Benoît Francis Patrice Loeuille

Towards a phylogenetic classification of Lychnophorinae (Asteraceae: Vernonieae)

São Paulo, 2011

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Orientador

To my grandfather,
who made me discover
the joy of the vegetal world.

Chacun sa chimère

Sous un grand ciel gris, dans une grande plaine poudreuse, sans chemins, sans gazon, sans un chardon, sans une ortie, je rencontrai plusieurs hommes qui marchaient courbés.

Chacun d'eux portait sur son dos une énorme Chimère, aussi lourde qu'un sac de farine ou de charbon, ou le fourniment d'un fantassin romain.

Mais la monstrueuse bête n'était pas un poids inerte; au contraire, elle enveloppait et opprimait l'homme de ses muscles élastiques et puissants; elle s'agrafait avec ses deux vastes griffes à la poitrine de sa monture et sa tête fabuleuse surmontait le front de l'homme, comme un de ces casques horribles par lesquels les anciens guerriers espéraient ajouter à la terreur de l'ennemi.

Je questionnai l'un de ces hommes, et je lui demandai où ils allaient ainsi. Il me répondit qu'il n'en savait rien, ni lui, ni les autres; mais qu'évidemment ils allaient quelque part, puisqu'ils étaient poussés par un invincible besoin de marcher.

Chose curieuse à noter : aucun de ces voyageurs n'avait l'air irrité contre la bête féroce suspendue à son cou et collée à son dos; on eût dit qu'il la considérait comme faisant partie de lui-même. Tous ces visages fatigués et sérieux ne témoignaient d'aucun désespoir; sous la coupole spleenétique du ciel, les pieds plongés dans la poussière d'un sol aussi désolé que ce ciel, ils cheminaient avec la physionomie résignée de ceux qui sont condamnés à espérer toujours.

Et le cortège passa à côté de moi et s'enfonça dans l'atmosphère de l'horizon, à l'endroit où la surface arrondie de la planète se dérobe à la curiosité du regard humain.

Et pendant quelques instants je m'obstinai à vouloir comprendre ce mystère; mais bientôt l'irrésistible Indifférence s'abattit sur moi, et j'en fus plus lourdement accablé qu'ils ne l'étaient eux-mêmes par leurs écrasantes Chimères.

Charles Baudelaire, *Petits poèmes en prose ou Le Spleen de Paris*

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RESUMO

Rumo a uma classificação filogenética de Lychnophorinae (Asteraceae: Vernonieae)

Uma hipótese filogenética das Vernonieae Americanas, baseada em uma matriz morfológica e em três regiões moleculares (ITS, *ndh*F, *rpl*32-*trn*L), revela a existência de quatro linhagens principais neste grupo. Três desses linhagens correspondem, com alguns ajustes, às subtribos Chrestinae, Lychnophorinae e Vernoniinae. A última linhagem é principalmente composta de Lepidaploinae e Elephantopinae. Para uma circunscrição de Lychnophorinae monofilética, devem ser aqui incluídos duas pequenas subtribos (Centratherinae, Sipolisiinae) e três gêneros monotípicos (*Albertinia*, *Blanchetia* e *Gorceixia*), tendo como sinapomorfia a presença de heliangolidos nas partes aéreas. Nossos resultados mostram que a sincefalia provavelmente surgiu três ou quatro vezes ao longo da evolução das Vernonieae Americanas. As características especiais desses agregações de capítulos em cada linhagem sugerem que a formação da sincefalia deve estar relacionada a diferente funções biológicas: atração nas Chrestinae, dispersão nas Rolandrinae ou proteção nas Lychnophorinae.

A análise filogenética das Lychnophorinae foi realizada baseada numa matriz morfológica e quatro regiões moleculares (ETS, ITS, *ndh*F, *rpl*32-*trn*L), a fim de delimitar gêneros monofiléticos na subtribo, e alcançar uma melhor compreensão das relações entre seus gêneros. O gênero mais rico da subtribo, *Lychnophora*, com 32 espécies descritas, emergiu como polifilético, envolvendo três principais linhagens não estreitamente relacionadas. A maioria dos clados obtidos estão associados a conceitos de gêneros já existentes e podem ser definidos por uma combinação simples de caracteres morfológicos. *Albertinia*, *Blanchetia* e *Gorceixia* são as linhagens mais basais, enquanto *Eremanthus* e *Lychnophora* stricto sensu emergiram como o clado mais derivado, que contém metade das espécies da subtribo. Porém, as relações entre os demais clados persistem apenas parcialmente resolvidas.

