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Photoperiodic control of extension growth, bud dormancy and flowering of *Nerium indicum* Mill. and *Thevetia peruviana* Schum.

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Abstract. Plants of *N. indicum* and *T. peruviana* grew taller and produced more leaves under LD than under ND condition. While *T. peruviana* plants were taller and had more leaves under ND than under SD, those of *N. indicum* did not differ under the two photoperiods. In both cases LDS delayed the onset of bud dormancy but hastened the initiation of floral buds. While in *T. peruviana* floral buds were not formed under SD condition, in *N. indicum* floral buds were formed but they did not develop into flowers. While in *N. indicum* more flowers were produced under LD than under ND condition, in *T. peruviana* the number produced was higher under ND than under LD condition.

Keywords. Photoperiod; extension growth; bud dormancy; flowering; *Nerium indicum*; *Thevetia peruviana.*

1. Introduction

Studies on the effect of photoperiod on extension growth, bud dormancy and flowering of woody species have shown that in general while long days prolong the period of extension growth and therefore delay the onset of dormancy, short days hasten the onset of rest (Nanda 1963; Whalley and Cockshull 1976; Bhatnagar and Talwar 1978; Singh and Nanda 1981). The floral response, however, varies with the plant species. Thus, the young seedlings of *Coffea arabica* produce floral buds under short day condition (Piringer and Borthwick 1955) while in *Hydrangea* (Piringer and Stuart 1955) and *Malus hupehensis* (Zimmermann 1971) floral buds are induced under long day conditions. Davidson and Hamner (1957) have reported that although long days induce floral buds in *Rhododendron catawbiense*, short days are needed for their development into flowers. In contrast to this, Mirov (1956) has reported that photoperiod does not affect the flowering response of 35 exotic pines. This paper deals with the effect of photoperiod on extension growth, bud dormancy and flowering of two garden plants, *Nerium indicum* and *Thevetia peruviana*.

2. Materials and methods

Plants of *Nerium indicum* Mill. were raised by planting one-year old stem cuttings (15 cm each), while those of *Thevetia peruviana* Schum. were raised from the seed collected locally from a healthy tree growing in the Panjab University Campus. The seed was sown on February 1, 1980 in 3:1 mixture of field soil and sand in earthenware pots (25 cm dia) under three photoperiodic regimes namely; long day (LD) – consisting of continuous illumination which was provided by supplementing the normal day-length by unfiltered 200 watt light from incandescent lamps which provided light intensity of about 3000 lux at the level of the plants; normal day ND - consisting of natural day-length conditions prevailing at Chandigarh (figure 1) and short day (SD) – consisting of 8 hr daily light alternating with 16 hr dark which was provided by covering the plants with thick tarpaulin sheets daily from 1700 hr to 900 hr which led to the rise in temperature in the range of 3-6°C throughout the course of experimentation. To ensure healthy growth, Hoagland's nutrient solution (Hoagland and Arnon 1939) was supplied to the plants twice a week during the course of experimentation from April 1980 to June 1981.

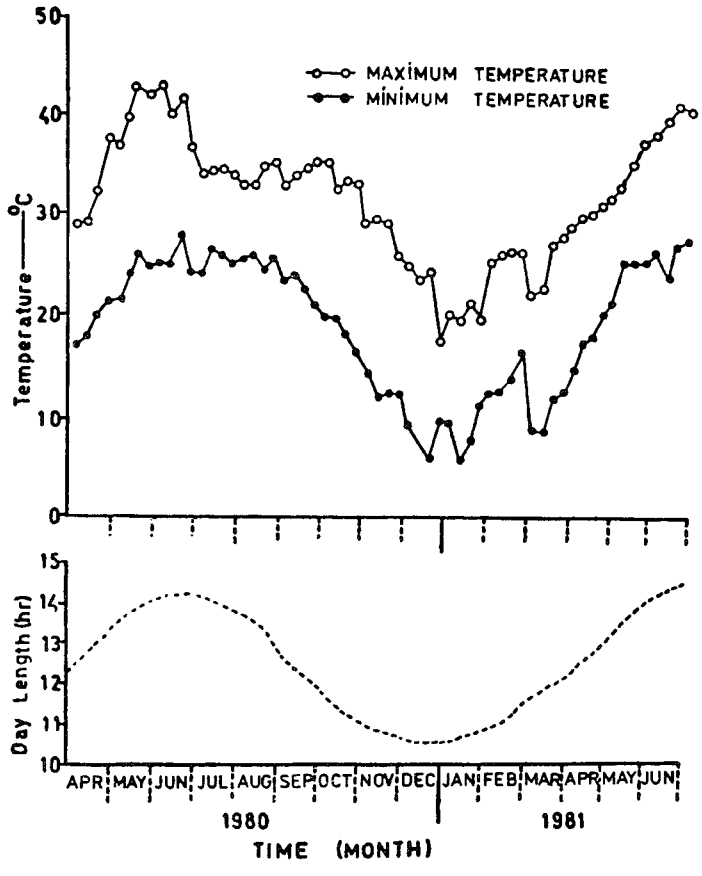

Figure 1. Temperature and day length conditions prevailing at Chandigarh during April 1980 to June 1981.

