The seed germination characteristics of *Phedimus*

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（2016 年 3 月 28 日　受理）

1. Introduction

In this study, we examined germination characteristics of *Phedimus* (*KIRINSO* in Japanese) particularly with respect to the temperature conditions and the storage period for the seeds. The purpose is to determine the correct sowing and temperature and environmental conditions.

First, I will tell you what Pheimus is. There are varieties of *Phedimus kamtschaticum*: evergreen, semi-evergreen and defoliation. They bloom small yellow flowers. Originally they are wild grasses, but are now used for rooftop gardening and flowerbed. They are increased by cutting propagation. Propagation by seed germination is not performed because the seeds are too small to sow.

The merit of cutting propagation is to grow easily child strains. However, if the parent is sick, or it has a factor of some diseases, the strains obtained by cutting propagation are very likely to catch the same disease. Therefore, it is difficult to keep the plants green for a long time when they are used for rooftop gardening.

2. Method of Survey

For test plants in the present experiment, *Phedimus takesimensis* and two types of *Phedimus kamtschaticus* named as A and B for comparison were used. Seeds of *Phedimus takesimensis* were collected at Toin University of Yokohama on September 1, 2014 (***Photo 1***). Seeds of *Phedimus kamtschaticus* A were collected in the rocky places on the coast of Niigata Prefecture in August 31, 2014 (***Photo 2***). Seeds of *Phedimus kamtschaticus* B were collected in rocky hills in Niigata Prefecture in October 1, 2014 (***Photo 3***).

The first experiment was to see how the temperature difference would influence germination. Each seed was immediately seeded after collection. *Phedimus takesimensis* and *Phedimus kamtschaticus* A were seeded on September 5, 2014. *Phedimus kamtschaticus* B were seeded on October 10, 2014. We used a machine (Biotron) which can change the inside temperature to

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Photo 1. *Phedimus takesimensis*
(Toin University of Yokohama)

Photo 2. *Phedimus kamtschaticus* A
(The rocky places on the coast of Niigata Prefecture)

Photo 3. *Phedimus kamtschaticus* B
(Rocky hills in Niigata Prefecture)

watch the procedure of germination. 5 sections of the Biotron were set to 10℃, 15℃, 20℃, 25℃, 30℃ respectively (***Photo 4***). Measurements were taken every one week after sowing, and continued until they reached the final germination rate（***Photo 5***）.

The second experiment was to investigate how the differences of the temperature, seeds

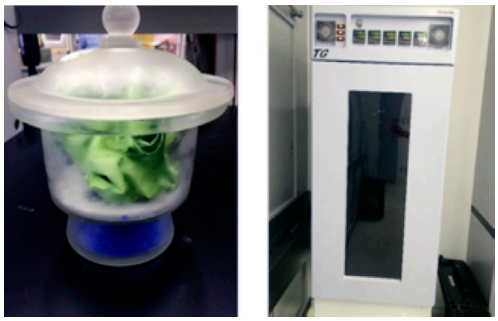


Photo 4 Desiccators and Biotron

* NIPPON MEDICAL & CHEMICAL INSTRUMENTS CO.,LTD.
(LH-200 RDSMD type)

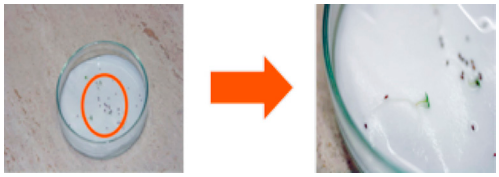


Photo 5 The situation that Phedimus germinated

age and storage environment would influence germination. We stored the seeds immediately after harvest at ①normal temperature and ②low temperature. The storage conditions for both experiments were as follows: Normal temperature was 20℃ in a dark room. Low temperature was 5℃ in the refrigerator. The seeds with silica-gel were put in desiccators to maintain the humidity at about 30%. After 3 months storage at normal temperature and low temperature, we did a germination experiment. The germination temperature at that time was set at 10℃ and 25℃.

3. The results

3-1 The first experiment to see how the temperature difference would influence germination

(i) *Phedimus takesimensis* (*Fig. 1*)

Phedimus takesimensis germinated between 10℃ and 30℃ when the seeds were sown just after harvesting them. The seeds germinated from one to two weeks after implantation.

It reached the final germination rate From 3 to 4 weeks after germination rate at 20–25 ℃ was 20%, while it was about 15 % at 30℃.

(ii) *Phedimus kamtschaticus* A (*Fig. 2*)

Phedimus kamtschaticus A did not germinated. A few seeds germinated exceptionally but germination was not observed in many petri dishes, so *Phedimus kamtschaticus* A is considered sterile.