Com o objetivo de comparar a influência de uma representação hierárquica de hipóteses de homologia em inferência filogenética, uma matriz morfológica das Vernonieae Americanas e uma das Lychnophorinae (Asteraceae) foram ambas analisadas usando a parcimônia e análise de três itens. Os resultados divergiram muito não só em termos de topologia, mas também no número de homologias recuperadas. A análise de três itens parece recuperar um maior conteúdo de informação das matrizes originais. O nível elevado de homoplasia já reconhecido em dados morfológicos de Vernonieae foi aqui confirmado e a maioria dos clados não são sustendados por sinapomorfias.

Baseada nos resultados das análises filogenéticas realizadas, propõe-se aqui uma nova classificação da subtribo Lychnophorinae, e uma sinopse é apresentada. As subtribos

Centratherinae e Sipolisiinae são reduzidas a sinonímia de Lychnophorinae e três gêneros (*Albertinia*, *Blanchetia*, *Gorceixia*) são transferidos para a subtribo. Como agora circunscrita, Lychnophorinae compreende 18 gêneros e 104 espécies distribuídas principalmente no domínio do cerrado do Planalto Central Brasileiro. Propõe-se a sinonimização de *Oiospermum* sob *Centratherum*, e de *Irwinia* sob *Blanchetia*. Devido ao fato de *Lychnophora*, como atualmente circunscrito ter-se mostrado polifilético, suas espécies tiveram que ser rearranjadas em três gêneros monofiléticos: *Lychnophora* s.s., *Lychnocephalus* e um novo gênero agora descrito, *Lychnophorella*. 17 novas combinações são propostas bem como 10 novas sinonímias. As descrições de oito novas espécies de Lychnophorinae são apresentadas: *Eremanthus brevifolius*, *Heterocoma gracilis*, *H. robinsoniana*, *Minasia ramosa*, *Paralychnophora glaziouana*, *Piptolepis campestris*, *P. monticola* e *P. schultziana*. A sinopse inclui os dados fundamentais de todas as espécies de Lychnophorinae: status taxonômico, dados sobre os tipos nomeclaturais, distribuição geográfica e habitat, além de notas taxonômicas.

ABSTRACT

Towards a phylogenetic classification of Lychnophorinae (Asteraceae: Vernonieae)

A phylogenetic hypothesis of American Vernonieae based on three molecular regions (ITS, *ndh*F, *rpl*32-*trn*L) and on a morphological dataset reveals the existence of four main lineages in the group. Three of these lineages correspond, with a few adjustments, to subtribes Chrestinae, Lychnophorinae and Vernoniinae. The last lineage is mainly composed of Lepidaploinae and Elephantopinae. In order to keep the Lychnophorinae monophyletic, two small subtribes (Centratherinae, Sipolisiinae) and three monotypic genera (*Albertinia*, *Blanchetia* and *Gorceixia*) must be to transferred to Lychnophorinae, which has the presence of heliangolide in aerial parts as a synapomorphy. Our results show that syncephaly probably appeared independently three or four times in the course of evolution of American Vernonieae. Special features of these aggregation of heads in each lineage suggest that the formation of syncephalia is related to different biological functions: attractive in Chrestinae, disseminative in Rolandrinae or protective in Lychnophorinae.

A phylogenetic analysis of Lychnophorinae was further performed based on a morphological dataset and on four molecular regions (ETS, ITS, *ndh*F, *rpl*32-*trn*L), in order to delimit monophyletic genera in Lychnophorinae, and to achieve a better understanding of the relationships between the genera of the subtribe. The richest genus of the subtribe, *Lychnophora*, with 32 described species, emerged as polyphyletic, involving three main lineages not closely related. Most clades obtained are associated with some existing generic concept and can be defined by a simple combination of morphological characters. *Albertinia*, *Blanchetia* and *Gorceixia* are the most basal lineages, whereas *Eremanthus* and *Lychnophora* stricto sensu emerged as the most derived clade, which contains half of the species of the subtribe. However, relationships between the remaining clades persist partially unresolved.

Aiming to compare the influence of a hierarchical representation of homology hypotheses on phylogenetic inference, two morphological datasets of American Vernonieae and Lychnophorinae (Asteraceae) have been analyzed using parsimony and three-item analysis. The results widely diverged not only in terms of topology but also in the number of homologies recovered. The three-item analysis appears to retrieve a higher information content from the original datasets. The already acknowledged high level of homoplasy in Vernonieae morphological data is here confirmed and most of the clades are not supported by synapomorphies.

