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**O GÊNERO *HYPOLEPIS* BERNH.  
(DENNSTAEDTIACEAE) NA AMÉRICA DO SUL**

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## RESUMO

*Hypolepis* Bernh. é um gênero sub-cosmopolita com ca. 80 táxons, e com pouquíssimos estudos taxonômicos. O presente trabalho trata da revisão taxonômica das espécies ocorrentes na América do Sul, incluindo a Ilha de Cocos (Costa Rica). O mesmo se desenvolveu, principalmente, através do estudo morfológico dos tipos nomenclaturais e de exsicatas oriundas de herbários europeus, sul-americanos e de um neo-zeolandês. Algumas espécies também foram estudadas em campo. Para a América do Sul (incl. Cocos) são aqui reconhecidas 27 espécies, e um total de 31 táxons (espécies, subespécies e variedades). Destas, 11 representam novidades nomenclaturais: *H. acantha* Schwartsb., *H. bogotensis* var. *glabra* H. Karst. ex Schwartsb. & J. Prado, *H. flexuosa* var. *zimmerae* Schwartsb. & J. Prado, *H. galapagensis* Schwartsb. & J. Prado, *H. krameri* Schwartsb. et al., *H. paulistana* Schwartsb. & J. Prado, *H. pedropaloensis* Schwartsb. & J. Prado, *H. rugosula* subsp. *poepigiana* (Mett.) Schwartsb. & J. Prado, *H. rugosula* subsp. *pradoana* Schwartsb., *H. stolonifera* var. *nebularis* Schwartsb., e *H. trinationalis* Schwartsb. Grande parte dos táxons foram re-circunscritos, especialmente *H. flexuosa* Sodiro var. *flexuosa*, *H. mitis* Kunze ex Kuhn, *H. poepigii* (Kunze) R.A. Rodr., *H. repens* (L.) C. Presl, *H. rigescens* (Kunze ex Mart.) T. Moore, e *H. stolonifera* Fée var. *stolonifera*. Foram reconhecidos oito padrões biogeográficos para os táxons: “neotropical”, “circum-caribenho”, “circum-amazônico”, “Monte Roraima”, “andino”, “ilhas”, “sul-brasileiro”, e “austral”. Altitudes mínimas e máximas parecem ser fortes fatores limitantes de distribuição. O tratamento taxonômico apresenta chaves de identificação, sinónimas, tipificações, descrição dos táxons, mapas de distribuição, ilustrações, material examinado, e comentários taxonômicos e/ou nomenclaturais. Em adição, são apresentadas breves discussões morfológicas, ecológicas, biogeográficas, de conceitos específicos e infra-específicos de alguns táxons, e de grupos informais de espécies; além de pranchas com secções anatômicas de quatro espécies.

## ABSTRACT

*Hypolepis* Bernh. is a sub-cosmopolitan genus with ca. 80 *taxa*, and with few taxonomic studies. The present work deals with the taxonomic revision of the South American species, including the Cocos Island (Costa Rica). It has been based, mainly, on the morphological study of nomenclatural types and exsiccates from European, South American, and New Zealand herbaria. Some species were also studied in nature. For South America (incl. Cocos Island), 27 species are here recognized, and a total of 31 *taxa* (species, subspecies, and varieties). Among these, 11 represent nomenclatural novelties: *H. acantha* Schwartsb., *H. bogotensis* var. *glabra* H. Karst. ex Schwartsb. & J. Prado, *H. flexuosa* var. *zimmerae* Schwartsb. & J. Prado, *H. galapagensis* Schwartsb. & J. Prado, *H. krameri* Schwartsb. et al., *H. paulistana* Schwartsb. & J. Prado, *H. pedropaloensis* Schwartsb. & J. Prado, *H. rugosula* subsp. *poepigiana* (Mett.) Schwartsb. & J. Prado, *H. rugosula* subsp. *pradoana* Schwartsb., *H. stolonifera* var. *nebularis* Schwartsb., and *H. trinationalis* Schwartsb. Most *taxa* were re-circumscribed, especially *H. flexuosa* Sodiro var. *flexuosa*, *H. mitis* Kunze ex Kuhn, *H. poepigii* (Kunze) R.A. Rodr., *H. repens* (L.) C. Presl, *H. rigescens* (Kunze ex Mart.) T. Moore, and *H. stolonifera* Fée var. *stolonifera*. Eight bio-geographical patterns were recognized: “Neotropical”, “circum-Caribbean”, “circum-Amazonian”, “Mount Roraima”, “Andean”, “islanders”, “southern Brazilian”, and “Austral”. Minimum and maximum elevations seem to be strong limiting factors of distribution. The taxonomic treatment presents keys to *taxa*, synonymies, typifications, *taxa* description, distribution maps, illustrations, studied material, and taxonomic and/or nomenclatural comments. In addition, it is presented short discussions about morphology, ecology, bio-geography, specific/intra-specific concepts of some *taxa*, and informal groups of species; also, plates with anatomical sections of four species.

