



**MINISTÉRIO DA EDUCAÇÃO
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E INOVAÇÃO
UNIVERSIDADE FEDERAL RURAL DA AMAZÔNIA - UFRA
MUSEU PARAENSE EMÍLIO GOELDI - MPEG
PROGRAMA DE PÓS-GRADUAÇÃO EM CIÊNCIAS BIOLÓGICAS –
BOTÂNICA TROPICAL**



ANDRÉ LUIZ DE REZENDE CARDOSO

ZINGIBERALES NA VOLTA GRANDE DO XINGU, PARÁ, BRASIL

**BELÉM
2014**



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Dissertação apresentada à Universidade Federal Rural da Amazônia e ao Museu Paraense Emílio Goeldi, como parte das exigências do Programa de Pós-Graduação em Ciências Biológicas, área de concentração em Botânica Tropical, para a obtenção do título de **Mestre**.

Orientadora: Profa. Dra. Anna Luiza Ilkiu Borges Benkendorff

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RESUMO

Zingiberales Griseb é uma ordem de monocotiledôneas que inclui oito famílias (Cannaceae, Costaceae, Heliconiaceae, Lowiaceae, Marantaceae, Musaceae, Strelitziaceae e Zingiberaceae), com espécies de importância econômica e ecológica. Os estudos das famílias desta ordem na Amazônia ocorreram, em sua maioria, na porção ocidental, que perfazem o registro de cerca de 160 espécies, que representam mais da metade das Zingiberales conhecidas para o Brasil. Esse dado indica a necessidade de se ampliar o estudo florístico dessa ordem a outras áreas da Amazônia. Este trabalho teve como objetivo investigar a riqueza de Zingiberales na Volta Grande do Xingu, Pará, Brasil, e realizar um tratamento taxonômico que permita a identificação dos táxons registrados. A área de estudo está situada na região da Volta Grande do Xingu, nos municípios de Vitória do Xingu, Altamira, Senador José Porfírio e Anapu. Os métodos de amostragem consistiram em coletas intensas e ao acaso nos fragmentos florestais ao longo das rotas de acesso e na área de construção da Usina Hidroelétrica de Belo Monte. Foram registradas 28 espécies, distribuídas em 10 gêneros e cinco famílias, a saber: Costaceae (*Chamaecostus* três spp.: *Costus*, quatro spp., duas variedades), Heliconiaceae (*Heliconia*, oito spp., duas subsp.), Marantaceae (*Goeppertia*, três spp.; *Hylaeanth*e, uma sp.; *Ischnosiphon*, três spp.; *Monotagma*, duas spp; *Thalia*, uma sp.), Strelitziaceae (*Phenakospermum*, uma sp.) e Zingiberaceae (*Renealmia* duas spp.). *Goeppertia squarrosa* (L. Andersson & H. Kenn.) Borchs. & S. Suárez é registrada pela primeira vez no Brasil, enquanto *Costus amazonicus* subsp. *krukovii* Maas, *Heliconia marginata* (Griggs) Pittier e *Hylaeanth*e *unilateralis* (Poepp. & Endl.) A.M.E. Jonker & Jonker são primeira ocorrência para o estado do Pará.

Palavras-chave: Costaceae, Heliconiaceae, Marantaceae, Strelitziaceae, Zingiberaceae.

ABSTRACT

Zingiberales Griseb. is an order of monocots which includes eight families (Cannaceae, Costaceae, Heliconiaceae, Lowiaceae, Marantaceae, Musaceae, Strelitziaceae and Zingiberaceae), with species of economic and ecological importance. Most studies of *Zingiberales* in the Amazon were performed in its western portion. However, the ca. 160 species registered in the Brazilian Amazon represent more than a half of the *Zingiberales* known from Brazil. The status of knowledge of the order in the Brazilian Amazon indicates the need of extend the floristic studies to further areas. The aim of this study was to investigate the richness of *Zingiberales* in the Volta Grande do Xingu, Pará, Brazil, and to provide a taxonomic treatment which allows the identification of the registered taxa. The study area encloses the area named Volta Grande do Xingu, which is mainly located in the municipality of Vitória do Xingu, but also Altamira, Senador José Porfírio, and Anapú, in Pará State. The sampling methods consist of intense and random sampling in forest fragments along the access routes to the building area of Power Plant of Belo Monte. A total of 28 species belonging to 10 genera and five families were recorded: *Costaceae* (*Chamaecostus* three spp.: *Costus*, four spp., two varieties), *Heliconiaceae* (*Heliconia*, eight spp., two subspecies), *Marantaceae* (*Goeppertia*, three spp.; *Hylaeanth*e, one sp.; *Ischnosiphon*, three spp.; *Monotagma*, two spp; *Thalia*, one sp.), *Strelitziaceae* (*Phenakospermum*, one sp.) and *Zingiberaceae* (*Renealmia* one spp.). *Goeppertia squarrosa* (L. Andersson & H. Kenn.) Borchs. & S. Suárez (*Marantaceae*) is first recorded to Brazil, while *Costus amazonicus* subsp. *krukovii* Maas (*Costaceae*), *Heliconia marginata* (Griggs) Pittier (*Heliconiaceae*), and *Hylaeanth*e *unilateralis* (Poepp. & Endl.) A.M.E.Jonker & Jonker (*Marantaceae*) are first records for Pará state.

Keywords: Costaceae, Heliconiaceae, Marantaceae, Strelitziaceae, Zingiberaceae.

1. CONTEXTUALIZAÇÃO

Zingiberales Griseb. é uma ordem de monocotiledôneas que compreende as famílias Cannaceae, Costaceae, Heliconiaceae, Lowiaceae, Marantaceae, Musaceae, Strelitziaceae e Zingiberaceae, abrangendo 96 gêneros e cerca de 2.000 espécies (KRESS; SPECH, 2005). Sua distribuição pantropical sugere um histórico de origem no supercontinente de Gondwana (KRESS; SPECHT, 2006).

Nesta ordem há espécies de importância alimentícia, paisagística, medicinal, artesanal, além de produtoras de ceras, fibras, combustível e fécula (HIGBEE; SIEVERS, 1945; CORRÊA, 1984; ERDMAN; ERDMAN, 1984; KRESS, 1990a; OLIVEIRA *et al.*, 2006). Apresenta também grande importância ecológica, visto que Cannaceae, Costaceae, Heliconiaceae, Marantaceae, Musaceae, Strelitziaceae e Zingiberaceae têm suas folhas usadas como alimento por larvas de diferentes espécies de borboletas e mariposas do Neotrópico (BROWN, 1992).

A polinização por pássaros ocorre em todas as famílias desta ordem, havendo gêneros como *Canna* L. (Cannaceae), *Strelitzia* Aiton (Strelitziaceae), *Heliconia* L. (Heliconiaceae) e *Costus* L. (Costaceae) bem conhecidos pelas suas flores ornitófilas vistosas (CRONK & OJEDA, 2008). Há também espécies de *Musa* L. (Musaceae), *Heliconia*, *Phenakospermum* Endl. (Strelitziaceae) e *Canna* polinizadas por morcegos (FLEMING *et al.*, 2009). Costaceae é polinizada principalmente por abelhas e pássaros (MAAS, 1972) e a ornitofilia, associada a beija-flores, evoluiu diversas vezes no Neotrópico a partir de espécies ancestrais polinizadas por abelhas (SPECHT, 2006). Marantaceae, por sua vez, é polinizada principalmente por abelhas e mais raramente por mariposas (KENNEDY, 2000), enquanto Zingiberaceae é a maior família de monocotiledôneas polinizada por vertebrados (ENDRESS, 1994).

No Brasil, são conhecidas atualmente 280 espécies de Zingiberales distribuídas em sete famílias (FORZZA *et al.*, 2013). A família com mais representantes no país é Marantaceae, com 198 espécies (BRAGA, 2013a), seguida de Heliconiaceae (29 spp.) (BRAGA, 2013b), Costaceae (24 spp.) (MAAS; MAAS, 2013a), Zingiberaceae (23 spp.) (MAAS; MAAS, 2013b), Cannaceae (4 spp.) (MAAS H.; MAAS; OLIVEIRA, 2013) Musaceae e Strelitziaceae (1 sp. cada) (SOBRAL, 2013a,b).

Apesar do estudo das famílias desta ordem na Amazônia estar concentrado principalmente na sua porção ocidental (SOUZA; FORZZA, 1999; COSTA *et al.*, 1999a, 1999b, 2008, 2011; MAAS; MAAS, 2005; FORZZA, 2007), mais da metade das Zingiberales

conhecidas para o Brasil tem ocorrência no bioma Amazônia, para onde há registro de 160 espécies, sendo 97 de Marantaceae (BRAGA, 2013a), 23 de Heliconiaceae (BRAGA, 2013b), 22 Costaceae (MAAS; MAAS, 2013a), 15 de Zingiberaceae (MAAS; MAAS, 2013b), duas de Cannaceae (MAAS; MAAS; OLIVEIRA, 2013) e uma de Strelitziaceae (SOBRAL, 2013b). Entre as 23 espécies endêmicas da Amazônia, Marantaceae tem o maior número de representantes com 16 espécies (BRAGA, 2013a), seguida de Costaceae (5 spp.) (MAAS; MAAS, 2013a), Heliconiaceae e Zingiberaceae (1 sp. cada) (BRAGA, 2013b; MAAS; MAAS, 2013b).

Entre 1990 e 2006, foram descritas 2.875 novas espécies de Angiospermas do Brasil (SOBRAL; STEHMANN, 2009), das quais 14 pertencem a Marantaceae, uma a Heliconiaceae e uma a Zingiberaceae. Destas, apenas *Heliconia lucieae* Barreiros, *Renealmia microcalyx* Maas & H.Maas e *Calathea neblinensis* H. Kenn tem origem na Amazônia.

O rio Xingu é um dos maiores afluentes da margem direita do rio Amazonas. Esse rio nasce a oeste da Serra do Roncador e ao norte da Serra Azul, no leste do Mato Grosso, e percorre a direção sul-norte, paralelo aos rios Tapajós e Tocantins e após pouco mais de 2.000 km, deságua ao sul da ilha de Gurupá, no estado do Pará (SALOMÃO *et al.*, 2007). Próximo à cidade de Altamira, no lugar conhecido como Volta Grande do Xingú, o rio quadruplica de largura e forma diversas cachoeiras e ilhas, onde um desnível de 96 metros concentra boa parte do potencial hidrelétrico do rio, sendo, por isso, o local escolhido para a construção da Usina Hidrelétrica de Belo Monte (COSTA *et al.*, 2012).

Os inventários prévios à construção da hidroelétrica foram voltados principalmente para as espécies do estrato arbóreo (DANTAS; MÜLLER, 1980; CAMPBELL *et al.*, 1986; CARDENAS, 1987, 1988; MPEG, 2002; SALOMÃO *et al.*, 2007), permanecendo ainda praticamente desconhecida a flora de monocotiledôneas de subosque desta região.

O objetivo deste trabalho foi identificar a riqueza de espécies de Zingiberales que ocorrem na Volta Grande do Xingu, Pará, e realizar um tratamento taxonômico que permita a identificação dos táxons.

A presente dissertação foi elaborada na forma de um artigo tratando a riqueza e a taxonomia das Zingiberales da Volta Grande do Xingu, Pará, Brasil.

1.1. REVISÃO DE LITERATURA

Scitaminaea foi o termo aplicado por Lineu, em suas ordens naturais, a um grupo de plantas que se distingue por sua qualidade agradável, útil e valiosa. O termo é derivado do latim *Scitamentum*, qualquer coisa de um gosto agradável ou saboroso (ROSCOE, 1828).

Bentham e Hooker (1883) reconheceram *Scitaminae* como família contendo quatro tribos: Museae, Zingibereae, Maranteae e Canneae, ainda que tratada sob o nome descritivo de ordem. Wettstein (1935) às elevou à ordem e Hutchinson (1959) estabeleceu o nome Zingiberales, baseado no epíteto Zingiberides de Griseb (1854).

Kress e Specht (2006) dataram a origem deste grupo entre 127-121 milhões de anos, período compatível com a hipótese de que houve radiação rápida das Zingiberales no início Terciário há cerca de 65 milhões de anos.

Zingiberales é uma ordem amplamente aceita pela maioria dos taxonomistas e filogenistas, reunindo oito famílias: Musaceae, Strelitziaceae, Lowiaceae, Heliconiaceae, Zingiberaceae, Costaceae, Cannaceae e Marantaceae (NAKAI, 1941; TOMLINSON, 1962; TAKHTAJAN, 1980; CRONQUIST, 1981; DAHLGREN *et al.*, 1985; KRESS, 1990a; APG, 1998; APG II, 2003; APG III, 2009).

Kress et al. (2001) baseado em dados moleculares e morfológicos e forneceram uma estimativa das relações filogenéticas entre as famílias de Zingiberales: (Musaceae ((Strelitziaceae, Lowiaceae) (Heliconiaceae ((Zingiberaceae, Costaceae) (Cannaceae, Marantaceae))))), que não difere significativamente das anteriores baseadas apenas em dados morfológicos.