Based on the results of the phylogenetic analyses performed, a new classification of the subtribe Lychnophorinae is here proposed. The subtribes Centratherinae and Sipolisiinae are reduced to synonymy of Lychnophorinae and three genera (*Albertinia*, *Blanchetia*, *Gorceixia*)

are transferred to the subtribe. As now circumscribed, Lychnophorinae comprises 18 genera and 104 species distributed mostly in the cerrado domain of the Brazilian Central Plateau. *Oiospermum* is synonymized under *Centratherum*, and *Irwinia* under *Blanchetia*. Because *Lychnophora* as currently circumscribed was shown to be polyphyletic, it is here dismantled into three monophyletic genera: *Lychnophora* s.s., *Lychnocephalus* and a new genus described herein, *Lychnophorella*. 17 new combinations are proposed as well as 10 new synonymies. The descriptions of eight new species of Lychnophorinae are presented: *Eremanthus brevifolius*, *Heterocoma gracilis*, *H. robinsoniana*, *Minasia ramosa*, *Paralychnophora glaziouana*, *Piptolepis campestris*, *P. monticola* and *P. schultziana*. The synopsis provides the taxonomic status, data on nomeclatural types, geographical distribution, and taxonomic notes for each species.

INTRODUCTION

1. The study group

Asteraceae (or Compositae) is one of the largest flowering plants families (about 10%) with ca. 24,000–30,000 species in 1,600–2,000 genera, distributed in all continents but Antarctica and nearly all habitats with its higher diversity found open formations, mostly in temperate and arid regions as well as tropical and subtropical mountains. The family is easily recognized by its florets arranged on a receptacle in centripetal heads (capitula) and surrounded by bracts (phyllaries), by anthers fused in a ring with a mechanism of secondary pollen presentation, and by the presence of cypselae often with a pappus (Bremer, 1994; Wagstaff and Breitwieser, 2002; Funk et al., 2005, 2009; Jeffrey, 2007). Asteraceae is monophyletic based on morphological and molecular phylogenetic analyses (Bremer, 1987; Jansen and Palmer, 1987; Kim et al., 1992; Panero and Funk, 2002).

Currently 12 subfamilies are recognized, with 43 tribes (Funk et al., 2009). Vernonieae is one of the major tribes of Asteraceae (subfamily Cichorioideae) with ca. 1100 species placed into 129 genera (Keeley et al., 2007; Keeley and Robinson, 2009). They are distributed into two main biodiversity centers (Brazil and Africa). The Vernonieae are very variable in habit (from small herbs to large trees), bearing leaves generally alternate and discoid capitula with white, blue or purple florets (rarely red or yellow). The most distinctive feature of the Vernonieae is given by the styles, which are slender with filiform, pilose style branches and a pilose upper shaft, but this type of styles also occur in the tribe Lactuceae of the same subfamily Cichorioideae. The pollen is highly ornamented, lophate, sublophate, echinate or psilate (Keeley and Jones, 1979; Bremer, 1994; Robinson, 1977, 2007; Keeley and Robinson, 2009).

If the delimitation of the tribe has posed few problems (but see Funk and Chan, 2009 for the position of *Distephanus*), much more problematical are subtribal classification and delimitation of genera (Bremer, 1994). Historically, the tribe has been organized around the large genus *Vernonia* (ca. 1,000 spp.), which was traditionally defined by the lack of features present in other Vernonieae genera. Phytochemical, cytological and palynological studies have indicated a putative paraphyly or polyphyly of *Vernonia*, which was confirmed by phylogenetic analyses based on morphological (Keeley and Turner, 1990) or molecular data (Keeley and Jansen, 1994; Keeley et al., 2007), and a subtribal classification was proposed by Robinson et al. (1980) and further modified (Robinson, 1999a, b; Keeley and Robinson, 2009). Subsequently the generic concept of *Vernonia* has been restricted to a small group of 22 taxa mostly from North America and other species placed in new (or re-established) genera (summarized in Robinson 1999a, b, 2007). Another characteristic of the tribe is its high number of monotypic or two species genera (about 60%) which clearly reflects how poorly understood are the relationships between the genera and subtribes of Vernonieae (Keeley et al., 2007; Keeley and Robinson, 2009).

The monophyly of the tribe is supported by molecular (Kim and Jansen, 1995; Kim et al., 1998; Panero and Funk, 2002; Goerzten et al., 2003; Funk et al., 2005) and morphological data (Bremer, 1987). Keeley et al. (2007) published the first phylogeny of the tribe based on DNA sequence data (ITS, *ndh*F and *trn*L-F) including 90 species (35 genera) (Fig. 1). It revealed a complex biogeographic history: Vernonieae is a Gondwanan group but there is not a clear separation between New and Old World lineages; nonetheless, the limited taxonomic sampling used in that analysis prevents solid conclusions about the subtribes and genera relationships.

