VASCULAR UNDERSTORY PLANT COMPOSITION IN A MICROTOPOGRAPHIC SETTING, ATCHAFALAYA BASIN, LOUISIANA

Steven R. Helm
School of Renewable Natural Resources, Louisiana State University, Baton Rouge, LA 70803

1Current address: U.S. Army Corps of Engineers, P.O. Box 2946 (CENWP-PM-E), Portland, OR 97208-2946

ABSTRACT

Understory plant frequencies were recorded in a microtopographic setting in the Atchafalaya Basin, Louisiana during summer 1993 and summer 1994. Microtopography on the study area greatly influences duration of inundation. Habitat preferences of many herbs and woody seedlings to either bottomland hardwood ridges or slightly lower baldcypress-tupelogum swales were apparent. Other species were generalists and occurred commonly in both habitat types. Of the 87 taxa recorded, mostly at the species level, 49 showed affinities to bottomland hardwood ridges and 9 to baldcypress-tupelogum swales.

KEYWORDS: Atchafalaya Basin, Louisiana, plant frequencies

INTRODUCTION AND STUDY AREA

Understory plants were recorded in the Atchafalaya Basin, Louisiana during the summers of 1993 and 1994 as a component of studies aimed to assess wildlife habitat following Hurricane Andrew, which impacted the area in August, 1992. Studies on plant distribution relative to elevation in bottomland forests of the southeastern U.S. have focused primarily on woody plants. Data presented here details herbaceous plant and woody seedling abundance and could be useful in planning projects that aim to restore bottomland hardwood and baldcypress-tupelogum forests in interspersed, microtopographic settings and could perhaps be useful in refining regional wetland indicator statuses of plants.

The study area is located south of Interstate 10 between the Atchafalaya and Mississippi Rivers in Iberville Parish, Louisiana. Thirty-three study plots were located approximately 10 km south of Ramah in sections 59 and 61 (T8S-R10E). Fifteen plots were located approximately 10 km west of Plaquemine and 15 km east of the above-mentioned plots in section 9 (T9S-R11E).

The study area occurs at elevations less than 3.0 m mean sea level (msl) (U.S.D.I. Geol. Surv. 1953a and 1953b) within a very gentle ridge-samble complex that results in an interspersion of two forest types: Bottomland hardwood forests occupying slightly elevated areas (hereafter referred to as “ridges”) with an overstory comprised mainly of Acer negundo, Acer rubrum, Celtis laevigata, Fraxinus pennsylvanica, Liquidambar styraciflua, and Ulmus americana; and baldcypress-tupelogum forests (hereafter referred to as “swales”) occupying slightly lower areas comprised of Taxodium distichum and Nyssa aquatica, but also supporting Acer rubrum, Celtis laevigata and Fraxinus pennsylvanica.

In addition to the presence of two forest types, the study area was characterized by pulpwood [less than 25 cm diameter at breast height (dbh)] and sawtimber (greater than 25 cm dbh) sized trees and different degrees of hurricane damage (see Helm 1995; Salyer 1995). Understory plant frequencies with respect to every combination of forest type, tree size, and degree of hurricane damage for each sampling period are appended in Helm (1995), but the present paper will address microtopographic effects as indicated by forest type.

Small elevational differences greatly impact durations of flooding within the study area. Water typically inundates swales from late winter through early summer, while ridges typically support some standing water during this time period, primarily after heavy rainfall. Ridge plots were typically dry during understory vegetation sampling in the summers of 1993 and 1994 while many swale plots supported some shallow standing water. Non-inundated areas of swale plots during summer typically supported saturated soils to the surface. Rain is the primary source of water in the study area but water influx from flooding of nearby bayous occasionally occurs. Deep water
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baldcypress-tupelogum swamps are characterized by standing water throughout the growing season (Huenneke and Sharitz 1986). Swales in the study area can be considered shallow water baldcypress-tupelogum swamps and provide opportunity for germination of a diversity of species during the summer because of the general availability of non-inundated ground.