Musaceae Juss. compreende dois gêneros, *Musa* (incluindo *Musella* (Franch.) C.Y. Wu) com aproximadamente 35 espécies e *Ensete* Horan., com seis espécies, não havendo espécies nativas do Neotrópico (STEVENSON; STEVENSON, 2004a). Os laticíferos, mesofilo laminar especializado com septo parenquimatoso vascular e não vascular, filotaxia espiralada, flores unissexuais e frutos bacatos distinguem os membros de Musaceae das outras Zingiberales (KRESS, 1990a).

Strelitziaceae Hutchinson apresenta três gêneros e seis ou sete espécies, sendo quatro ou cinco de *Strelitzia*, restritas ao sudeste da África; uma espécie de *Ravenala* Adans. endêmica de Madagascar e uma espécie de *Phenakospermum* da América do Sul (STEVENSON; STEVENSON, 2004b). Características únicas da família são o tronco lenhoso (característica perdida em alguns membros de *Strelitzia*), três sépalas livres, duas

pétalas fundidas que encobrem os cinco (ou seis em *Ravenala*) estames férteis e frutos capsulares loculicidas e lenhosos (KRESS, 1990a)

Lowiaceae Rydley, cujo gênero monotípico *Orchidantha* N. E. Brown compreende de cinco a oito espécies, está distribuída no Sudeste Asiático e em algumas ilhas do Pacífico (KRESS, 1990a). A lâmina foliar especializada com mesofilo composto por arranjos irregulares de células grandes e pequenas, vários pares de veias longitudinais paralelas à nervura central distinta e pétala adaxial elaborada em um grande labelo, são as autapomorfias da família, que não possui representantes no Neotrópico (KRESS, 1990a).

Heliconiaceae Vines possui um único gênero, *Heliconia*, que abrange cerca de 200 espécies distribuídas primariamente no Neotrópico. Seis espécies apresentam uma disjunção, sendo encontradas nos Trópicos do Velho Mundo (KRESS, 1990b; STEVENSON; STEVENSON, 2004c). A simetria invertida das flores, com a sépala mediana adaxial, a presença de um único estaminódio oposto à sépala não pareada, grãos de pólen heteropolares, um único óvulo por lóculo e frutos drupáceos são caracteres diagnósticos desta família (KRESS, 1990a).

Zingiberaceae Martinov é a maior família nas Zingiberales, consistindo em 46 gêneros e cerca de 1.300 espécies. São distribuídas pantropicalmente, com apenas um gênero (*Renealmia* L.f., 55 spp.) de distribuição neotropical e africana, além de quatro gêneros (*Alpinia* Roxb., *Curcuma* L., *Hedychium* J. Koenig e *Zingiber* Mill.) introduzidos e naturalizados no Neotrópico (STEVENSON; STEVENSON, 2004d; KRESS, 1990a). *Aframomum* K. Schum., *Aulotandra* Gagnep. e *Siphonochilus* J.M. Wood & Franks são encontrados apenas na África e o restante dos gêneros está distribuído no Leste Asiático e nas ilhas do Pacífico (KRESS, 1990a). A fusão dos estaminódios laterais do anel estaminal interno em um labelo, a presença de um par de glândulas nectaríferas na base do estilete e a presença de células contendo óleos essenciais ou ethericos são autapomorfias desta família (KRESS, 1990a). Os membros neotropicais de *Renealmia* foram revisados taxonomicamente (MAAS, 1977), bem como a família teve a filogenia e classificação revisada do ponto de vista molecular (KRESS *et al.*, 2002).

Costaceae Nakai consiste de sete gêneros e cerca de 150 espécies distribuídas pantropicalmente. *Costus* (100 spp.) é o gênero mais diversificado no Neotrópico, mas também ocorre na África. *Monocostus* K. Schum. (1 sp.), *Dimerocostus* Kuntze (2 spp.) e *Chamaecostus* C.D. Specht & D.W. Stev. (8 spp.) são restritos ao Neotrópico. *Paracostus* C.D. Specht apresenta uma espécie na Malásia e outra em Camarões. *Cheilocostus* C.D. Specht está representado por quatro espécies do Sudeste Asiático, Malásia e Nova Guiné.

Tapeinochilos Miq. apresenta 16 espécies distribuídas da Papuásia ao noroeste da Austrália (SPECHT; STEVENSON, 2006). Talos aéreos bem desenvolvidos, as vezes esgalhados, filotaxia espiralada, fusão dos cinco staminódios em um labelo, filamento e conectivo petaloides, grãos de pólen distintamente aperturados e com paredes resistentes à acetolise são caracteres únicos desta família (KRESS, 1990a). Costaceae passou por revisão taxonômica (MAAS, 1972), bem como teve sua filogenia e classificação revisada com base em dados moleculares (SPECHT *et al.*, 2001; SPECHT; STEVENSON, 2006).

Cannaceae Juss possui um único gênero (*Canna*,) distribuído por todo Neotrópico, com estimativas do número de espécies que variam de 9 a 50 (SEGEREN; MAAS, 1971). Todas as espécies Asiáticas e Africanas foram introduzidas do novo mundo (STEVENSON; STEVENSON, 2004e). A presença de células de mucilagem e estigma petaloide fundido em um único estame fértil são as mais óbvias autapomorfias da família (KRESS, 1990a).

Marantaceae R.Br. é a segunda maior família da ordem, com 30 gêneros e aproximadamente 550 espécies. Esta família é particularmente diversa no Neotrópico, onde é representada por cerca de 450 espécies (BORCHSENIUS *et al.*, 2012). A maioria dos gêneros é endêmica da África, Ásia ou do Neotrópico (ANDERSSON; CHASE, 2001). Possíveis apomorfias da família incluem pulvino foliar, venação cruzada da lamina foliar uniformemente distribuídas, venações laterais sigmóides, pares de flores terminais enantiomorfos, dois estaminódios internos (um cuculado e outro caloso, modificados em estruturas para a liberação explosiva do pólen) e um único óvulo por lóculo (KRESS, 1990a). Marantaceae teve sua relação intragenérica revisada com base em caracteres moleculares (ANDERSON; CHASE, 2001), bem como o gênero *Calathea* G. Mey teve seus limites genéricos redefinidos (BORCHSENIUS *et al.*, 2012) e *Monotagma* K. Schum. passou por revisão taxonômica (HAGBERG, 1990; HAGBERG; ERIKSSON, 2011).

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2. Zingiberales in the Volta Grande do Xingu, Pará, Brazil ¹

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RESUMO (*Zingiberales* na Volta Grande do Xingu, Pará, Brasil)

Zingiberales é uma ordem de monocotiledôneas que inclui oito famílias com espécies de importância econômica e ecológica. Os estudos das famílias desta ordem, realizados principalmente na Amazônia ocidental, reúnem mais da metade das *Zingiberales* conhecidas para o Brasil, indicando a necessidade ampliar esses estudos a outras áreas da Amazônia. Este trabalho objetivou investigar a riqueza de *Zingiberales* e realizar um tratamento taxonômico que permita a identificação dos táxons na Volta Grande do Xingu, Pará, Brasil. A área de estudo está situada nos municípios de Vitória do Xingu, Altamira, Senador José Porfírio e Anapu. Foram realizadas coletas intensas por meio de caminhada livre em fragmentos florestais. Foram registradas 28 espécies, distribuídas em 10 gêneros e cinco famílias (*Costaceae*, *Heliconiaceae*, *Marantaceae*, *Strelitziaceae* e *Zingiberaceae*). *Goeppertia squarrosa* é registrada pela primeira vez no Brasil, enquanto *Costus amazonicus* subsp. *krukovii*, *Heliconia marginata* e *Hylaeanthus unilateralis* são primeira ocorrência para o estado do Pará.

Palavras-chave: *Costaceae*, *Heliconiaceae*, *Marantaceae*, *Strelitziaceae*, *Zingiberaceae*.

ABSTRACT (*Zingiberales* in the Volta Grande do Xingu, Pará, Brazil)

Zingiberales is an order of monocots which includes eight families with species of economic and ecological importance. Studies of this order mainly conducted in western Amazonia gather more than half of *Zingiberales* known for Brazil, indicating the need to expand these studies to other areas of the Amazon. The aim of this study was to investigate the richness of *Zingiberales* in the Volta Grande do Xingu, Pará, Brazil, and to provide a taxonomic treatment which allows the identification of the registered taxa. The study area encloses the municipality of Vitória do Xingu, Altamira, Senador José Porfírio, and Anapú, in Pará State. The sampling methods consist of intense and random sampling in forest fragments. 28 species belonging to 10 genera and five families (*Costaceae*, *Heliconiaceae*, *Marantaceae*, *Strelitziaceae* e *Zingiberaceae*) were recorded. *Goeppertia squarrosa* is first recorded to Brazil, while *Costus amazonicus* subsp. *krukovii*, *Heliconia marginata*, and *Hylaeanthus unilateralis* are first records to Pará state.

Key words: *Costaceae*, *Heliconiaceae*, *Marantaceae*, *Strelitziaceae*, *Zingiberaceae*.

2.1. Introduction

Zingiberales Griseb is an order of monocots which includes the families *Cannaceae*, *Costaceae*, *Heliconiaceae*, *Lowiaceae*, *Marantaceae*, *Musaceae*, *Strelitziaceae* and *Zingiberaceae* (Nakai, 1941; Tomlinson, 1962; Takhtajan, 1980; Cronquist, 1981; Dahlgren *et al.*, 1985; Kress, 1990a; APG, 1998; APG II, 2003; APG III, 2009), comprising 96 genera and about 2,000 species (Kress & Specht, 2005). Its pantropical distribution suggests the origin in the supercontinent of Gondwana (Kress & Specht, 2006). *Zingiberales* apomorphies are root hair cells shorter than other epidermal cell, sieve tube plastids containing starch, presence of silica bodies, epigynous flowers, lack of distinctive apertures on the pollen grains, and the occurrence of arillate seeds (Dahlgren *et al.*, 1985).

Zingiberaceae is the largest family of *Zingiberales*, consisting of 53 genera and more than 1,200 species with pantropical distribution and only one genus (*Renealmia*, 55 spp.) distributed in Africa and in the Neotropics (Kress *et al.*, 2002). The genera *Alpinia* Roxb., *Curcuma* L., *Hedychium* J. Koenig and *Zingiber* Mill. were introduced and naturalized in the Neotropics (Stevenson & Stevenson, 2004a; Kress, 1990a). The fusion of lateral staminodes of the inner staminal whorl into a labellum stem, the presence of a pair of nectar glands at the base of the style, and the presence of cells containing essential or ethereal oils are autapomorphies of this family (Kress, 1990a). The neotropical *Renealmia* was taxonomically reviewed (Maas, 1977), and the phylogeny and classification of the family is currently based on molecular data (Kress *et al.*, 2002).

Costaceae consists of seven genera and about 150 species pantropically distributed (Specht & Stevenson, 2006). Anatomical autapomorphy of *Costaceae* are multicellular, uniseriate, unbranched hairs with the base never settled lower (Tomlinson, 1956, 1962). Well-developed, sometimes-branched aerial stem, the distinctive monostichous spiral phyllotaxy,

and the fusion of five staminodes into a labellum are the most common synapomorphies sited as defining *Costaceae* (Specht & Stevenson, 2006).

Costaceae is separated from *Zingiberaceae* based on the non-aromatic vegetative body, spirally arranged leaves, and anther appendages (Nakai, 1941). Molecular and morphological data analyzed in a phylogenetic framework confirm its monophyly (Kress, 1990a, 1995; Kress *et al.*, 2001; Specht *et al.*, 2001; Specht, 2006). This family was taxonomically reviewed by Maas (1972) and a new generic classification based on molecular and morphological characters reflecting its phylogenetic relationships was proposed by Specht & Stevenson (2006). A reevaluation of the traditional taxonomy indicated that floral characters and pollination syndromes, commonly used to identify groups, exhibit homoplasy when analyzed in a cladistic framework and are thus unreliable as taxonomic indicators (Specht *et al.*, 2001; Specht, 2006; Specht & Stevenson, 2006).

As the second largest family of the order, *Marantaceae* comprises 30 genera and approximately 550 species. It is particularly diverse in the Neotropics, which is represented by about 450 species (Borchsenius *et al.*, 2012). Most genera are endemic to three major areas: Africa, Asia and the Neotropics (Andersson & Chase, 2001). Apomorphies of the family include the leaf pulvinus, sigmoid lateral veins and evenly spaced cross-veins of the leaf blade, terminal enantiomorphic pairs of flowers, two inner staminodes (cucullate and callous staminoes, which are modified into structures for the explosive release of the pollen at pollination), and a single ovule per locule (Kress, 1990a). The traditional subdivision of *Marantaceae* into a triovulate and a uniovulate tribe or the informal groups previously recognized was not confirmed by molecular phylogenetic analysis carried out by Anderson & Chase (2001). Their study showed a large unresolved grade and the most genera collected in Volta Grand do Xingu appears in different branches, except *Ischnosiphon* Körn. and

Monotagma K. Schum., which were inserted in the so-called *Calathea* group with three further genera, but with no support.