(iii) *Phedimus kamtschaticus* B (*Fig. 3*)

Phedimus kamtschaticus B showed differences depending on the set temperature. Germination was promoted from 15℃ to 25℃. At 10℃ and 30℃, germination was suppressed.

The earliest germination was observed in the seeds at 20℃ and they reached the final germination rate 30% after 25 weeks. It reached the final germination rate of 30% after 25 weeks. In the seeds at 15℃ and 25℃, the final germination rate was about 20%.

3-2 The second experiment to investigate how the differences of temperature, seeds age and storage environment would influence germination

(i) *Phedimus takesimensis* (*Fig. 4*)

The seeds stored for 3 months at normal temperature of 10℃and 25℃ germinated but The seeds stored for 3 months at normal temperatures of 10℃ and 25℃ germinated, but the germination reaction was later than that without storage.

The final germination rate was about 20% at 10℃ and 40% at 25℃, which were higher than those of the seeds without storage.

In the case of the seeds stored at low temperature, the same tendency was found as the seeds sored at normal temperature. The seeds stored for 3 months germinated after 3 or 4 weeks after implantation. The germination rate was also high.

(ii) *Phedimus kamtschaticus* A (*Fig. 5*)

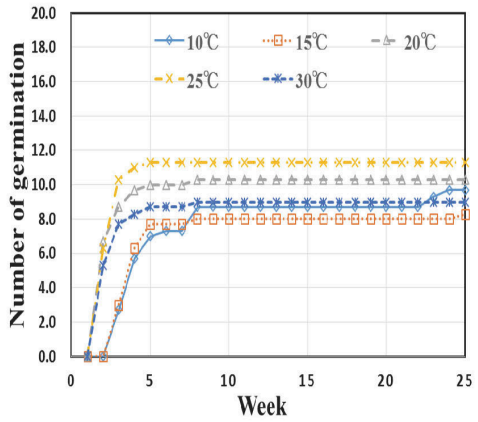


Fig.1 *Phedimus takesimensis*

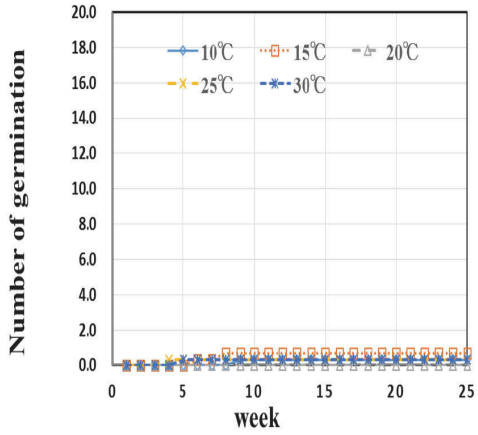


Fig.2 *Phedimus kamtschaticus* A

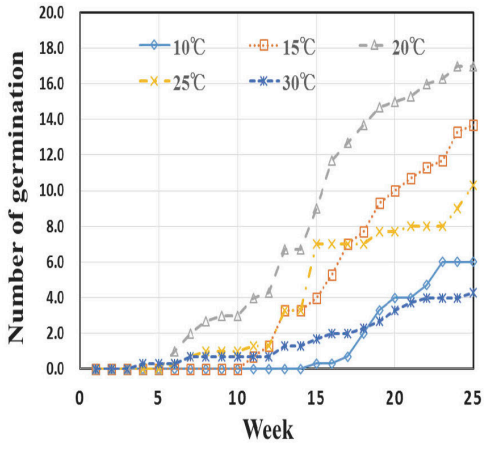


Fig.3 *Phedimus kamtschaticus* B

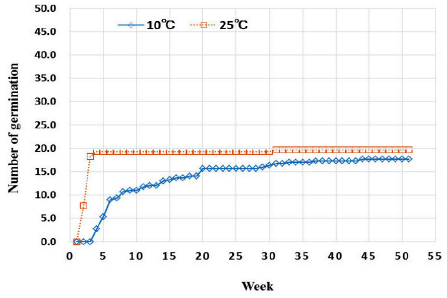
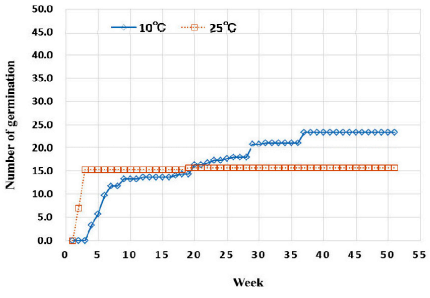
	Normal temperature	Low temperature
After 3 months storage		