Observations of extension growth were recorded at 14-day intervals whereas the number of leaves was counted daily. Records were also maintained of the dates of initiation of floral buds. The number of floral buds produced and the time taken for them to open into flowers were also recorded. The period of dormancy' in this paper refers to the period during which the shoot apex remained apparently inactive and no new leaves were produced on the plant.

3. Observations

The results are presented diagrammatically in figures 2 and 3 and table 1.

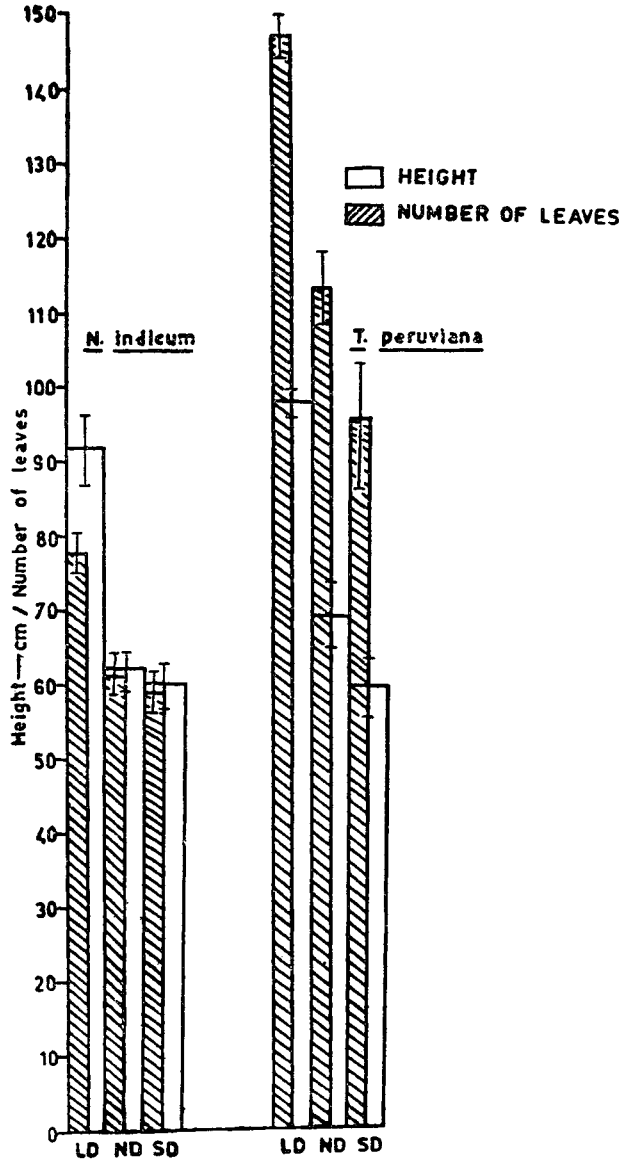

Figure 2. Effect of photoperiod on height of the main axis and number of leaves produced on *N. indicum* and *T. peruviana.*

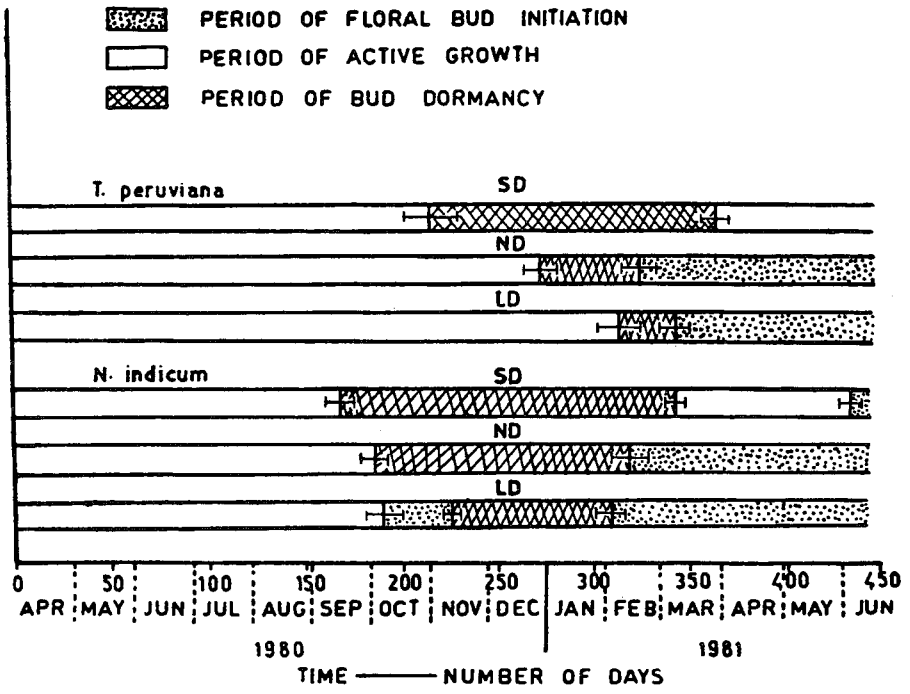

Figure 3. Effect of photoperiod on periods of active growth and bud dormancy in *N. indicum* and *T. peruviana*.

