

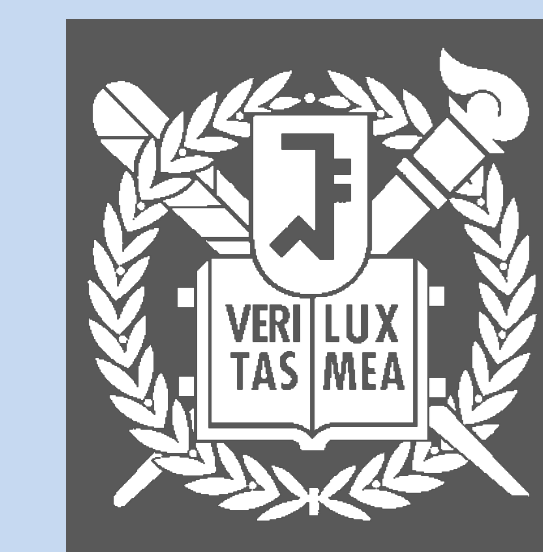
Dormancy Habit Differences by the GA/ABA Balance in Morphological (MD) and Morphophysiological (MPD) Seed Dormancy

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Introduction

- The key role of gibberellin (GA) and abscisic acid (ABA) in seed dormancy and germination is well known.
- It appears to be the GA/ABA ratio, but not the hormone contents, controls germination.
- However, most of these studies used seeds of *Arabidopsis thaliana*, *Sorghum bicolor*, *Nicotiana*, which have only physiological dormancy (PD).
- There have been few reports on hormonal regulation of dormancy in buried seeds with morphological (MD) and morphophysiological dormancy (MPD).
- In this study, the phenology of embryo development and germination in seeds of *Aquilegia buergeriana* and *Adonis amurensis* (Ranunculaceae) was investigated in the natural field soil, and the seasonal changes of endogenous phytohormone levels (ABA and GAs) were analyzed.

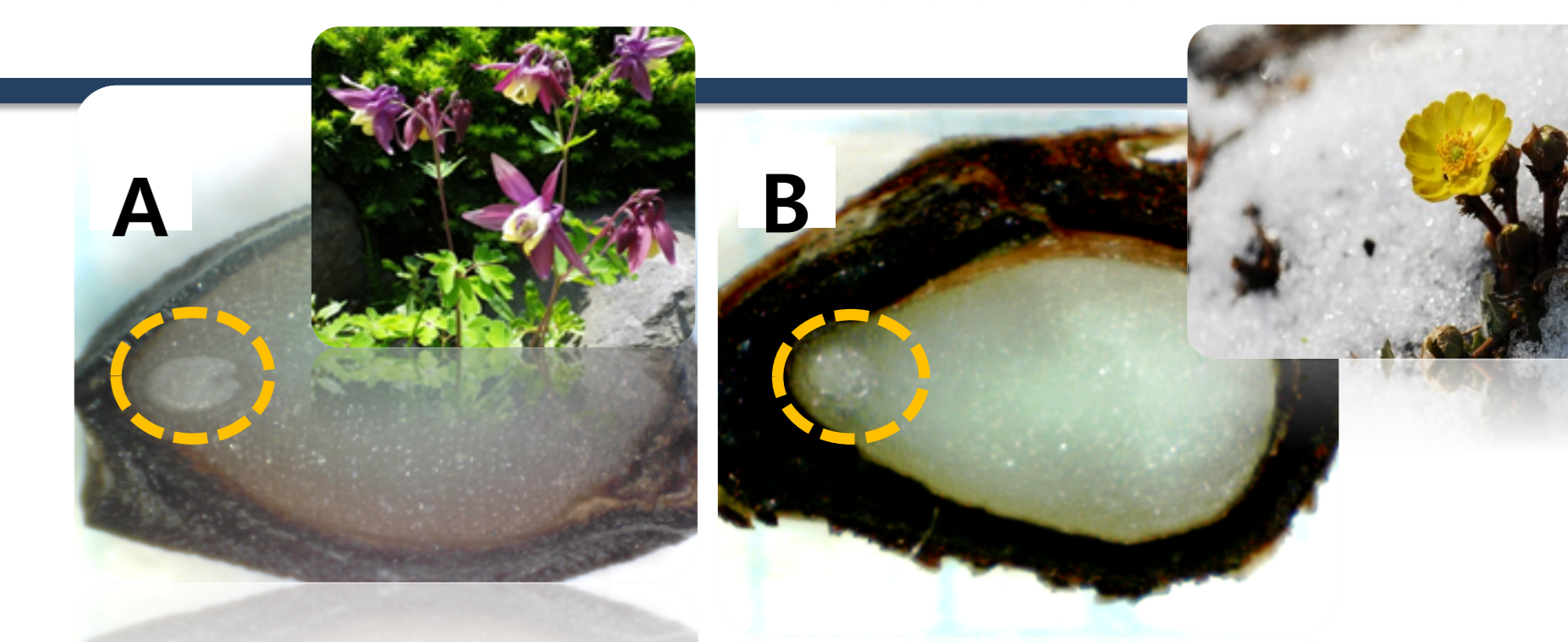


Fig. 1. Underdeveloped embryos in seeds of *Aquilegia buergeriana* (A) and *Adonis amurensis* (B)