Heliconiaceae has a single genus *Heliconia*, which includes about 200 species primarily distributed in the Neotropics, with few species occurring in the Paleotropics (Kress, 1990b; Stevenson & Stevenson, 2004b). The inverted symmetry of the flowers with median sepal adaxial, presence of a single staminode opposed to the unpaired sepal, heteropolar pollen grains, a single ovule per locule and drupelike fruits are autapomorphies of the family (Kress, 1990a). The family was taxonomically reviewed on the base of morphological data (Anderson, 1981a, 1985, 1992), but molecular phylogeny does not confirm the current taxonomic structure of the genus, particularly in the position of the polyphyletic subgenus *Stenochlamys* (Marrouelli *et al.*, 2010).

Strelitziaceae includes three genera and seven currently recognized species, five of *Strelitzia*, restricted to southern Africa, one species of *Ravenala* Adans. endemic to Madagascar and one species of *Phenakospermum* from South America (Stevenson & Stevenson, 2004b). Unique features of the family are the woody trunk (absent in a few *Strelitzia* species), three free sepals, two petals fused that enclose five (or six in *Ravenala*) fertile stamens, and the woody fruits (Kress, 1990a). Although evolutionary trends and phylogenetic relationships of the family were investigated on the base of molecular and morphological data, the relationships among the genera still unclear (Cron *et al.*, 2012).

Zingiberales has important species for human feeding, landscaping, medicinal, handcraft, and is also a source of waxes, fibers, fuel and starch (Higbee & Sievers, 1945; Corrêa, 1984; Erdman & Erdman, 1984; Kress, 1990a; Oliveira *et al.* 2006). The ecological importance of the group is also remarkable by the use of leaves as food for larvae of different neotropical butterflies and moths (Brown, 1992), and by its relationships with bees, birds, and

bats involved in its pollinization (Maas, 1972; Endress, 1994; Kennedy, 2000; Specht, 2006; Cronk & Ojeda, 2008; Fleming *et al.*, 2009).

In Brazil, the order is represented by 280 species distributed in seven families (Forzza *et al.*, 2013), of which the most representative is *Marantaceae*, with 198 species (Braga, 2013a). The other families are represented in the Brazilian flora as follow: *Heliconiaceae* (29 spp.) (Braga, 2013b), *Costaceae* (24 spp.) (Maas & Maas, 2013a), *Zingiberaceae* (23 spp.) (Maas & Maas, 2013b), *Cannaceae* (four spp.) (Maas H. & Maas, 2013), *Musaceae* and *Strelitziaceae* (one sp. each) (Sobral, 2013a, 2013b). Between 1990 and 2006, 16 new species of Zingiberales were described from Brazilian specimens, of which only *Heliconia luciae* Barreiros, *Renealmia microcalyx* Maas & H.Maas, and *Calathea neblinensis* H. Kenn were collected in the Amazon (Sobral & Stehmann, 2009).

Except for a field guide for 71 species from the Tapajós-Xingu river interfluvium (Figueiredo *et al.*, 2012), most studies of Zingiberales in the Amazon were performed in its western portion (Costa *et al.*, 1999a, 1999b, 2008, 2011; Souza & Forzza, 1999; Maas & Maas, 2005; Forzza, 2007). Even so, the 161 species recorded in the Brazilian Amazon represent more than a half of the Zingiberales known from Brazil (Forzza *et al.*, 2013), of these, 97 belong to *Marantaceae* (Braga, 2013a), 23 to *Heliconiaceae* (Braga, 2013b), 22 to *Costaceae* (Maas & Maas, 2013a), 15 to *Zingiberaceae* (Maas & Maas, 2013b), two to *Cannaceae* (Maas H. & Maas, 2013), one to *Musaceae* (Sobral, 2013a) and *Strelitziaceae* (Sobral, 2013b) each. The 23 species of Zingiberales endemic to the Brazilian Amazon include 17 *Marantaceae* (Braga, 2013a), five *Costaceae* (five spp.) Maas & Maas, 2013a), one *Heliconiaceae*, and one *Zingiberaceae* (Braga, 2013b; Maas & Maas, 2013b).

The status of taxonomic knowledge about the group in the Brazilian Amazon indicates the need of to expand the floristic studies around this phytogeographic domain, especially in areas threatened by human activities. Previous floristic inventories in lower

Xingu river focused on tree species (Dantas & Müller, 1980; Campbell *et al.*, 1986; Cardenas, 1987, 1988; MPEG, 2002; Salomão *et al.*, 2007), and the remain plants, such as herbs, which include *Zingiberales*, remain to be satisfactorily studied..

The aim of this study was to investigate the richness of *Zingiberales* in the Volta Grande do Xingu, Pará, Brazil, and to provide a taxonomic treatment which allows the identification of the recorded taxa.

2.2. Materials and methods

The study area encloses the area named Volta Grande do Xingu, located in the lower Xingu river (Salomão *et al.*, 2007). The collected area is situated in the perimeter formed by the geographic coordinates 3°03'36"S and 52°10'50"W; 3°03'36"S and 51°36'08"W; 3°36'20"S and 51°36'08"W; 3°36'20"S and 52°10'50"W (Fig. 1), which is mainly located in the municipalitie of Vitória do Xingu, but also includes Altamira, Senador José Porfírio, and Anapú, in Pará State.

The climate is tropical humid, classified as type Am (Köppen-Geiger), with average temperatures of 27,3°C and annual precipitation around 2.123 mm (Silva *et al.*, 2009). The two most important vegetation types are Tropical Rain Forest (Alluvial formation and lower montane) and Open Rain Forest (Alluvial formation and lower montane with three floristic faciation: vines, palms and sororoca (a popular name to *Phenakospermum guyannense* (A.Rich.) Endl. ex Miq.)) (IBGE, 2012; Salomão *et al.*, 2007). In addition, the area is covered by secondary vegetation in various stages of succession (Salomão *et al.*, 2007).

The field work was accomplished from December 2011 to October 2013. The samples were collected and herborized according to Fidalgo & Bononi (1989).

The sampling methods consisted of intense and random sampling in the sites called Bela Vista, Belo Monte, Canal de Derivação, and Pimental, including islands as well as the forest fragments along the access routes called Travessão 27, Travessão 40, and Travessão 55 (Fig.1).

The collected specimens were deposited in the herbarium MG of the Museu Paraense Emílio Goeldi. The species were identified by using specialized bibliography, including original descriptions, comparison with specimens of the following herbaria: MG, IAN, RB, UB, CEN, and analysis of digital images of type specimens of the online herbaria BM, BR, F, G, GB, GH, K, LE, LINN, MO, NY, NYBG, P, R, RB, S, VEN, U (JSTOR/Global Plants).

The terminology for morphological structures are in accordance with Radford *et al.* (1974); Watson & Dallwitz (1992) and Kress & Stone (1993) to *Strelitizaceae*; Nakai (1941), Andersson (1981a, 1985, 1992) and Berry & Kress (1991) to *Heliconiaceae*; Maas (1977) and Larson *et al.* (1998) to *Zingiberaceae*; Maas (1972) and Specht & Stevensson (2006) to *Costaceae*; Maas-Van de Kramer & Maas (2008) to *Cannaceae*; Andersson (1976, 1977, 1981b, 1981c, 1984, 1986, 1998a), Jonker-Verhoef & Jonker (1975), Hagberg (1990), Hagberg & Eriksson (2011) and Vieira *et al.* (2012) to *Marantaceae*.

Author names and the herbarium acronyms follow with Brummitt & Powell (1992) and Thiers (2013), respectively. Geographic distribution of the taxa was based on specific bibliography for each family, Forzza *et al.* (2010, 2013), and electronic databases (TROPICOS, 2013; IPNI, 2013).

Measurements of leaves, inflorescences, spathes and seeds were made on dry material. Collectors' notes were included in the descriptions, when appropriate. Measurements of bracteoles, pedicels, flowers and fruits were made on rehydrated material.

For the taxonomic treatment, families and species are sorted alphabetically.

2.3. Results and discussion

The *Zingiberales* are represented in the study area by five families (Fig.2), 10 genera and 28 species. The richest family was Marantaceae, with five genus and ten species, followed by Costaceae, with two genus and seven species; Heliconiaceae, with one genus and eight species; Zingiberaceae, with one genus and two species and Strelitziaceae with one single genus/species, which are presented bellow in alphabetical order of family and species.

Zingiberales Griseb. Grundr. Syst. Bot. 167. 1854.

The order is characterized by rhizomatous herbs, rarely arborescents, entire leaf lamina with lateral veins diverging from midrib, terminal or lateral inflorescence, with conspicuous colourfull bracts and zygomorphic flowers, and perianth consisting of separate calyx and corolla (Tomlinson, 1962).

Key to the families of *Zingiberales* in the Volta Grande do Xingu (adapted from Kress, 1990a):

1. Stem woody; lateral petals fused to enclose anthers *Strelitziaceae*
1. Stem not woody; lateral sepals free 2
2. Two arcs of air canals in leaf axis; fertile stamens 5; lateral stamens of inner and outer whorls fertile *Heliconiaceae*
2. One arc of air canals in leaf axis; fertile stamen 1; lateral stamens of inner and outer whorls sterile 3
3. Flower zygomorphy; sepals fused at base; style unmodified, situated between anther sacs 4
3. Flower assymetric; sepals free; style modified separate from anther *Marantaceae*

4. Phyllotaxy distichous; aromatic oils present in vegetative body; inner lateral staminodes fused into a labellum..... *Zingiberaceae*
4. Phyllotaxy spirally arranged; aromatic oils absent in vegetative body; all staminodes fused into a labellum *Costaceae*

Costaceae Nakai, J. Jap. Bot. 17: 203. 1941.

This family characteristically comprises acaulescent to large perennial rhizomatous herbs, unbranched, but occasionally with leafy shoots arising from the base of the inflorescence or from the axils of the leaves; leaves spirally arranged around the stem; terminal inflorescence on leafy stems or on separate leafless shoots; zygomorphic flowers; and stamen with broad petaloid filament that curves forward and closes the entrance to the tube of the flower, all staminodes fused into a labellum (Maas, 1972; Specht & Stevenson, 2006).

In Brazil, the family is represented by three genera and 24 species (Maas & Maas, 2013a). In the Volta Grande do Xingu, two genera (*Chamecostus* and *Costus*) and seven species (Fig. 3, 4 A-H) were found.

Key to the taxa of *Costaceae* recorded in the Volta Grande do Xingu:

1. Plants small, never exceeding 1 m long, occasionally acaulescent; bracts herbaceous to chartaceous; stigma cup-shaped (*Chamecostus*) 2
2. Bracts appendaged or with reflexed apices, anther caudate at the apex
.....*Chamaecostus subsessilis*
2. Bracts not appendaged or not with reflexed apices, anther not caudate at the apex 3
3. Bracts densely imbricate, yellow, 1-2 cm wide
.....*Chamaecostus fusiformis*
3. Bracts not imbricate, green, 0.4-0.8 cm wide *Chamaecostus lanceolatus*

1. Plants large, usually over 1 m long, occasionally branched; bracts coriaceous; stigma bilamellate with a bilobed dorsal appendage (*Costus*) 4
4. Labellum oblong-obovate when spread out, middle lobe not recurved 5
4. Labellum broadly obovate when spread out, middle lobe recurved 6
5. Corolla orange, 35-40 mm long; labellum orange to yellow*Costus scaber*
5. Corolla pinkish-red to salmon-red, 50-60 mm long; labellum pinkish-red 7
6. Corolla niveous, 50-60 mm long; labellum white or softly pinkish, broadly obovate when spread out, 50-60 mm long and 50-60 mm wide *Costus arabicus*
6. Corolla yellowish-white, 80-90 mm long; labellum yellow, broadly obovate when spread out, 80-90 mm long, 60-70 mm wide *Costus amazonicus* subsp. *krukovi*
7. Leaves glabrous *Costus spiralis* var. *spiralis*
7. Leaves sparsely to densely villose *Costus spiralis* var. *villosus*

Chamaecostus C.D. Specht & D.W. Stev., Taxon 55(1): 157–158, f. 1. 2006.

This genus is characterized by small or very small plants to occasionally acaulescent rosettes, never exceeding 1 m tall, with elliptical leaves, acuminate to long-acuminate at the apex; often capitate inflorescence, membranaceous calyx, tubulous corolla and labellum forming a long narrow tube that opens broadly at the apex. (Specht & Stevensson, 2006).

This genus comprises seven species restricted to the South America, from the Guyana Shield to the Amazonian lowlands of Bolivia and Brazil. In the Volta Grande do Xingu three species were found.

Chamaecostus fusiformis (Maas) C.D.Specht & D.W.Stev.,Taxon 55(1): 158. 2006.

Type: -Brazil, 5/IV/1924 (fl.), Kuhlmann, J.G.1916, (holotype, U (photo!)); isotype, RB (photo!)) Fig. 4 A.