## INTRODUÇÃO GERAL

O presente trabalho trata da Revisão Taxonômica do gênero *Hypolepis* Bernh. (Dennstaedtiaceae) para a América do Sul. O trabalho encontra-se dividido em um grande capítulo contendo o tratamento taxonômico geral e mais cinco anexos.

O grande capítulo geral foi redigido na língua Inglesa, uma vez que se prevê sua publicação neste idioma. Este capítulo contém:

I. Introdução, com os sub-itens: Histórico do gênero, Classificações supra-genéricas tradicionais, Abordagens recentes – relações filogenéticas de *Hypolepis*, e A necessidade de estudos taxonômicos adicionais.

II. Materiais e Métodos.

III. Resultados e Discussão, com os subitens: Conceitos de espécie conflitantes, *Hypolepides* no Mundo, Aspectos ecológicos, Padrões biogeográficos, Morfologia, Grupos de espécies, Tratamento taxonômico, Espécies exóticas cultivadas, Nomes excluídos, Nomes duvidosos, e Registros duvidosos para a América do Sul.

IV. Referências Bibliográficas.

V. Lista de Nomes Científicos.

Neste grande capítulo também são apresentadas ilustrações da maioria das espécies, mapas de distribuição, e pranchas com fotos de secções anatômicas.

Os cinco anexos (também na língua Inglesa) são referentes a artigos já publicados durante o desenvolvimento da Tese, manuscritos aceitos para publicação, porém ainda aguardando a publicação efetiva (no prelo), ou a manuscritos submetidos à publicação e aguardando aceite efetivo. Tais anexos contêm autorias distintas, ou são referentes a temas a serem publicados independentemente (*e.g.* propostas de conservação de nomes científicos), por isso foram segregados do capítulo principal, e enviados a publicação anteriormente à defesa da Tese; são eles:

Anexo I – (1911) Proposal to conserve the name *Hypolepis nigrescens* Hook. (Dennstaedtiaceae) against *Hypolepis nigrescens* (Schrad.) Nees (Cyperaceae). Publicado na revista *Taxon*, vol. 58, fasc. 4, pág. 1369, ano 2009, de autoria de Pedro Bond Schwartsburd (Doutorando) e Jefferson Prado (Orientador). Este artigo é referente

ao pedido de conservação do nome *Hypolepis nigrescens* Hook. (Dennstaedtiaceae), usado por mais de 150 anos, perante um homônimo mais antigo: *Hypolepis nigrescens* (Schrad.) Nees (Cyperaceae). Tal pedido foi deferido, e o nome publicado por Hooker agora é um *nomen conservandum*.

Anexo II – (1990) Proposal to conserve the name *Pteris arachnoidea* (*Pteridium arachnoideum*) against *Aspidium brasilianum* and *Pteris psittacina* (Dennstaedtiaceae). Publicado na revista *Taxon*, vol. 60, fasc. 1, págs. 234-235, ano 2011, de autoria de Pedro Bond Schwartzburd (Doutorando) e Jefferson Prado (Orientador). Um nome atrelado ao gênero *Hypolepis* (*Hypolepis brasiliana* (C. Presl) Kuhn) revelou ter um basiônimo mais antigo (*Aspidium brasilianum* C. Presl) para a uma das samambaias mais conhecidas e economicamente importantes da América do Sul: *Pteridium arachnoideum* (Kaulf.) Maxon. A fim de se evitar uma mudança nomenclatural drástica, foi pedida a conservação do basiônimo mais utilizado (*Pteris arachnoideum* Kaulf.), perante *Aspidium brasilianum* (e *Pteris psittacina* C. Presl). Este pedido também foi deferido, e o nome publicado por Kaulfuss é agora um *nomen conservandum*.

