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## TYPE SPECIMENS OF *INULA (PITYOPSIS) GRAMINIFOLIA* (ASTERACEAE: ASTEREAEE)

### JOHN C. SEMPLE

Department of Biology, University of Waterloo  
Waterloo, Ontario Canada N2L 3G1  
[jcsemp@uwaterloo.ca](mailto:jcsemp@uwaterloo.ca)

and

### FLORIAN JABBOUR

Institut de Systématique, Évolution, Biodiversité (ISYEB)  
Muséum national d'Histoire naturelle, CNRS, Sorbonne Université,  
EPHE, Université des Antilles,  
57 rue Cuvier, CP39, 75005 Paris, France

### ABSTRACT

Recent proposed changes to the nomenclature of the goldenaster genus *Pityopsis* disagreed significantly on the application of the name *Inula graminifolia*, the basionym of *Pityopsis graminifolia*. In order to clarify the problem, the three known collections of *Inula graminifolia* in the Herbarium of the Muséum national d'Histoire naturelle, Paris (P) collected by André Michaux were examined. The holotype collection has small heads with many stipitate glands on the distal portion of the phyllaries and obvious long hairs on the peduncles. This is also the case for the isotype collection. A third collection by Michaux is mixed with a shoot with larger heads and shoots with smaller heads and all with phyllaries with few or no stipitate glands. Thus, the third specimen is not part of the same taxon as the holotype and isotype.

The *Pityopsis graminifolia* (Michx.) Nutt. complex includes goldenasters native to the southeastern USA, southern Mexico, Guatemala, Belize, western Honduras, and the Bahamas. The complex includes either a single species with multiple varieties (Semple & Bowers 1985; Semple 2006) or the complex might be divided into multiple species with more narrowly defined morphological and ecological limits. Semple and Bowers (1985) presented a revision of the genus *Pityopsis* Nutt. recognizing seven species. Four species were placed in *P.* sect. *Pityopsis* and all are narrowly to very narrowly distributed species. *Pityopsis pinifolia* (Elliott) Nutt. is a rare species found along the eastern edge Piedmont along the “fall line” counties of North Carolina, South Carolina, and Georgia, (and Mississippi, Nesom 2019). *Pityopsis falcata* (Pursh) Nutt. is native to the Atlantic Coastal plain from Cape Cod, Massachusetts to southern New Jersey. *Pityopsis flexuosa* (Nash) Small is native to a few counties around Tallahassee, Florida. *Pityopsis ruthii* (Small) Small is confined to a small area in southeastern Tennessee along short sections of the Hiwassee and Ocoee Rivers (Moore et al. 2016). Three additional species were included in *P.* sect. *Graminifoliae* (Small) Semple. *Pityopsis oligantha* (Chapm. ex Torr. & A. Gray) Small has big glandular heads and occurs in the Florida Panhandle and adjacent counties in Alabama and Georgia. *Pityopsis aspera* (A. Gray) ex Small has glandular peduncles and includes two varieties: var. *aspera* is confined to a small area in southern Georgia and adjacent northern Florida; var. *adenolepis* (Fernald) Semple & F.D. Bowers occurs from northeastern Virginia to northern Florida and west to southern Mississippi. Lastly, there is the more widely distributed species *P. graminifolia* in the broad sense, occurring from Delaware to southern Ohio and south to southern Florida, and west through the southern states to eastern Texas and disjunct in Latin America as noted above; most forms of the species have long narrow lower stem and rosette leaves and all have peduncles with long white cobwebby hairs. Five varieties were recognized within *P. graminifolia* by Semple and Bowers (1985, and followed in Semple 2006). Diploid var. *graminifolia* was defined on the basis of having smaller heads with inner phyllaries that are obviously stipitate glandular (Fig. 1); such plants occur from southern North Carolina to northern Florida and west to Mississippi on the outer coastal plain. Diploid var. *tenuifolia* (Torr.) Semple & F.D. Bowers has small heads with inner phyllaries that are not strongly glandular; *Chrysopsis microcephala* Small and combinations on that name were treated as synonyms; var. *tenuifolia* in this sense occurs from North Carolina to southern Florida and west to east and south Texas and extending north into Arkansas and extreme eastern Oklahoma. Diploid var. *aequilifolia* F.D. Bowers & Semple has smaller heads and stiff densely-arranged ovate-lanceolate stem leaves and occurs in Peninsula Florida. Tetraploid and rarely hexaploid var. *latifolia* (Fernald) Semple and F.D. Bowers has mid-sized heads with phyllaries that are not glandular (or with a few obscure glands); the stem leaves are narrowly lanceolate; the range occupies the entire area described for the species. Hexaploid var. *tracyi* (Small) Semple has large heads without obvious glands and is confined to the Florida Panhandle. Ploidy level data was presented and summarized in Semple and Bowers (1987) with additional counts reported by (Semple & Cook 2004; Semple et al. 2015, 2019 in press).