Plants caanoid, up to 75 cm long. Rhizomes to 35 cm long, 0.7 cm wide. Leaf sheaths tubulous, membranaceous, 5-10 cm long, 3-6 mm wide, sparsely puberulous; ligule truncate, 1-2 mm long, glabrous to long fimbriate; petiole 2-3 mm long, glabrous; leaf blades narrowly obovate, green, 6-23 cm long, 2-5 cm wide, apex acuminate, glabrous except on minutely puberulous adaxial margin. Inflorescence fusiform, 5-11 cm long, 1-2 cm wide; bracts ovate-triangular, chartaceous, densely imbricate, yellow, ca. 3 cm long, 1-2 cm wide, glabrous or sparsely minutely puberulous, apex acute to obtuse, sometimes mucronate, callus 3-7 mm long; bracteoles bilobed, membranaceous, white, 5-14 mm long, 1-2 mm wide, lobes triangular. Calyx cylindrical, membranaceous, yellow, reddish-brown punctate, 11-15 mm long, 6-8 mm wide, glabrous, lobes triangular, 1 mm long, 1 mm wide at base; corolla cylindrical, membranaceous, yellow, reddish-brown punctate, 60 mm long, 50 mm wide, tube fused for 40 mm long, glabrous, lobes obovate ca. 20 mm long, 6-8 mm wide; labelum

obovate, yellow, ca. 35 mm long, 30 mm wide, adnate to stamen. Stigma cup-shaped; ovary ellipsoid, 3-5 mm long, 1-2 mm wide, glabrous. Capsule unknown.

Distribution: Brazil (PA, MT) and Suriname (Maas & Maas, 2013a; TROPICOS, 2013).

Chamaecostus fusiformis is easily recognized in the field by its glabrous leaves, except on minutely puberulous adaxial margin and fusiform inflorescence.

This species was collected in Open Rain Forest, on rocky soil and on rocky outcrops.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [399860, 9619855 UTM 22], 15.III.2012 (fl.), *F.A. Raul 156* (MG); *ibid.*, coordinates [399951, 9619994 UTM 22], 08.III.2012 (fl.), *L.C. Piacentini 157* (MG); *ibid.*, coordinates [418008, 9635616 UTM 22], 24.V.2012, *L.C. Antônio 184* (MG); *ibid.*, 25.IV.2013, *J.S Prado 1247* (MG).

Additional specimens: BRAZIL. Pará: Altamira, rio Xingu, canal da Boa Esperança, morro do Bandeira, 11.II.1987 (fl.), *S.A.M. Souza 1179* (RB).

Chamaecostus lanceolatus* subsp. *pulchriflorus (Ducke) C.D.Specht & D.W.Stev., Taxon 55(1): 158. 2006. Type: Brazil, 1/VII, 1915 (fl.), Ducke 15649, (type BM (photo!), lectotype G (photo!), designated by Maas, 1972; isoelectotypes P (photo!)). Fig. 4 B.

Plants caespitose, 19-23 cm tall. Rhizomes 3-4 cm long, 0.3-0.5 cm wide. Leaf sheaths tubulose, chartaceous, 3-5 cm long, 0.2-0.44 cm wide, glabrous; ligule truncate, 1-2 mm long, glabrous; petiole 1-2 mm long glabrous; leaf blades narrowly elliptic, green 5-10 cm long, 1.5-2.8 cm wide, apex acuminate, densely minute-puberulous. Inflorescence subcapitata, 4-6 cm long, 0.5-2 cm wide; bracts narrowly triangular, herbaceous to chartaceous, green, 1-3 cm long, 0.4-0.8 cm wide, densely minute-puberulous, callus 1-4 mm long; bracteole bilobed, bicarinate adaxially, tubular, often deeply split abaxially, herbaceous to chartaceous, green,

10-14 mm long, 2-3 mm wide, lobes triangular, 1-3 mm long, 1-2mm wide. Calyx cylindrical, deeply split during anthesis, herbaceous to chartaceous, green, 20-30 mm long, lobes triangular, 2-4 mm long, 3-4 mm wide, densely minute-puberulous, callus 2 mm long; corolla obovoid, membranaceous, red to orange, 50-60 mm long, 6-12 mm wide, fused for 15-20 mm long, lobes narrowly ovate, 25-30 mm long, 3-5 mm wide, densely minute-puberulous; labellum suborbicular, red to orange, 25-30 mm long, 30-36 mm wide, margins crenulate, shortly fimbriate, adnate to stamen. Stigma cup-shaped; ovary ellipsoid, 3-6 mm long, 1 mm wide, glabrous. Capsule unknown.

Distribution: Brazil (MA, MT, PA) (MAAS & MAAS, 2013a; SPECHT & STEVENSON, 2006; TROPICOS, 2013), Suriname, and French Guiana (FUNK *et al.*, 2007).

Chamaecostus lanceolatus subsp. *pulchriflorus* is easily recognized in the field by subcapitata inflorescence with bracts narrowly triangular, herbaceous to chartaceous.

This species was collected in Open Rain Forest, on rocky soil.

According to Maas (1972) *Chamaecostus lanceolatus* subsp. *pulchriflorus* has the calyx 2-2.5 times longer than the bracts, and seems to be restricted to the eastern Amazon, while *C. lanceolatus* subsp. *lanceolatus* the calyx and bracts have almost the same length.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [411438, 9627227 UTM 22], 19.I.2012 (fl.), A.Cardoso s/n (MG); *ibid.*, Belo Monte, X-XII.2007 (fl.), R.P.Salomão 1052 (MG); *ibid.*, Basin of rio Xingu, Gleba Bacajá, Lote 88, just below mouth of rio Bacajá, 50° 47' 50" W 03° 22' 20"S, 21.XI.1980 (fl.), G.T.Prance *et al.* P.26376 (MG); *ibid.*, Inferno Verde, Dique 2, 27.XI.1986 (fl.), A.T.G.Dias 589 (MG).

Chamaecostus subsessilis (Nees & Mart.) C.D.Specht & D.W.Stev., Taxon 55(1): 158. 2006. Type: Brazil, (fl.), Wied. M, s.n., (isotype BR (photo!)) Fig. 4 C.

Plants rosulate, up to 15 cm tall. Rhizomes 2-4 cm long, 0.2-0.4 cm wide. Leaf sheaths tubulose, membranaceous, 2.5-6 cm long, 0.5-2 cm wide, apex obtuse, sparsely to rather densely puberulous; ligule truncate, ca. 1 mm long, puberulous; petiole absent. Leaf blades elliptic, 13-29 cm long, 5-12 cm wide, apex acute, abaxially and adaxially densely strigose, margins densely ciliate. Inflorescence subcapitate; bracts tubulose, herbaceous, green, ca. 40 mm long, 5-12 mm wide, densely puberulous; lobes narrowly triangular to triangular, foliaceous, green, 5-35 mm long, 0.5-22 mm wide, apex acute to mucronate, densely puberulous abaxially and adaxially; bracteoles bilobed at apex, bicarinate adaxially, tubular, membranaceous, withish, 25-32 mm long, 4-10 mm wide, lobes narrowly triangular to triangular, 2-15 mm long, 2-4 mm wide, densely puberulous; pedicelate 6 mm long, glabrous. Calyx cylindrical, deeply split during anthesis, membranaceous to herbaceous, greenish-white, reddish-brown punctate, 30-40 mm long, 10-14 mm wide, densely puberulous, lobes narrowly triangular to deltate, mucronate, 4-8 mm long, 3-5 mm wide; corolla tubulose, membranous, yellow, reddish-brown punctate, 57-70 mm long, 50-70 mm wide, soldered in a tube 22-30 mm long, lobes narrowly elliptic, 30-40 mm long, 7-12 mm wide, apex mucronate, densely puberulous; labellum orbicular to broadly obovate, yellow, reddish-brown punctate, 50-60 mm long, 70-80 mm wide, margins fimbriate, becoming glabrescent when old, adnate to stamen. Stigma cup-shaped; ovary elliptic, 7-13 mm long, 2-3 mm wide, sericeous. Capsule unknown.

Distribution: Brazil (AC, PA, RO, BA, CE, MA, DF, GO, MT, MG, SP) (MAAS & MAAS, 2013a) and Bolivia (TROPICOS, 2013).

Chamaecostus subsessilis is easily recognized in the field by its rosulate habit, subcapitate inflorescence with bracts bracts tubulose, herbaceous.

This species was collected in Open Rain Forest, on rocky soil.

The wide distribution and polymorphism of this species explain its many synonyms (Maas, 1972). A single population of acaulescent strigose plants were found in the Volta Grande do Xingu collected in Open Rain Forest, on rocky soil.

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, Coordinates [402843, 9623368 UTM 22], 27.III.2012 (fl.), *D.A.A. Gomes 164* (MG).

Additional specimen: BRAZIL. Pará: Altamira, Igarapé Ipixuna, affluent of Rio Xingu, 5km S of settlement, Araweté Indian Reserve, [lat: -4.82 long: -52.52 WGS84], 20.III.1986, *W.L. Balée 1986* (NY).

Costus L. Sp. Pl. 1: 2. 1753.

This genus is characterized by rhizomatous perennial herbs of moderate to large habit, 1–5 m, usually unbranched stems, spirally arranged leaves with ligulate sheaths; terminal inflorescence on leafy stem or on special leafless shoots directly from the rhizome, with conspicuous persistent imbricated bracts and labellum equaling or surpassing the corolla. (Maas, 1972; Specht & Stevenson, 2006).

Costus is the largest genus of *Costaceae* and has the broadest morphological circumscription. Its is restricted to the tropical moist forests of Africa and America with species diversity centered in the Neotropics (Specht & Stevenson, 2006).

Costus amazonicus* subsp. *krukovii Maas, Fl. Neotrop. 8: 71, f. 32 g–i. 1972. Type: Brazil, 27/XI/1934(fl.), Krukoff, B.A. 7165, (holotype S (photo!); isotypes K (photo!), U (photo!), NY (photo!)). Fig. 4 D.

Plants caennoid, 2-3 m long. Rhizome 4-17 cm long, 2-4,5 cm wide. Leaf sheaths tubulous, chartaceous, 8-23 cm long, 2.2-2.9 cm wide, glabrous; ligule retuse 5-6 mm long, apex truncate, glabrous; petiole inconspicuous to 2 cm long; leaf blades narrowly ovate to

narrowly obovate, adaxially green, abaxially purple, 16-23 cm long, 5-8 cm wide, apex long-acuminate, glabrous. Inflorescence ovoid to cylindric, 5-6 cm long, 3-4 cm wide, apex obtuse, from a separate leafless shoot 24-26 cm long, sheaths obovate, apex truncate, 2-3 cm long, 1-2 cm wide; bracts broadly ovate, coriaceous, exposed part green, covered part red, 20-30 mm long, 20-30 mm wide, apex obtuse, margins entire, glabrous, callus 5-10 mm long; bracteoles ovate, chartaceous, white, 17-25 mm long, 15-20 mm wide, glabrous, margins entire. Calyx cylindrical, membranous, yellowish-white, 15-17 mm long, 5-9 mm wide, lobes shallowly triangular to triangular, 3-5 mm long, 2-3 mm wide, glabrous; corolla tubulous, membranous, yellowish-white, 77-90 mm long, 50-68 mm wide, tube soldered 17-20 mm long, lobes narrowly obovate, 60-70 mm long, 25-30 mm wide, glabrous; labellum broadly obovate, yellow, 80-90 mm long, 60-70 mm wide, lateral lobes dark-red striped, middle lobe yellow striped, red margined. Stigma cup-shaped; ovary elliptic, 5-8 mm long, 2-4 mm wide, densely to sparsely sericeous. Capsule unknown.

Distribution: Brazil (AC, AM, MT, PA) (Maas & Maas, 2013a); Colombia, Ecuador and Peru. (Maas, 1972, 1977).

This taxon is easily recognized by the ovoid to cylindric inflorescence developed from a separate leafless shoot.

It was collected in Open Rain Forest, on rocky soil.

Costus amazonicus subsp. *krukovii* presents a glabrous corolla and entire bract margins, while *C. amazonicus* subsp. *amazonicus* has a puberulous corolla and the margins of bracts irregularly fimbriate.

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [4012810, 9652858 UTM 22], 18.I.2012 (fl.), L.C. Piacentini s/nº (MG); *ibid.*, coordinates [3094674, 9629334 UTM 22], 26.04.2013 (fl.), R.B. Santos, 1248 (MG).

Costus arabicus L., Sp. Pl. 1: 2. 1753. Type: French Guiana, 8-22/I/1938(fl.), Albert C. Smith 2869, (holotype MO (photo!)). Fig. 4 E.

