

Short Communication

**OBSERVATIONS OF FLOWERING CANE  
(*ARUNDINARIA GIGANTEA*) IN LOUISIANA,  
MISSISSIPPI, AND SOUTH CAROLINA**

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**ABSTRACT**—The reproductive phenology of cane (*Arundinaria gigantea*) is poorly understood. We report observations of flowering cane in Louisiana, Mississippi, and South Carolina from 1986 to 2002. An apparent gregarious flowering event occurred in southeastern Louisiana and an adjacent county in Mississippi during the spring of 1986. During most other years, we found only small numbers of fertile culms. Fertile culms generally died within a few months of flowering, although some produced flowers for two consecutive growing seasons. Our observations suggest that *A. gigantea* undergoes both gregarious and sporadic flowering, and highlight the need for additional long-term research.

*Key words:* *Arundinaria gigantea*, bamboo, canebrake, gregarious flowering, sporadic flowering.

**INTRODUCTION**

Bamboos (Bambusoideae) exhibit three modes of flowering: gregarious, sporadic, and continuous (McClure 1966, Janzen 1976, Clark 1989, John et al. 1993, Nadgouda et al. 1997, Judziewicz et al. 1999). Gregarious flowering is typical of woody bamboos; flowering occurs simultaneously over a wide geographical area after long periods of vegetative growth (up to 120 years in some species), at regular, species-specific intervals only once during the life of the plant. Gregarious flowering is generally followed by death of the plant. Various hypotheses have been proposed to explain the evolutionary significance of gregarious flowering. Janzen (1976) suggested that large seed crops produced after flowering events function to satiate predators and ensure that at least some seeds survive to germinate. Kelly (1994) noted that gregarious flowering increases the likelihood of successful pollination



FIGURE 1. *Left:* Small canebrake at Fontainebleau State Park, St. Tammany Parish, Louisiana (December 2001). *Right:* Dead floricanes following gregarious flowering event of 1986 at Clark Creek Natural Area, Wilkinson County, Mississippi (August 1986).

in wind pollinated species such as bamboos, and Taylor et al. (1991) speculated that death of parent plants after flowering may produce openings that favor the establishment of bamboo seedlings. Sporadic flowering occurs at irregular and unpredictable intervals, and death of the plant may or may not occur. Continuous flowering is characteristic of herbaceous bamboos, and occurs annually without subsequent death of the plant. Because flowering is infrequent and inter-flowering intervals are often lengthy relative to the life span of investigators, little is known about the reproductive cycles of many species of bamboo (McClure 1966, Soderstrom and Calderón 1979, Shor 2001). Field observations of flowering are therefore noteworthy and essential for understanding the reproductive biology of bamboos (Marsh 1977, Soderstrom and Calderón 1979, Pohl 1982, Clark 1989, Pohl 1991, Judziewicz et al. 1999).

Cane (*Arundinaria gigantea* [Walter] Muhl.) is a monopodial bamboo with erect culms (to 10 m) bearing evergreen foliage, occurring throughout most of the southeastern United States, and forming dense monotypic stands known as canebrakes (Fig. 1) (Marsh 1977, Platt and Brantley 1997, Platt et al. 2001, Platt et al. 2002). Fertile *A. gigantea* exhibits two morphotypes (Fig. 2): 1) woody culms with lateral flowering branches known as floricanes (*sensu* Marsh 1977), and 2) herbaceous radical shoots, often arising from the same rhizomes as the former, and bearing a terminal in-





FIGURE 2. Fertile morphotypes of *Arundinaria gigantea*: floricane bearing lateral flowering branches (*left*) and radical shoots with terminal inflorescences (*right*). Photographed along the Amite River in East Baton Rouge Parish, Louisiana and at Clark Creek Natural Area, Wilkinson County, Mississippi (March 1986).

florescence (Brown 1929, Gilly 1943, Hughes 1951). Reports of gregarious flowering in many Asian bamboos probably led to the assumption of a similar reproductive mode in cane (e.g., Steyermark 1963, Hitchcock 1971, Gould 1975, Janzen 1976, Tucker 1988), but evidence is contradictory and flowering phenology remains poorly understood (Marsh 1977, Platt and Brantley 1997, Shor 2001). Furthermore, recent accounts of flowering by *A. gigantea* are lacking; with the exception of Marsh (1970, 1971, 1977), most observations were made over 50 years ago (Cocks 1908, Brown 1929, Deam 1929, West 1934, West 1935, Hughes 1951, Winterringer 1952). Herein we describe recent flowering events in Louisiana, Mississippi, and South Carolina, and comment on the reproductive cycle of *A. gigantea*.

