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GROWTH AND SURVIVAL OF *POLYGONUM CUSPIDATUM* AND *POLYGONUM WEYRICHII* SEEDLINGS IN THE ALPINE AREA OF MT. FUJI (EXTENDED ABSTRACT)

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Polygonum cuspidatum SIEB. *et* ZUCC. and *Polygonum weyrichii* F. SCHMIT. var. *alpinum* MAXIM. are perennial herbaceous pioneer plants. They are co-dominating in early stages of succession on bare volcanic gravel and lava fields on Mt. Fuji. The upper limit of their altitudinal distribution on Mt. Fuji is at 2500–2600 m a. s. l. and 3300 m a. s. l. for *P. cuspidatum* and *P. weyrichii*, respectively. MARUTA (1983) showed that the upper distribution limit of *P. cuspidatum* was determined by the winter survival capacity of current-year seedlings, which was reduced with increasing altitude The purpose of this study is to make clear the cause of the difference in the upper distribution limit between the two species The growth and survival of the native current-year seedlings of them were compared at a place near the upper distribution limit of *P cuspidatum* (2500 m). Furthermore, in order to identify the causes determining the upper limit of *P. weyrichii*, the same attempt was made at two upper localities One of them was close to the upper distribution limit (3200 m), and the study was made for a native population of current-year seedlings. The other study site is the top of Mt. Fuji (3776 m), and an artificially seedling population was used. The population was raised from seeds, which were collected at 1400 m and sown at 3776 m in the previous autumn.

Winter survival rate was observed in early June when seedlings started to sprout at 2500 m in the following year Winter survival rate of the current-year seedlings at 2500 m was 3% and 15% for *P. cuspidatum* and *P. weyrichii*, respectively. The result showed that the difference in the winter survival rate between the two species at 2500 m was responsible for their different altitudinal distribution Winter survival of the two species was primarily related to the weight at the end of the growing season (Fig 1). Seedlings of both species need to grow more than about 16 mg d. w. for the first winter survival after germination

Four percentage of *P. cuspidatum* seedlings at 2500 m a. s l could grow more than the critical size of 16 mg d. w. at the end of the growing season (Fig. 2A) But the percentage of seedlings more than 16 mg d w. at the end of the season was 51% for *P. weyrichii* at the elevation (Fig. 2B) Higher winter survival rate of *P weyrichii* seedlings at 2500 m was mainly due to larger seedling dry weight at the end of the growing season. The difference in seedling dry weight between *P cuspidatum* and *P weyrichii* was attributable to the difference in the initial dry weight ($0\ 88 \pm 0\ 16$ mg d. w for *P cuspidatum*, $2\ 48 \pm 0\ 33$ mg d. w for *P. weyrichii*), and not to a different

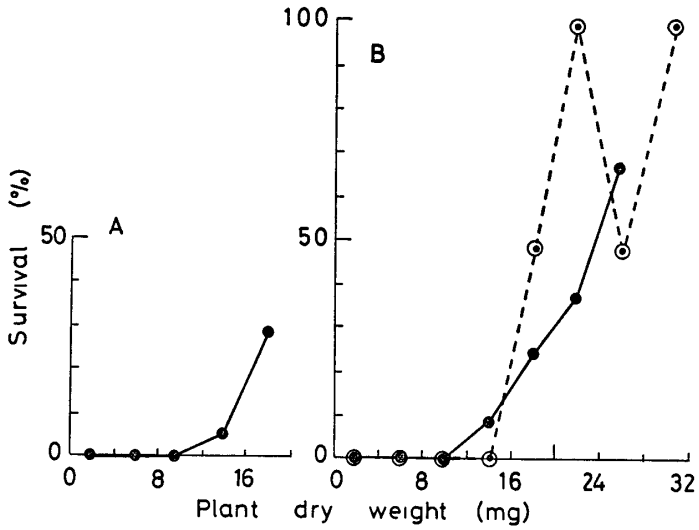

Fig 1. A Survival of P. cuspidatum *seedlings during winter at 2500 m as related to the plant weight measured at the end of the growing season B Survival of* P weyrichii *seedlings during winter at 2500 m (●) and 3200 m (⊙) as related to the plant weight measured at the end of the growing season Seedlings were divided into the rank every 4 mg d. w., and a survival percentage was the value for seedlings which were pooled into a rank The cause of the reduced survival percentage for seedlings ranked into 24–28 mg at 3200 m was not known.*

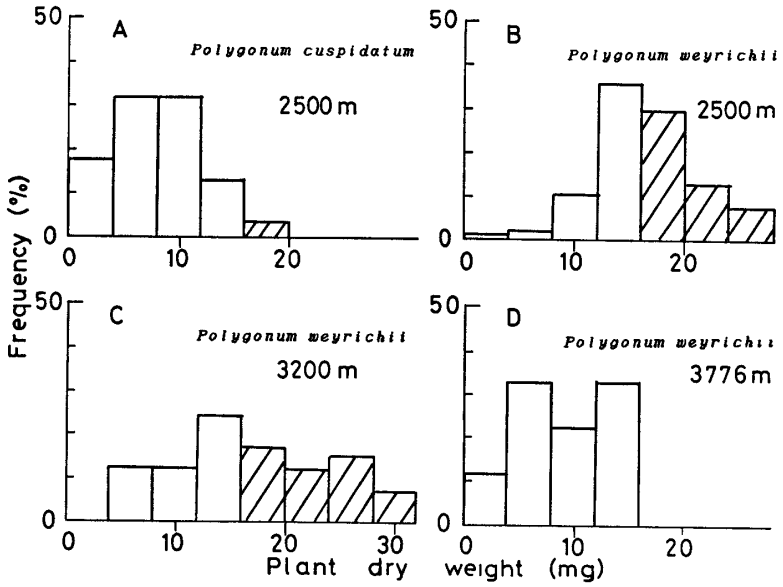

Fig 2 Frequency distributions of seedling weight measured at the end of the growing season. A: P cuspidatum *seedlings at 2500 m. B* P. weyrichii *seedlings at 2500 m. C* P. weyrichii *seedlings at 3200 m. D* P weyrichii *seedlings at 3776 m. Seedlings were divided into the rank every 4 mg d w , and a frequency was the value for seedlings which were pooled into a rank. Hatched column denotes plants which grew to more than the critical size of 16 mg d w*

relative growth rate. Thus, large initial dry weight would be an effective character for a seedling to mature before winter during a short growing season at high altitude.

The winter survival percentage of *P. weyrichii* seedlings, which was observed at the sprouting time, was 15% at 2500 m and 25% at 3200 m, and no seedlings survived at the top of Mt. Fuji (3776 m). Therefore, it was also hypothesized as in the case of *P. cuspidatum* that winter survival capacity of the current-year seedlings restricted distribution of *P. weyrichii* at altitude higher than 3200 m. The growing period of *P. weyrichii* seedlings was the same value of about three months at both 2500 m and 3200 m At both altitudes, *P. weyrichii* seedlings terminated their growth intrinsically after three months growing period, which would be a sufficient length to mature for winter survival. The climate was mild enough for sufficient seedling growth at 2500 m and 3200 m, where about 50% of seedlings could grow to more than the critical size (Figs. 2B, C). At the top of Mt. Fuji, however, seedlings matured insufficiently due to the shortness of the growing season (40–50 days), and the consequent decline in dry matter production (Fig. 2D).

Reference

MARUTA, E. (1983): Growth and survival of *Polygonum cuspidatum* on Mt. Fuji. Oecologia, **60**, 39.

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