Among the 21 subtribes currently recognized in Vernonieae, the subtribe Lychnophorinae is nearly endemic to Brazil (only one species occurs outside) and contains 11 genera and ca. 100 species (Dematteis 2007; Robinson 2007; Keeley and Robinson, 2009). Most species are restricted to *campo rupestre* areas in the highlands of southeastern and northeastern Brazil and to cerrado (Brazilian savanna), a region that represents also one of the centers of diversity of the tribe Vernonieae. Established by Bentham (1873), the subtribe initially contained taxa with one- to few-flowered capitula with the capitula densely aggregated into glomerules or syncephalia and possessing simple biseriate, paleaceous, rarely setose, pappus setae (Hind, 2000). But this traditional definition has been completely abandoned by Robinson in his review of American Vernonieae, through the inclusion of genera with separate heads (*Anteremanthus*, *Minasia*, *Piptolepis*, *Proteopsis*) in Lychnophorinae (Robinson 1992, 1999, 2007; Keeley and Robinson, 2009) and proposal of a set of alternative characteristics (not necessarily restricted to Lychnophorinae, but rather consistent within the group) to define the subtribe: lack of enlarged nodes or sclerified cells at the bases of the styles, usual extensive presence of a pubescence of T-shaped hairs, presence of sclerified cells and lack of glands in the anther appendages and presence of type A pollen (Robinson, 1992). The only available molecular phylogeny (Keeley et al., 2007) does not bring any clue for the Lychnophorinae problem, due to the poor sampling of Brazilian taxa.

The genera currently recognized in the subtribe Lychnophorinae are: *Anteremanthus*, *Chronopappus*, *Eremanthus* (including *Vanillosmopsis*), *Lychnophora* (including *Haplostephium*), *Lychnophoriopsis*, *Minasia*, *Paralychnophora*, *Piptolepis*, *Prestelia*, *Proteopsis* and *Vinicia.* Generic limits between *Eremanthus*, *Lychnophora*, *Lychnophoriopsis*, and *Paralychnophora* are the most problematic (see Hind 2000 for a recent review).

General aspects of plants and capitula of Vernonieae-Lychnophorinae species treated in this thesis may be appreciated at figure 1 from Chapter 1 (page 67), figures 1 and 5 from Chapter 2 (pages 125 and 127), and figures 2–4 from Chapter 5 (pages 420-422).

2. Goals

The objectives of the present thesis are:

- to evaluate the phylogenetic relationships within the American Vernonieae and test the monophyly of the subtribe Lychnophorinae, composed in great part by syncephalous taxa, as well as providing preliminar hypotheses about the evolution of syncephaly based on the phylogeny;
- to delimit monophyletic genera in Lychnophorinae, to confirm or refute the generic assignment of several Lychnophorinae species, and to achieve a better understanding of the relationships between the genera of this subtribe;
- to present a synopsis of Lychnophorinae, providing the taxonomic status, synonyms, data on nomenclatural types, geographical distribution, habitats, and taxonomic notes for each species.

3. Significance

The Cerrado Domain, one of the biodiversity hotspots recognized by Myers et al. (2000), is a savanna covering ca. 2 million km^2 of the Central Brazilian Plateau, extending west into Bolivia, south to Paraguay, and east to the Caatinga Domain (Prance, 1996; Daly and Mitchell, 2000; Fiaschi and Pirani, 2009). The highest levels of endemism and diversity in the Cerrado are found in the *campos rupestres* (Joly, 1970; Giulietti and Pirani, 1988; Harley, 1995; Rapini et al., 2002). These formations occur on areas above 900–1000 m along the mountains of the Espinhaço Range (Minas Gerais and Bahia states) and the Chapada dos Veadeiros (Goiás state), covered by a low, mostly herbaceous or shrubby vegetation on sandy or rocky soils (Giulietti and Pirani, 1988; Prance, 1994; Harley, 1995; Simon and Proença, 2000; Silva and Bates, 2002; Fiaschi and Pirani, 2009). In the *campos rupestres* it is noteworthy a conspicuous convergent evolution of the habit, leaf shape, and pubescence between sclerophyllous evergreen small trees, shrubs and subshrubs from several families (Asteraceae, Ericaceae, Lamiaceae, Melastomataceae, Velloziaceae etc.) (Coile and Jones, 1981; Hind, 1993).