Fig.4 ***Phedimus takesimensis***

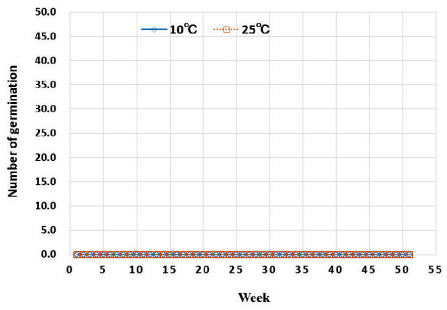
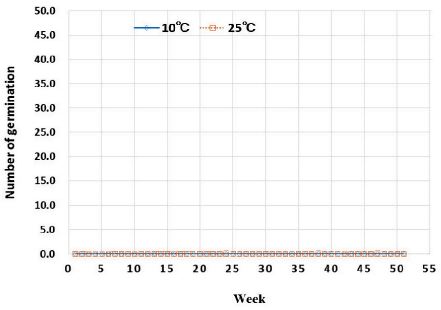
	Normal temperature	Low temperature
After 3 months storage		

Fig.5 ***Phedimus kamtschaticus*** **A**

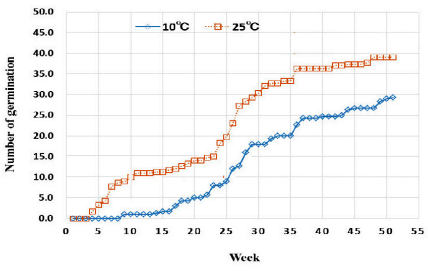
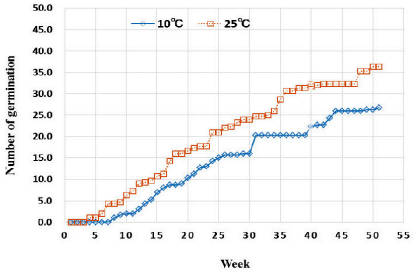
	Normal temperature	Low temperature
After 3 months storage		

Fig.6 ***Phedimus kamtschaticus*** **B**

No germination occurred in the seeds stored for 3 months at 10℃ and 25℃. They are likely to be sterile, as described in the seeds without storage.

The seeds stored at low temperature showed the same results as those stored at normal temperature. No germination was observed.

(iii) ***Phedimus kamtschaticus*** **B (*Fig. 6*)**

The seeds stored at normal temperature of 10℃ and 25℃ for 3 months germinated. Different from the reaction of the seeds without storage, it took long time for the seeds to germinate. The seeds stored at 25℃ showed the higher germination rate, while the seeds stored at 10℃ showed the smaller germination rate than the seeds without storage.

The seeds of low temperature storage showed the same tendency as those of normal temperature storage. The seeds for 3 months storage germinated, but the seeds stored at 25℃ showed lower germination rate compared to those without storage.

4. Conclusion

Phedimus takesimensis germinated from 10℃ to 30℃ although the number of days needed for germination was varied.

Phedimus kamtschaticus B germinated well between 15℃–25℃, but at 10℃ and 30℃ it did not germinate.

Compared the germination rate of *Phedimus takesimensis* fresh seeds with that of the storage seeds at higher temperature, the storage seeds showed the higher germination rate.

In the case of *Phedimus kamtschaticus* B, the rate of the fresh seeds germination was very low but the storage seeds germinated well at 30℃.

Regarding the storage seeds, there was no difference due to the storage temperature.

Phedimus kamtschaticus and *Phedimus takesimensis* flowers bloom in May and they form seeds in about a month or so. It is found that the germination of *Phedimus takesimensis* is prompted if the seeds are sprayed in the intense heat periods when they were formed. On the contrary, germination of *Phedimus kamtschaticus* is suppressed if they are sprayed at high temperature. Therefore, it is safely said that the two types of *Phedimus* are ecologically different.

The pressure from tall wild grasses is fatal to *Phedimus takesimensis* which has wide habitat. It is considered important for *Phedimus takesimensis* to avoid germination this period.

Notes

The group of *KIRINSO* was referred to as *sedum genus* but the latest classification in recent years classified *KIRINSO* in *Phedimus* genus. Therefore, *Phedimus* is used in this paper.

Reference

1) Kentaro IIJIMA, Shiro WAKUI, Masaaki YUI (2006): Experimetal Studies on the Seed Germination Characteristics of Sedum japonicum and Sedum mexicanum, The Japanese institute of Landscape Architecture 69(5), pp.455–460