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BRIEF COMMUNICATION

QUANTITATIVE ASPECTS OF THE INFLUENCE OF DAY-LENGTH AND TEMPERATURE ON SEDUM TELEPHIUM (CRASSULACEAE)

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Under natural conditions the leafy shoots of *Sedum telephium* L. are strictly annual and produce only a single terminal inflorescence. The leafy shoots arise in early spring from the hibernating buds on a short, leafless sympodial rhizome with tuberous roots. The flowering shoots of *S. telephium* are monocarpic as in most perennial *Sedum* species. After the flowering period they die off, except for the lowermost, very short internodes which are added to the rhizome.

According to ALLARD & GARNER (1940), VON DENFFER (1941) and FUNKE (1943) *S. telephium* is a typical long-day (LD) plant. Allard and Garner found that its leafy shoots require days of at least 17 hours to reach the flowering stage and in nature the plant will remain in a vegetative state up to approximately the 39th degree of latitude. Furthermore, they observed that the hibernating buds, which will give rise to next year leafy shoots, are formed more readily under short-day (SD) conditions (10–13 h).

In many Crassulaceae day-length and temperature also affect the size, shape and succulence of the leaves as well as the length of the shoots and the development of tuberous roots (HARDER & VON WITSCH 1941, VON DENFFER 1941). However, in *S. telephium* (including *S. maximum* (L.) Hoffm.) Von Denffer found no difference between the succulence of the leaves of plants grown in SD and in LD.

The present experiment was carried out using plant cuttings from a single population of tetraploid *S. telephium* (2n = 48) in an orchard near the Dutch village Kesteren (province of Gelderland). From 20th of May onwards 10 batches of plants with an average length of 12 cm and about 20 leaves were grown in a phytotron in SD (8 h) or LD (16 h) at temperatures of 9°, 13°, 17°, 21° and 25°. The experiment was terminated on 16th August. Two plants from each batch were measured. The results are summarized in *table 1*. It should be borne in mind however, that the plants grown in LD received twice as much light as the plants in SD and consequently their weights differed accordingly.

After twelve weeks the plants grown in LD (batch 6–10) all had inflorescences and the batches 8 and 9, cultivated at 17° and 21 °C, were already in flower (*fig. 1*). The plants grown in SD had almost stopped growing and did not have inflorescences (batch 1–5, *fig. 1*). The leaves of the SD plants at 9 °C (batch

Table. 1. Mean values of the numbers of parts (n), weights (g), lengths (cm), leaf-surfaces (cm^2), water content (%) and succulence (water content per dm^2) of two plants of each batch.

Batch	Treatment		Roots		Buds		Shoots		Leaves					Inflorescences		Total
no.	day	°C	g	$\%H_2O$	n	g	cm	g	n	cm^2	g	$\%H_2O$	Succ.	g	$\%H_2O$	g
1	SD	9	19.8	76	8	2.8	18	3.0	16	96	5.3	94	5.2	–	–	30.9
2	SD	13	23.4	75	7	2.4	25	4.5	34	420	22.6	95	5.1	–	–	52.9
3	SD	17	24.1	73	12	2.2	21	4.1	45	598	35.5	95	5.7	–	–	65.9
4	SD	21	28.2	73	12	1.8	22	5.6	48	687	46.4	95	6.4	–	–	82.0
5	SD	25	24.5	71	9	0.8	27	6.8	48	630	46.7	95	7.1	–	–	78.8
mean	SD	–	24.0	73	10	2.0	22	4.8	38	486	31.3	95	6.1	–	–	62.1
6	LD	9	24.1	76	4	0.17	628	17.7	51	740	86.9	91	10.7	7.3	83	136.2
7	LD	13	36.5	73	4	0.33	64	15.7	53	812	69.4	92	7.9	8.6	82	130.5
8	LD	17	21.8	72	4	0.24	68	18.9	49	889	75.8	94	8.0	13.6	83	130.3
9	LD	21	20.2	69	2	0.04	75	20.3	49	769	69.4	93	8.4	27.3	82	137.2
10	LD	25	17.4	71	0	–	82	25.9	50	792	77.4	93	9.1	20.0	79	140.7
mean	LD	–	24.0	72	3	0.16	69	19.7	50	800	75.8	92	8.8	15.4	82	135.0
11	LD	–	33.9	71	2	0.03	63	26.8	44	471	56.1	92	11.0	26.2	84	143.0