Asteraceae is one of the most important flowering plant families of the Central Brazilian Plateau displaying an amazing diversity (Hind, 1995; Munhoz and Proença, 1998). In this region, the tribe Vernonieae is one of the most species-rich (Hind, 1993). A large majority of Lychnophorinae occurs in the cerrado and *campo rupestre* and frequently exhibits many features which are likely to be protective against fire or against herbivory.

Cerrado and *campo rupestre* ecosystems suffer from several threats, in particular cattle-raising, charcoal production and indiscriminate collection of whole plants for horticultural use (Giulietti et al., 1997; Ratter et al., 1997; Silva and Bates, 2002) and their conservation requires detailed

studies to achieve a better understanding of biodiversity origins and, especially, the evolutionary history of these taxa. The subtribe Lychnophorinae provides, with its geographic distribution nearly restricted to the Central Brazilian Plateau and its high morphological diversity, a unique biological model to study diversification and speciation.

4. Conceptual framework

The principal objective of systematics is to produce a predictive classification of life diversity reflecting the relationships between its elements, and includes the survey, discovery, inventory and description of species diversity (Knapp and Press, 2010). The genealogical history of species, or group of species, forms a pattern of ancestry and descent, which may be represented by a cladogram (Nelson, 1973). The aim of cladistics is to establish sister-group relationships that are hypothesized through the analysis of characters (Kitching et al., 1998). The use of cladistics analyses aiming to achieve better systems of classification of living organisms at any level of taxonomic hierarchy has been since paradigmatic in Biological Science, and a great wealth of methods have been developed in order to produce stronger supported phylogenies.

Simultaneous phylogenetic analysis (also called 'total evidence' but see Lecointre and Deleporte, 2004; Rieppel, 2005) produces best-supported hypotheses, and so maximizes congruence among different sources of data (Nixon and Carpenter, 1996). In order to establish a phylogenetic classification based on monophyletic groups supported by morphological synapomorphies (= secondary homologies) it is indispensable to test the primary homology hypotheses through the congruence test (Patterson, 1982; de Pinna, 1991). Standard cladistic analysis operates on the basis of character congruence, in which the congruence of all characters is assessed simultaneously. Only this approach guarantees finding the cladogram containing the maximal explanatory power (Nixon and Carpenter, 1996; Jenner, 2004).

The *phylogenetic species concept* (or *cladistic species concept*) followed in the present thesis, defines the species as 'the smallest aggregation of (sexual) populations or (asexual) lineages diagnosable by a unique combination of character states' (Nixon and Wheeler, 1990; Wheeler and Platnick, 2000). In practice, the use of this species definition is relatively similar to the L.I.T.U. (Least-inclusive Taxonomic Unit) of Pleijel and Rouse (2000). Concept of monophyly should not be applied to species since no hierarchical structure is observed at the tokogenetic level or it reduces unwarrantedly the meaning of monophyly to a unique evolutionary origin (for a review of species monophyly, see Rieppel 2010). Species are here understood as the basic unit for phylogenetic reconstruction; otherwise in the absence of hierarchy, on what basis are we to assume that a resulting cladogram may be interpreted as showing phylogenetic relations (Nelson and Platnick, 1981; Wheeler and Platnick, 2000) ?

5. Structure of the thesis

Besides the present Introduction and a Conclusion, the thesis is composed of five chapters:

- Chapter 1 presents the phylogenetic analyses of American Vernonieae focusing on syncephaly evolution. The manuscript follows the format instructions of the international periodical *Taxon*, to which it will be submitted conjointly with Sterling C. Keeley, Lúcia G. Lohmann and José R. Pirani.
- Chapter 2 comprises the phylogenetic analyses of the subtribe Lychnophorinae with a discussion of systematic implications. The manuscript follows the format instructions of the international journal *Systematic Botany*, to which it will be submitted conjointly with João Semir, Lúcia G. Lohmann and José R. Pirani.
- Chapter 3 explores the contributions of a hierarchical homology representation in phylogenetic inference based on analyses of two morphological datasets of American Vernonieae and Lychnophorinae. The manuscript follows the format instructions of the international journal *Plant Systematics and Evolution*, to which it will be submitted conjointly with René Zaragüeta-Bagils and José R. Pirani.
- Chapter 4 is composed of five taxonomic studies in Lychnophorinae. First part comprises the description of a new species of *Eremanthus* and several new synonymization (paper accepted for publication in *Kew Bulletin* conjointly written with Jenifer C. Lopes and José R. Pirani). An amplified concept of the genus *Heterocoma* is the subject of the second part as well as the descriptions of two new species of that genus (paper to be submitted to *Systematic Botany* conjointly with Jimi N. Nakajima, Denise M. Trombert Oliveira, João Semir and José R. Pirani). The third part comprises the description of a new species of *Minasia* (paper accepted for publication in *Phytotaxa* conjointly written with Harold Robinson and João Semir). The fourth part deals with the description of a new species of *Paralychnophora* with some comments on the identity of *P. bicolor* (paper to be submitted to *Brittonia* conjointly written with João Semir and José R. Pirani). The description of three new species of *Piptolepis* is the subject of the fifth part (paper accepted for publication in *Kew Bulletin* conjointly written with João Semir, David J. N. Hind and José R. Pirani).
- Chapter 5 presents the synopsis of the Lychnophorinae, corresponding to classification of the subtribe that incorporates the phylogenetic analyses results presented in Chapter 2. It will be submitted to the international periodical *Havard Papers in Botany* conjointly with João Semir and José R. Pirani, after a further visit to European herbaria aiming to complement and fill some pending blanks in the manuscript, mostly to check type specimens and to select lectotypes where necessary.