Sharkey clay and Fausse association soils have been mapped on the study area (U.S.D.A. Soil Conserv. Serv. 1977). They formed in clayey alluvium during the Holocene and are considered hydric soils (U.S.D.A. Soil Conserv. Serv. 1995). The Sharkey series (very fine, montmorillonitic, nonacid, thermic, Vertic Hapludults) consists of poorly drained, very slowly permeable soils on slopes of 0-3% and occurs at elevations from 1.5-6.1 m msl on low and intermediate parts of natural levees of the Mississippi River and its distributaries. The Fausse series (very fine, montmorillonitic, nonacid, thermic, Typic Fluvaquents) consists of very poorly drained, very slowly permeable soils on slopes less than 0.5% and occurs at elevations less than 3.0 m msl in backswamps (U.S.D.A. Soil Conserv. Serv. 1977). On the study area, Sharkey soils are more typical of ridges and Fausse soils of swales.

METHODS

It became apparent when in the field and upon analysis of plant frequencies data, that many taxa showed marked differences in abundance with respect to forest type but not with respect to tree size or degree of hurricane damage and, therefore, understory plant frequency would be best presented with respect to forest type. Effects of light penetration, however, are discussed briefly below. Also, records of plants recorded during winter are noted below.

Study plots were established during summer 1993. Data were recorded within 1 m² quadrats during summer 1993 and summer 1994. Quadrats resulted from division of 4 m² subplots. Four subplots were randomly located within each of 48, 0.1 ha plots resulting in 768 quadrats. Equal numbers of plots were established on ridges and in swales.

Understory vegetation included plants that were no taller than 1 m. Presence of understory plants was recorded by taxon in each quadrat. Plants were required to be rooted in a quadrat to be considered present. Within each forest type, frequency was calculated for each plant taxon; frequency equal to the percent of quadrats in which at least one plant of a given taxon occurred.

Paired t-tests were used to detect differences in plant taxon frequencies, mostly at the species level, on ridges versus swales for summer 1993 and summer 1994 combined. Alpha=0.05 was the significance level chosen for each taxon-based test.

RESULTS AND DISCUSSION

Differences in understory plant frequencies on the study area are believed to have resulted primarily from species-specific sensitivity to varying degrees of wetness with respect to abilities of plants to germinate and grow. Flood frequency and duration (hydroperiod) are the primary factors influencing woody plant distribution in bottomland forests of the southeastern U.S. (Grell et al. 2005; Wall and Darwin 1999). Of the 87 taxa recorded during summers 1993 and 1994, 49 showed affinities to ridges and 9 to swales. Extremely low p-values (≤ 0.01) were associated with many of the taxa, both herbs and woody seedlings, indicating strong habitat affinities (Table 1).

Woody seedlings with strong affinities to ridges included Acer negundo, Cornus drummondii, Forestiera acuminata, Ilex decidua, Liquidambar styraciflua, Planera aquatica, Sabal minor, and Sambucus canadensis. Only Acer rubrum showed a strong affinity to swales. Celtis laevigata, Fraxinus pennsylvanica, and Ulmus americana seedlings were common in both ridge and swale habitats (frequencies per m² ≥ 5% in each habitat type) and could be considered generalists with respect to elevation at the seedling stage. Among woody vines, Berchemia scandens was abundant in both habitats. Although not identified to species level, Rubus spp. was abundant and showed a strong affinity to ridges.
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Species with strong affinities to ridges included *Asplenium platyneuron*, *Campsis radicans*, *Cocculus carolinus*, *Duchesnea indica*, *Elephantopus tomentosus*, *Eupatorium semiserratum*, *Hydrocotyle umbellata*, *Lonicera japonica*, *Melothria pendula*, *Oplismenus setarius*, *Parthenocissus quinquefolia*, *Perilla frutescens*, *Polygonum virginianum*, *Sanicula canadensis*, *Thelypteris palustris*, and *Vitis rotundifolia*. Conversely, *Eclipta prostrata*, *Phanopyrum gymnocarpon*, *Pluchea foetida*, *Rhynchospora corniculata*, and *Senecio glabellus* showed strong affinities to swales. *Ampelopsis arborea*, *Boehmeria cylindrica*, *Brunnichia ovata*, *Justicia ovata*, and *Vitis aestivalis* were common in both habitats. Many of the taxa, both woody and herbaceous, that showed no habitat affinity occurred in low frequencies. In these cases, habitat affinities may be obscured by the statistical inability to demonstrate differences in frequencies between habitat types because of sample size limited by inherent plant abundance.