Anexo III – Typification of *Polypodium rugosulum* Labill. (= *Hypolepis rugosula*, Dennstaedtiaceae), a new subspecies, a new status for one variety. Publicado na revista *Webbia*, vol. 66, fasc. 2, págs. 155-163, ano 2011, de autoria de Pedro Bond Schwartzburd (Doutorando) e Jefferson Prado (Orientador). Este artigo trata da lectotipificação de *Polypodium rugosulum* Labill. (*Hypolepis rugosula* (Labill.) J. Sm., tipo da Tasmânia), uma nova subespécie (*H. rugosula* subsp. *pichi-sermolliana* Schwartzb. & J. Prado, ocorrente na África Continental e Ilha de Fernando Po), e uma nova combinação (*H. rugosula* subsp. *africana* (C. Chr.) Schwartzb. & J. Prado, ocorrente em Madagascar e Bourbon). Embora este artigo possa aparentar não ter relação direta com a Tese, ele é estritamente relacionado a ela: *Hypolepis rugosula* é uma espécie sub-cosmopolita, com duas subespécies presentes na América do Sul (subsp. *poepigiana* (Mett.) Schwartzb. & J. Prado *ined.*, e subsp. *pradoana* Schwartzb. *ined.*), e necessitava de uma efetiva lectotipificação e esclarecimentos taxonômicos.

Anexo IV – Two new species of *Hypolepis* (Dennstaedtiaceae: Pteridophyta) from Mount Roraima region (N South America) and a revised key for the Guianan species. Artigo aguardando publicação efetiva (no prelo) pela revista *Fern Gazette*, vol. 19, fasc. 1, págs. 1-9, ano 2012, de autoria de Pedro Bond Schwartzburd (Doutorando), Michel

Boudrie (Pesquisador autônomo, da Guiana Francesa), e George Cremers (Pesquisador do Museu de História Natural de Paris). Este artigo trata da descrição de duas espécies novas de *Hypolepis*, ocorrente na região do Monte Roraima, e de uma lista atualizada das espécies ocorrentes nas três Guianas, com chave de identificação. O Anexo 4 consiste na prova gráfica do artigo, previamente a suas últimas mínimas modificações.

Anexo V – Three new taxa of *Hypolepis* (Dennstaedtiaceae) from the Brazilian Atlantic Forest, and a key to the Brazilian taxa. Artigo “provisoriamente aceito” à publicação, aguardando “confirmação de aceite” e “instruções futuras”, pela revista *Kew Bulletin*, previsão de publicação em 2012, de autoria de Pedro Bond Schwartzburd (Doutorando). Este manuscrito trata da descrição de uma espécie, uma subespécie, e uma variedade novas de *Hypolepis*, além de uma chave para os táxons brasileiros. A versão em anexo refere-se à segunda submissão do manuscrito, pós-revisão; originalmente, as fotos dos táxons *in vivo* são coloridas.

***HYPOLEPIDES SUD-AMERICANAE* – A TAXONOMIC REVISION OF THE GENUS *HYPOLEPIS*  
BERNH. (DENNSTAEDTIACEAE) IN SOUTH AMERICA**

**INTRODUCTION**

**History of the genus**

The genus *Hypolepis* was originally described by Johann J. Bernhardt (1806 [1805]) based on *Lonchitis tenuifolia* G. Forst. (= *Hypolepis tenuifolia* (G. Forst.) Bernh.), a plant from the Tanna Island (Vanuatu), collected by Johann G.A. Forster, during the second James Cook's expedition in search for the *Terra Australis*, between 1772 and 1775 (Forster 1786, Stafleu & Cowan 1976, Brownsey & Chinnock 1984, 1987, Brownsey 1987, Nicolson & Fosberg 2004).

