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OBSERVATIONS ON TOOTHACHE GRASS (*CTENIUM AROMATICUM* [POACEAE: CHLORIDEAE]) WITH PARTICULAR REFERENCE TO FIRE

M.H. MacRoberts & B.R. MacRoberts

Bog Research, 740 Columbia, Shreveport, Louisiana 71104 U.S.A.

ABSTRACT

Ctenium aromaticum is fire dependent. In Louisiana we have observed that flowering is confined to the first postfire growing season. Experiments with mechanical removal of litter produced interesting but not consistent results.

KEY WORDS: *Ctenium aromaticum*, bog, fire, Kisatchie National Forest, Poaceae

During our work on Louisiana bogs (MacRoberts & MacRoberts 1988, 1990a, 1991, 1992), we have had the opportunity to observe the effect of fire, usually by way of prescribed dormant season (winter) burns, on various plant species (MacRoberts & MacRoberts 1990b). One of these is a perennial grass, *Ctenium aromaticum* (Walt.) Wood, coloquially known as toothache grass.

Toothache grass is a common bog species. Its range extends along the southern coastal plain from Virginia to Florida, westward to western Louisiana. *Ctenium* is the dominant ground cover in some of the bogs we have studied (MacRoberts & MacRoberts 1991); while in others it is entirely absent (MacRoberts & MacRoberts 1988, 1990a, 1992). It is a conspicuous grass, growing in clumps. The erect flowering culms are up to 140 cm tall with as many as 40 inflorescences per square meter. In some bogs in western Louisiana there are hundreds of thousands of inflorescences.

We first became aware that there was some relationship between fire and *Ctenium* flowering when we spent a couple of days (15 and 16 June 1990) in the pine savannahs near Lake Ramsay, a few miles northwest of Covington, Louisiana. We noted that in a large savannah bisected by a road, flowering *Ctenium* blanketed the side that had been burned the previous winter; whereas on the other side of the road, which had not been burned, *Ctenium* had not put up any new flowering stems. In another instance, on the unburned

side of a fire line through a savannah there were only old *Ctenium* flowering stems; whereas on the other side, which had been burned only a few months previously, *Ctenium* flowered profusely.

In 1991 we were presented with a test of our earlier observations. In a section of the Kisatchie Ranger District of the Kisatchie National Forest, where we do much of our bog research and where all of the bogs have *Ctenium*, the Forest Service regularly sets prescribed burns. In February 1990, they burned three compartments containing twenty-seven bogs. *Ctenium* bloomed profusely in all of these bogs that summer. In early 1991, the Forest Service burned only one of these three compartments containing $14\frac{1}{2}$ bogs (one bog straddles two compartments and had a fire line through it; another bog only partly burned presumably because of high moisture content). Between July 13 and August 3, 1991, we surveyed these twenty-seven bogs.

The results of the survey were clear: *Ctenium* flowered in profusion in all bogs or parts of bogs burned in 1991; only old stems were present in unburned bogs. The bog that straddles two compartments and the bog that only partly burned provide the test. In both cases, *Ctenium* did not flower in the unburned portions but flowered in the burned portions. Counting the half bogs, 14 ($13 + \frac{1}{2} + \frac{1}{2}$) bogs were burned and flowered, while 13 ($12 + \frac{1}{2} + \frac{1}{2}$) were not burned and did not flower.

We have subsequently made many similar observations on toothache grass in the Kisatchie Ranger District and in the Vernon Ranger District. It is such a consistent indicator of fire history that we now use the condition of *Ctenium* flower stalks (since they do not readily drop) as the best indicator for determining when a bog last burned. New flower stalks signify that it was burned since the last growing season, old but standing flower stalks indicate one year past, bedraggled stalks indicate that an area was burned two years ago, and no stalks but leaf clumps that it was burned three or more years ago.