Recently, Bridges and Orzell (2018), focusing on the Peninsula Florida taxa proposed breaking up *P. graminifolia* in the broad sense into five species. *Pityopsis graminifolia* was noted to have small heads with glandular phyllaries which follows the application of the name by Semple and Bowers (1985). *Pityopsis aequilifolia* (F.D. Bowers & Semple) E.L. Bridges & Orzell occurs “exclusively on xeric sands, in both Florida scrub and fire-prone sandhills within central Florida” (Bridges & Orzell 2018). *Pityopsis microcephala* Small was noted to have very narrow leaves and that further study supporting it as a separate species distinct from *P. graminifolia* was needed across the range of the two taxa. *Pityopsis tracyi* (Small) Small was noted to have large involucre 12-14 mm high and to have robust lower stem and rosette leaves and was confined to

“somewhat poorly to poorly drained pine savannas and seasonally wet grasslands with a historical high fire return interval” in Peninsula Florida. *Pityopsis latifolia* (Fernald) Bridges & Orzell was considered to have involucre 8-12 mm high and to have few soft narrow stem leaves and be restricted to southern Florida. Bridges and Orzell (2018) noted their uncertainty about how to deal with plants included in *P. graminifolia* var. *latifolia* by Semple and Bowers (1985) outside Peninsula Florida and taxonomic problems with applying other names listed in synonymy in Semple and Bowers (1985) to possibly separate races, e.g., names based on and *Erigeron nervosus* Willd., synonym *Pityopsis nervosa* (Willd.) Dress and *Chrysopsis correllii* Fernald.

Even more recently Nesom (2019) proposed an alternative approach to the broadly delimited *Pityopsis graminifolia* with very different results from Bridges and Orzell (2018) in how some names were applied. Nesom (2019) recognized 12 species of *Pityopsis* with the delimitations of *P. aspera*, *P. falcata*, *P. flexuosa*, *P. oligantha*, *P. pinifolia* and *P. ruthii* being in agreement with Semple and Bowers (1985) and Semple (2006). The dot distribution map for *P. pinifolia* shows many more collections and one from Alabama, which were not known by Semple and Bowers (1985) because the location was uncertain and was the neotype for the species selected by Semple and Bowers (1985). Nesom (2019) split *S. graminifolia* sensu lato into 6 separate species that do not correspond to varieties in Semple and Bowers (1985) and Semple (2006). Most significantly, the name *P. graminifolia* is applied to what was *P. graminifolia* var. *latifolia* in Semple and Bowers (1985) and Semple (2006) and *P. tracyi* was expanded to include diploid and tetraploid plants from Peninsula Florida as well as the large headed hexaploids included in *P. graminifolia* var. *tracyi* by Semple and Bowers (1985) and Semple (2006). Nesom (2019) delimited *S. aequilifolia* the same way that Semple and Bowers (1985) and Semple (2006) delimited *S. graminifolia* var. *aequilifolia* but at species rank. Nesom (2019) applied the name *P. microcephala* to small headed plants with densely stipitate glandular phyllaries and mapped a range that is similar to that of *P. graminifolia* var. *graminifolia* in Semple and Bowers (1985). Plants that were included in var. *microcephala* in Semple and Bowers (1985) and Semple (2006) were treated as *P. tenuifolia* (Torr.) Nesom occurring west of the Mississippi River, and into other taxa east of the Mississippi.