Materials & Methods

Mature fruits were collected on 6~16 May 2012 from *A. amurensis* and 18 June 2012 from *A. buergeriana* growing in the Hantaek Botanical Garden, Yongin, Korea.

- Phenology : Seeds of *A. amurensis* and *A. buergeriana* were sown on 15 Jul. 2012 and on 1 Aug. 2012. And embryo growth, germination, and seedling emergence were monitored.
- Sampling
 - *A. buergeriana* seeds collected in 2012 were buried on 1 Aug. 2012 in the experimental garden and then exhumed three times after burial: 1) seed at harvest, 2) seeds at 6 days after burial, and 3) seeds at 12 days after burial.
 - *A. amurensis* seeds collected in 2012 were buried on 15 Jul. 2012 in the experimental garden and then exhumed seven times after burial: at harvest, on 28 Aug., on 26 Sep., on 31 Oct., on 31 Dec. in 2012, and 29 Jan. and 28 Feb. in 2013. The exhumed seeds at each time were used for the phytohormones analyses.
- Endogenous Phytohormones (ABA and GA) Analyses : HPLC-ESI-MS/MS system in The National Instrumentation Center for Environmental Management (NICEM)

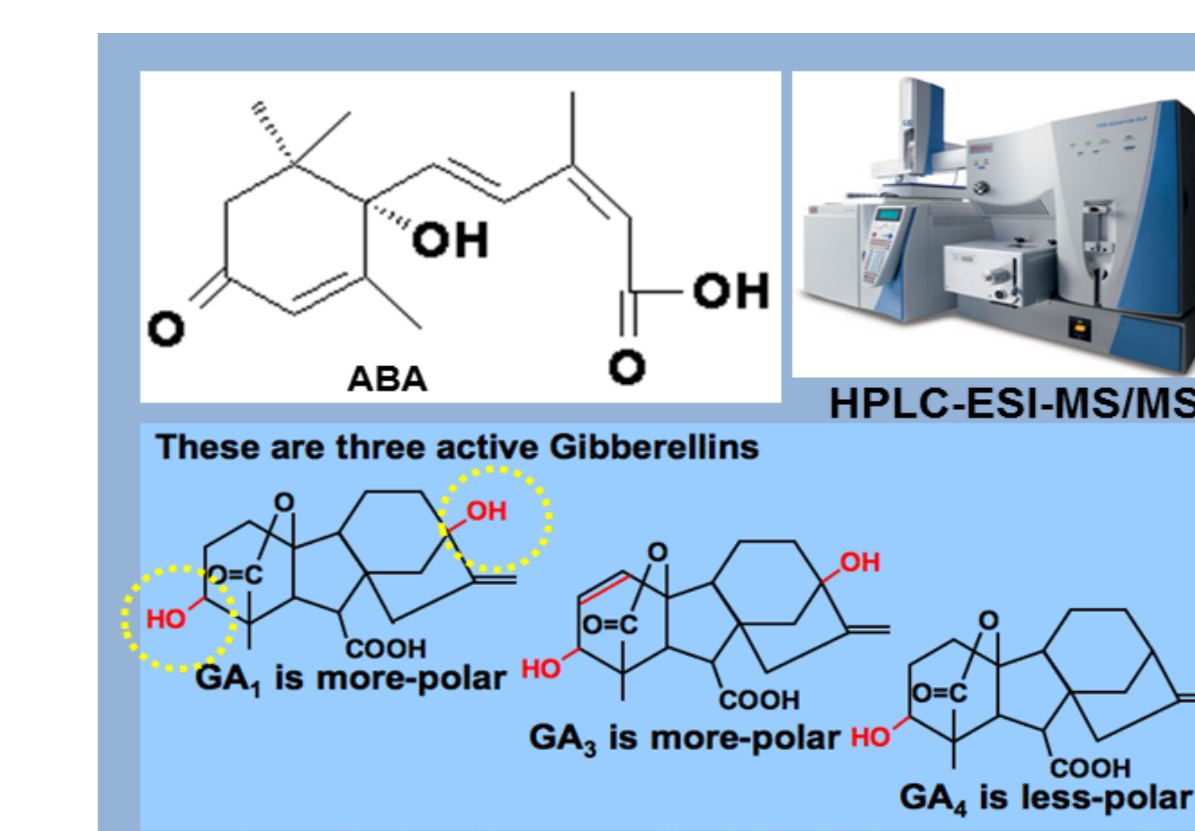


Fig. 2. Endogenous phytohormones analysis by HPLC-ESI-MS/MS

Results & Conclusions

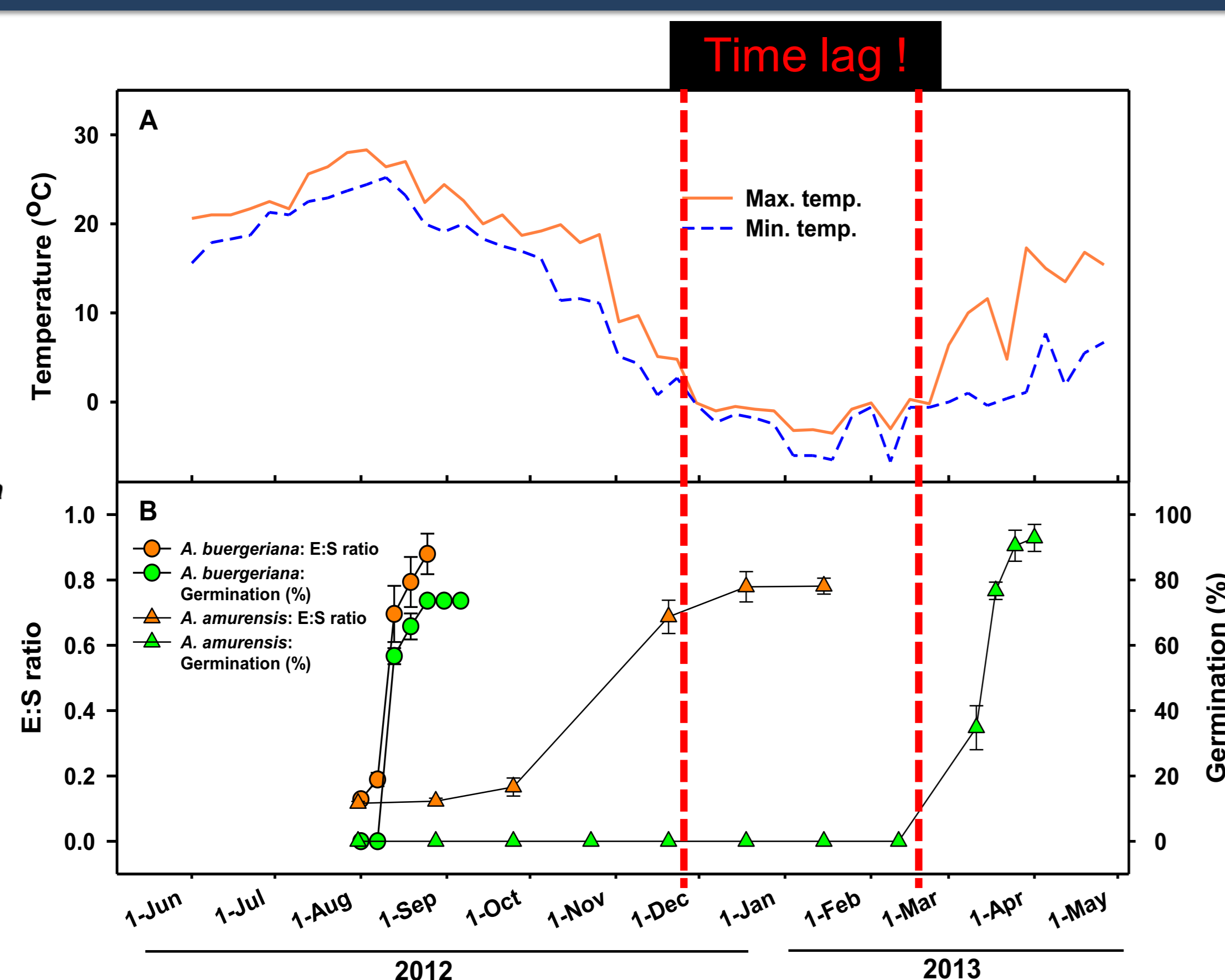


Fig. 3. The phenology of embryo growth, germination, and seedling emergence in the natural environment. The E:S ratio is the ratio of embryo length to seed length.