In order to further test the relationship between fire and *Ctenium* (flowering on January 4 and 11, 1992) we established 22 permanent one meter square plots in *Ctenium*-rich areas of eight bogs in the Kisatchie Ranger District. Each plot was sickled and carefully raked to remove litter. In bogs where it is present, *Ctenium* is the major source of litter, which is often so deep that it obscures the ground. All plots were established in bogs that had the same fire history; they had been burned two years ago. Four of the bogs (11 plots) were burned in early February 1992, while the other four bogs (11 plots) were not burned. The nonplot portions of all bogs acted as the control. Our purpose was to see whether the removal of litter without fire would have the same effect as its removal by fire (see Facelli & Pickett 1991).

On June 6, 1992, when the *Ctenium* in the burned bogs was in full flower we examined all of the plots. The *Ctenium* in unburned plots did not put up inflorescences (nor did any of the *Ctenium* elsewhere in these bogs), while *Ctenium* in plots in burned bogs flowered (as did *Ctenium* throughout these

bogs). On June 6, the plots in both burnt and unburnt bogs were open: bare soil and small forbs, such as *Drosera*, *Chaptalia*, *Utricularia*, and *Xyris*, were visible. The absence of litter, therefore, does not seem to be the controlling factor in *Ctenium* flowering. What was somewhat surprising was that the *Ctenium* in the cleared plots in burned bogs flowered even though these plants could not have burned much since most of the litter had been removed. How hot the fire became in such plots is not known, but perhaps close proximity to high temperatures produced by adjacent litter may have helped to produce the effect. Larger plots might have shown a central/peripheral effect (eliminating the possibility of an edge effect) and should be considered in future studies. However, in our experience, one meter plots should be sufficiently large since, in bogs that have not completely burnt, at the burn edge there is always a sharp line of flowering and nonflowering *Ctenium* within inches of one another.

While it is a common observation that winter or spring burns usually stimulate greater growth and flowering in grasses, flowering entirely confined to the first postfire growing season is apparently rare (Biswell & Lemon 1943, Daubenmire 1968, Komarek 1974, Vogl 1974, Knapp & Seastedt 1986, Stolzenburg 1991, Christensen 1988, Robbins & Myers 1989). This apparent dependence in *Ctenium*, insofar as we have been able to discover, has not been previously reported (but see comments by Grelen & Hughes 1984:46).

The relationship of *Ctenium* and fire may not be so simple as this, however. Steve Orzell and Edwin Bridges (pers. comm). report that, while both nongrowing season and growing season burns produce a dramatic display of flowering in *Ctenium*, they have seen individual plants flower in areas where there has not been any recent fire. While Orzell & Bridges do not give quantitative data, out of the tens of thousands of plants we have observed, we have only seen a few that had bloomed in the absence of fire.

However, let us make one caveat to the above. When we initially established our meter plots to determine if mechanical clearing affected flowering, we established some backup plots on the Vernon Ranger District of the Kisatchie National Forest 60 km to the south of our study plots. We did not re-examine these since they were not needed. But as fate would have it, we had a potted *Ctenium* plant at our home and it produced a single flower stalk in late July. This plant had not been burned. We therefore decided that we should check our plots to see if flowering might be delayed. We examined five of the Vernon Ranger District backup plots on August 4. The bogs in which they were established had not been burned the previous year and there were no new flower stems. But in the five plots, there were 0, 1, 3, 9, and 25 stems in flower. None of these plots showed any ground disturbance additional to the mechanical clearing we had done or any other factors that might account for flowering. Although this is a drastic reduction in flowering as compared to burned plots, it is flowering nonetheless. The next day we re-examined all 11 plots on the Kisatchie Ranger District. None had flowers!

Clearly, additional observations are required to establish the factors involved in stimulating flowering in *Ctenium*. Perhaps there are regional or site specific differences affecting or complicating *Ctenium* flowering as appears to be the case with other grasses (*e.g.*, Robbins & Myers 1989), factors that would be interesting to explore further.

It has long been thought that southeastern bogs and savannahs, like many other plant communities within the longleaf pine ecosystem, are maintained by fire (Folkerts 1982, Smith 1991, Frost *et al.* 1986, Martin & Smith 1991, Platt *et al.* 1988, Robbins & Myers 1989, Bridges & Orzell 1989, Noss 1988, Olsen 1992). The existence of a fire dependent species like *Ctenium aromaticum*, which is fidel to bogs and wet savannahs, certainly strengthens this view.

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