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# Combinational dormancy of *Vicia angustifolia* seed and its ecological significance

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**Keywords:** Combinational seed dormancy, hydrottime model, *Vicia angustifolia*.

## Introduction

Combinational dormancy is a common phenomenon in seed of temperate legume species, however, less is known about its ecological role in an alpine environment (Hu *et al.* 2013). *Vicia angustifolia* is an annual herbaceous legume, widely distributed in the Qinghai-Tibet Plateau. The purpose of this study is to explore the seed dormancy characteristics of *V. angustifolia* and its ecological significance.

## Materials and methods

Fresh and one year stored *V. angustifolia* seed was used for the present study. Fresh and one year stored seeds were incubated at 20°C for 14 days to test the impermeability of the seed coat. To characterize seed germination response to temperature and water potential ( $\psi$ ), fresh and 1-year-stored scarified seeds were tested for germination at PEG solutions with different water potentials at 10, 15 and 20°C, respectively. To test seed physiological state in the field, fifteen nylon bags with 100 seeds each were placed on the soil surface in Xiahe County after they were harvested on October 2011. Seeds were exhumed in December, February and April, and were germinated at 20°C in the dark. The number of dead, germinated, imbibed ungerminated and hard (unimbibed) seeds were counted after 14 days. Germination times of stored and fresh seeds were analyzed by repeated probit regression based on the hydrottime model to estimate water relation parameters (Bradford 1990).

## Results and Discussion

After one year storage, hard seed increased from 25% to 90% (data not shown). This indicates physical dormancy (PY) existed both in fresh and 1-year-stored seed. Moreover, storage under dry conditions makes seeds become impermeable. PY have been proposed as an important mechanism in preventing germination after seed dispersal (Van Assche and Vandeloos 2010). However, in the present study this seems to be not the case, because percentage of hard seed at harvest was low, and an increase trend was not observed when exposed to the field, though it did increase when dry stored in the laboratory.

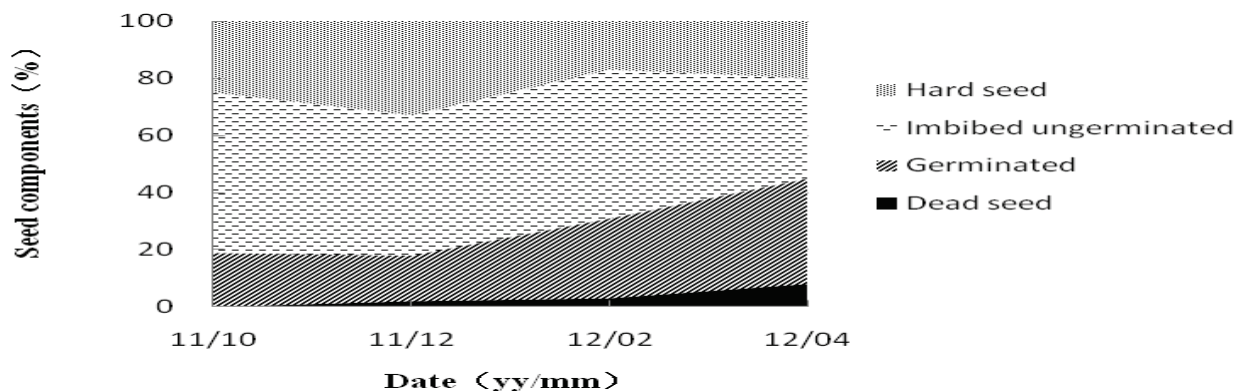
Consistent with the reports on physiological dormancy (PD) in seeds of other herbaceous Fabaceae species, scarified stored *V. angustifolia* seeds germinated faster and higher than fresh seeds especially at higher temperature such as 20°C (Table 1). Thus, we conclude that the embryos of *V. angustifolia* have some degree of PD, and thus combinational dormancy in this species. Moreover, the expression of seed dormancy at high temperature is often interpreted as a mechanism to prevent seed germination under high summer temperature (Van Assche and Vandeloos 2010). However, this is not the case in the present study because temperature during the seed dispersal season is not high enough to prevent seed germination. The hydrottime model revealed that stored *V. angustifolia* seeds had a significantly lower  $\psi_b(50)$  than fresh seeds (Table 2).

**Table 1. Germination percentage and germination rate ( $T_{50}$ ) of fresh and 1-year-old scarified seeds of *V. angustifolia* incubated at 10, 15 and 20°C for 28 days. Different letters for Germination and  $T_{50}$  indicate significant differences.**

Seed lot	Germination (%)			$T_{50}$ (days)		
	10°C	15°C	20°C	10°C	15°C	20°C
Fresh	96 ± 2 a	98 ± 1 a	77 ± 5 b	4.0 ± 0.8 c	18.9 ± 0.2 b	27.3 ± 0.2 a
Stored	93 ± 3 a	93 ± 3 a	97 ± 2 a	3.3 ± 0.0 c	2.2 ± 0.1 d	1.6 ± 0.0 e

**Table 2. Characterization of the germination responses of *V. angustifolia* seed lots to water potential at 10, 15 and 20°C by parameters of the hydrottime model.  $\theta_H$ , hydrottime constant;  $\psi_b(50)$ , median base water potential;  $R^2$ , coefficient of determination of regression**

Seed lots	$\theta_H$ (MPa.d)			$\psi_b(50)$ (MPa )			$R^2$		
	10°C	15°C	20°C	10°C	15°C	20°C	10°C	15°C	20°C
Fresh seed	4.8	2.8	4.2	-0.95	-0.53	-0.34	0.875	0.954	0.894
Stored seed	5.9	4.7	3.6	-1.46	-1.35	-1.14	0.906	0.919	0.9464



**Figure 1.** Seed components of *V. angustifolia* while on the soil surface in the field from October 2011 to April 2012.

A higher  $\psi_b$  (50) implies that germination of fresh seeds will be greatly reduced or prevented when water availability is limited, which may partly explain why seeds did not germinate in the field although temperatures were appropriate for germination. Further, the burial experiment showed that the percentage of imbibed non-germinated seeds decreased from 56 to 35% after 6 months' burial (Fig. 1), implying that PD was alleviated during this time and that germination occurs in early spring.

### Conclusion

In brief, *V. angustifolia* exhibited combinational seed dormancy, and physiological dormancy (PD) plays an important role in preventing seed germination after

dispersal by shifting  $\psi_b$  (50) to a more positive value.

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### References

- Hu XW, Li TS, Wang J, Wang YR, Baskin CC, Baskin JM (2013) Seed dormancy in four Tibetan Plateau *Vicia* species and characterization of physiological changes in response of seeds to environmental factors. *Seed Science Research*, DOI: <http://dx.doi.org/10.1017/S0960258513000019>
- Van Assche JA, Vandeloock F (2010) Combinational dormancy in winter annual Fabaceae. *Seed Science Research* **20**, 243-256.