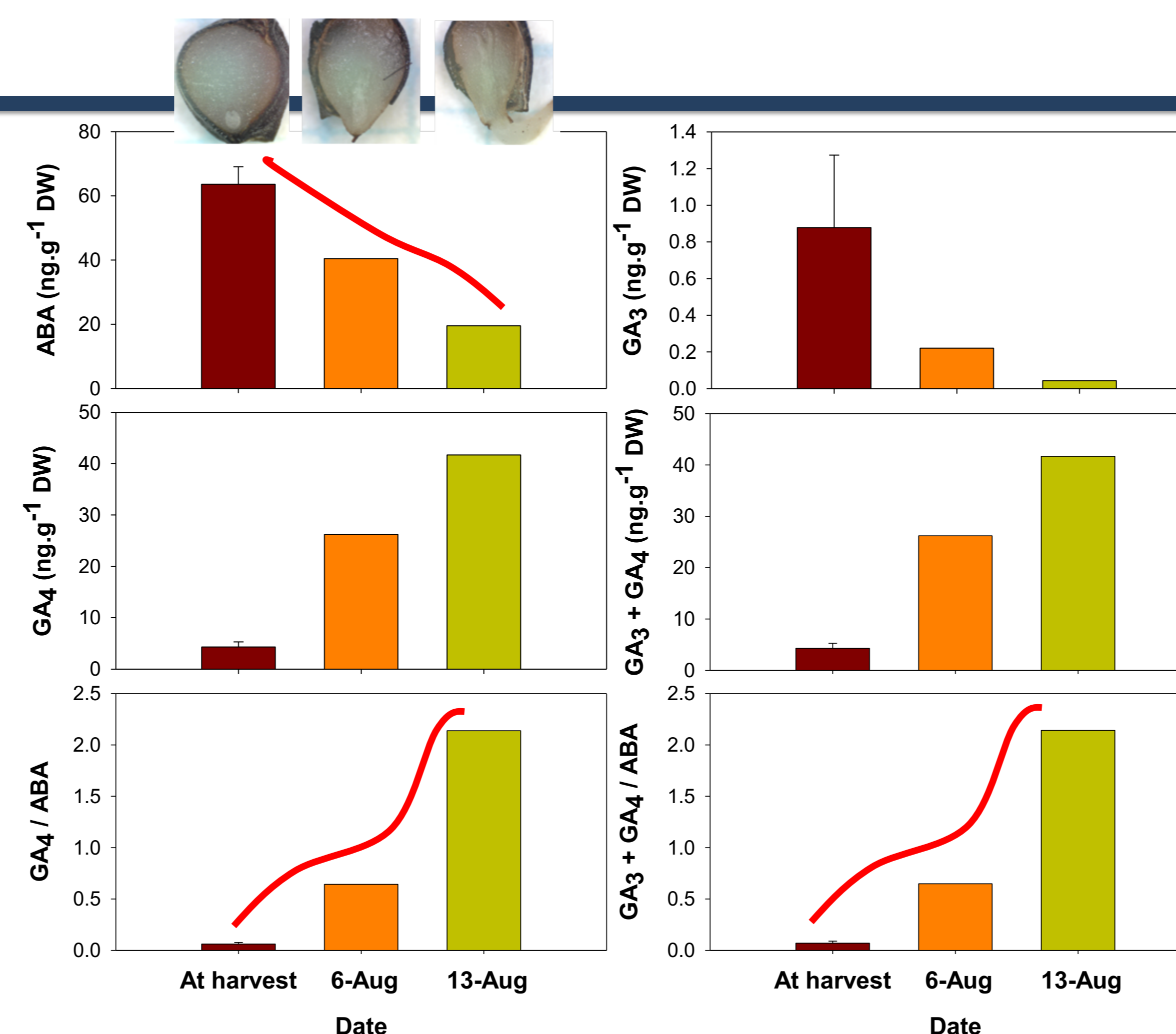


Fig. 4. Changes in the concentrations of endogenous phytohormones (ABA, GA₃) in *Aquilegia buergeriana* seeds.

