スイートピー品種‘アーリーラベンダー’における多蕾個体の自殖後代および多蕾個体と通常個体との交雑後代の着蕾数について

<table>
<thead>
<tr>
<th>項目</th>
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</thead>
<tbody>
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Number of buds per inflorescence of progeny obtained from self-pollination of the many-buds type and cross-pollination of the many-buds type and normal type of sweet pea variety 'Early Lavender'

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Summary
A plant with inflorescences bearing many buds was identified in sweet pea variety 'Early Lavender'. This plant was termed 'many-buds' type. The number of buds per inflorescence of the many-buds type fluctuated irregularly. The number of buds per inflorescence and the fluctuation in number of buds per inflorescence of progeny obtained by self-pollination of the many-buds type was similar to that of the parent. Cross seedlings were obtained by crossing the many-buds type and normal type. There was no difference in the number of buds per inflorescence and fluctuation in the number of buds per inflorescence between the cross seedling and normal type. Thus, the many-buds type may be recessive for this trait.

Key Words: fluctuation, cross seedling, number of buds, progeny, sweet pea

Introduction
Sweet pea (Lathyrus odoratus L.) is an important plant for ornamental cut flowers. The varieties currently used produce three to seven buds per inflorescence. Up to four florets bloom at a time. The number of buds per inflorescence is influenced by flower bud abscission and plant vigor, which fluctuates irregularly (Fudano et al. 2009, Namikawa and Miura 1974). It is very important to only harvest flowers with four or five buds to prevent flower bud abscission and maintain plant vigor (Inoue 2007).

The number of buds per inflorescence of the winter-flowering sweet pea variety 'Early Lavender' is approximately five (Fudano et al. 2009), and is excellent for the number of buds it produces per inflorescence and its stability. However, we found a plant with inflorescences bearing ten or more buds when 'Early Lavender' was grown. The mode of inheritance of the number of buds per inflorescence may be able to be clarified by using plants with inflorescences bearing ten or more buds. In this study, we investigated the number of buds per inflorescence and its fluctuation in progeny obtained by self-pollination of plants with inflorescences bearing many buds and cross-pollination of plants with inflorescences bearing many buds with normal plants.

Materials and Methods
Winter flowering variety 'Early Lavender' seeds obtained from a commercial nursery were soaked in distilled water for approximately 6 h. Pre-germinated seeds were stored for 2 weeks at 1°C. Three seeds were sown per hole in containers (90 cm × 180 cm × 30 cm) on September 1, 1996. Inter- and intra-row spacing was 50 and 20 cm, respectively. The containers were placed in a plastic greenhouse, which was maintained at a minimum temperature of 5°C with natural day length. Plants with inferior growth were thinned out to leave two plants per hole. Liquid fertilizer (N:P:K = 14:8:16)
that had been diluted to give a nitrogen concentration of 200 ppm was applied at 30 L per container every week, from October onwards. All axillary buds and tendrils were removed at the earliest possible stage of growth. The vines were trained horizontally. In order to maintain plant vigor, the first and the second inflorescences were removed just after budding. Inflorescences were harvested when the three basal florets were fully open. The number of buds per inflorescence, length and diameter of the flower stalk, fresh weight and dry matter of the cut flower, length and diameter of the internode, and length and width of the leaflet were measured for all inflorescences harvested from 33 plants. Fluctuation in these traits was calculated using coefficients of variation.

Plant 96L26 bearing many buds per inflorescence and 96L12 with the normal five buds per inflorescence was selected. They were self-pollinated in March 1997 and the seeds were collected in May 1997. Plants 97LV1, 97LV2, 97LV3, 97LV4, and 97LV5 (the self-pollinated progeny derived from 96L26), and 97LS1, 97LS2, 97LS3, 97LS4, 97LS5, and 97LS6 (from 96L12) were grown from 1997 to 1998. The pollen of 97LS5 was crossed with 97LV5 in March 1998, and the seeds were collected in May 1998. The seeds were grown from 1998 to 1999, and the number of buds per inflorescence was counted for all inflorescences harvested from them.