Plants caenoid, 1-3 m long, often branched. Rhizome 5-14 cm long, 1.5-2 cm wide. Leaf sheaths tubular, 10-17 cm long, 1.2-2.5 cm wide glabrous; ligule retuse, 2-5 mm long, 2-3 mm wide, apex truncate, glabrous; petiole 2-3 mm long, glabrous; leaf blades narrowly ovate to narrowly obovate, green 15-22 cm long, 3-6 cm wide, apex short-acuminate, glabrous. Inflorescence ovoid to fusiform, 4.5-8.5 cm long, 3-4.5 cm wide, terminal on a leafy stem; bracts broadly ovate, coriaceous, exposed portion green, hidden portion red, 2.5-4.5 cm long, 2-3 cm wide, apex acute or obtuse, puberulous, callus 3-6 mm long; bracteoles ovate, chartaceous, pinkish-red, 20-30 mm long, 15-25 mm wide, sparsely puberulous. Calyx tubulose, membranaceous, pinkish-red, 12-20 mm long, 8-12 mm wide, puberulous, lobes triangular, 2-4 mm long, 4-6 mm wide; corolla obovate, membranous, white, 50-60 mm long, 40-50 mm wide, glabrous, tube 15-20 mm long, lobes narrowly obovate, 40-45 mm long, 13-20 mm wide; labellum broadly obovate, white or rose-colored, yellow in the centre, 50-60 mm long, 42-55 mm wide, middle lobe recurved. Stigma cup-shaped; ovary obovoid, 3-8 mm long, 2-3 mm wide, glabrous. Capsule unknown.

Distribution: Brazil (AC, AM, AP, PA, RO, MA, BA, MT, RJ, SP, SC, PR (Maas & Maas, 2013a), Argentina, Bolivia, Caribbean, Colombia, Ecuador, French Guiana, Guyana, Paraguai, Peru, Suriname, and Venezuela (TROPICOS, 2013).

The species is easily identified in the field by its green inflorescence with white corolla, frequently with rose-colored labellum and stamen. Another diagnostic feature of the species is the often branched habit, with shoots arising from the axils of the lowest bracts or from leaf-axils.

This species was collected in Tropical Rain Forest, on alluvial formation.

Specimen examined: BRAZIL. Pará: Altamira, Belo Monte, rio Xingu, Volta Grande do Xingu, [396218, 9622462 UTM22], 20.I.2012 (fl.), D.A.A. GOMES s/n (MG).

Additional specimen: BRAZIL. Pará: Altamira, rio Xingu, Belo Monte, X.2007 (fl.) R.P. Salomão 1051 (RB).

Costus scaber Ruiz & Pav. Fl. Peruv. 1: 2–3, t. 3 1798. Fig. 4 F.

Plants caanoid, 0.5-2 m long. Rhizome 3-8 cm long, 2-3 cm wide. Leaf sheaths tubular, 10-19 cm long, 2-3.5 cm wide; ligule oblique, 2-8 mm long, apex truncate, hairy; petiole 3-8 mm long, minute-puberulous to glabrous; leaf blades narrowly elliptic, green, 8-25 cm long, 3-10 cm wide, glabrous to sparsely puberulous adaxially, costa densely strigulose, glabrous to minute-puberulous abaxially. Inflorescence ovoid to cylindrical, 2-8 cm long, 1.5-3 cm wide, terminal on a leafy stem; bracts broadly ovate, coriaceous, orange-red, 2-3 cm long, 2-3 cm wide, apex obtuse, glabrous to puberulous, callus yellow, 3-8 mm long; bracteole ovate, chartaceous, reddish, 8-10 mm long, 6-8 mm wide, glabrous to puberulous. Calyx elliptic, membranaceous, reddish, 3-5 mm long, 2-3 mm wide, rather densely puberulous to glabrous, lobes triangular, 1-2 mm long, 1-2 mm wide; corolla obovate, membranaceous, orange, 35-40 mm long, 20-28 mm wide, glabrous, tube 8-10 mm long, lobes narrowly obovate, 25-30 mm long, 8-10 mm wide; labellum oblong-obovate, orange to yellow, 20-22 mm long, 15-18 mm wide, lateral lobes rolled inwards, forming a tube of 6-10 mm in diam. Stigma cup-shaped; ovary elliptic, 5-8 mm long, 2-3 mm wide, puberulous. Capsule ellipsoid to subglobose, 7-10 mm long, 4-6 mm wide, glabrous to densely puberulous at the apex, seeds black.

Distribution: Brazil (AC, AM, PA, RO, BA, PE, MT, ES, SC) (Maas & Maas, 2013a), Bolivia, Caribbean, Colombia, Costa Rica, Ecuador, French Guiana, Guatemala, Guyana, Honduras, Mexico e Panama (TROPICOS, 2013).

Costus scaber can be recognized by its small cylindrical inflorescence, with orange-red bracts and redish-orange flowers.

This species was collected in Tropical Rain Forest, on alluvial and submontane formations, and its secondary vegetation.

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [4018081, 9639736 UTM 22], 21.III.2013 (fl.), R.B. SANTOS, 1941. (MG); *ibid.*, coordinates [4114100, 9653178 UTM 22], 02.VIII.2012 (fr.), D.A.A. GOMES, 142 (MG); *ibid.*, coordinates [4113480, 9648522 UTM 22], 25.IX.2013 (fl.), R.B. SANTOS, 1999 (MG); *ibid.*, coordinates [0395383, 9619824 UTM 22], 13.I.2012 (fl.), L.C. ANTONIO, s/n. (MG).

Additional specimens: BRAZIL. Pará: Basin of rio Xingu, Gleba Bacajá, lote 88, just below mouth of rio Bacajá, 22.11.1980 (fl.) D. Daly & U. Maciel 2506022 (US [NMNH-Botany_BR])

Costus spiralis (Jacq.) Roscoe, Fl. Peruv. 1: 2–3, t. 3. 1798. Type: Brazil, /1/1817(fl.), Wied, M. s.n. (holotype BM (photo!)). Fig. 4 G.

Plants caenoid, 1-2.5 m long. Rhizomes 6-10 cm long, 3-6 cm wide. Leaf sheaths tubular, 12-21 cm long, 1.9-3.8 cm wide glabrous; ligule retuse, 4-10 mm long, apex truncate, glabrous or villose towards the margins; petiole 2-17 mm long, glabrous to villose; leaf blades narrowly elliptic, 7-30 cm long, 5-9 cm wide, apex acuminate, glabrous to densely villose adaxially and abaxially. Inflorescence ovoid, 6-9.5 cm long, 3-5 cm wide, apex obtuse, terminal on a leafy stem; bracts broadly ovate, coriaceous, red, 2-3 cm long, 2.5-3.4 cm wide, apex obtuse, glabrous or puberulous; callus 5-10 mm long, green to yellowish green; bracteoles ovate, chartaceous, purple-red, 15-20 mm long, 23-30 mm wide, glabrous to sparsely puberulous. Calyx oblong, membranaceous, purple-red, 7-10 mm long, 3-4 mm wide, glabrous to sparsely puberulous, lobes shallowly triangular, 2-4 mm long, 3-4 mm

wide; corolla obovate, membranaceous, pinkish-red, 50-60 mm long, 35-47 mm wide, glabrous, tube 10 mm long, lobes narrowly obovate-elliptic, 35-40 mm long, 10-20 mm wide; labellum oblong-obovate, pinkish-red, distally yellowish, 25-30 mm long, 20-25 mm wide, lateral lobes rolled inwards, forming a slender tube of 7-10 mm in diam., apex irregularly crenulate. Stigma cup-shaped; ovary oblong, 5-10 mm long, 3-4 mm wide, densely sericeous to glabrous. Capsule ellipsoid, 10-13 mm long, 4-6 mm wide, glabrous, seeds black.

Distribution: Brazil (AM, AP, PA, CE, MA, PE, GO, MS, MT, MG, RJ, SP, PR, SC) (MAAS & MAAS, 2013a), Bolivia, Caribbean, Colombia, Costa Rica, Ecuador, French Guiana, Guatemala, Guyana, Honduras, Mexico, Panamá (TROPICOS, 2013)

Costus spiralis is recognized by its red ovoid inflorescence, with pinkish-red flowers. Two varieties were collected in the study area: *Costus spiralis* (Jacq.) Roscoe var. *spiralis*, with glabrous leaves, and *Costus spiralis* var. *villosus* Maas, with sparsely to densely villose leaves.

This species was collected in Tropical Rain Forest, Open Rain Forest and its secondary vegetation.

***Costus spiralis* (Jacq.) Roscoe var. *spiralis*.**

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [402853, 9622778 UTM 22], 02.X.2013 (fl.), R.A.S. FONSECA 2057. (MG).

***Costus spiralis* var. *villosus* Maas., Fl. Bras. 3(3): 55. 1890.**

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [0401688, 9622536 UTM 22], 13.01.2012 (fl.), E. Takanohashi, s/n. (MG); *ibid.*, coordinates [400530, 9634168 UTM 22], 11.05.2012 (fr.), D.A.A. Gomes, 196 (MG); *ibid.*, coordinates [0401688, 9622536 UTM 22], 13.01.2012 (fl.), L.C. Antonio, s/n. (MG).

Additional specimens: BRAZIL. Pará: rio Xingu, Largo do Irineu, base do morro entre as cachoeiras do Pirarara e do Sapiquara, mata de terra firme, solo areno-argiloso, 01.01.1987, A.T.G. Dias *et al.* 868 (INPA).

Heliconiaceae Nakai. J. Jap. Bot. 17: 201. 1941.

Heliconia L., Mant. Pl. 2: 147, 211. 1771.

This family has a single genus *Heliconia*, that characteristically comprises rhizomatous herbs, often very tall, with distichous leaves, usually terminal inflorescence on leafy shoots but sometimes on specialized shoots bearing only bladeless sheaths, flowers subtended by showy bracts, perianth zygomorphic, all elements fused to form a basal tube, lateral sepals and petals fused above tube, median sepal free (Andersson, 1981a, 1998b).

In Brazil, 29 species are registered (Braga, 2013b). In the Volta Grande do Xingu, the genus is represented by eight species and two subspecies (Fig. 5).

Key to the taxa of *Heliconiaceae* recorded in the Volta Grande do Xingu:

1. Inflorescence erect 2
2. Spathes distended *Heliconia acuminata*
2. Spathes deeply concavous 3
3. Spathe angle less than 25 ° 4
4. Inflorescence with spathes usually contiguous to imbricate.....
- *Heliconia densiflora* subsp. *densiflora*
4. Inflorescences with spathes usually distinctly separated.....
- *Heliconia densiflora* subsp. *angustifolia*
3. Spathe angle more than 25 ° 5
5. Spathes irregular to spirally disposed 6

6. Inflorescence indumentum arachnoid *Heliconia spathocircinata*
6. Inflorescence glabrous *Heliconia bihai*
5. Spathes distichous alternate 7
7. Flower glabrous *Heliconia psittacorum*
7. Flower hirsute *Heliconia hirsuta*
1. Inflorescence pendent 8
8. Spathes distichous alternate, margins involute at base *Heliconia marginata*
8. Spathes irregular to spirally disposed *Heliconia chartacea*

Heliconia acuminata L.C.Rich. Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 15(Suppl.): 26–27, t. 11–12. 1831. Type: French Guiana, Richard, L.C., s.n, (holotype P (photo!)). Fig. 6 A.

Plant musoid, 1-1.5 m tall, shoots monomorphic. Rhizome to 2-4 cm long, 2-3 cm wide. Leaf sheaths amplexicaulis, glabrescent to quite glabrous; petiole 8-20 cm in ultimate leaf, to 51 cm in lower ones, glabrous; leaf blade elliptic to narrowly elliptic 9-11.9 cm wide x 30-42 cm long, adaxially glabrous, abaxial surface waxy. Peduncle 28.5- 54 cm, glabrous. Inflorescence erect, 8-12 cm long with 4-6 spathes, spathe angle 80-120°; rachis flexuous, the same colour as spathes, glabrous, internodes 2-2.5/1.9-3.0/1.9-2.8/1.2-2.6/1-1.2 cm; spathes distended, distichous, straight uniformly curved, red or orange, more brightly colored abaxially than adaxially, glabrous 10.4-15.5 x 0.7-1.3/9.6-12 x 0.7-1/ 7.5-9.6 x 0.6-0.8/ 5.3-7.9 x 0.6-0.8/ 3-3.5 x 0.3 cm; bracteoles glabrous, 2.0-3.9 cm; pedicels glabrous, 0.7-1.2 cm. Perianth prominently keeled, sharply triangular in cross-section, straight uniformly curved with free sepal proeminent at anthesis, 29-53 mm, glabrous, varying in colour from orange to yellow with blackish-green subapical eye-spots (on both petals and sepals). Staminode conduplicate and shouldered with short to prominent cusp, 6-10 mm long, 2-3 mm wide. Style

densely barbate towards tip. Ovary glabrous, 4-5 mm long 3-4 mm wide. Capsule 7-8 mm long, 7-8 mm wide.

Distribution: Brazil (AM, AP, PA, MA, RR), French Guiana, Guyana, Suriname and Venezuela (Anderson, 1985; Braga, 2013b; TROPICOS, 2013).