#### METHODS

Our initial observations (1986 to 1989) of flowering were made opportunistically during the course of other fieldwork, but more recently (1990 to 2002) we actively searched cane stands for fertile culms. During most years we counted flowering culms; however, during 1986 we estimated the number of fertile culms in Wilkinson County, Mississippi based on the approximate area encompassed by flowering stands. We measured the height (from ground to apical meristem) of small ( $<1.0$  m) culms, and estimated the height of larger culms ( $>1.5$  m) in 0.5 m increments. If return visits were feasible, individual culms were flagged with brightly colored surveyors' tape and located again in subsequent years to ascertain culm survival.

TABLE 1. Observations of flowering cane (*Arundinaria gigantea* [Walter] Muhl.) in Louisiana, Mississippi, and South Carolina (1986 to 2002).

Year	Month	State	Parish/County	Notes
1986	March	Louisiana	East Baton Rouge	106 floricanes (1 to 2.5 m).
	March	Louisiana	East Feliciana	52 floricanes (0.5 to 2 m).
	March	Louisiana	West Feliciana	144 floricanes (1.5 to 3 m).
	March	Mississippi	Wilkinson	About 100,000 fertile culms; both floricanes (to 5.5 m) and radical shoots; culms not flagged, but many dead in June and August 1986.
1987	March	Mississippi	Wilkinson	Clump of 14 floricanes (1.5 to 2.0 m).
1989	April	Louisiana	East Baton Rouge	3 floricanes (0.4 to 0.9 m) browsed by cattle.
	April	Louisiana	Livingston	2 floricanes (1.5 m).
	April	Mississippi	Wilkinson	7 widely scattered floricanes (1.5 to 2.5 m); same site where numerous fertile culms found in 1986.
	May	Louisiana	East Baton Rouge	Flowering culms at two sites. Clump of 11 floricanes (0.5 to 1 m) flagged at one site; 8 alive and single culm flowering in November 1990; three alive and flowering in February 1991. At second site 39 culms (1 to 2 m) flowering; 7 alive and 3 flowering in March 1991. All floricanes at both sites found dead in June 1991.
1991	February	Louisiana	East Baton Rouge	2 floricanes (2 m tall) amidst patch of 32 dead culms with dried inflorescences; probably flowered 1990; both culms dead in December 1991.
1992	September	South Carolina	Abbeville	Single floricanes (2.5 m).
	April	South Carolina	Pickens	21 floricanes (1.5 to 2 m); all culms dead in October 1992.
	May	Louisiana	East Baton Rouge	6 floricanes and 2 radical shoots (0.5 to 1 m); 5 alive in August 1992; 4 alive in October 1993, but all dead in October 1994.
1993	April	South Carolina	Greenville	38 floricanes (1 to 4 m).
	October	South Carolina	Pickens	69 dead floricanes (1.5 to 5 m) with dried inflorescences and two living floricanes (0.4 m) with flowers.

TABLE 1. Continued.

Year	Month	State	Parish/County	Notes
1994	March	South Carolina	Anderson	1 dead florican (1.5 m) with inflorescence and two living, but decadent floricanes (2.5 m); probably flowered in 1993.
1995	March	South Carolina	Richland	47 and 32 floricanes (1.5 to 3.5 m) at two sites, respectively.
	May	South Carolina	Anderson	18 floricanes (1.0 to 1.5 m); 13 flagged culms relocated in April 1996; 3 dead and 10 alive, but not flowering.
	May	South Carolina	Pickens	About 500 floricanes in 0.5 ha patch; 50 culms flagged; all flagged culms and most (ca. 90%) unflagged culms dead in October 1995.
	June	Louisiana	East Baton Rouge	16 floricanes (0.4 to 1.0 m) in cultivated patch; flagged culms dead in March 1997, but 14 recent floricanes present.
1996	March	South Carolina	Berkeley	3 floricanes (2.0 m).
	May	South Carolina	Anderson	56 floricanes (1.0 to 2.5 m).
1999	June	Louisiana	East Baton Rouge	2 floricanes (1.0 m); dead in May 2000.
2000	April	Louisiana	East Baton Rouge	10 floricanes (1.5 to 2 m); patch destroyed by urban development.
2001	April	Louisiana	St. Tammany	Flowering culms (0.2 to 3.0 m) at two sites. 39 floricanes flagged at one site and 35 relocated in March 2002; 10 dead, 25 living, and 22 fertile culms. 12 floricanes flagged at second site; all dead in March 2002.