The dominant overstory species in swales, *Taxodium distichum* and *Nyssa aquatica*, were sparsely represented as seedlings. Conversely, dominant overstory species on ridges (*Acer negundo*, *Acer rubrum*, *Celtis laevigata*, *Fraxinus pennsylvanica*, and *Ulmus americana*) were well represented as seedlings on ridges. *Acer rubrum*, *Celtis laevigata*, and *Fraxinus pennsylvanica*, all represented in the overstory in swales but to a lesser degree than *Taxodium distichum* and *Nyssa aquatica*, were common as seedlings in swales. *Taxodium distichum* can germinate and develop under partial shade while *Nyssa aquatica* is shade intolerant. Neither can germinate under inundated conditions and both can be adversely affected in the seedling stage by prolonged flooding (Burns and Honkala 1990). Also, various microsite characteristics can influence seedling abundance of both species (Huenneke and Sharitz 1986). As seedlings of less water tolerant species were numerous even in swale plots, prolonged flooding was not thought to have adversely affected seedling establishment of *Taxodium distichum* and *Nyssa aquatica*. Low seedling abundance of *Nyssa aquatica* may be related to the generally dense forest canopy (see discussion below on light penetration and understory plant abundance). Factors resulting in the paucity of *Taxodium distichum* seedlings are not clear.

**NOTES ON LIGHT PENETRATION AND UNDERSTORY PLANT ABUNDANCE**

As noted above, the study was conducted in areas of pulpwood (high value timber was harvested during the 1960’s) and sawtimber sized trees and varying degrees of damage from Hurricane Andrew. Although this paper focuses on microtopographic influences on plant abundance, overstory canopy cover, an indicator of light penetration, is another potentially important factor affecting plant occurrence (Menges and Waller 1983) and will be summarized here. For a more detailed discussion on overstory-understory relationships on the study area, see Helm (1995) and Helm and Chabreck (2004). Overstory canopy cover was measured on the study plots using a spherical densitometer (Lemmon 1956) held at a height of 1 m and showed no differences in plots characterized by pulpwood versus sawtimber sized trees or ridges versus swales but was dependent on degree of hurricane damage. Differences in understory plant frequencies with respect to degree of hurricane damage, however, emerged only several times when analyzing data, and could be statistical artifacts of the large number of taxa studied. While degree of hurricane damage dictated amount of overstory canopy cover, amount of light penetration to the forest floor may not have been related to hurricane damage one year after the hurricane during summer 1993 because of leaf production on downed trees that provided shade but were not entirely accounted for in readings of overstory canopy cover. Tree death and resultant leaf loss two years after the hurricane in summer 1994, however, was thought to have resulted in differences in light penetration to the forest floor with respect to degree of hurricane damage and affected understory cover, understory cover being greater in heavily damaged plots than in moderately and lightly damaged plots. Differences in light penetration during summer 1994, however, although difficult to absolutely quantify, were apparently not great enough to produce taxon-specific differences in understory plant frequencies.

**NOTES ON PLANTS RECORDED DURING WINTER**

Understory plants were also recorded on the study plots during January 1995 and are appended in Helm (1995). During winter 1995
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### Table 1. Mean understory plant frequency per m² for summers 1993 and 1994 (combined), differences in frequencies between forest types (bottomland hardwood ridges and baldcypress-tupelogum swales) (reported for $P<0.05$), and habitat affinities in the Atchafalaya Basin, Louisiana. 1Scientific names in accord with Kartesz (1994).