About thirty years later, Karel B. Presl (1836) “restored” and re-circumscribed the genus *Hypolepis* (“*Nomen Bernhardianum restituendum erat*”), combining into it plants from the Neotropics, New Zealand, and Africa, especially the (pre-)Linnaean *Lonchitis repens* L. (= *Hypolepis repens* (L.) C. Presl – described by Linnaeus 1753, based on Plumier 1705), plus *Cheilanthes dicksonioides* Endl. (= *H. dicksonioides* (Endl.) Hook.), *C. anthriscifolia* Kaulf. (= *H. sparsisora* (Schrad.) Kuhn), and two South-American species that had just been described by Gustav Kunze (1835), based on Eduard F. Poeppig's collections: *C. hostilis* Kunze (= *H. hostilis* (Kunze) C. Presl) and *C. parallelogramma* Kunze (= *H. parallelogramma* (Kunze) C. Presl). Presl (1836) segregated such names mainly from the genus *Cheilanthes* Sw., which presents the sori morphology very similar (marginal, punctate, the receptacle originated at the tip of a vein, and protected by a semi-lunate pseudo-indusia), but their position is along the lamina margins, and they can often be confluent; on the other hand, the sori of *Hypolepis* is located at the sinuses of the lamina. Presl (1836) also added vegetative characters as diagnostic for *Hypolepis*, for example, the rhizomes creeping, the fronds big and highly dissected, the petioles and rachises “muricate” in *H. repens*, etc.

A second addition to the circumscription of *Hypolepis* was done by John Smith (1846), who combined *Polypodium rugosulum* Labill. (= *H. rugosula* (Labill.) J. Sm.), a plant collected in van Diemen's Land (Tasmania) by Jacques J. H. de Labillardière (or, “de la Billardière”), during the French expedition *in search of la Pérouse* (Labillardière

1800, 1802, 1806, Brownsey & Chinnock 1984, 1987, Apfelbaum 1977, Schwartzburd & Prado 2011b). Smith (1846 - continuing his previous ideas in Smith 1842) transferred this species to *Hypolepis* based on the vegetative similarities between this *taxon* and the other *Hypolepides*, since its sori is sub-marginal and the lamina margins are *not* differentiated into a pseudo-indusia – the sorus is, or, better, seems, unprotected. Later, Friedrich A. M. Kuhn (1868) reinforced this conception combining Carl P. Thunberg's (1784) well known *Polypodium punctatum* Thunb., whose type is from Japan, into *H. punctata* (Thunb.) Mett. in Kuhn – although wrongly identifying plants from Fernando Po Island with this name (see for example Adams 1975, Schwartzburd & Prado 2011b).

But, from the mid XIX to the early XX centuries, the other Pteridologists (*e.g.* Fée 1852, 1869, 1873, Hooker 1858, 1862, Mettenius 1858, 1865, Hooker & Baker 1868, Bentham & Mueller 1878, Philippi 1881, Colenso 1883, 1891, Diels 1902, Christ 1905, Christensen 1906 (but see below), van Alderwerelt van Rosenburgh 1908, Domin 1914, Cheeseman 1925) have not fully accepted (or understood) such circumscription for *Hypolepis*. They confused within it some pseudo-indusiate species nowadays ascribed to *Adiantopsis* Fée, *Aspidotis* (Nutt. ex Hook. & Baker) Copel., *Cheilanthes*, *Dennstaedtia* Bernh., *Plecosorus* Fée, and *vice-versa* - due to soral similarities, and not considering the vegetative differences; and, contemporary, they regarded *Polypodium punctatum* and *Pol. rugosulum* (and their allies/synonyms) within *Dryopteris* Adans., *Nephrodium* Michx., *Phegopteris* (C. Presl) Fée, *Polypodium* L., *Polypodium* sect. *Phegopteris* C. Presl, or *Polypodium* sect. *Euphegopteris* Hook. & Baker – that would nowadays represent plants ascribed to the families Dryopteridaceae and Thelypteridaceae, respectively – due to the sub-marginal “naked” sori.

The idea about regarding *Polypodium punctatum* and *Pol. rugosulum* within genus *Hypolepis* arouse again, reinforced by the studies on the anatomy of such ferns in comparison to *Hypolepis s.str.* by Gwinne-Vaughan (1903) and Bower (1928). With this, Christensen (1913, 1920, 1924, 1925, *apud* Carse 1926, 1931, 1932, 1934; and Christensen & Skottsberg 1920) finally accepted the concept of *Hypolepis* as suggested by Smith (1846), considering in this genus both *H. punctata* and *H. rugosula*. He also drew a clearer line between the pseudo-indusiate *Hypolepides* and the species of *Cheilanthes*, *Aspidotis*, and *Adiantopsis*. Christensen (1913, 1934) was immediately followed by Ching (1940) and Copeland (1947), and since then, *Hypolepis*' concept has



stabilized (e.g. Tryon & Tryon 1982, Bronwsey & Chinnock 1987, Kramer 1990, Moran 1995, Mickel & Smith 2004, Schwartsburd & Prado 2011b, etc.).