### RESULTS AND DISCUSSION

We observed flowering *A. gigantea* in five parishes of Louisiana, one county in Mississippi, and six counties in South Carolina from 1986 to 2002 (Table 1). In 1986 we observed what appeared to be a gregarious flowering event in East Baton Rouge, and East and West Feliciana Parishes, Louisiana and adjacent Wilkinson County, Mississippi. Flowering was especially profuse at Clark Creek Natural Area (Pond, Mississippi) and vicinity where most culms were fertile. Although we neglected to flag a sample of fertile culms, return visits during June and August 1986 found extensive stands of dead cane, many bearing dried inflorescences (Fig. 1). Similar observations of apparent gregarious flowering by cane and subsequent die-off of entire canebrakes have been reported by others (Le Page du Pratz 1774, Fleming 1779–1780, Elliott 1816–1824, Lamson-Scribner 1896, Mohr 1901, Deam 1929, Wells 1932). The last reported gregarious flowering event occurred in Arkansas during 1969 (Marsh 1970). Given the current rarity of large canebrakes (Noss et al. 1995, Platt and Brantley 1997, Brantley and Platt 2001, Platt et al. 2002), gregarious flowering events are probably much reduced in scale compared to those reported historically, and thus likely to be overlooked by contemporary workers.

Exclusive of 1986, we found flowering culms during 13 of 17 (76.4%) years of observation (Table 1). During most years, flowering was confined to small numbers of scattered floricanes, usually growing within larger stands of sterile culms. Similarly, during eight years of observation Cocks (1908) noted that “certain clumps . . . bloomed every year”. Brown (1929) found fertile culms scattered throughout a large canebrake for three consecutive years, and in a later personal communication (cited in Marsh 1977) stated that he “continued to observe cane flowering in the Baton Rouge area almost yearly”. Others also reported finding small numbers of widely scattered fertile culms over periods ranging from two to eight consecutive years (West 1934, Hughes 1951, Marsh 1977), and after reviewing herbarium material at the Smithsonian Institution, Shor (2001) concluded that *A. gigantea* flowered “somewhere almost every year . . . since 1872”.

Death of fertile culms is widely assumed to occur within the same growing season as flowering (Wells 1932, Radford et al. 1968, Hitchcock 1971) due to the depletion of rhizomal nutrient reserves (Janzen 1976). However, few modern observers actually comment on post-flowering culm survival (McClure 1966). Brown (1929) reported that fertile culms cut after flowering resprouted the following year and continued to flower. Marsh (1977) followed the fate of flagged culms to ascertain survival and concluded that while most fertile culms flowered and died during the same season, a small number produced flowers for two consecutive years. Likewise we noted that most fertile culms died within a few months of flowering, although some produced flowers for two consecutive growing seasons (Table 1).

We found fertile floricanes ranging from 0.2 to 5.5 m in height (Table 1). Many smaller floricanes appeared stunted, browsed, or mechanically cut. Similar observations of flowering cane stubble are frequent in the literature

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(Brown 1929, Hughes 1951, Winterringer 1952, Marsh 1970). We found fertile radical shoots at only two sites; they were abundant in Wilkinson County, Mississippi during the gregarious flowering event of 1986 and two fertile radical shoots were found among a patch of eight stunted floricanes in East Baton Rouge Parish, Louisiana during 1992.

The majority of our observations ( $n=25$ ) occurred during March (8), April (7), and May (5), but flowering was also observed in February (1), June (2), September (1), and October (1). Others reported flowering from February to July (Cocks 1908, Brown 1929, Hughes 1951, Winterringer 1952, Marsh 1970, Marsh 1977), but we are unaware of any observations during September or October. The fertile culms we observed during these months probably initiated flowering earlier in the season.

In summary, our observations suggest that both gregarious and sporadic flowering occur in *A. gigantea*. Gregarious flowering events are infrequent and the length of the flowering cycle remains undetermined. Previous estimates ranging from three to 50 years (Fleming 1779–1780, Elliot 1816–1824, Lamson-Scribner 1896, Mohr 1901, Deam 1929, Wells 1932) are largely speculative (Platt and Brantley 1997). Additionally, our observation of small numbers of fertile culms during most years and similar reports by others suggest that sporadic flowering occurs between gregarious flowering episodes. Bamboos may exhibit more than one flowering mode (McClure 1966) and many gregarious species also flower sporadically between gregarious flowering events (Clark 1989). We speculate that earlier confusion regarding the flowering cycle of *A. gigantea* arose when observations of sporadic flowering were mistakenly interpreted as gregarious flowering events.

Finally, our observations highlight the need for additional long-term research on the flowering behavior of *A. gigantea*. Flowering cycles can only be determined by repeated observations of the same population over a long period, often exceeding the professional life span of investigators (McClure 1966, Clark 1989, Judziewicz et al. 1999). To this end our observations of gregarious flowering in 1986 provide important baseline data and we recommend that *A. gigantea* in the Clark Creek Natural Area and vicinity be monitored annually for flowering activity. Furthermore, although the length of the flowering cycle is probably constant, flowering is unlikely to be synchronous across the geographic range of a species (Clark 1989). Therefore long-term monitoring of additional populations of *A. gigantea* throughout the southeastern United States is warranted.

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