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SKUNK-CABBAGE: A HOMEOTHERMIC PLANT IN THE PENNSYLVANIA FLORA

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Thermogenesis in plants is a rare phenomenon in which a plant actively works to increase the temperature of its flower or inflorescence. Although thermogenesis costs energy, this investment reaps huge reproductive benefits for the plant: heat plays a crucial role in the volatilization of odors that attract pollinators, although additional roles also are likely in certain cases. Thermogenesis is known from certain species in the families Araceae (aroids), Cycadaceae (cycads), Nymphaeaceae (water-lilies), Nelumbonaceae (lotuses), and Annonaceae (custard-apples).

Fig. 1. A skunk-cabbage plant (*Symplocarpus foetidus*). Photo from the Public Domain. [This and other images are in color on the Web version of this article.]

Eastern skunk-cabbage, *Symplocarpus foetidus* (Araceae), is a perennial forb native to eastern North America and is found in wet woods, marshes and stream sides (Fig. 1). Skunk-cabbage is singular among thermogenic plants in North America in that it is also homeothermic (i.e., capable of maintaining a constant internal temperature despite changes in its surrounding environment, much like mammals). Its thermogenic capability allows its inflorescence (Fig. 2) to grow and melt its way through the ice and snow of winter prior to its blooming (February to April, depending on latitude), and gives it a head-start in the "reproductive race" and nearly eliminates all pollinator competition. Its homeothermic capability allows it to maintain a relatively constant, high temperature that may be optimal for its unseasonably early pollen and ovule development which, in turn, can determine

Fig. 2. A skunk-cabbage inflorescence. The spadix is concealed by the carrion-colored spathe. Photo © Sue Sweeney.

fertilization and seed development success. Such thermoregulation during blooming also would be optimal for the volatilization of odors that attract its carrion-feeding, insect pollinators. This heat also likely rewards poikilothermic (cold-blooded) pollinators during the cool months that skunk-cabbage blooms by warming their wings and assisting in their departure which, in turn, heightens skunk-cabbage's reproductive success because another skunk-cabbage flower is likely to be the next place the pollinator will go to. Through the lens of an infrared camera, Ito et al. (2003) were able to show that a skunk-cabbage's **spadix** (the term for the spike-like inflorescence of an aroid) maintained a relatively uniform temperature between 22-27°C while the ambient winter air temperatures fluctuated diurnally over the course of seven days between lows below zero and highs of 15-18°C! The key to skunk-cabbage's homeothermy lies in the spadix's ability to perceive ambient air temperature and adjust its rates of heat-generating cellular respiration in order to regulate its internal temperature. Although we know the spadix in skunk-cabbage regulates its temperature, the underlying mechanism behind its ability to sense ambient air temperatures is still in debate.

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