| Scientific Name and Author  | Frequencyridge | Frequencyswale | p-value | Habitat |
|-----------------------------|----------------|---------------|---------|---------|
| *Acer negundo* L.           | 22.4           | 9.9           | 5x10⁻⁵  | Ridge   |
| *Acer rubrum* L.            | 14.7           | 24.3          | 0.004   | Swale   |
| *Acmella oppositifolia* (Lam.) R.K. Jansen | 0.3 | 0.7 |          |         |
| *Ampelopsis arborea* (L.) Koehne | 27.3 | 23.6 |          |         |
| *Ampelopsis cordata* Michx. | 4.0            | 9.1           | 0.04    | Swale   |
| *Asimina triloba* (L.) Dunal | 2.2            | 0.0           | 0.05    | Ridge   |
| *Asplenium platyneuron* (L.) B.S.P. | 2.5 | 0.0 | 0.01 | Ridge   |
| *Aster* spp. L.             | 2.3            | 0.5           |         |         |
| *Berchemia scandens* (Hill) K. Koch | 12.9 | 14.0 |          |         |
| *Boehmeria cylindrica* (L.) Sw. | 55.2           | 54.8          |         |         |
| *Brunnichia ovata* (Walt.) Shinners | 9.2 | 6.9 |          |         |
| *Campsis radicans* (L.) Seem. ex Bureau | 12.0 | 3.0 | 0.005 | Ridge   |
| *Carya aquatica* (Michx. f.) Nutt. | 0.0 | 0.5 |          |         |
| *Celtis laevigata* Willd.   | 23.2           | 26.8          |         |         |
| *Cephalanthes occidentalis* L. | 0.3            | 0.0           |         |         |
| *Ciclospermum leptophyllum* (Pers.) Sprague | 1.0 | 0.1 | 0.05 | Ridge   |
| *Cirsium* spp. P. Mill.     | 6.3            | 0.4           | 4x10⁻⁵  | Ridge   |
| *Coccusculus carolinus* (L.) DC. | 3.5            | 0.3           | 0.004   | Ridge   |
| *Cornus drummondii* C.A. Mey. | 9.2            | 1.7           | 6x10⁻⁴  | Ridge   |
| *Crataegus* spp. L.         | 0.5            | 0.0           | 0.05    | Ridge   |
| *Cynodon dactylon* (L.) Pers. | 3.1            | 0.4           | 0.03    | Ridge   |
| *Cyperaceae*                | 16.0           | 41.7          | 2x10⁻⁵  | Swale   |
| *Desmodium* spp. Desv.      | 0.8            | 0.1           | 0.05    | Ridge   |
| *Dichondra carolinensis* Michx. | 1.3            | 0.1           | 0.02    | Ridge   |
| *Diodia virginiana* L.      | 0.5            | 2.0           |         |         |
| *Diospyros virginiana* L.   | 1.2            | 0.4           |         |         |
| *Duchesnea indica* (Andr.) Focke | 10.6           | 1.0           | 7x10⁻⁴  | Ridge   |
| *Eclipta prostrata* (L.) L.  | 0.8            | 8.3           | 0.002   | Swale   |
| *Elephantopus tomentosus* L. | 5.6            | 0.1           | 3x10⁻⁵  | Ridge   |
| *Eupatorium semisserratum* DC. | 30.3           | 5.0           | 9x10⁻⁶  | Ridge   |
| *Forestiera acuminata* (Michx.) Poir. | 1.8 | 0.0  | 0.009  | Ridge   |
| *Fraxinus pennsylvanica* Marsh. | 16.4           | 11.6          |         |         |
| *Gleditsia triacanthos* L.  | 0.3            | 0.3           |         |         |
| *Hamamelis virginiana* L.   | 0.0            | 2.2           |         |         |
| *Heliotropium* spp. L.      | 0.0            | 0.9           |         |         |
| *Hydrocotyle umbellata* L.  | 16.9           | 6.0           | 0.0005  | Ridge   |
| *Hypericum* spp. L.         | 0.1            | 0.5           |         |         |
| *Ipex decidua* Walt.        | 3.5            | 1.2           | 0.01    | Ridge   |
| *Ilex opaca* Ait.           | 0.1            | 0.0           |         |         |
| *Justicia ovata* (Walt.) Lindau | 9.0            | 10.9          |         |         |
| *Leersia oryzoides* (L.) Sw. | 2.0            | 0.9           |         |         |
U.S.D.I. Geol. Surv. 1953a (photorev. 1980). Addis, Louisiana quadrangle. 7.5 min. series.

U.S.D.I. Geol. Surv. 1953b (photorev. 1980). Grosse Tete SW, Louisiana quadrangle. 7.5 min. series.

Wall, D.P. and S.P. Darwin. 1999. Vegetation and elevation gradients within a bottomland hardwood forest of southeastern Louisiana. Amer. Midl. Natur. 142:17-30.

### Table 1. Mean understory plant frequency per m² for summers 1993 and 1994 (combined), differences in frequencies between forest types (bottomland hardwood ridges and baldcypress-tupelogum swales) (reported for $P<0.05$), and habitat affinities in the Atchafalaya Basin, Louisiana. Scientific names in accord with Kartesz (1994).

