all infestation sites were on the main trunk and within 50 cm of the ground. This conflicts with earlier reports that young dogwoods are attacked mostly at the crown (2, 3). It is known that definite breaks in the bark are prerequisite for young borers to gain entry into the cambium (4). In the present study, most infestations in young trees were associated with obvious bark injuries, particularly lawn mower damage. In contrast, most infestation sites in older trees (≥ 20–cm diameter) were higher up in the limb crotches or major branches, and were generally associated with pruning scars, cankers, or areas of cracked and raised bark. It is likely that in older trees, mechanical injuries are usually not severe enough to allow entry of borers through the thick bark.

This study suggests that where borers are a problem, the planting of trees in full sun should be avoided. Care should be exercised to avoid mechanical injuries, particularly during the spring when peak emergence occurs. We have found the use of lawn mower guards around the trunks of small trees to be of considerable value.

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Influence of Temperature, Water Stress and BA on Vegetative and Reproductive Growth of *Schlumbergera truncata*[1]

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***Abstract*. The number of flower buds formed on plants of *Schlumbergera truncata* (Haw.) Moran (Thanksgiving cactus) was reduced by high water stress during flower initiation and was unaffected by night temperature (13° vs. 17°C) under short days. Application of 100 ppm benzylamino purine (BA) increased flower bud number by 40% when sprayed 2 weeks after the initiation of a short day treatment and increased phylloclade number up to 150% when applied during long day photoperiods.**

Grower interest in the cacti commonly referred to as Thanksgiving or Christmas has increased in recent years due to interest in crop diversification (2). Plants with "toothed" phylloclades (segments) and zygomorphic flowers (*Schlumbergera truncata*) are classified as Thanksgiving cactus (3) and plants with smooth-edged phylloclades and zygomorphic flowers (*S. bridgesii*) are called Christmas cactus. Most commercial cultivars grown today are Thanksgiving cactus.

Flowering in Christmas cactus is inhibited under any photoperiod at 21–24°C, promoted by short days (SD) at 17–18° and not influenced by photoperiod at 13° as flowering occurs under both SD and long days (LD) (6). Vegetative growth of Thanksgiving cactus 'Weihnachtsfreude' occurs under LD at temperatures above 20°. At 15°, flower initiation occurs regardless of daylength (up to 18 hr studied), while 10° prevents flower initiation completely (7, 8). Thanksgiving cactus 'Christmas Cheer' flowered under LD after 6 weeks of SD when grown at 22–32° (5). Yonemura (11) found the optimum temperatures for flower initiation to be 15–20° and the critical photoperiod for flower initiation to be 12 hr. Finally, many growers severely water stress *Schlumbergera* plants to induce flower initiation (9).

Yonemura (11) reported that BA promoted the number of flower buds under inductive conditions and increased the number of phylloclades under LD on Thanksgiving cactus. Promotion of axillary shoot formation of *Hylocereus trigonus* by BA has also been reported (10).

Our objectives in these experiments were to investigate the influence of water stress, temperature, and BA on flower bud initiation of *Schlumbergera truncata*.

Expt. 1, water stress. One-year-old vegetative plants of Thanksgiving cactus 'White Christmas' growing in 10 cm clay pots were placed in greenhouses at 13 ± 2°C or 17 ± 2° night temperature with 21 ± 3° day temperature. All plants were irrigated on September 17 and thereafter half of the plants were either watered when the soil surface became dry (normal water) or received no water for 21 days (drought). Short day treatment (9 hr day) was initiated September 17 and terminated November 4, 1980 (6 weeks). Each photoperiod/watering treatment consisted of 3 replications of 4 plants each which were randomized within each greenhouse. The number of flower buds and open flowers were counted on November 20, 1980.

