INTERNAL FACTORS OF *LUPINUS POLYPHYLLUS* INVASIVITY IN WARMING CLIMATE CONDITIONS

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Introduction

In Lithuania, the invasive lupin, *Lupinus polyphyllus* Lindl., occupies many natural habitats, changing their composition or destroying them completely. Ability to adaptively alter morphological, anatomical and physiological traits to local environmental variations is especially well expressed by all invasive plants. Because of global warming, many aspects of plant development and growth can be affected. The processes determining invasiveness are not equally expressed at all invasive plants (Erfmeier *et al.*, 2011). Strategies of investigation of alien plant internal factors determining their invasiveness are at an early stage. The main goal of the work was to evaluate intercellular chains determining survival of invasive species in warming climate conditions.

Materials and Methods

Test objects were one of the seven most dangerous invasive plant species for Lithuanian ecosystems, namely *L. polyphyllus*, and non-invasive *L. luteus* L. IAA content and status were measured employing TLC, HPLC methods (Shimadzu PROMINENCE LC-20). ATPase activity was assessed according liberated P_i. The simulation of climate warming was an increase of air temperature from +25°C to 35°C.

Results and Discussion

The results of comparative study of changes of phytohormone IAA content and status showed that during early phases of growth and development of invasive species, they were supplied by more IAA from reserve tissues of germinating seeds (cotyledons) and possibly for a longer time of growth. Preliminary results of identification of IAA metabolites suggest that the major amount of IAA-amides is characteristic for invasive lupin in comparison with non-invasive lupin (Table 1). The invasive species was characterized as having major amount of ethylene, and intensified the utilization of resources of IAA-amide complexes for maintaining IAA homeostasis under the unfavorable environmental conditions. IAA increased growth of invasive lupin roots more intensively at 25°C than at 30°C. The roots of both species grew independently of the temperature of environment during the early phases of development (up to 2 days), but gravitropic movement of *L. polyphyllus* roots was stronger at 25°C (Figure 1). The better facilities for survival of invasive species has been revealed by investigations of the activity of barrier membrane ATP-ases and electrochemical potential differences. It was shown that invasive plant was capable to maintain the differences of transmembrane electrochemical potential in the conditions of lower hydrolysis of ATP (Darginavičienė, Jurkonienė, 2013).

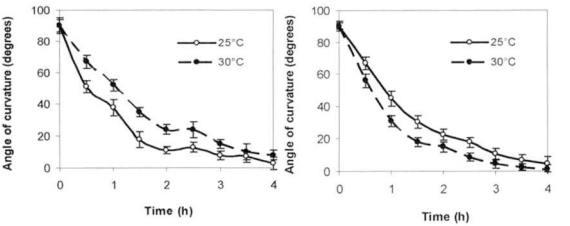

Figure 1. The gravitropic response of *L. polyphyllus* (a) and *L. luteus* (B) roots after 90° reorientation at different temperature

Table 1. IAA and its reserve compounds stocks in *L. polyphyllus* and *L. luteus* leaves

IAA status	*L. luteus* (IAA, µg/10 g fresh weight)	*L. polyphyllus* (invasive) (IAA, µg/10 g fresh weight)
IAA (free form)	278 ± 19	290 ± 12
IAA-ester	166 ± 19	191 ± 23
IAA-amide	417 ± 11	819 ± 12
IAA metabolites	21.2 ± 0.8	12.2 ± 3.2

Conclusions

Cotyledons of the invasive lupin contain more IAA than those of the non-invasive yellow lupin. Invasive lupins sprouts are better supplied with IAA from the cotyledons from IAA-reserve compounds. A specific IAA-conjugate for invasive lupin was detected. Higher ethylene content was found in invasive lupin sprouts than in non-invasive. IAA promotes root growth of invasive lupin more strongly at 25°C than at 30°C. The invasive lupin maintains transmembrane electrochemical potential in the lower energy liberated by ATP hydrolysis. Alterations in root cell growth provoked by elevated temperature can determine the negative modifications of root system which may led to the decrease of invasive lupine population.

References

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