

Development of water impermeability in seeds of black locust (*Robinia pseudoacacia*), an invasive species in Japan



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Introduction

Black locust (*Robinia pseudoacacia*) was introduced into Japan as a revegetation plant. This exotic plant species is expanding naturally along forest roadsides and river basins throughout Japan, and which is leading to adverse impacts on the species composition of the original vegetation and the ecosystem.

Black locust seeds are known as "hard seeds". However some of them are able to absorb water and germinate without scarifying. In this study, we focused on where seeds absorb water and development of water impermeability.

Water impermeability depending on storage periods of seeds and mother trees

Does water impermeability in seeds change by mother trees and storage periods?

Materials and methods

- Seeds collected in October 2006



"Seeds in autumn" borne in 2006 were collected from one tree.



"Seeds in the previous year" borne in 2005 and the seedpods left on the branch were collected from other tree.

Seed in autumn

Seed in the previous year

Definition of water absorption

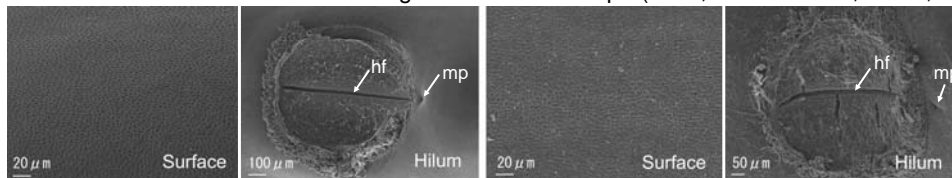


Absorbed seed (two times larger than non-absorbed seed)

Non-absorbed seed

Results

Seeds were observed with a scanning electron microscope (SEM; JSM-5310LV, JEOL, Tokyo)



Seeds in autumn

Seeds in the previous year

We didn't find any differences of structures of surfaces and hilums between seeds in autumn and seeds in the previous year

hf: hilum fissure, mp: micropyle

Table 1. Absorbed seeds and non-absorbed seeds 30 days after sowing

	Absorbed	Non-absorbed	
Seeds in autumn	145(80.6%)	35(19.4%)	a
Seeds in the previous year	1(0.8%)	119(99.2%)	b
	Number of seeds (percentage)		

Different letters are significantly different according to Fisher's test at $P < 0.05$

80.6% of seeds in autumn absorbed water.

But only 0.8% of seeds in the previous year absorbed water.

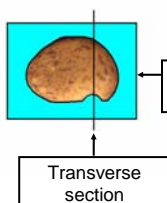
Water impermeability may be affected by mother trees, or passage on the branch more than 1 year. We didn't find any differences of structure of seed surface.

The place where seeds absorb water

Where do seeds absorb water?

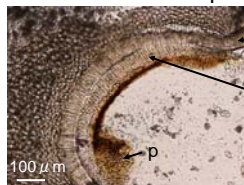
Materials and methods

We observed anatomical features of seed coats and conducted experiment of water absorption of seeds covered with Vaseline (petrolatum). Seeds collected in May 2007 were embedded in Epoxy resin (Epok 812, Oken Co. Ltd., Tokyo) and observed with light microscope.

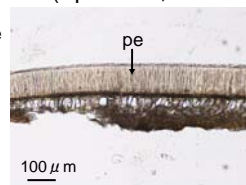


Vertical section

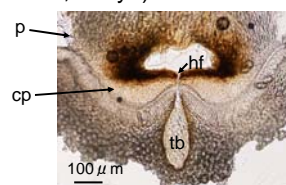
Transverse section



Hilum of vertical section



Seed coat of transverse section



Hilum of transverse section

Seed coat and hilum had characteristic structures.
 p: parenchyma, cp: counter palisade, pe: palisade epidermis, hf: hilum fissure, tb: tracheid bar

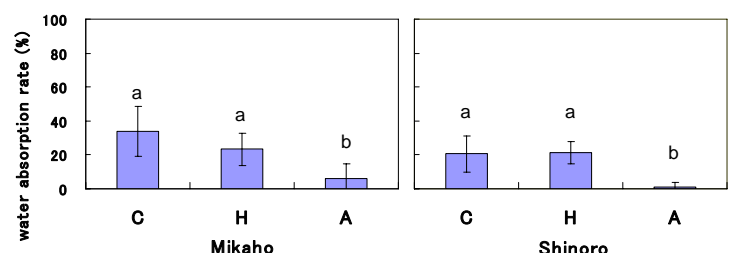
Results

Chart 1. Rates of water absorption 30 days after sowing
 Seeds are collected at Mikaho and Shinoro in Sapporo, Hokkaido.

C: Seeds covered without Vaseline

H: Seeds covered with Vaseline at hilums

A: Seeds covered with Vaseline entire seed coats



Different letters are significantly different according to Tukey's multiple comparison tests at $P < 0.05$

Covering with Vaseline was efficient. Black locust seeds absorbed water not only from hilums but also from entire seed coats.

Conclusion

- Water impermeability of black locust seed coat may be affected by mother tree or/and passage on the branch more than 1 year.
- Black locust seeds absorbed water not only from around hilums but also from entire seed coats.
- We should investigate that how water impermeability in seeds of black locust is obtained on the branch in future experiments.