I hereby declare that all the new names and new combinations will be published in periodicals and, consequently, the present thesis should not be considered as the effective publication of these names.

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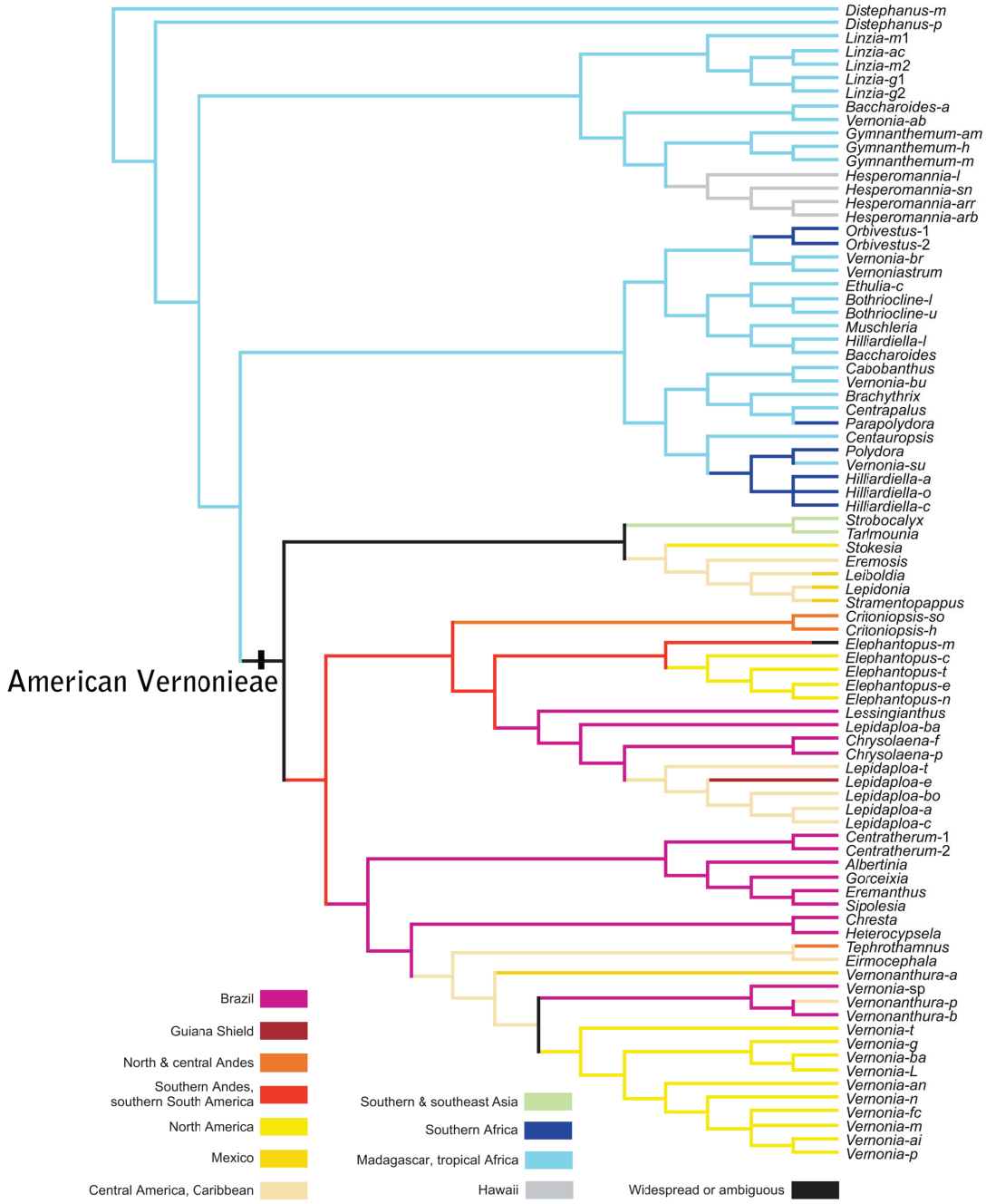