There was little difference in total number of flowers between temperature regimes and maximum total flower number occurred under normal water regimes (Table 1). This is contrary to accepted concepts among commercial growers (9). It may be that dry soil is more directly related to disease prevention rather than flower initiation. In our experience, commercial growers often produce their plants in soils of high water holding capacity (i.e. "heavy" soils), and severe root disease problems involving *Pythium* (4) and *Phytophthora* (1) often occur. Maintaining cool temperatures during the shortening days of fall results in a slow-drying medium which may be the cause of disease problems commonly observed with this plant. Moisture stressing plants may have originated as a process to prevent disease but became associated with flower initiation.

Expt. 2 and 3, BA. Ten vegetative 'Christmas Charm' plants in 10 cm clay pots were placed at 17° and sprayed to runoff with 100 ppm BA (0.1% Aqua-Gro) 2 weeks before, at the start (October 2, 1979), or 2 weeks after the start of SD.

Application of 100 ppm BA to plants 2 weeks after the start of SD stimulated flower bud formation (Table 2, Fig. 1) as reported by Yonemura (11). Some phylloclades on BA-treated plants formed 12–15 buds (Fig. 1) while others formed 2–3. While similar num-

Table 1. Effect of night temperature and water regime on Thanksgiving cactus 'White Christmas.'

Temperature (°C)	Water regime[z]	Flower buds and flowers per phylloclade
17	+	1.4a[y]
	–	1.0b
13	+	1.5a
	–	1.2b

[z](+) = Plants watered when soil was dry.
(–) = Plants received no water for 21 days after initiation of experiment.
[y]Mean separation within columns by Duncan's multiple range test, 5% level.

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Table 2. Influence of a 100 ppm BA spray and application time on flower bud development in Thanksgiving cactus 'Christmas Charm.'

Treatment	Buds per phylloclade	Buds flowering (%)
Control - no BA	3.4 a[z]	60
BA 2 weeks before start of SD	3.6 a	69
BA at start of SD	3.9 a	54
BA 2 weeks after start of SD	5.6 b	58

[z]Mean separation within columns by Duncan's multiple range test, 5% level.

bers of buds flowered on all treated plants, generally only 4–5 buds flowered on phylloclades with very high bud numbers.

'White Christmas' plants which flowered in November were grown for 30 days under LD (100 lux incandescent light, 2200–0300, December 15 to January 15) at 17°C night, 20° day temperature. New vegetative growth was not evident at time of BA application. Thirty individual plants were placed under SD January 15 while 30 remained under LD. Plants were sprayed with 0, 50, or 100 ppm BA on January 15 or 2 weeks later. Plants were randomized under each photoperiod. The number of flower buds and phylloclades were counted on March 15.

BA did not increase flower bud numbers on SD treated plants (Table 3). However, plants maintained under LD formed more phylloclades when sprayed with BA (Table 3, Fig. 1). One apparent explanation could be that vegetative growth was initiated on some shoots during the 30 day LD period, and that transfer to SD plus the application of BA stimulated or maintained phylloclade development (Table 3). Yonemura reported that plants become dormant after blooming and vegetative growth was necessary for subsequent flower induction. Vegetative growth occurred even under SD when dormancy was broken (11). Therefore, plants in this experiment were likely dormant, and reproductive growth would not be expected; vegetative growth however did occur even under SD conditions.

The following conclusions can be drawn from these experiments: 1) withholding water for 21 days until noticeable vegetative wilting occurred during flower initiation decreased number of flowers, 2) BA applied at 100 ppm 2 weeks after the start of SD on receptive plants increased flower bud number and under LD, phylloclade number.