Nesom (2019), working from online digital images, considered that P00742815 (Fig. 2) was the holotype of *Inula graminifolia* and that P00742818 (Fig. 3) included one isotype shoot of *P. latifolia* and two shoots of *P. microcephala*. These conclusions needed further investigation and the results are presented below.

In 1984, the first author visited the Muséum national d’Histoire naturelle in Paris and examined a Michaux collection (Fig. 1) included in the P-MICH historical collection (Thiers, continuously updated). This was a short visit and only specimens on a list sent earlier by mail were provided for examination. The holotype of *Inula graminifolia* was one of the specimens included on the list. Stipitate glands were observed on the small heads of the single shoot on the specimen (Fig. 4), which bore a TYPE label at the time and an annotation by William T. Gillis dated 1 juin 1976 and noting that the specimen was the type of *Inula graminifolia* Michx. The first author annotated the specimen as the holotype of *Inula graminifolia* and took several black and white photographs during the 1984 visit. This was the only Michaux collection of *Inula graminifolia* examined in 1984 and is the only one of the three Michaux collections examined in preparing this publication that includes a handwritten label indicating the classification of the specimen at the time. The second author compared the writing with known hand script of André Michaux and concluded that the label was likely written by Michaux himself. Thus, this collection is the only real choice for holotype of *Inula graminifolia*, the basionym of *Pityopsis graminifolia*. Only plants with small heads and stipitate glands on the phyllaries can be included in *P. graminifolia* var. *graminifolia*, as was done by Semple and Bowers (1985) and Semple (2006), or in a narrowly defined *P. graminifolia* as done by Bridges and Orzell (2018). Involucre on the holotype averaged about 5.6 mm high.

The other two Michaux collections (P00742818 and P00742815) were not seen by the first author in 1984 and were examined at his request by the second author in 2019. Both collections have a printed ISOTYPE label on the sheets. The three shoots on P00742818 have small heads (involucre averaging 6.1 mm tall) and phyllaries with glands (Figs. 2 and 5). Thus, P00742818 is similar to the holotype and is treated here as an isotype of *Inula graminifolia*. The two shoots on P00742815 differ in head size (taller left shoot with involucre averaging 9.1 mm high; right shoot with involucre averaging 8.8 mm); both shoots have phyllaries with few or no glands (Figs. 3 and 6). Therefore, P00742815 is not the same taxon as the holotype of *Inula graminifolia* and should not be considered as an isotype. Shoot “a-b” and shoot “d” are all part of the Michaux collection, acquired at one point by the E. Drake herbarium. The material was included in P in a second step.

A much larger study is needed to resolve questions on whether splitting up *Pityopsis graminifolia* into more narrowly defined separate species and how many species should be recognized. If additional research determines that *P. latifolia* should be limited to plants in Florida, then *Pityopsis nervosa* (Willd.) Dress [Baileya 19: 166. 1975.] based on *Erigeron nervosus* Willd. [Sp. Pl., 3: 1953. 1803.] is the oldest species epithet to apply to the much more widely distributed species level taxon occurring in much of the southeastern USA, southern Mexico, Guatemala, and Belize. The Bahamian populations could belong to *P. latifolia* or *P. nervosa* depending upon study results. Further work is needed to determine whether it is appropriate to split these small headed non-glandular *P. microcephala* into an eastern taxon under that name and a western *P. tenuifolia*. A multivariate study of the kind being done on multiple groups of *Solidago* recently might provide a solution to these problems (e.g., Semple et al. 2017; Semple et al. 2018). Cutting edge DNA based research may also provide solutions, if polygenomic sampling is utilized on sufficient numbers of specimens (see Wadl et al. 2011). Single gene or internal transcribed spacer sequencing will probably not be sufficient (Brouillet et al. 2009). The first author has split *Solidago* into many more species in recent years (Semple 2019) than were recognized in 2006 and would likely conclude that splitting a broadly defined *P. graminifolia* into 5-6 or more species now is an appropriate solution at this time pending results of new studies. Selecting the correct names to apply will necessitate doing more than looking at online digital images of type collections because critical indument details are not clearly visible even on the higher resolution images now available.