### **Traditional supra-generic classifications**

Throughout the different Classification Systems, based mainly on morphology (see Pichi-Sermolli 1973), *Hypolepis* has generally being considered as related to other ferns with marginal sori (with the exception of *H. punctata* and *H. rugosula* until 1920-1930's), for example in: *Adiantaceae: Lonchitideae* (Presl 1836); *Polypodiaceae: Pterideae: Chilosoreae* (Smith 1842); *Polypodiaceae: Pteridineae: Cheilantheae: Hypolepideae* (Fée 1852); *Polypodiaceae: Pterideae* (Hooker 1858), *Polypodiaceae: Dennstaedtioidae: Hypolepideae* (Christensen 1938); *Hypolepidaceae* (Ching 1940); *Pteridaceae* (Copeland 1947); *Hypolepidaceae* (Pichi-Sermolli 1977); *Dennstaedtiaceae: Dennstaedtieae* (Tryon & Tryon 1982); and *Dennstaedtiaceae: Dennstaedtioidae* (Kramer 1990).

In a different point of view, and because of *Hypolepis rugosula*, Smith (1846, 1875) went against his own previous System (Smith 1842), and placed *Hypolepis* within the ferns with abaxial sori, in *Polypodiaceae: Polypodieae*, and in *Polypodiaceae: Desmobrya: Phegopterideae: Phegoptereae*, respectively. Mettenius (1865) had a similar concept, placing *Hypolepis* along with *Phegopteris*, in *Aspidiaceae*.

### **Recent approaches - phylogenetic relationships of *Hypolepis***

The current tendency of the Systematic of ferns and plants in general is to circumscribe the *taxa* according to their phylogenetic relationships, recognizing monophyletic units. The *Dennstaedtiaceae* circumscription (*sensu* Smith *et al.* 2006, 2008 – based on Hasebe *et al.* 1994, 1995, Wolf *et al.* 1994, Wolf 1995, Pryer *et al.* 2004, etc.) has become reasonably stable and well defined, both by genetic evidences and morphological consistency.

But, concerning the generic monophyly of *Hypolepis* little is known, and the circumscription of *Hypolepis sensu* Smith (1846) is, once again, doubtful. The unique study which dealt with *Hypolepis*' species was that of Wolf (1995). His results suggest

that *Hypolepis* as considered as sub-Cosmopolitan is indeed monophyletic – since the three species analysed (from Australia, Western Samoa, and Ecuador) appeared grouped together with a *bootstrap* of 100% (parsimony, testing *rbcL*), in comparison with other Dennstaedtiaceae species. But, since only three species (among a Universe of ca. 80 *taxa* of *Hypolepis*, plus dozens placed in other genera) were analysed, it is hard to tell about the whole monophyly of the genus.

Thus, the aim of the present work is to deal with the South-American species themselves, and infra-specific *taxa* (characterization, distribution, synonymies, typification, etc.), rather than to deal with a *generic unit*. Possibly, the four *informal groups* named below, based just on their morphological characters, may be further split into four genera, intermixed within another Dennstaedtiaceae genera, segregated within *Hypolepis* as *subgenera* or *sections*, or yet be maintained as a monophyletic genus as currently defined. But, of course, a World-wide molecular/morphological analysis for the whole family is required to solve these hypotheses, and to reach a more natural classification.