**Results and Discussion**

Both mean and coefficient of variation for the number of buds per inflorescence were highest for 96L26 and clearly differed from the other plants (Fig. 1). Here, 96L26 was defined as the many-buds type and 96L12 was defined as the normal type. The number of buds per inflorescence of 96L26 fluctuated irregularly, whereas 96L12 was relatively consistent (Fig. 2). The length of the flower stalk of the many-buds type 96L26 was somewhat longer than in the other plants (Fig. 3A). Because flower buds differentiate

![Fig. 1. Relationship between means and coefficients of variation in the number of buds per inflorescence in sweet pea 'Early Lavender'.](image1)

![Fig. 2. Changes in the number of buds per inflorescence in sweet pea 'Early Lavender'.](image2)
acropetally in sweet pea inflorescences (Nanikawa and Miura 1974), the flower stalk may elongate following the differentiation of the flower buds. Both, means and coefficients of variation for fresh weight and dry matter of cut flowers of the many-buds type, 96L26, had a tendency to be higher than that of the normal type, 96L12 (Figs. 3C and D). There was no difference in the means and coefficients of variation of diameter of flower stalk and the vegetative organs (length and diameter of internode, and length and width of leaflet) between the many-buds and normal types (Figs. 3B, E, F, G, and H). The many-buds type only differed from the normal in reproductive traits, which were influenced by the number of buds per traits, which were influenced by the number of buds per inflorescence. It is, therefore, suggested that only the gene which controls the

![Graphs showing the relationship between means and coefficients of variation for eight traits in sweet pea 'Early Lavender'.](image)

Fig. 3. Relationship between means and coefficients of variation for eight traits in sweet pea 'Early Lavender'. A: Length of flower stalk (cm); B: Diameter of flower stalk (cm); C: Fresh weight of cut flower (g); D: Dry matter of cut flower (g); E: Length of internode (cm); F: Diameter of internode (cm); G: Length of leaflet (cm); H: Width of leaflet (cm). ○: 'Early Lavender'; □: Many-buds type 96L26; ●: Normal type 96L12.
number of buds per inflorescence differs between the normal 'Early Lavender' and the many-buds type 96L26.

Varieties of sweet pea can be broadly divided into summer, spring, and winter flowering types on the basis of their flowering period. It has been shown that flowering is promoted by seed vernalization and long-day light cycles (Hayashi et al. 1986, Inoue 2002, Ross and Murfet 1985). Occasionally, the seeds of two or more types may be mixed in market seed. Commercial growing requires a homogeneous flowering period and it is thought that the market seed does not have a fixed, heritable flowering period. Our results indicate that in addition to the flowering period, the number of buds per inflorescence is not a fixed heritable trait in market seed.

Both, means and coefficients of variation in the number of buds per inflorescence of progeny obtained from self-pollination of the many-buds type 96L26 and the normal type 96L12 were similar to their parental types (Fig. 4). Mean and coefficient of variation in the number of buds per inflorescence of the six cross seedlings of the many-buds type 97LV5 (progeny obtained by self-pollination of the many-buds type 96L26) and the normal type 97LS5 (progeny obtained by self-pollination of the normal type 96L12) were 6 and 20% or less, respectively (Fig. 5). These values were similar to those of the normal type parent 97LS5. The sweet pea is diploid: there are 14 chromosomes (Herrick et al. 1993). Thus, on the assumption that the number of buds per inflorescence has normal diploid inheritance, the many-buds trait may be recessive.

Growth habits of legumes, tomatoes, and sesame have
been divided into determinate and indeterminate types (Kim and Okubo 1996, Robinson and Wilcox 1998, Uzun and Çağirgan 2006, Welty et al. 2007). Determinates grow to a determined point where florets form and stop. Indeterminates continue to grow and axillary buds become florets. The growth habits of inflorescences may be one of the factors determining the number of buds per inflorescence. 'Early Lavender' inflorescences are determinate, but the number of buds per inflorescence and its variation in the many-buds type 96L26 resemble 'Early Pink' which has indeterminate inflorescences. Bernard (1972) reported that in Glycine max, three growth habits (determinate, semi-determinate, and indeterminate) were controlled by two major genes. The gene governing the number of buds per inflorescence, investigated in this paper, may be a gene controlling the growth habits of the inflorescence in the many-buds type 96L26. The results of this study suggest that some 'Early Lavender' plants have the indeterminate gene, and when a plant is homozygous for that gene, the plant forms inflorescences bearing many buds.

Literature Cited

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摘 要
スイートピー品種‘アーリーラベンダー’から着蕾数が多く、着蕾数が大きく変動する個体を見いだした。この多蘊型の自殖後代の着蕾数および着蕾数の変動係数は親個体とはほぼ同じであった。多蘊型の自殖後代と通常型の自殖後代との交配後代の着蕾数および着蕾数の変動係数は通常型と差異がなかった。したがって、多蘊型が劣性であると推察される。

キーワード：変動，交配実生，着蕾数，後代，スイートピー