Fig. 1 Bayesian inference phylogram based on the combined analysis of DNA sequences of ITS, *ndh*F, *trn*L-F for 90 taxa of Vernonieae. (Modified from Keeley and Robinson, 2009).

humillima (Fig. 1H) but far to be reached in *Eremanthus polycephalus*). Reduction to a single floret per capitulum is very common in Lychnophorinae (mostly in *Eremanthus* and *Lychnophora*). Capitula fusion occurs in *Eremanthus* (Fig. 1I) and *Paralychnophora* via interwoven pubescence of phyllaries or concrescence of receptacle and phyllaries tissues (MacLeish, 1987) (Fig. 5JKL). Thereby, each ovule is protected by the phyllaries, an additional tissue (from the receptacle and/or phyllaries) and in some cases by secondary bracts (e.g., *E. cinctus*). This structure probably limits the action of feeding insects. The disseminule is the cypsela and no trends towards reduction of the floret are encountered in the subtribe.

CONCLUDING REMARKS

This study encourages further investigation in American Vernonieae. A more complete taxonomic sampling is needed to recognize monophyletic subtribes, especially regarding the Piptocarphinae and the Vernoniinae. Our results show the monophyly of Chrestinae, Elephantopinae and Lychnophorinae, with minor adjustments. Only for the latter a phytochemical synapomorphy was found, while the two others are diagnosable by a simple combination of morphological characters (including microcharacters). The formation of a syncephalium is a multifactorial complex, and field studies are necessary to test the functional hypotheses we propose in the present study.

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us to reflect on the reasons for such extensive convergence (as defined by Scotland 2011), especially for characters of which its adaptative value is uncertain (e.g., style basal node and other microcharacters). It also appeals to the necessity of more morphological studies in order to formulate more robust homology hypotheses. Moreover, Loeuille et al. (in press; Chapter 3) stress the possible role of past hybridization on the evolutionary course of Lychnophorinae by documenting the existence of two putative intergeneric hybrids, thus identification and exclusion of taxa with a hybrid origin would also be a necessary step in these analyses.

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especially in the Espinhaço moutain range as well as in Serra da Canastra, while *E. brevifolius* is currently known only from the type collection in Serra Talhada, a northeastern extension of Serra do Cipó, the region is well known to have many endemics in the Compositae. Two other species of *Eremanthus* (*E. elaeagnus* and *E. erythropappus*) have been recorded, at the moment, in Serra Talhada. *Eremanthus brevifolius* is probably a microendemic to this region, a distribution pattern common in the Lychnophorinae. The type locality has been very poorly collected until now which probably explains why we have found only a single collection even after visiting most of the brazilian herbaria. Even if it might be considered challenging to describe a new species based on a single collection, such characteristics as the number of series of pappus setae and of florets per capitulum clearly prevent us to consider it as conspecific with *E. elaeagnus*.

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lanulose stems (vs. densely lanate, very rarely lanulose) and slender (0.09–0.7 cm vs. 1.2–2.9 cm diam.), smaller leaves (4.5–13.5 × 1.4–5.9 cm vs. 11.5–26.5 × 5–10 cm) and fimbrillate margins of inner phyllaries (vs. usually entire). The new species is smaller and never presents a dense lanate indumentum such as *H. ekmaniana*. Both species hardly occur in sympatry: *H. ekmaniana* is found in the Chapada dos Veadeiros, Serra dos Pireneus, Chapadão de Catalão in the Goiás State and rarely in Minas Gerais State (few collections in western part of Serra da Canastra), *H. robinsoniana* occurs in the Serra da Canastra and Furnas reservoir region (Minas Gerais State). *H. ekmaniana* grows in rocky soil close to water streams or waterfalls usually in more shadier spots than *H. robinsoniana* which inhabits drier rocky outcrops.