Heliconia acuminata usually presents more or less arachnoid indumentum on the midrib of the abaxial surface of the leaf blade, as well as on the inflorescence and perianth. However, the specimens collected in the Volta Grande do Xingu were glabrous. The morphologically closest species of *Heliconia acuminata* is *H. psittacorum*, which is a slender, glabrous species with pronounced ascending spathes, less conspicuous sepal keels and short cuspidate staminode. *Heliconia acuminata* has distended spathes, conspicuously keeled sepals, and long cuspidate staminode.

This species was collected in Tropical Rain Forest on lower montane formation, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [393348, 9648595 UTM 22], 02.V.2013 (fl., fr.), F.A. Raul 1256 (MG); *ibid.*, coordinates [392840, 9647881 UTM 22], 02.V.2013 (fl.), F.A. Raul 1258 (MG); *ibid.*, coordinates [392399, 9647488 UTM 22], 01.V.2013 (fl.), F.A. Raul 1260 (MG); *ibid.*, coordinates [411178, 9653579 UTM 22], 03.VI.2013 (fl., fr.), F.A. Raul 1412 (MG).

Additional specimens: BRAZIL. Pará: Altamira, rio Xingu, Assurini Indians, Morro do Bandeira, 12.VI.1986 (fl.), W. L. Balée 2430 (NY).

Heliconia bihai (L.) L., Mant. 2: 211.1771. Type: Suriname, Anon. 80, (Neotype, LINN (photo!)). Fig. 6 B.

Plant musoid, 2-5 m long, shoots monomorphic. Rhizome to 5-19 cm long, 3-5 cm wide. Leaf sheaths, amplexicaulis, green, red spotted, glabrous; petiole 40-105 cm long,

glabrous; leaf blade narrowly elliptic, green, 50-100 cm long, 17-45 cm wide, apex acuminate, base cuneate, glabrous with an irregularly distributed waxy coating. Peduncle inconspicuous to 20 cm long, glabrous. Inflorescence erect, reddish, 35-68 cm, with 5-9 spathes; rachis flexuous the same colour as spathes, internodes 4.2-7.7/3.9-7.5/3.5-5.5/3.5-5.3/3.4-4.9 cm, glabrous. Spathes boat shaped, yellow on the sides, red on the keel, margin green, irregular to spirally disposed, held at an angle of 40-90°, 12-31 X 2.5-5.6/11-23 x 2.1-4.0/10-19.0 x 3-4.5/ 9.4-17 x 2.8-3.9/ 9.5-15 x 2.5-2.9 cm, glabrous with an irregularly distributed waxy coating; cincinni with 8-22 flowers; bracteoles boat shaped, whitish, 4.5-6.4 cm long, 1.7-3.4 cm wide, sparsely pilose on the keel. Perianth almost straight, basely white, distally pale green to apex, 54-72 mm long. Staminode oblong, conduplicate, 4-15 mm long, 1-3 mm wide, basely inserted 12-23 mm above of perianth, markedly widened below apex. Style filiform glabrous. Pedicel 8-12 mm long, glabrous. Ovary elliptic, white, 5-8 mm long, 3-4 mm wide, glabrous. Capsule obovoid, blue. 9-11 mm long, 7-8 mm wide.

Distribution: Brazil (Pará), Caribbean, Colombia, French Guiana, Guatemala, Guyana, Honduras, Mexico, Panama, Peru, Suriname and Venezuela (Andersson, 1981a; TROPICOS, 2013).

Heliconia bihai is characterized by spathes proximally, yellow on the sides, red on the keel, and green on the margin, acute buds with unequal sepals and staminode inserted near the perianth apex.

Heliconia bihai is close related to *H. stricta* Huber, from which it differs mainly by floral characters. *Heliconia bihai* has usually glabrous, acute buds with conspicuously unequal sepals and staminode more than 10 mm above the perianth base, while *H. stricta* has flowers (with exceptions) densely villous near the apex, obtuse buds with sepals of more or less equal length, and staminode inserted less than 8 cm above the perianth base.

Additionally, *H. bihai* is generally the stouter species in the study area with larger inflorescences, more spathes, and keel parabolic.

This species was collected in Tropical Rain Forest, on alluvial formation, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [399399, 9633034 UTM 22], 10.II.2012 (fl.), *F.A. Raul 149* (MG); *ibid.*, coordinates [419928, 9635944 UTM 22], 18.IX.2013 (fl., fr.), *R.A.S. Fonseca s/nº* (MG); *ibid.*, coordinates [404390, 9635967 UTM 22], 18.IX.2013, *R.A.S. Fonseca s/nº* (MG); *ibid.*, coordinates [416700, 9647735 UTM 22], 01.V.2013, *F.A. Raul 1257* (MG).

Heliconia chartacea Lane ex Barreiros. Revista Brasil. Biol. 32: 205–207. 1972.

Type: Brazil, 26/XI/1923, Kuhlmann, J.G 882, (holotype, RB (photo!)). Fig 6 C.

Plant canoid, 2-4 m tall, shoots monomorphic. Rhizome 7-15 cm long, 4-7 cm wide. Leaf sheaths amplexiaculis, green, glabrous to minutely puberulous; petiole 35-64 cm, glabrous or glabrescent to arachnoid; leaf blade oblong, green, 43-117 cm long, 17-32 cm wide, irregularly lacerated, apex acute, cuneate at the base, glabrous on both sides. Peduncle 9-27 cm long, slender, densely puberulous. Inflorescence pendent, red, 18-36 cm long with 6-13 spathes; rachis strongly flexuose in smooth curves, densely puberulent, internodes 3.6-4.5/3.3-4.3/ 2.9-4/ 2.8-3.8/2.7-3.8/2.5-3.5 cm; spathes lanceolate when flattened out, scarlet with green margins, irregular to spirally disposed, spathe angle 90-120 ° reflexed, densely puberulous, shallowly boat-shaped, 22.8-29.8 x 2.1-2.6/ 18.6-21.5 x 1.9-2.8/ 16.5-19.2 x 1.7-2.2/ 16.4 -18 x 1.6-2.1/ 14.2-16.4 x 1.5-1.9 cm; cincinni with 6-12 flowers; bracteoles triangular-lanceolate, whitish-green, 6.2-8.3 cm long, 1.4-2.6 cm wide, pubescent on the keel. Perianth curved toward the larger sepal, green, 27-35 mm long, hirsute-arachnoid indument, sepals all free. Staminode convex with a long cusp, 12-18 mm long, 2-3 mm wide, inserted

12-23 mm above of perianth. Style barbate on the lower side. Pedicels 8-12 mm long. Ovary elliptic, white, 7-9 mm long, 4-5 mm wide, pubescent. Capsule not seen.

Distribution: Brazil (AC, AM, PA, MA), Caribbean, Colombia, French Guiana, Guatemala, Guyana, Honduras, Mexico, Panama, Peru, Suriname and Venezuela (Braga, 2013b; TROPICOS, 2013).

Heliconia chartacea can be recognized by its lacerated leaf blade, pendent inflorescence with long spathes, strongly flexuose and densely puberulous rachis, inflorescence and spathes. *Heliconia collinsiana* Griggs, from Central America, is a close relative species with glabrous rachis, inflorescence and spathes.

This species was collected in Open Rain Forest and Tropical Rain Forest, on alluvial formation, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [398328, 9636567 UTM 22], 14.II.2012, *F.A. Raul* 140 (MG); *ibid.*, coordinates [411410, 9653178 UTM 22], 08.II.2012 (fl.), *D.A.A. Gomes* 148 (MG); *ibid.*, coordinates [413211, 9652271 UTM 22], 11.II.2012 (fl.), *D.A.A. Gomes* 150 (MG); *ibid.*, coordinates [417538, 9642028 UTM 22], 29.IV.2013, *J.S. Prado* 1167 (MG).

Heliconia densiflora Verlot. Rev. Hort. 40: 112. 1869.. Fig. 6 D.

Plant musoid, 1-2 m long, shoots often dimorphic. Rhizome to 10-65cm long, 1-1,5 cm wide. Leaf sheaths amplexicaulis, green, glabrous or with a slightly conspicuous ephemeral arachnoid indumentums; petiole of ultimate leaf 6 cm long, up to 18 cm in lower leaves; leaf blades narrowly elliptic, dark green with paler midrib above more or less glossy, 40-90 cm long, 7-10.2 cm wide, glabrous to densely arachnoid on midrib beneath. Peduncle 15-35 cm long, glabrous. Inflorescence erect, orange, 15-20 cm long, with 5-9 spathes, spathes; rachis straight, glabrous or subglabrous, internodes 1.7-3/1.5-2.8/ 1.3-2.1 cm; spathes

orange to red, distichous alternated, spathe angle 10-20°, glabrous to richly arachnoid, 16-20x 1.3-2.1/10-15 x 1.2-1.9/6.5-10 x 1.0-1.6 cm; bracteoles boat shaped, orange, 2.5-3.3 cm long, 2.1-2.9 cm wide, glabrous or subglabrous,; pedicels 0.6-1.0 cm long, glabrous. Perianth filiform curved, yellowish to orange with dark green eye-spots on the lateral petals near tip, the apex whitish, 40-57 mm long, glabrous. Staminode convex to conduplicate, markedly shouldered with long cusp, 10-19 mm long, 3-5 mm wide. Style barbate distally on lower side. Ovary elliptic, whitish orange, 6-10 mm long, 3-4 mm wide, glabrous or subglabrous. Capsule obovate, blue, 10-15 mm long, 6-7 mm wide.

Distribution: Brazil (AC, AM, PA, RO), Bolivia, Caribbean, Colombia, French Guiana, Guyana, Peru, Suriname and Venezuela (Braga, 2013b; TROPICOS, 2013).

Heliconia densiflora is characterized by deep spathes with angle $\leq 25^\circ$. The species is similar to *H. ignescens* G.S. Daniels & F.G. Stiles, which has shallower spathes, spathes angle 5-50° and a Central America distribution.

Heliconia densiflora subsp. *densiflora* was collected in Open Rain Forest and Tropical Rain Forest, on lower montane formation, and secondary forest. *Heliconia densiflora* subsp. *angustifolia* was collected in Open Rain Forest and Tropical Rain Forest, on alluvial formation, and secondary forest.

Heliconia densiflora* subsp. *densiflora

Petiole usually more than 1/4 of the blade length; leaf blade ovate with base usually cordate, width usually 1/4 of length. Arachnoid indument on leaf sheath, midrib beneath and above in the leaf blades, spathes and bracteoles. Inflorescence with spathes usually contiguous to imbricate.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [4117510, 9642752 UTM 22], 25.IX.2013 (fl.), R.B. Santos s/n (MG)

Heliconia densiflora* subsp. *angustifolia L. Anderss. Opera Bot. 82: 77, f. 52C, 53^a. 1985. Type: Brazil, Oriximiná, Mineração Santa Patricia, 8/VII/1980, Cid, C.A.; Ramos, J.; Mota, C.D. 1365 (holotype, GB (photo!)).

Petiole usually less than 1/4 of the blade length. Leaf blade narrowly elliptic or oblong, with less than 1/4 of length, glabrous. Inflorescences with spathes usually distinct separated.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [395911, 9619731 UTM 22], 13.I.2012 (fl., fr.), *E.Takanohashi* s/n (MG).

Heliconia hirsuta L.f. Suppl. Pl. 158–159. 1781 [1782]. Type: Panama, 8/X/1973, M. Nee 7304 (neotype, MO (photo!)). Fig. 6 E.

Plants zingiberoid, 2-4 m long, shoots monomorphic. Rhizome to 3-7 cm long, 2-3 cm wide. Leaf sheaths amplexicaulis oblong, green, glabrous to densely pilose; petiole 1.0-1.5 cm long, glabrous; leaf blades ovate to oblong, green, 8.3-15 cm long, 22-40 cm wide, in upper leaves of normal shoots, slightly rounded at base, apex acuminate, glabrous on both sides, sometimes with a more or less distinct waxy coating on surface beneath. Peduncle 10-31 cm long, glabrous to hirsute or arachnoid. Inflorescence erect, orange, 6-12 cm long, with 4-8 spathes; rachis erect, straight, glabrous to densely hirsute or arachnoid, internodes 0.9-2/ 0.6-1.4/ 0.5-1.2/ 0.4-1.1/ 0.4-1.0/ 0.4-0.8/ 0.3-0.8 cm; spathes boat shaped, orange or red, sometimes with green shades at base and/or apex, distichous alternated, spathe angle 10-80 °, glabrous to slightly arachnoid, 9.0-10 x 0.4-1.1/ 6-8x0.4-1.3/ 5.1-7.4x0.4-1.1/ 4.6-6.2x0.4-0.9/ 4.0-5.2x0.4-0.7 cm; bracteoles triangular, white, 1.6-3 cm long, 1.5-2.5 cm wide, glabrous to sparsely pilose on keel; pedicels 14-21 mm long, densely hirsute to arachnoid-pilose. Perianth straight to slightly curved, orange to red with distinct dark green “eye-spots” near apex on free sepals and petals, 25-45 mm long, conspicuously flattened from the sides and “V”shaped

in cross section with sharp angles, hirsute. Staminode convex to conduplicate, subtriangular, usually hood-shaped, 2-3 mm long, 1-4 mm wide with a small and distinct cusp. Style filiform, white, minutely pilose distally on lower side. Ovary ellipsoid, orange, 3-5 mm long, 2-4 mm wide, hirsute to arachnoid. Capsule ovoid, 8-10 mm long, 6-8 mm wide.