Table 1. Effect of photoperiod on flowering of *N. indicum* and *T. peruviana*.

Photoperiod	Days to floral bud initiation	Number of floral buds	Days taken to flower opening	Number of flowers	Number of plants out of 10 that produced floral buds
			N. indicum		
LD	190.5±2.50	70.8±2.81	314.4±2.81	17.5±1.71	10
ND	315.2±3.40	35.6±3.10	356.7±4.31	10.5±3.81	10
SD	340.0±4.21	3.0±1.05	—	—	10
			T. peruviana		
LD	340.5±3.42	6.1±2.40	360.8±4.21	4.5±2.85	10
ND	320.7±5.16	18.7±3.08	348.9±3.91	10.6±1.31	10
SD	—	—	—	—	—

± SE at 95% level of significance

3.1 *Extension growth and number of leaves*

Figure 2 shows that plants of both the species grew taller and produced more leaves under LD than under ND and SD conditions. While in *N. indicum* the height

and number of leaves produced under SD condition did not differ from that produced under ND condition, in *T. peruviana* plants remained significantly shorter and produced fewer leaves under SD than under ND condition.

3.2. *Periods of growth and bud dormancy*

In *N. indicum*, plants continued growth till mid November under LD as compared to that till early October and mid September under ND and SD conditions, respectively. The period of rest that followed also lasted till early February under LD but till mid February and early March under ND and SD conditions, respectively (figure 3).

In *T. peruviana*, growth continued till early February under LD condition but lasted till the end of December and October under ND and SD conditions, respectively. The period of rest that followed and which lasted till mid-February and early February under ND and LD conditions, respectively, continued till early March under SD condition.

It may be noted that in both the species the period of rest was shorter under LD but longer under SD than under ND condition (figure 3).

3.3. *Days to floral bud initiation*

In *N. indicum*, floral bud initiation in plants under LD condition started in early October prior to the onset of dormant phase. In contrast to this under ND condition floral buds were initiated in mid February. Floral bud formation under both these conditions continued till the end of June when the experiment was terminated. In contrast to this, the formation of floral buds under SD condition was delayed to early June. Floral bud initiation, thus, occurred earlier under LD but later under SD than under ND condition (figure 3).

In *T. peruviana* floral bud initiation was observed immediately after the period of rest in plants exposed to LD or ND conditions so that it occurred earlier under ND than under LD condition (table 1). Plants maintained under SD condition did not produce floral buds. It may be noted that the hastening effect of LDs was markedly more in *N. indicum* than in *T. peruviana*.

3.4. *Days to floral bud opening*

Although LDs hastened the initiation of floral buds, the initiated buds in *N. indicum* took longer to develop into flowers under LD than under ND condition. Floral buds produced under SD condition in this species did not develop into flowers at all. In contrast to this in *T. peruviana* while the initiation of floral buds occurred earlier under ND condition, their development was hastened under LD condition (table 1). As stated earlier, plants of this species did not produce floral buds under SD condition.

3.5. *Number of floral buds and flowers*

Table 1 shows that while in *N. indicum* the number of floral buds and flowers was higher under LD than under ND condition, in *T. peruviana* it was higher under ND than under LD condition. As stated earlier, in *T. peruviana* no floral buds were produced under SD condition and in *N. indicum* a few floral buds which were produced did not develop into flowers.

4. Discussion

The early onset of dormant phase under SD condition in plants of both the species reported in this paper is in accord with the results reported earlier in some other plants (Nanda 1963; Whalley and Cockshull 1976; Bhatnagar and Talwar 1978; Singh and Nanda 1981). Hastened onset of rest period in plants under SD condition may be due to accumulation of some growth inhibitory substance (s) (Wareing and Saunders 1971) or to a decrease in photosynthates due to reduced daily light period.

The fact that in *N. indicum* floral buds are produced even under SD condition, while in *T. peruviana* they are not produced under this photoperiod shows that while the former is quantitative, the latter is qualitative long day in its response to photoperiod.

But the more interesting point is that in *N. indicum* although floral buds are produced, they fail to develop into flowers showing that the photoperiodic requirement for the completion of these two phases *i. e.*, (i) induction of floral buds and (ii) their development into flowers, may not be the same. That the requirement of these two phases may vary is shown in soybean (Jindal and Nanda 1978) and *Bauhinia acuminata* (Singh and Nanda 1981). It cannot, however, be ruled out that failure of buds of this species to develop into flowers may be due to the limitation of photosynthates under SD condition. This is particularly in the light of work of Ramina *et al* (1979) and Even-Chen and Sachs (1980) who reported that photosynthetic availability influences the flowering intensity in *Bougainvillea.*

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