Counting the numbers of hairs and glands on phyllaries will be tedious but may be necessary after assembling a large sample of *Pityopsis* herbarium collections from the entire range of the species and including all races. Using a dissecting scope at 40-70. magnification is still a necessity in modern systematic botany.

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Figure 1. Holotype of *Inula (Pityopsis) graminifolia*, Michaux s.n. (P-MICH). No bar code.



Figure 2. Isotype of *Inula (Pityopsis) graminifolia*, Michaux s.n. (P00742818). <<http://coldb.mnhn.fr/catalognumber/mnhn/p/p00742818>>

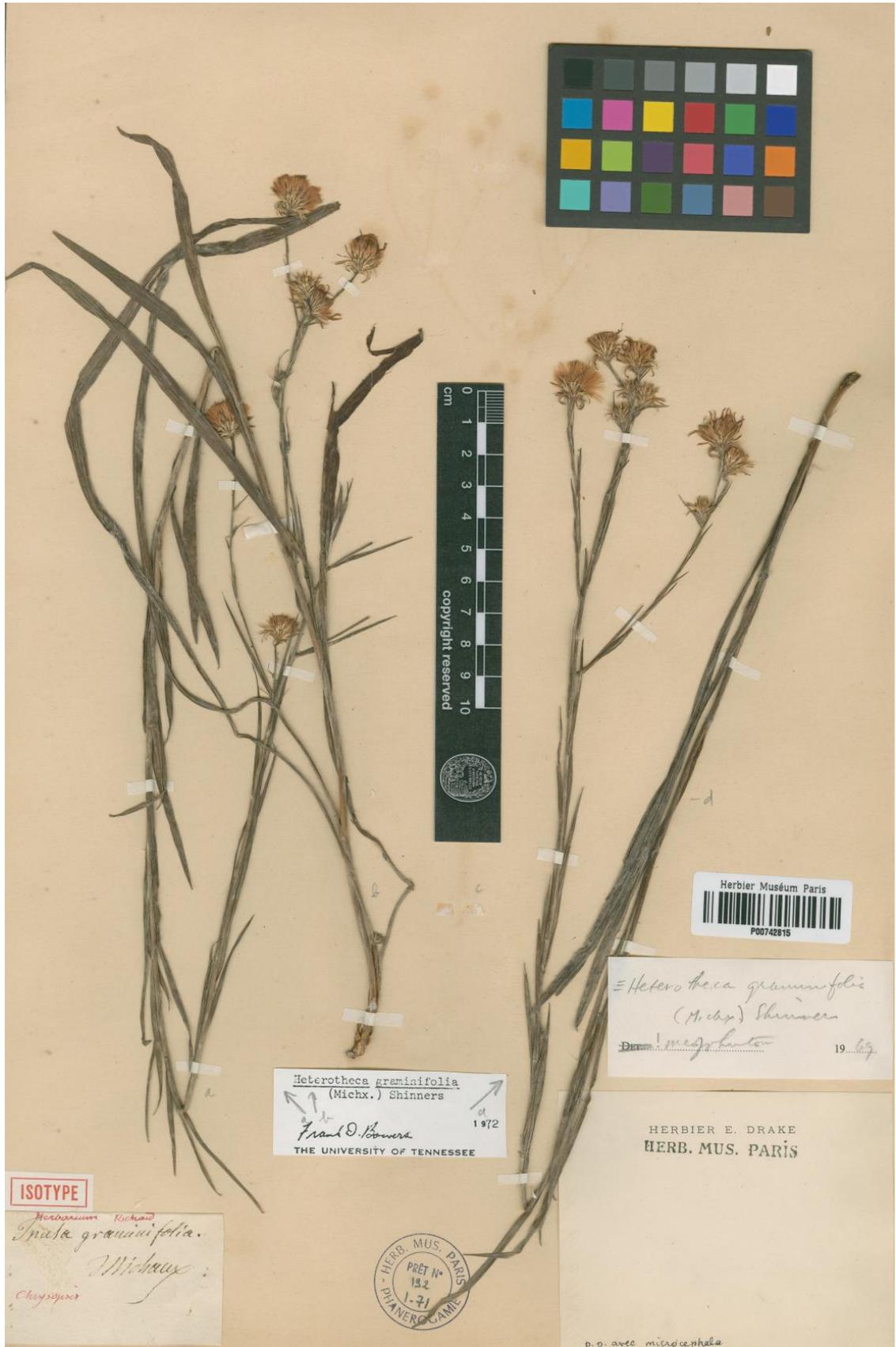
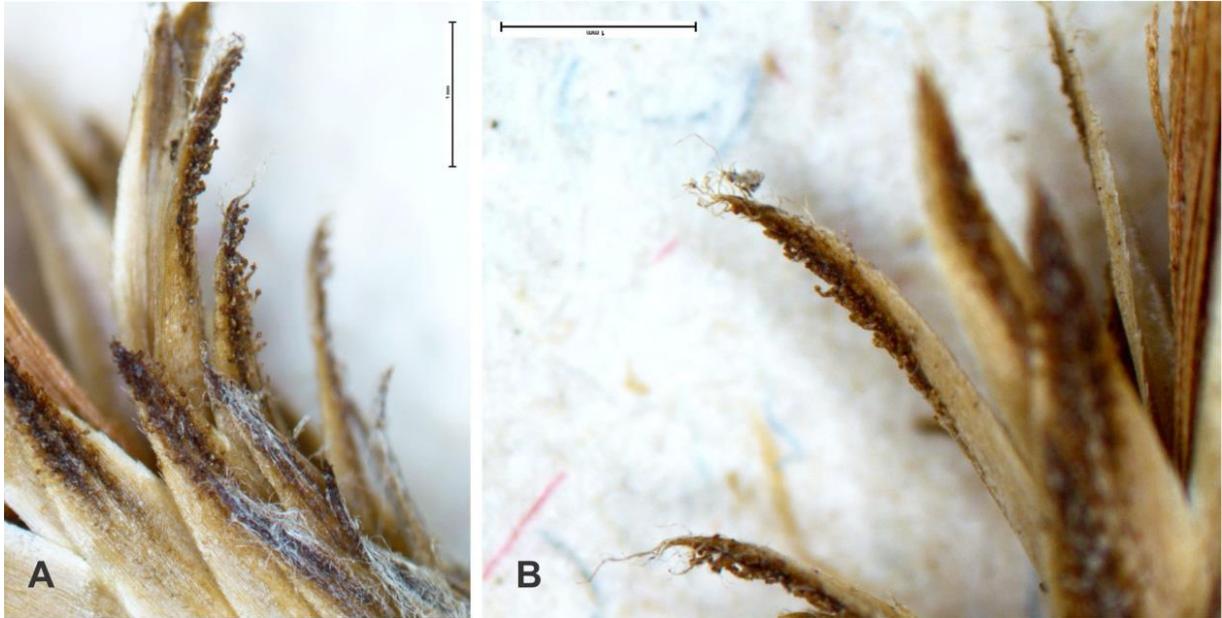