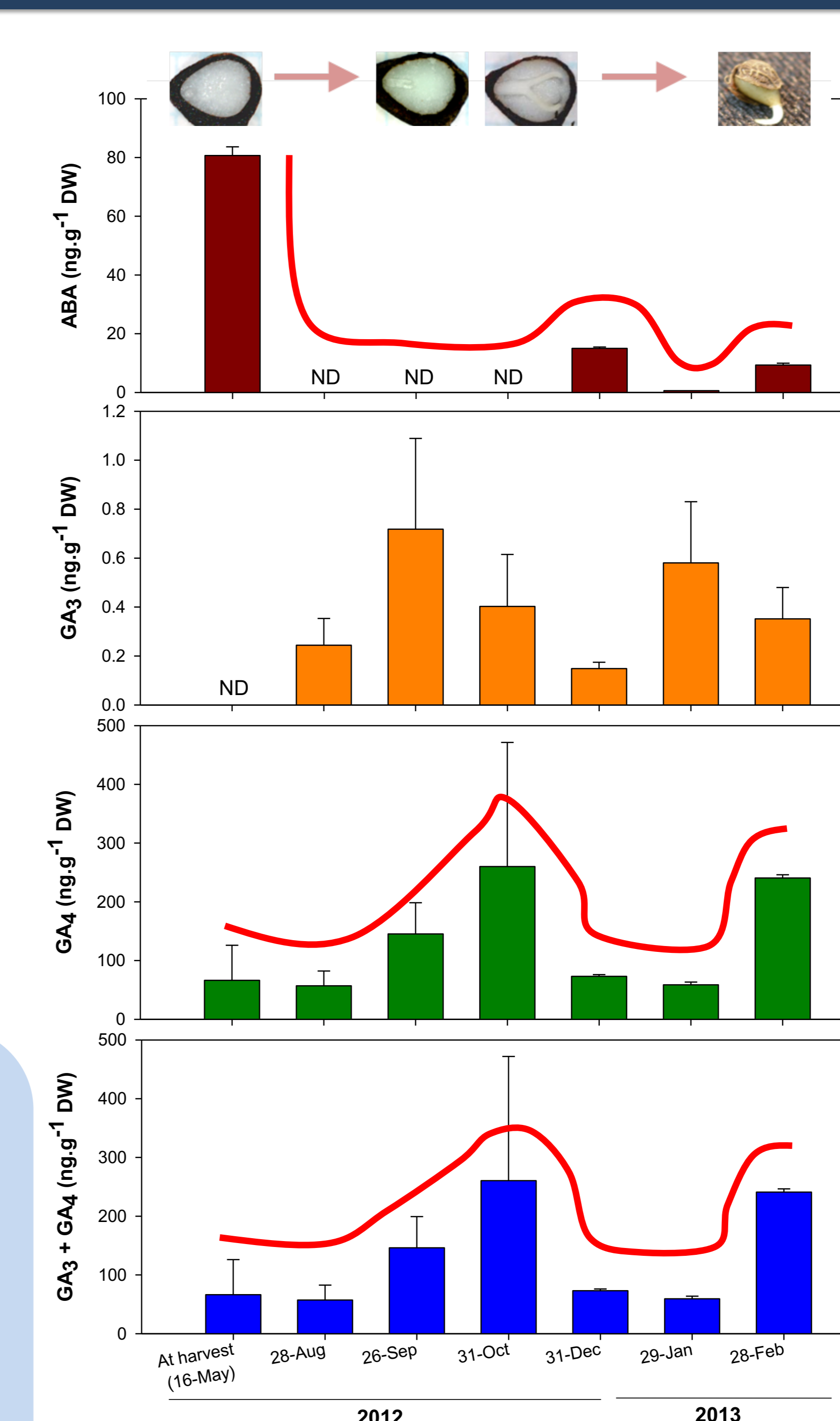


Fig. 5. Changes in the concentrations of endogenous phytohormones (ABA, GA₃) in *Adonis amurensis* seeds.

	Summer	Autumn	Winter	Spring
<i>Aquilegia buergeriana</i>				
Depth of dormancy	High	Medium	Low	None
ABA	High	Medium	Low	None
GA	Low	Medium	High	Very High
GA/ABA balance	Low	Medium	High	Very High
<i>Adonis amurensis</i>				
Depth of dormancy	High	High	High	Medium
ABA	High	High	High	Medium
GA	Low	Low	Low	High
GA/ABA balance	Low	Low	Low	High

Fig. 6. The schematic diagram of endogenous phytohormone regulation of MD and MPD.

- *A. buergeriana* seeds had MD, and embryo growth and germination were completed within 30 days in nature when soil temperatures were high. On the other hand, *A. amurensis* seeds had MPD, and experienced high in summer followed by cold temperatures in winter to break seed dormancy in nature
- MD and MPD were regulated by phytohormones (ABA and GAs)
- The changes of GA/ABA ratio were similar to the changes of embryo growth and germination in the buried seeds.
- These results indicate that MD and MPD in the basal angiosperm taxa also could be controlled by hormone balance model.