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A new species of the Devonian lycopod genus, *Leclercqia*, from the Emsian of New Brunswick, Canada

Patricia G. Gensel [a,*], Andrew E. Kasper Jr.[b]

[a] *Department of Biology, University of North Carolina, Chapel Hill, NC 27599, USA*
[b] *Department of Botany, Rutgers University, Newark, NJ, USA*

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Abstract

A new species of the fossil lycopsid genus, *Leclercqia*, is reported from the Early Devonian (Emsian) of northern New Brunswick, Canada. The plant remains consist of dochotomizing axes covered with numerous, small, closely spaced leaves. The leaves are laminar and divided distally into five segments which curve upwards. An ellipsoidal sporangium attaches to the adaxial surface, proximal to divisions, of many leaves. Sporangia contain abundant and well-preserved spores assigned to the sporae dispersae genus *Acinosporites*. The habit of the plant is proposed to be that of an herbaceous lycopsid. *Leclercqia andrewsii* differs from the type species, *L. complexa*, in the organization of its leaf segments: all five segments curve or bend upward after the point of forking. The genus has previously been described from mostly Middle Devonian sediments of North America, South America (Venezuela), Australia (Queensland), and Europe, and also from the Early Devonian of North America. This account adds another Emsian occurrence of the genus *Leclercqia* in North America, documents a new species, and presents evidence of novel variation in early Devonian leclercqioid lycopsids relative to those present in the Middle Devonian.

Keywords: Early Devonian; lycopsid; *Leclercqia*; New Brunswick; Canada

1. Introduction

The presence of plant fossils in the continental deposits along the north shore of New Brunswick, Canada has been known since the time of Sir J. W. Dawson (Dawson, 1882). However, it is only within the last several decades that renewed interest has produced significant new data, starting with the studies of *Psilophyton princeps* by Hueber (1967) and Hueber and Banks (1967) and of *Drepanophycus* by Grierson and Hueber (1968). These papers are, to the best of our knowledge, the first clear-cut references in the literature illustrating plants from immediately west of Dalhousie Junction, N.B. The lycopod locality reported here is about 150 yd east of Grierson and Hueber's (1968) Locality 1 and the plant to be described may be one of the "number of unidentifiable lycopod fragments" they speak of. Several other taxa have been described in the intervening years, totaling 9 genera from 6 outcrops, in this approximately half-mile distance (Table 1), including new zosterophylls, basal euphyllophytes, e.g. trimerophytes and plants of uncertain affinities such as *Chaleuria* Andrews et al. (1974) and *Oocampsa* Andrews et al. (1975), and others. Additional plant types are currently being studied.

* Corresponding author. Tel.: +1 919 962 6937; fax: +1 919 962 1625.
E-mail address: pgensel@bio.unc.edu (P.G. Gensel).

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Table 1
Plant taxa described from northern New Brunswick sites, extending from about 1/2 mi west of Dalhousie Junction to the outskirts of Dalhousie, N.B.

Trimerophytes	
Psilophyton princeps	Hueber, 1967
Psilophyton charientos	Gensel, 1979
Psilophyton coniculum	Trant and Gensel, 1985
Pertica dalhousii	Doran et al., 1978
Zosterophyllopsids	
Zosterophyllum divaricatum	Gensel, 1982a
Sawdonia acanthotheca	Gensel et al., 1975
Oricilla bilinearis	Gensel, 1982b
Lycopsids	
Drepanophycus spinaeformis	Grierson and Hueber, 1968; Li et al., 2000
Drepanophycus gaspianus	Grierson and Hueber, 1968
Leclercqia andrewsii	Kasper, 1977; this paper
Incertae sedis	
Chaleuria cirrosa	Andrews et al., 1974
Oocampsa catheta	Andrews et al., 1975
Bitelaria dubjanskii	Johnson and Gensel, 1992

Several genera of mostly Middle to Late Devonian lycopsids are now regarded as belonging to the Protolepidodendrales as summarized in Gensel and Berry (2001) and Berry (1996). The lycopsid to be described here is most similar to the protolepidodendracean genus *Leclercqia*, in having five-segmented leaves and adaxially borne sporangia. The occurrence of this plant, and remains that most closely resemble *L. complexa* from a nearby outcrop in this New Brunswick sequence, constitute two of four occurrences of these lycopsids in the Early Devonian. The others are *Leclercqia complexa* from the Emsian of Wyoming, USA (Tanner, 1984) and remains attributed to that species from the latest Emsian, possibly earliest Eifelian, Trout Valley Formation, Maine, USA (Kasper and Forbes, 1979). Another protolepidodendracean lycopsid taxon occurs in the Emsian of New Brunswick, in which leaves are more segmented. Some of these earlier occurrences document additional diversity within this group, particularly in organization of leaves. A specimen with much branched leaves from the Pragian Posongchong Formation in China, *Cervicornis* Li et Hueber 2000 may also be of interest relative to these plants, once fertile structures are found.

2. Locality and geology

The plant fossils were collected during the summers of 1972 and 1973 from an area about 6 mi west of Dalhousie on the north shore of New Brunswick, Canada. The locality is on the south bank of the Restigouche River about 1/2 mi west of the point where Provincial Highway 11 crosses the Canadian National Railway tracks at Dalhousie Junction, New Brunswick, Canada (Oak Bay Map 22 B/2 East, Edition 1 ASE, Series A 761). This is locality B of Andrews et al. (1974) and Gensel and Andrews (1984). The cliffs here are covered by soil and dense vegetation that slumps periodically, revealing the bedrock. The fossiliferous lenses are ephemeral because weathering, the tides, and ice flow in winter rapidly destroy exposed outcrops.

The plants were found in a large, slumped block resting on the beach at the high tide mark. The presence of intact soil and trees on the block indicated that it had not come from very high on the cliff. The bedding plane was almost vertical and the beds were in a strike nearly parallel to the beach. This permitted the removal of rock bed by bed exposing plant remains at different descending levels.

This sequence of sediments has not been formally described or named in recent years. In the classic treatment of the regional geology, Alcock (1935, p. 81) mentions that "On the New Brunswick side, three-quarters of a mile west of Dalhousie Junction, beds of buff sandstone outcrop in low cliffs along the coast." These beds are probably the same as the fossil plant locality and are included under his discussion of the Middle Devonian Gaspé Sandstone. In his regional geologic map accompanying the text, however, this area west of Dalhousie Junction is shown as the Bonaventure Formation, which as discussed below, is not accurate.

Unpublished spore studies indicate these sediments are late Early Devonian or late Emsian in age (Gensel and Andrews, 1984; McGregor, personal communication 1975), attributable to the *Grandispora* subzone of the *annulatus lindlarensis* assemblage zone of McGregor (1973, 1977) and high in the *annulatus-sextantii* zone of Richardson and McGregor (1986). Accurate assignment to recognized formations and correlation with other Devonian strata in New Brunswick and Quebec has not been attempted recently (see Dineley and Williams (1968) and Gamba (1990)). Based on recent data for nearby areas (Wilson et al., 2004; Wilson, personal communication), this sequence is either equivalent to the upper part of the Val d'Amour Formation of the Dalhousie Group or to the Atholville beds of the Campbellton Formation (Loc. Q of Gensel and Andrews, 1984; Atholville Member of the Campbellton Fm. in Gamba, 1990). In the absence of a formal description, these sediments have been referred to the Campbellton Formation (Greiner, 1973; Wilson et al., 2004).