| Scientific Name and Author | Frequency | p-value | Habitat |
|----------------------------|-----------|---------|---------|
| Acer negundo L. | 22.4 | 9.9 | 5x10⁻⁵ | Ridge |
| Acer rubrum L. | 14.7 | 24.3 | 0.004 | Swale |
| Acmelea oppositifolia (Lam.) R.K. Jansen | 0.3 | 0.7 | |
| Ampelopsis arborea (L.) Koehne | 27.3 | 23.6 | |
| Ampelopsis cordata Michx. | 4.0 | 9.1 | 0.04 | Swale |
| Asimina triloba (L.) Dunal | 2.2 | 0.0 | 0.05 | Ridge |
| Asplenium platyneuron (L.) B.S.P. | 2.5 | 0.0 | 0.01 | Ridge |
| Aster spp. L. | 2.3 | 0.5 | |
| Berchemia scandens (Hill) K. Koch | 12.9 | 14.0 | |
| Boehmeria cylindrica (L.) Sw. | 53.2 | 54.8 | |
| Brunnichia ovata (Walt.) Shinners | 9.2 | 6.9 | |
| Campsis radicans (L.) Seem. ex Bureau | 12.0 | 3.0 | 0.005 | Ridge |
| Carya aquatica (Michx. f.) Nutt. | 0.0 | 0.5 | |
| Celtis laevigata Willd. | 23.2 | 26.8 | |
| Cephalanthus occidentalis L. | 0.3 | 0.0 | |
| Ciclospermum leptophyllum (Pers.) Sprague | 1.0 | 0.1 | 0.05 | Ridge |
| Cirsium spp. P. Mill. | 6.3 | 0.4 | 4x10⁻⁵ | Ridge |
| Cocculus carolinus (L.) DC. | 3.5 | 0.3 | 0.004 | Ridge |
| Cornus drummondii C.A. Mey. | 9.2 | 1.7 | 6x10⁻⁵ | Ridge |
| Crataegus spp. L. | 0.5 | 0.0 | 0.05 | Ridge |
| Cynodon dactylon (L.) Pers. | 3.1 | 0.4 | 0.03 | Ridge |
| Cyperaceae | 16.0 | 41.7 | 2x10⁻⁴ | Swale |
| Desmodium spp. Desv. | 0.8 | 0.1 | 0.05 | Ridge |
| Dichondra carolinensis Michx. | 1.3 | 0.1 | 0.02 | Ridge |
| Diosidia virginiana L. | 0.5 | 2.0 | |
| Diospyros virginiana L. | 1.2 | 0.4 | |
| Duchesnea indica (Andr.) Focke | 10.6 | 1.0 | 7x10⁻⁴ | Ridge |
| Eclipta prostrata (L.) L. | 0.8 | 8.3 | 0.002 | Swale |
| Elephantopus tomentosus L. | 5.6 | 0.1 | 3x10⁻⁵ | Ridge |
| Eupatorium semisserratum DC. | 30.3 | 5.0 | 9x10⁻⁶ | Ridge |
| Forestiera acuminata (Michx.) Poir. | 1.8 | 0.0 | 0.009 | Ridge |
| Fraxinus pennsylvanica Marsh. | 16.4 | 11.6 | |
| Gleditsia triacanthos L. | 0.3 | 0.3 | |
| Hamamelis virginiana L. | 0.0 | 2.2 | |
| Heliotropium spp. L. | 0.0 | 0.9 | |
| Hydrocotyle umbellata L. | 16.9 | 6.0 | 0.0005 | Ridge |
| Hypericum spp. L. | 0.1 | 0.5 | |
| Ilex decidua Walt. | 3.5 | 1.2 | 0.01 | Ridge |
| Ilex opaca Ait. | 0.1 | 0.0 | |
| Justicia ovata (Walt.) Lindau | 9.0 | 10.9 | |
| Leersia oryzoides (L.) Sw. | 2.0 | 0.9 | |
| Species                        | Percentage | Growth | Notes                  |
|--------------------------------|------------|--------|------------------------|
| Liquidambar styraciflua L.     | 4.7        | Ridge  |                        |
| Lonicera japonica Thunb.       | 11.7       | Ridge  |                        |
| Ludwigia spp. L.               | 6.4        | Ridge  |                        |
| Lythrum spp. L.                | 8.9        | Ridge  |                        |
| Melothria pendula L.           | 17.3       | Ridge  |                        |
| Mikania scandens (L.) Wild.    | 3.8        | Ridge  |                        |
| Nyssa aquatica L.              | 0.3        |        |                        |
| Oplismenus setarius (Lam.) Roemer & J.A. Schultes | 52.2 | Ridge |                        |
| Oryza spp. L.                  | 1.8        | Ridge  |                        |
| Panicum spp.                  | 8.5        | Ridge  |                        |
| Parthenocissus quinquefolia (L.) Planch. | 47.3 | Ridge |                        |
| Perilla frutescens (L.) Britt. | 4.3        | Ridge  |                        |
| Phananpyrum gymnocarpon (Elli.) Nash | 1.6 | Ridge |                        |
| Pityphylla lanceolata (Michx.) Greene | 0.0 |        |                        |
| Phytolacca americana L.       | 0.3        |        |                        |
| Planaria aquatica J.F. Gmel.   | 7.8        | Ridge  |                        |
| Plantago spp. L.               | 0.0        |        |                        |
| Platanus occidentalis L.       | 0.0        |        |                        |
| Pluchea foetida (L.) DC.       | 0.8        | Swale  |                        |
| Poaceae                        | 10.4       | Ridge  |                        |
| Polygonum spp. L.              | 20.0       | Ridge  |                        |
| Polygonum virginianum L.       | 26.0       | Ridge  |                        |
| Quercus spp. L.                | 4.0        | Ridge  |                        |
| Rynchospora corniculata (Lam.) Gray | 0.1 | Swale |                        |
| Rubus spp. L.                  | 67.2       | Ridge  |                        |
| Sabal minor (Jacq.) Pers.      | 1.6        | Ridge  |                        |
| Sambucus canadensis L.         | 4.8        | Ridge  |                        |
| Samolus valerandi L.           | 0.1        |        |                        |
| Sanicula canadensis L.         | 23.7       | Ridge  |                        |
| Saururus cernuus L.            | 16.2       | Swale  |                        |
| Senecio glabellus Poir.        | 3.9        | Swale  |                        |
| Sisyrinchium albidum Raf.      | 0.0        |        |                        |
| Smilax spp. L.                 | 9.8        | Ridge  |                        |
| Solidago spp. L.               | 0.3        | Ridge  |                        |
| Sonchus oleraceus L.           | 0.0        |        |                        |
| Taxodium distichum (L.) L.C. Rich. | 0.0 |        |                        |
| Thelypteris palustris Schott   | 16.9       | Ridge  |                        |
| Toxicodendron radicans (L.) Kuntze | 60.0 | Ridge |                        |
| Trachelospermum dfferm (Walt.) Gray | 0.1 |        |                        |
| Ulmus americana L.             | 17.4       | Ridge  |                        |
| Vicia spp. L.                  | 0.5        |        |                        |
| Viola spp. L.                  | 20.3       | Ridge  |                        |
| Vitis aestivalis Michx.        | 8.9        |         |                        |
| Vitis rotundifolia Michx.      | 8.9        | Ridge  |                        |