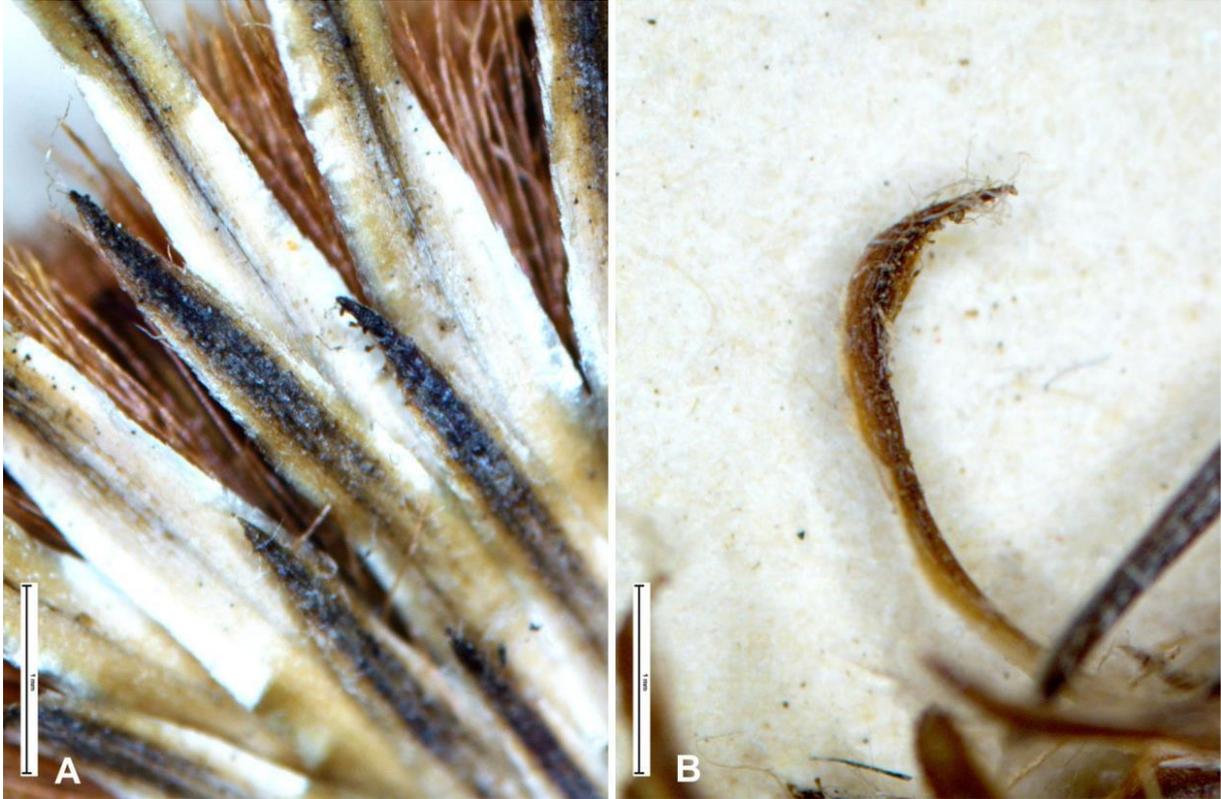
Figure 3. Mixed collection of *Pityopsis latifolia* and *P. microcephala*, Michaux s.n. (P00742815) rejected as an isotype of *P. graminifolia*. <<http://colddb.mnhn.fr/catalognumber/mnhn/p/p00742815>>



Figures 4. Phyllaries details of the holotype of *Inula graminifolia*. Scale bar = 1 mm in A and B



Figures 5. Phyllaries details of the isotype of *Inula graminifolia* (00742818). Scale bar = 1 mm, A and B.



Figures 6. Phyllaries details of the *Pityopsis latifolia* (A) and *P. microcephala* (B); Michaux s.n. P00742815. Scale bar = 1 mm in A and B