Distribution: Brazil (AC, AM, PA, RO, RR, TO, DF, GO, MS, MT, MG, SP, PR), Argentina, Belize, Bolivia, Caribbean, Colombia, Ecuador, French Guiana, Guyana, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Suriname and Venezuela (Braga, 2013b; TROPICOS, 2013).

Heliconia hirsuta is characterized by the zingiberoid habit, distinctly pedunculate inflorescences, hirsute perianth, and a small and usually hood-shaped staminode. The species resembles *H. schumanniana* Loes, but the latter one presents sessile to short pedunculate inflorescence, glabrous perianth, and obovate staminode, while *H. hirsuta*, has a longer pedunculate inflorescence, hirsute perianth and subtriangular, usually hood-shaped staminode.

This species was collected in Open Rain Forest and Tropical Rain Forest, on alluvial and lower montane formations, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [402648, 9622556 UTM 22], 13.I.2012 (fl., fr.), *E. Takanohasil s/n* (MG) *ibid.*, coordinates [398672, 9635961 UTM 22], 11.V.2012 (fl., fr.), *D.A.A. Gomes 182* (MG); *ibid.*, coordinates [415815, 9633118 UTM 22], 19.VI.2012 (fl., fr.), *L.C.C. Antônio 432* (MG); *ibid.*, coordinates [402295, 9623770 UTM 22], 25.V.2013 (fl.), *E. Takanohashi 1345* (MG); *ibid.*, coordinates [402678, 9622437 UTM 22], 08.V.2013 (fl., fr.), *E. Takanohashi 1366* (MG); *ibid.*, coordinates [402023, 9624305 UTM 22], 24.IX.2013 (fl., fr.), *R.A.S. Fonseca s/n* (MG).

Heliconia marginata (Griggs) Pittier. Man. Pl. Usual. Venez. 299. 1926. Type: Panama, 4/IV/1908, Williams, R.S. 696 (holotype, NY (photo!)). Fig. 6 F.

Plant musoid, 1.5-3 m long, shoots monomorphic. Rhizome to 3-7 cm long, 4-6 cm wide. Leaf sheaths amplexicaulis, green, glabrous; petiole 23-40 cm in ultimate leaf, 32-56 cm in lower ones, glabrous; leaf blade oblong, green, 46-80 cm long, 8-15 cm wide, acute at apex, rounded at the base, glabrous on both sides. Peduncle 5-9 cm long, slender, softly puberulent. Inflorescence pendent, 14-27 cm long with 6-10 spathes, spathe angle 90-120 °, rachis strongly flexuose in smooth curves, minutely puberulent, internodes 1.7-2.5/ 1.6-2.3/ 1.4-2.3/ 1.2-2.1 cm; spathes distichous alternate, shallowly boat-shaped, ovate-lanceolate when flattened out, gradually narrowed to an obtuse apex, reflexed, scarlet with yellow margins, puberulous, 7.8-9.8 x 1.7-4.2/ 7.6-9.4 x 1.9-3.9/ 7.5-9.2 x 2.1-3.5 /7.4 -8.8 x 2.1-3.4 cm; bracteoles triangular-lanceolate, white, 4.2-7.3 cm long, 1.2-1.7 cm wide, apex acute, pubescent on the keel. Perianth curved toward the larger sepal, orange, 42-57 mm, glabrous, sepals all free, corolla limb three-toothed, middle tooth somewhat smaller than others. Staminate convex with a long cusp, 10-20 mm long, 2-3 mm wide. Style filiform barbate on the lower side. Ovary elliptic, whitish pink, 10-13 mm long, 4-6 mm wide, glabrous or subglabrous. Capsule not seen.

Remarkable diagnostic features of *Heliconia marginata* are inflorescence pendent, rachis strongly flexuose and minutely puberulous, spathes 7.4-9.8 cm long, distichous, persistent and red with yellow margins. The close related *H. juruana* Loes differs from *H. marginata* by having caducous bracts.

This species was collected in Tropical Rain Forest, on alluvial formations, and secondary forest.

Distribution: Brazil (AC, PA, MT, MS), Bolivia, Caribbean, Colombia, Costa Rica, Ecuador, French Guiana, Guyana, Honduras, Panamá, Peru, Suriname and Venezuela (Braga, 2013b; TROPICOS, 2013). This is the first record for Pará State.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [396471, 9634204 UTM 22], 06.XII.2011 (fl.), V.M. *Barbacena* s/n (MG).

Heliconia psittacorum L.f. Suppl. Pl. 158. 1781 [1782]. Type: Suriname, 4/IV/1908, Dahlberg, C.G.C. 13 (isotype LINN (photo!)). Fig. 6 G.

Plant musoid, 0.5-2 m long, shoots monomorphic. Rhizome to 2-4 cm long, 2-3 cm wide. Leaf sheaths, amplexicaulis, green, with scant arachnoid indumenta distally near the margin; petiole 5-24 cm, glabrous, poorly demarcated when short; leaf blade elliptic to oblong, green, 20-52 cm long, 15-20 cm wide, rounded at base, apex acuminate, glabrous. Peduncle 15-45 cm, glabrous. Inflorescence erect, whitish-pink, 12-18 cm long with 4-7 spathes; rachis erect, straight, glabrous, internodes 1.8-3.8 /1.6-3.4/ 1.4-3.3/ 1.2-3.1 cm; spathes distichous alternated, slightly curved, usually white-greenish outside and them pinkish toward tip and inside, spathe angle <10-40 ° glabrous, with a waxy coating, which is thick and flasky, 10-25x0.8-1.1/ 8-15x0.5-1.1/ 10-12x0.5-0.9/ 8-10x0.5-0.8/ 6-9x0.5-0.7 cm; bracteoles triangular, whitish-pink, 4-7 mm long, 4-5 mm wide, glabrous. Perianth slightly curved with free sepal more or less salient, orange with dark green “eye-spots” on sepals and petals distally, 30-52 mm long, glabrous. Staminode convex, slightly shouldered with a short cusp 6-12 mm long, 1-3 mm wide. Style filiform, densely barbate toward apex. Ovary elliptic, whitish pink, 6-8 mm long, 4-5 mm wide, glabrous. Capsule ellipsoid, blue, 7-10 mm long, 6-8 mm wide.

Distribution: Brazil (AM, PA, RO, RR, TO, GO, MT, AL, BA, CE, MA, PB, PE, PI, SE), Bolivia, Caribbean, Colombia, French Guiana, Guyana, Honduras, Mexico, Peru, Suriname and Venezuela (Braga, 2013b; TROPICOS, 2013).

Heliconia psittacorum is a species complex characterized by ascending spathes, and glabrous leaf blades, inflorescences and flowers. The plants from Volta Grande do Xingu resembles the plant originally described as *H. sylvestris* (Gleason) L.B. Sm., which is currently a synonym of *H. psittacorum* according to Anderson (1985).

This species is morphologically similar to *H. acuminata* subsp. *psittacorastra*, from which can be distinguished by the convex staminode with a short cusp, instead of a long, narrow and tapering cusp as in *H. acuminata* subsp. *psittacorastra*.

This species was collected in Open Rain Forest and Tropical Rain Forest, on alluvial and lower montane formations, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [395583, 9626881 UTM 22], 03.I.2013 (fl., fr.), *R.B. Santos* 897 (MG); *ibid.*, coordinates [404390, 9635967 UTM 22], 18.IX.2013 (fl.,fr.), *R.A.S. Fonseca* s/n (MG).

Heliconia spathocircinata Aristeg. Bol. Soc. Venez. Ci. Nat. 22(98–99): 18, 20, t. 1961.. Fig. 6 H.

Plant musoid, 1-3 m long, shoots monomorphic. Rhizome to 4-7 cm long, 3-6 cm wide. Leaf sheaths amplexicaulis, green, indumentum arachnoid; petiole 23-40 cm long, arachnoid, sparsely and inconspicuously so; leaf blade, oblong, adaxially dark green, midrib often paler, 19-80 cm long, 8.2-22 cm wide,, midrib sparsely to densely arachnoid beneath. Peduncle 0.5-10 cm long, glabrous. Inflorescence erect, red, 20-33 cm long with 5-8 spathes, rachis twisted, red, sparsely arachnoid, internodes 2.8-3.2/ 2.8-4/ 2.7-3.5/ 2.8-3/1.5-2.8 cm long; spathes spirally disposed, uniformly red to orange, with margins yellowish, spathe angle

60-90 °, sparsely arachnoid, especially distally and marginally, finely hirtelous inside along margin, 10-18.5 x 2.2-2.4/9.8-17.5 x 2-2.3/8.5-13.5 x 2.0-2.8/7.9-13.6 x 1.9-2.4 cm; bracteoles triangular, brownish, 3.5-4.3 cm long, 3.2-4 cm wide, membranaceous, dissolved when in fruit, arachnoid,; pedicel 4-8 mm long, glabrous. Flowers largely enclosed by spathe at anthesis; perianth nearly straight to slightly curved, yellow, 48-69 mm long, not gibbous, distinctly brownish-arachnoid on sepal margins, tube 9-11 mm, ventral sepals markedly shorter than petals. Staminode distinctly shouldered with cusp. Ovary oblong, white, 4-6 mm long, 2-5 mm wide, glabrous. Capsule in level with spathe margins at maturity, elliptic, blue, 7-9 mm long, 7-9 mm wide.

Distribution: Brazil (AC, AM, AP, PA, MT, AL, BA, CE, PE, ES, MG, RJ, SP), Bolivia, Caribbean, Colombia, Ecuador, French Guiana, Guyana, Panamá, Peru, Suriname and Venezuela (Braga, 2013b; TROPICOS, 2013).

Heliconia spathocircinata is easily distinguished by the erect inflorescence, with spathes spirally disposed, uniformly red to orange colored with yellowish margins. It is similar to *H. irrasa* Lane ex R.R. Sm., *H. nubigena* L. Anderss., and *H. albicosta* (G.S. Daniels & F.G. Stiles) L. Anderss., but differ specially by the arachnoid indumentum of the inflorescence. *Heliconia spathocircinata* distribution is restricted to the South America, while the other three species are restricted to the Central America.

This species was collected in Open Rain Forest and Tropical Rain Forest, on alluvial formation, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [402648, 9622556 UTM 22], 13.I.2012 (fl.), *E. Takanohashi* s/n (MG); *ibid.*, coordinates [414059, 9633800 UTM 22], 30.IV.2013 (fl.), *J.S. Prado 1168* (MG).

Marantaceae R. Br., Voy. Terra Austral. 2: 575. 1814.

The family is characterized by rhizomatous herbs, sometimes lianescent and high-climbing with distichous leaves, terminal or lateral inflorescence, simple or a more or less complex synflorescence. Flowers are asymmetric; sepals distinct; petals, androecial elements, and style fused to form a corolla tube, the inner staminodes basally fused to form a staminal tube which more or less exceeds the level where the corolla lobes. (Andersson, 1998a).

In Brazil, the family is represented by 11 genera and 198 species (Braga, 2013a), of which five genera and nine species were also collected in the Volta Grande do Xingu. The species *Goeppertia squarrosa* (L. Andersson & H. A. Kenn.) Borchs. & S. Suárez. is recorded for the first time in Brazil.

Key to the taxa of *Marantaceae* recorded in the Volta Grande do Xingu:

1. Plants with a stem, the leaves arising from internodes 2
2. Plants often very large, usually climbing, bamboo-like *Ischnosiphon gracilis*
2. Plants large, usually not climbing, palm-like 3
3. Leaf cluster distichally at top of the same stem, sometimes branched; 2-5m tall; leaf blade ovate to elliptical, rounded at base; adaxially pilose on midrib and apex, abaxially glabrous *Ischnosiphon obliquuos*
3. Leaf cluster at the ground; up to 1 m tall; leaf blade narrowly subelliptical, cuneate at base; on both sides pilose on midrib and apex..... *Ischnosiphon petiolatus*
1. Plants stemless, the leaves arising from the ground 4
4. Leaf sheath margins prematurely decaying, leaving a network of persistent fibers *Hylaeante unilateralis*
4. Leaf sheath margins remaining throughout life span of the leaf, when eventually disintegrating, not leaving a network of fibers 5

- 5. Inflorescences clearly branched..... 6
- 6. Synflorescences long paniculate; bracts papiraceous, deciduous
.....*Thalia geniculata*
- 6. Synflorescence short paniculate; bracts coriaceous and persistent 7
- 7. Synflorescence lax; florescences 4.2–18.5 cm long, bending*Monotagma plurispicatum*
- 7. Synflorescence congested; florescences 2.2–9.5 cm long, erect *Monotagma spicatum*
- 5. Inflorescences obovoid to ellipsoid 8
- 8. Inflorescence on a separate leafless shoot*Goeppertia elliptica*
- 8. Inflorescence terminal on a leafy shoot 9
- 9. Spathes spreading, narrowly ovate to lanceolate*Goeppertia squarrosa*
- 9. Spathes overlapping, ovate to elliptic*Goeppertia micans*

Goeppertia Nees. Linnaea 6: 337. 1831.