### **The need of additional taxonomic studies**

*Hypolepis* is commonly recognized as genus lacking taxonomic studies, and in urgent need of local to World-wide revisions, as lately pointed out: “Over 20 species have been recognized in America but there are probably fewer; a modern revision of these and of the paleotropical species is needed.” (Tryon & Tryon 1982: 400); “Species delimitation in *Hypolepis* is often difficult, and is made more so by the absence of a monographic revision of the group.” (Proctor 1989: 177); “*Hypolepis* (...). The American species are in need of a modern taxonomic revision.” (Tryon & Stolze 1989: 109); “*Hypolepis* (...). The number of species is estimated at about 40, but the genus is not well known.” (Kramer 1990: 88); “*Hypolepis* es uno de los géneros de helechos menos estudiados taxonómicamente. (...) y probablemente varias especies nuevas esperan descripción.” (Moran 1995: 153); “*Hypolepis thysanochlaena* (...). The New World taxa with non-spiny axes are in need of revision.” (Mickel & Smith 2004: 353); “*Hypolepis scandens* (...). Given its similarity to *H. parallelogramma* and the inadequate taxonomic knowledge of the genus *Hypolepis*, we would not be surprised if *H. scandens* is fairly widespread in the tropical Andes” (Kessler & Smith 2007: 194).

These authors estimated ca. 40-50 species of *Hypolepis* for the whole World, and ca. 15-20 for the Americas.

## CONSIDERAÇÕES FINAIS

Como mencionado na Introdução, *Hypolepis* é um gênero que foi pouquíssimo estudado taxonomicamente e, como se imaginava, várias novidades taxonômicas e nomenclaturais poderiam surgir. Realmente tal suposição foi confirmada: são reconhecidas para a América do Sul, incluindo a Ilha de Cocos (Costa Rica), 27 espécies, e um total de 31 táxons (incluindo espécies, subespécies e variedades). Destas, 11 apresentam novidades nomenclaturais: *H. acantha* Schwartsb. *ined.*, *H. bogotensis* var. *glabra* H. Karst. ex Schwartsb. & J. Prado var. *nov.*, *H. flexuosa* var. *zimmerae* Schwartsb. & J. Prado var. *nov.*, *H. galapagensis* Schwartsb. & J. Prado sp. *nov.*, *H. krameri* Schwartsb. *et al. ined.*, *H. paulistana* Schwartsb. & J. Prado sp. *nov.*, *H. pedropaloensis* Schwartsb. & J. Prado sp. *nov.*, *H. rugosula* subsp. *poepigiana* (Mett.) Schwartsb. & J. Prado *stat. nov.*, *H. rugosula* subsp. *pradoana* Schwartsb. *ined.*, *H. stolonifera* var. *nebularis* Schwartsb. *ined.*, e *H. trinationalis* Schwartsb. *ined.*

Além destas novidades, a maioria das outras espécies teve seu conceito re-circunscrito; inclusive, algumas foram “resgatadas” de sinonímias prévias. São elas: *Hypolepis bogotensis* var. *bogotensis*, *H. flexuosa* var. *flexuosa*, *H. hostilis*, *H. mitis*, *H. nuda*, *H. parallelogramma*, *H. poepigii*, *H. pteroides*, *H. repens*, *H. rigescens*, *H. rugosula* (ver também Anexo III e V), *H. stolonifera* var. *stolonifera*, e *H. viscosa*. Em adição, uma espécie é agora reconhecida por um *nomem conservandum* (*Hypolepis nigrescens* Hook.), e outra teve seu nome rejeitado (*Aspidium brasilianum* C. Presl, uma vez combinado como *Hypolepis brasiliana* (C. Presl) Kuhn) – ver Anexos I e II, respectivamente.

O número total de espécies pertencentes ao gênero, anteriormente estimado em 40–50 para o Mundo (das quais 15–20 ocorreriam nas Américas), é agora estimado em ca. 80 táxons (ca. 65 spp., mais algumas subespécie e variedades). Dos ca. 80 táxons, ca. 40–45 ocorrem nas Américas, ca. 30 na Australásia (Oceania, SE Asiático, E Asiático), e apenas três ou quatro na África.

Dentre as espécies sul-americanas, oito padrões biogeográficos de distribuição podem ser reconhecidos, e estes são baseados em subdivisões de padrões previamente identificados. São eles: “neotropical”, “circum-caribenho”, “circum-amazônico”, “Monte Roraima”, “andino”, “ilhas”, “sul-brasileiro”, e “austral”. Além da latitude e tipos vegetacionais, as altitudes mínimas e máximas parecem ser também fortes fatores

limitantes da distribuição dos táxons. O padrão “andino” é o mais rico (com 10 táxons), seguido por “sul-Brasileiro” (com seis).

