureides could be transported through the root symplasm to the nodule

vasculature for xylem transport to the shoot.Amide contains more nitrogen than amino acids. Thus, amide gets transported through the xylem vessels. Important amides are asparagine and glutamine which are present in the structure of proteins in plants. These are formed from aspartic acid and glutamic acid respectively, just by adding another amino group.Their importance lies in their biological activities like antitumor, anthelmintic, antispasmodic, antifungal, antibacterial, insecticidal, and herbicidal activities.

CONCLUSION

Legumes are important crops with great agronomic and ecologic interest, since they can get most of the nitrogen for development thanks to symbiotic association with nitrogen-fixing bacteria. Legumes develop nodules to carry out the nitrogen fixation process. The nitrogen fixed in nodules can be transported to the upper part of the plants as amides (amidic legumes) or ureides (ureidic legumes). Without ureides nodules cannot be formed and N fixation cannot happen. Greengram contains large portion of ureids storage that acts for production of legheamoglobin.

REFERENCES

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