Floral initiation and development of the Illinois endangered species, *Iliamna remota*, with different photoperiods

A.L. McDonnell, H.R. Owen, and J.M. Coons
Department of Biological Sciences, Eastern Illinois University, Charleston, IL 61920

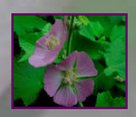
Abstract. *Iliamna remota* Greene (Malvaceae) is an endangered species in Illinois where it is endemic and isolated to Langham Island in the Kankakee River. Little is known about the floral biology of this species. The objective of this study was to determine how photoperiod affects floral initiation and development. *Iliamna remota* seeds were obtained from Prairie Moon Nursery. Seeds were dipped into hot water (80ºC) for ten seconds to break dormancy, and planted 1 cm deep in Jiffy® soilless seedling mix in cell packs (5x5x5cm) in two trays. Trays were placed into growth chambers at 25ºC with one photoperiod of 8h/16h (light/dark) at an average of 656 µmol/m²/sec light intensity and another photoperiod of 16h/8h (light/dark) at an average of 332 µmol/m²/sec light intensity. One seedling was transplanted into each of 32 round plastic pots (13x15cm) per chamber. Plants were fertilized biweekly with Peter's® 20-20-20 at 1.25g/L. Plant heights plus numbers of leaves, flower buds, and flowers at anthesis were recorded weekly. After 17 weeks, plants growing with 16h light showed a significantly greater mean height (74cm), number of leaves (43), buds (11), and flowers (6) than mean height (20cm) and number of leaves (24) of plants growing with 8h light. Plants with an 8h light photoperiod did not develop flowers or buds. Buds were first observed during week 11 and anthesis was first observed during week 13 on plants grown with the 16h light photoperiod. Thus, plants require long days for floral initiation and development, providing useful information for future pollination studies to determine the breeding mechanism (selfing vs. crossing) of this rare species.

Introduction

Iliamna remota is a state endangered, herbaceous, perennial species occurring on Langham Island in the Kankakee River, Kankakee County, Illinois (Herkert and Ebinger, 2002). Plants typically grow 1.5 to 2.0 m tall in open habitats along the northwest portion of the island (Glass *et al.*, 2003). Stems and leaves are pubescent with leaves alternately arranged. The plant's inflorescence is a raceme with flowers ranging from white to lavender.

Little information about the reproductive biology of this species is available. Previous studies observed flowering from June through August, suggesting long day photoperiodism (Schwegman, 1984; Glass *et al.*, 2003). Photoperiod requirement information would be useful for controlled studies in a greenhouse and for conservation efforts with regard to breeding mechanisms for floral and seed production to ensure the survival of the population on Langham Island.

The objective of this study was to determine how photoperiod affects floral initiation and development.



Materials and Methods

- Seeds were obtained from Prairie Moon Nursery (Winona, MN) and stored in seed desiccator at 4ºC and 40% relative humidity.
- Seeds were treated with hot water (80ºC) for 10 seconds and planted in cell packs containing Jiffy® soilless potting mix. Two cell pack trays, each containing 50 seeds, were placed in each of two Conviron® growth chambers at 25ºC with fluorescent lighting at either 16h/8h light/dark photoperiod with 332 µmol/m²/sec light intensity or 8h/16h light/dark photoperiod with 656 µmol/m²/sec. Light intensity was set to equalize photon flux densities between different light treatments.
- Number of leaves were counted daily for 3 weeks until transplanted. Seedlings were transplanted after 27 days into 13x15cm round plastic pots containing Pro-Mix®. With 32 pots, each containing one transplanted seedling. Pots were placed in each of two growth chambers.
- After 4 weeks, height and numbers of leaves, floral buds and open flowers were recorded biweekly for 17 weeks.
- After 19 weeks light photoperiod was switched in the chamber set at 8h/16h light/dark to 16h/8h light/dark photoperiod. The weeks were recorded when floral buds and open flowers appeared.
- All data were analyzed using SPSS 13.0 by analysis of variance (ANOVA).

Helpers!

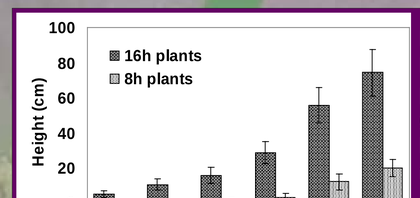
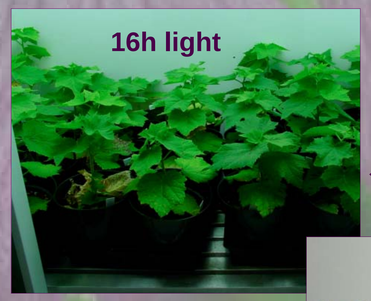


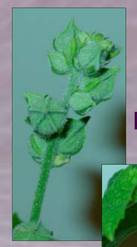
Figure 1. Heights of plants grown in both light treatments (means ± standard deviations).

Results

- Floral buds and open flowers were observed on plants growing in 16h light at week 11 and 13, respectively. Plants grown in 8h light did not produce floral buds.
- By week 17, mean height was significantly greater for plants grown in 16h light (74cm), compared to plants grown in 8h light (20cm).
- Number of leaves was significantly greater for plants grown in 16h light (43) compared to plants grown in 8h light (24).
- Floral buds were first observed on plants initially grown in the 8h light treatment 31 days after lights in chambers were changed from 8h/16h light/dark to 16h/8h light/dark photoperiod. Flowers were observed 13 days after buds.



Plants after 11 weeks



Floral buds and open flowers on plants grown in 16h light

Discussion

Since flowers were initiated on plants grown in 16h light/8h dark photoperiod and flowers were not initiated on plants in 8h light until the photoperiod was changed to 16h, a longer photoperiod was required for floral initiation, especially since total photon flux density was similar for both treatments. These results agree with floral development in the field, where flowering occurs from June throughout August (Glass *et al.*, 2003). Stem elongation also occurred more rapidly on plants growing in 16h light. Plants growing in 16h light were more than three times taller than plants grown in 8h light.

This information would be useful for pollination studies in controlled environments, such as a greenhouse, where floral initiation usually are subjected to natural photoperiods, and growth chamber studies, where photoperiods can be changed to accommodate light requirements for floral initiation. Also, information about the reproductive biology of this native species would be useful for conservation efforts, where floral initiation would be key for seed production.

Acknowledgements

The authors thank Sean Jones for assistance in data collection.

References

- Glass, W., J.E. Schwegman, R.R. Heidorn, and W.E. McClain. 2003. Twenty Years of the Endangered Kankakee Mallow (*Iliamna remota*, Greene, Malvaceae) on Langham Island, Kankakee County, Illinois. Illinois Department of Natural Resources Report. Springfield, IL. 5 pp.
- Herkert, J.R. and J.E. Ebinger. 2002. Endangered and Threatened Species of Illinois: Status and Distribution, Volume 1- Plants. Illinois Endangered Species Protection Board. Springfield, IL. p. 47.
- Schwegman, J.E. 1984. State of Illinois Recovery Plan for *Iliamna remota* Greene. Division of Forest Resources and Natural Heritage. Illinois Department of Conservation. Springfield, IL. 17 pp.

EASTERN ILLINOIS UNIVERSITY