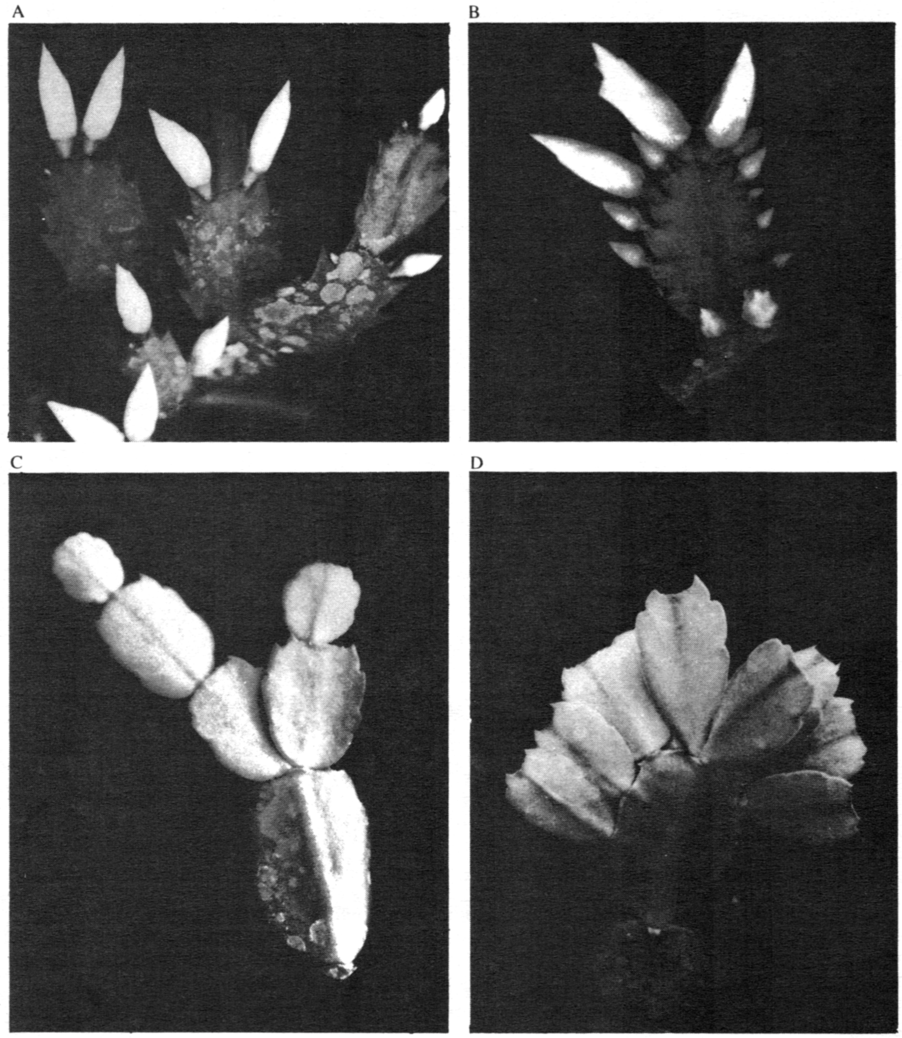

Fig. 1. Maximum observed vegetative and reproductive response of Thanksgiving cactus 'Christmas Charm' to a 100 ppm BA spray, A) SD, no BA; B) SD, 100 ppm BA; C) LD, no BA; D) LD, 100 ppm BA.

Table 3. Influence of BA and photoperiod on vegetative and reproductive development in *Schlumbergera truncata* 'Christmas Charm'.

Photoperiod	Application date	BA concn (ppm)	No. reproductive buds/phylloclade	No. vegetative shoots/phylloclade
SD	Jan. 15	0	0.7 bc[y]	1.0 a
		50	0.3 a	2.3 abc
		100	0.8 c	2.5 abc
	Jan. 29	50	0.3 a	1.7 ab
		100	0.4 ab	3.5 cd
LD	Jan. 15	0	0 a	2.1 abc
		50	0 a	5.1 e
		100	0 a	5.3 e
	Jan. 29	50	0 a	3.2 bcd
		100	0 a	4.3 de

[z]Plants had flowered during November under normal photoperiods, placed under long days (LD) from Dec. 15 to Jan. 15 when the experiment started and half the plants were placed under short days (SD).
[y]Mean separation with columns by Duncan's multiple range test, 5% level.

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