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Diagnostic key to the species of *Minasia*

1. Leaves oblanceolate..... 2
- Leaves linear, elliptic or ensiform 3
2. Leaves 12–22 cm long, 2.5–4.5 cm wide; florets 20–25; cypselae with setiluferous base and glabrous distal half ..... *M. alpestris*
- Leaves 5–8 cm long, 0.5–1 cm wide; florets ca. 40; cypselae with numerous setulae over whole surface ..... *M. pereirae*
3. Leaves rarely reaching 10 cm 4
- Leaves mostly longer than 10 cm long (up to 30 cm long)..... 5
4. Leaves 0.2–0.8 cm wide, subfleshy; florets 21–43 ..... *M. lewinsohnii*
- Leaves 0.1–0.2 cm wide, thin; florets 12–15 ..... *M. splettiae*
5. Inflorescence with heads congested in subspherical clusters ..... *M. scapigera*
- Inflorescence a panicle or solitary heads 6
6. Leaves 10–16 cm long, 0.4–0.7 mm wide; heads always pedunculate; cypselae with setiluferous base and glabrous distal half ..... *M. cabralensis*
- Leaves 6.18–26.2 cm long, 0.11–1.25 cm wide; heads sessile to pedunculate; cypselae totally setuliferous ..... *M. ramosa*

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4172 (BHCB); próximo da Lapa da Santa, 1100 m, 10 Aug 2004, *Viana & Mota 1820* (BHCB); subida para o alojamento da Chapada, próximo da Lapa da Santa, 20 Mar 2007, *Teles et al. 348* (BHCB); base do Pico Dois Irmãos, 20 Mar 2007, *Teles et al. 357* (BHCB); Mun. Serro, ca. 3-5 km E of Serro, road to Diamantina, 9 Aug 1960, *Maguire et al. 49119* (NY, RB, US); Distrito Augusto Clementino, Pedra do Cruzeiro, 18°41'37"S, 43°27'30"W, 774 m, 9 June 2008, *Loeuille et al. 451* (K, HAW, SPF).

Paralychnophora glaziouana is closely related to *P. bicolor* by its low number of florets per capitulum (2–4 in the former, 2–3 in the latter species), the other species of the genus having more than six florets per capitulum. However, the new species is easily distinguished from *P. bicolor* by its usually wide oblong or ovate leaves with rounded and truncate bases (vs. oblanceolate with cuneate bases), the upper surface of the leaf is regularly minutely alveolate (vs. minutely bullate or rugulose) and the margins are never revolute (vs. often broadly revolute) (Fig. 2). *P. glaziouana* can be confused with *P. harleyi*, but that species has 5–12 florets per capitulum and larger syncephalia. In terms of distribution, *P. glaziouana* is known only from the Espinhaço Range in Minas Gerais state, while *P. bicolor* occurs in the Chapada Diamantina and Serra das Lontras (Bahia state) (Amorim et al., 2010) and *P. harleyi* is restricted to the Chapada Diamantina.

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by the number of capitula per inflorescence and by the number of florets per capitulum, but the latter species has leaves longer (1.5 – 2.5 cm vs. 2 – 5 cm) and distinctly petiolate (vs. subsessile to shortly petiolate). The new species is also similar to *P. gardneri*, but the leaves of the latter are linear-elliptic to linear-oblong (vs. oblanceolate, linear-obovate to spatulate) and not glaucous (vs. glaucous). Most collections of *P. monticola* available come from Pico do Itambé, while the label of the Martius' collection indicates "Itambé do Mato Dentro", another locality in Minas Gerais. Nevertheless, it seems more likely that there has been some confusion with these similar names than a wider distribution of the species at the time of Martius'collection now restricted to the Pico do Itambé.

MISAPPLICATION OF THE NAME *PIPTOLEPIS PSEUDOMYRTUS*

Vernonia pseudomyrtus A. St.-Hil. (St. Hilaire, 1833), is a taxonomic synonym of *Vernonia buxoides* Less., (Lessing, 1829). When Schultz-Bipontinus (1863) described the genus *Piptolepis*, he provided the combination *P. pseudomyrtus* (A. St.-Hil.) Sch.Bip. as well as a description of the taxon based on the collection *Martius* 545. He also noticed that this material differred from the holotype of *Vernonia pseudomyrtus* (*Saint Hilaire* B1-910) by its solitary capitula and black glandular dotted adaxial leaves. It seems clear to us that Schultz-Bipontinus did not see the latter collection and only knew that species through the descriptions of Saint Hilaire (1833: 94, 367) and Candolle (1836: 17). These two collections belong to two different species, as Baker (1873: 144 vs. 145) noted; however by using an existing name and simultaneously excluding its type, Baker created the illegitimate later homonym *P. pseudomyrtus* Baker (*ICBN*, Art. 48.1; McNeill et al., 2006). The plants traditionally assigned to *P. pseudomyrtus* are not conspecific with the type collection but with the *Martius* collection. Since no other legitimate name has been published for these plants, they are here described as a new species.

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