O resultado final do tratamento taxonômico é satisfatório no sentido em que quase a totalidade dos tipos nomenclaturais foi estudada, a maioria das espécies foi re-circunscrita (especialmente em comparação com espécies de outras áreas geográficas, e.g. Oceania, América Central, Ásia, África), e poucos nomes permaneceram dúbios. As espécies que merecem estudos futuros, pois podem se tratar de complexos específicos ou espécies com relativamente alta variabilidade morfológica são: *Hypolepis flexuosa* (incluindo var. *flexuosa*, var. *zimmerae*, e provavelmente *H. muenchii*, *H. thysanochlaena*, e *H. trichochlaena*), e *H. stuebelii* (incluindo *H. acantha*, *H. grandis*, e *H. pedropaloensis*). Outros nomes, que foram respectivamente tratados como sinônimo duvidoso e espécie duvidosa, e merecem estudos futuros, são *H. minima* e *H. buchtienii*.

Quanto ao estudo morfológico de *Hypolepis*, alguns termos morfológicos foram adaptados da terminologia tradicional, a fim de se padronizar uma descrição mais precisa. Por exemplo, os seguintes termos foram adaptados: *catenate-acicular* (catenado-acicular) e *catenate-glandular* (catenado-glandular), para os tricomas; e  $\pi$ -*shaped* (em forma da letra  $\pi$ ) e  $\Omega$ -*shaped* (em forma da letra  $\Omega$ ), para a forma do feixe vascular do pecíolo. Muitas características (e estados das características) das plantas, anteriormente negligenciadas, mostraram ter fundamental importância taxonômica, como por exemplo: o tamanho das frondes, os tipos de feixes vasculares presentes nos pecíolos, a coloração dos pecíolos e raques, a forma das pinas basais (equilaterais ou inequilaterais), o indumento em geral (tipos, tamanhos, e localização dos tricomas), características dos pseudo-indúsios (espessura, coloração, ciliados ou não ciliados, etc), etc. Algumas imagens de secções anatômicas revelaram caracteres inéditos ou pouco estudados das espécies de *Hypolepis*, como, por exemplo, as diferentes formas dos feixes vasculares, as linhas de aeróforos dos rizomas e pecíolos, a ontogenia do feixe vascular da raque de segunda ordem, bem como dos acúleos.

O estudo morfológico de ca. 70-80% dos táxons de *Hypolepis* distribuídos pelo Mundo serviu de base para a elaboração de um *agrupamento informal* dos táxons, baseado estritamente em morfologia. Esta hipótese é uma idéia inicial, e incentiva-se que sejam feitos futuros estudos moleculares a fim de se corroborar ou rejeitar os grupos aqui mencionados. Quatro grandes grupos de espécies são claramente distintos

(*H. flexuosa*, *H. nigrescens*, *H. rugosula*, e *H. tenuifolia*), com grande sustentação citogenética (número cromossômico), de morfologia externa, e de morfologia interna (anatomia). Os estudos anatômicos aqui apresentados são extremamente preliminares e devem ser continuados, aliados aos estudos moleculares, citogenéticos, e de morfologia externa. Algumas características destes grupos são compartilhadas com outros gêneros de Dennstaedtiaceae e, portanto, uma análise global dos gêneros relacionados deve ser realizada para melhor circunscrever os gêneros desta família. Grupos menores, pertencentes ao grande grupo de *H. tenuifolia* também foram caracterizados e devem ser futuramente investigados.

Quanto às discussões acerca dos *conceitos específicos e infra-específicos* aplicado a alguns táxons de *Hypolepis*, especialmente a *H. punctata*, *H. rugosula*, e espécies afins, destaca-se que um novo conceito foi formulado. Este foi adaptado basicamente dos conceitos prévios de Christensen (1920, 1932, 1937, e Christensen & Skottsberg 1920), porém segregando as macro-populações de *H. rugosula* em subespécies, e ampliando ainda mais sua distribuição (ver também Anexos III e V). O tratamento taxonômico reunindo todas as subespécies de *H. rugosula* encontra-se em andamento (Schwartzburd & Prado *in prep.*); encoraja-se um estudo que envolva também citogenética e biologia molecular destas subespécies, tendo em foco questões como *especiação, rotas de migração, poliploidia e aneuploidia, hibridação, adaptação, reprodução vegetativa e sexuada*, etc.

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