**Paraphymatoceros Håssel, Gen. Nov. (Anthocerotophyta)**

Gabriela G. Håssel de Menéndez
Museo Argentino de Ciencias Naturales B. Rivadavia:
Avda A. Gallardo 470, 1405 DJR, Buenos Aires, Argentina

**Abstract**

Paraphymatoceros Håssel gen. nov. is described. It includes three species, *P. diadematus* Håssel sp. nov. from Chile, *P. hallii* (Austin) Håssel comb. nov. from USA and *P. minutus* (Mitt.) Håssel comb. nov. from South Africa. It differs from *Phymatoceros* Stotler, W. T. Doyle & Crand.-Stotl. in having a different kind of tuber, number of antheridia and spore wall ornamentation.

**Keywords:** Anthocerotophyta, Phymatoceros, Paraphymatoceros, Chile, USA, South Africa.

Paraphymatoceros Håssel gen. nov.

Thallus angustus, tenuis, tuberis scutiformibus marginalibus vel apicalibus viridulis vel auranticis. Capsula stomatophora cum columnella. Sporae et pseudoelateres flavescentes vel nigrescentes, superficie distalis gibbosae, centrum areis triangularibus proximalibus baculis instructis. Differt a Phymatoceros tubera neque sphaerica neque pedunculata.

Type species: *Paraphymatoceros diadematus* Håssel

This genus is distinct from *Phymatoceros* Stotler, W. T. Doyle & Crand.-Stotl. by the antheridia which are more numerous per cavity, the tubers present under the notch of growing points at wide incipient lobes or at tips of narrow lobes, are scutelliform, nearly plane dorsally with a laminar border which continues from the thallus border, and bulging ventrally, covered with rhizoids. The sporophyte has a dehiscence line between two rows of yellow to orange coloured thick walled cells, seen in young capsules, as happens in *Notothylas*. The spores show on distal surface a number of rounded protuberances and...