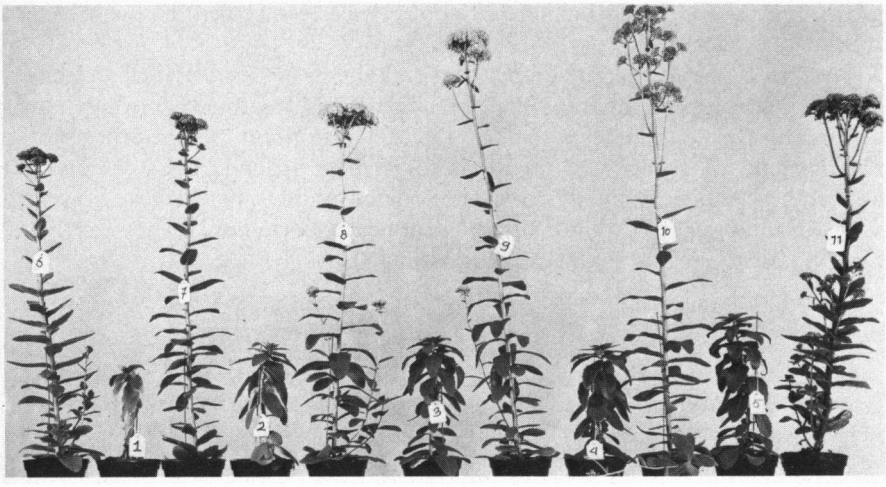

Fig. 1. Representative plants of the eleven batches of *Sedum telephium* L. grown in SD (batch 1–5) or LD (batch 6–10) at different temperatures; the plant labelled "II" was grown outdoors in a cold frame.

1) were wilting and had already been partly shed. Although the Dutch plants of *S. telephium* reacted as expected to day-length, they responded less extremely than the plants Allard and Garner used in their experiments.

In addition to prevent floral induction SD treatment has a marked effect on the subterranean parts of the plants. The total weight of the roots of the plants grown in SD and LD is exactly equal, but the roots of the plants grown in SD constitute 39% of the total weight of the plants whereas the roots of the plants grown in LD constitute only 18% of the total weight. Furthermore, the plants grown in SD had over 3 times as many hibernating buds as the plants in LD. The hibernating buds of the plants in SD were large; they constituted 3.2% of the total weight of the plants. The hibernating buds of the plants in LD constituted less than 0.2% of the total weight. On the one hand, SD treatment prevents the induction of flowering but on the other hand, it stimulates hibernation and the growth of the roots.

In addition to induce flowering LD treatment affects the growth of the shoots and the leaves. The length of the shoots of the plants grown in LD increased 6- to 7-fold during the experiment, whereas it only doubled in SD. In LD the shoots produced large quantities of secondary wood which almost entirely consisted of lignified fibres. The plants in SD had almost no secondary wood and had no lignified fibres. The plants grown in LD had more leaves than the plants grown in SD, and their leaves were significantly larger (mean leaf-surface; 16.0 cm^2 versus 11.8 cm^2) and more succulent ($P < 0.01$). These results contrast sharply with the observations of HARDER & VON WITSCH (1941) and VON DENFFER (1941) who found that the leaves of several species of the genus *Kalanchoe* Adanson and the leaves of *S. aizoon* L., *S. hybridum* Praeger, *S. kamtschaticum* Fisch. & Mey., *S. populifolium* Pall., and *S. selskanianum* Regel & Maack.

grown in SD were much smaller but about twice as succulent as the leaves of these taxa grown in LD.

The effects of the different temperature treatments are less obvious. In general a lower temperature enhances the effect of the SD treatment whereas higher temperatures tend to increase the LD effects. The optimum temperature for the Dutch plants of *S. telephium* in LD is somewhere around 20 °C. As reported above, the plants grown at 17° and 21 °C (batch 8 and 9) reached the flowering stage first and were by far the healthiest in appearance (*figure 1*). They resembled most closely the plants grown outside (batch 11).

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