The genus is characterized by herbs with basal and/or cauline leaves, uniformly green or with various types of patterning, terminal inflorescence on a leafy shoot or more rarely borne on a separate leafless shoot, assymetric flowers with elongated corolla tube, and straight or spreading lobes (Borchsenius *et al.*, 2012).

This genus comprises 248 species distributed from Mexico and the Caribbean islands to Argentina and Paraguay (Borchsenius *et al.*, 2012). In Brazil, 84 species are currently registered (Braga, 2013). In the Volta Grande do Xingu it is represented by three species.

Goeppertia elliptica (Roscoe) Borchs. & S. Suárez. Syst. Bot. 37(3): 630. 2012.

Type: Suriname, Wulschlaegel, W.R., s.n. (type F (photo!)). Fig. 8 A.

Plants caespitose, 0.4-0.6 m long, bearing 4-7 leaves. All leaves basal, mature flowering plants 1 leaf per shoot, inflorescence on a separate, nonleafy shoot. Rhizome stiff, woody, 2-4cm long, 0.9-1.4 cm wide. Stem glabrous. Cataphylls narrowly oblanceolate,

green, coriaceous; apex obtuse apiculate, glabrescent. Leaf sheaths terete, green or tinged with purple, 7,2-14,4 cm long, 0.5-1 cm wide, apex and margins becoming papery when eventually disintegrating, not leaving a network of fibers, glabrous; petiole 17-36 cm long, green to purple, glabrous; pulvinus 4.6 -6.5 cm long, olive-green or tinged purple, glabrous; leaf blades ovate to ovate-elliptic, adaxially plain green or patterned with thin paired white (pink in juveniles) lines between and paralleling the lateral veins, lower surface grey-green to dark purple, midrib green or purple, coriaceous, 25-37 cm long, 14- 27 cm wide, apex acuminate, obtuse to rounded, shortly attenuate, glabrous. Peduncle 25-67 cm long, green, occasionally glabrous to sparsely puberulous below, densely at apex. Inflorescence erect, 2.6-3.5 cm long with 4-9 spathes, on a leafless lateral shoot, lax; florescence broadly to depressed ellipsoid; spathes elliptic to obovate-elliptic, green, herbaceous, 1.2-2.1 cm long, 0.6-0.9 cm wide, spirally arranged, spreading, patent to reflexed, apex acute rachis evident, green, puberulous. Glabrous; florescence component of 1-2 flowering cymules; prophyll bicarinate, narrowly ovate-elliptic, light green, 1.5-2.2 cm long, 0.8-0.9 cm wide, membranaceous, apex obtuse, carinate, ridged below, minutely pilose along margin at base; interphylls bicarinate or tricarinate only at apex; bracteole 1 per flower pair, claviculate, brownish, 1.2-2.1 cm long, occasionally vestigial or absent. Flowers white; sepals narrowly elliptic to obovate-elliptic, light green, margins hyaline, herbaceous, 2-3 mm long x 5-9 mm wide, apex acute, glabrous or minutely tomentose at base; corolla tube, brownish, 31-33 mm long, glabrous; 2-lobes unequal, elliptic, tinged pale green, 14-18 mm long x 5-7 mm wide, apex acute to obtuse, glabrous. Staminodes brownish; outer staminode 1-2, angular-elliptic, 14-17 mm long, 9-11 mm wide, apex obtuse to rounded; callose staminode obovoid, bilobed, 13-15 mm long, 12-13 mm wide, petaloid apex; cucullate staminode 5-6 mm long, 4-5 mm wide. Stamen with narrow lateral petaloid appendage 2-3 mm wide; anther 3 mm long. Style and stigma yellow. Ovary 2-3 mm long, 3-4 mm wide, surface with minute irregular papillae, glabrous, rarely

minutely tomentose at junction with sepals. Capsule trilocular, ellipsoid, orange, 6-9 mm long, the locules deeply longitudinally grooved, apex slightly concave, sepals persistent, on elongated common pedicel. Seeds ellipsoid, blue, 7-9 mm long, 5 -7 mm wide outer surface rounded, faintly rugose, 2 inner faces flat.

Distribution: Brazil (AM, RR, MA, PA) French Guiana, Guyana, Suriname and Venezuela (Figueiredo *et al.*, 2012; Braga, 2013a; Maas & Maas, 2013; TROPICOS, 2013).

Goeppertia elliptica is recognized by the lax, inflorescence with few bracts, green sepals, brownish staminodes, lined foliage pattern, and rosulate green or purple abaxially. As other species of the genus, the individuals of *G. elliptica* do not retain the same color pattern in mature flowering plants.

Goeppertia elliptica resembles *G. bantae* Kennedy, and is distinguished by leaves all basal, rather than one or more stem leaves; coriaceous leaves, rather than thinner, herbaceous to subcoriaceous; totally glabrous blade, rather than pubescence on midrib and basal lamina; and pilose rather than glabrous corolla.

This species was collected in Open Rain Forest and Tropical Rain Forest, on lower montane formation, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [398328, 9619855 UTM 22], 14.II.2012 (fl.), *F.A. Raul 141*(MG); *ibid.*, coordinates [398323, 9636596 UTM 22], 27.III.2012, *D.A.A. Gomes 273* (MG); *ibid.*, coordinates [401081, 9636842 UTM 22], 08.V.2012, *D.A.A. Gomes 277* (MG); *ibid.*, coordinates [394674, 9629334 UTM 22], 26.IV.2013 (fr.), *R.B. Santos 1273*(MG); *ibid.*, coordinates [393817, 9630005 UTM 22], 02.V.2013, *E. Takanohashi 1280* (MG).

Goeppertia micans (L. Mathieu) Borchs. & S. Suárez. Syst. Bot. 37(3): 632. 2012.
Type: Guyana, Schomburgk, R. 97 (type K (photo!)). Fig. 8 B.

Plants rosulate, 10-25 cm long; with 4-6 buds, rosulate, each with 2-5 basal leaves and 1 cauline leaf. Rizome soft, herbaceous, 0.3-1cm long, 0.2-0.4 cm wide. Stem 12-20 cm long. Cataphylls lanceolates, green, apex acute. Leaf sheaths amplexicaulis, auriculate, green, 5.8-13.5 cm long, 2.2-5.2 cm wide, puberulous on both faces to sericeous at junction with stem, when eventually disintegrating, not leaving a network of fibers; petiole 0.5-13.5 cm, green, adaxially puberulous, abaxially subglabrous; pulvinus 0.4-1.5 cm long, green, tomentous on adaxial side, subglabrous abaxially; leaf blades narrowly elliptic, green, 6.4-19 cm long, 2.5-7.3 cm wide, herbaceous, softly corrugate, apex acuminate, base cuneate to obtuse, upper surface glabrous and lower surface glabrous to puberulous except on the pilose midrib, abaxially paler than adaxially. Peduncle 10-25 cm long, green, tomentose near the base, subglabrous near the apex. Inflorescence erect, 1-3 cm, with 3-7 spathes, florescence obovoid, 1-3.4 cm long, 0.5-0.8 cm wide; spathes ovate to elliptic, green, herbaceous, 6-13 mm long, 5-8 mm wide, spirally arranged, minutely pilose on both faces, sparsely hairy, spirally arranged, overlapping, acuminate; florescence component of 1-2 flowering cymules, bicarinate prophyll, ovate, apex acute, 5-6 mm long, 3-7 mm wide carina to carina 0.1 cm long, translucent; interphylls ovate, first one 6-7 mm long, 2-3 mm wide; bracteoles one or two per cymule, membranaceous, glabrous, translucent, lateral, channeled not keeled, 4-5 mm long, 2 mm wide. Flowers white; sepals ovate-triangular, whitish, membranaceous, 6-8 mm long, 2-3 mm wide, acute; corolla tube, whitish green, 4-8 mm long, glabrous; 2-lobed 5-7 mm long, 2 mm wide, glabrous; Stamines white. outer stamine obovate, 6-8 mm long, 4-6 mm wide, emarginated; callose stamine, 6-9 mm long, 4-5 mm wide; cucullate stamine, 4-5 mm long, 2-3 mm wide. Capsule not seen.

Distribution: Brazil (AC, AM, PA, RO) Belize, Bolivia, Colombia, Costa Rica, Ecuador, Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Peru, Suriname and Venezuela (Figueiredo *et al.*, 2012; Braga, 2013a; Maas & Maas, 2013; TROPICOS, 2013).

Goeppertia micans is one of the smallest species of Zingiberales in the Volta Grande do Xingu. It is easy to distinguish by its rosulate caespitose habit (10-25 cm long), and green narrowly elliptic, softly corrugate blades. Further diagnostic characters are the inflorescence tomentose near the base, subglabrous near the apex and obovoid florescence. This species is close related to *Goeppertia fucata* (H. Kenn.) Borchs. & S. Suárez, which is a smaller plant with obovate leaves and variegate sheath.

This species was collected in Tropical Rain Forest, on lower montane formations.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [392005, 9647492 UTM 22], 01.V.2012, *F.A. Raul 1194* (MG); *ibid.*, coordinates [393045, 9648116 UTM 22], 02.V.2013, *F.A. Raul 1197* (MG); *ibid.*, coordinates [392475, 9647368 UTM 22], 01.V.2013 (fl., fr.), *F.A. Raul 1280* (MG); *ibid.*, coordinates [392991, 9647588 UTM 22], 30.V.2013 (fr.), *F.A. Raul s/n.* (MG).

Goeppertia squarrosa (L. Andersson & H. A. Kenn.) Borchs.& S. Suárez. Syst. Bot. 37(3): 634. 2012. Type: French Guiana, 19/I/1981, Granville, J-J 4268 (holotype GB (photo!)). Fig. 9.

Plants rosulate, 0.5-1 m long; with 3-7 basal leaves and 1 cauline leaves on the main stem, bearing a single terminal, simple, pedunculate inflorescence; the leaf cluster is often complexed by the production of additional leafy shoots from the axils of the lower main shoot leaves. Rhizome soft, herbaceous, 2-7 cm long, 0.5-1 cm wide. Stem glabrous. Cataphylls lanceolate, green, apex acute. Leaf sheaths narrowly elliptic, green, 22-40 cm long, apex acute, drying papyraceous, hirtellous on abaxial face, glabrous on adaxial face to sericeous at junction with stem, when eventually disintegrating, not leaving a network of fibers; petiole proper, green, 5-27 cm long, puberulous; pulvinus fusiformis, green, 0.8-2 cm long, hirtellous on adaxial side; leaf blades narrowly elliptic, green, herbaceous, 17-52 cm long, 5-15.4 cm

wide, drying papyraceous, apex acuminate, base cuneate, upper and lower surface glabrous to minutely puberulous except on the pilose midrib, abaxially paler than adaxially. Peduncle green, 10-17 cm long, sparsely pilose below, densely so near apex, arising from the base or, in larger plants borne above an elongated stem internode up to 30 cm. Inflorescence erect, 16-30 cm; florescence ellipsoid, with 10-34 spathes; spathes narrowly ovate to lanceolate, green, herbaceous, 44-72 mm long, 14-22 mm wide, spirally arranged, minutely pilose to glabrous, except at junction with peduncle in lowermost, the base relatively broad, upper half abruptly acute to acuminate; florescence component of 2-3 flowering cymules; cymule brachyblastic, bicarinate prophyll narrowly ovate, apex acute, 35-42 mm long, 8-12 mm wide, carina to carina, 13-16 mm total width, glabrous; interphylls narrowly ovate-triangular, apex obtuse, first one 35-43 mm long, 8-11 mm wide; bracteoles one or two per cymule, dorsal, membranaceous, keeled and channeled, 27-32 mm long, 4 mm wide. Flower whitish or pale yellowish; sepals narrowly ovate-triangular, 11-14 mm long, 2-3 mm wide, membranaceous, acute; corolla tube yellow or white, 35-40 mm long, pilose with white hairs, 2-lobes 15-17 mm long, 6-9 mm wide, glabrous. Staminodes yellow or white; outer staminode obovate, 16-18 mm long, 8-10 mm wide, emarginate; callose staminode, 8-10 mm long; cucullate staminode 10-12 mm long. Capsule not seen.

Distribution: Bolivia, French Guiana and Guyana (TROPICOS, 2013). This is the first record of this species in Brazil.

Goeppertia squarrosa is distinguished by leaf sheath hirtellous on abaxial surface and adaxially glabrous to sericeous at the junction with the stem. Additionally, it has puberulous petiole and pulvinus hirtellous on adaxial surface, and blades glabrous to minutely puberulous, except by the pilose midrib. The inflorescence of *G. squarrosa* is basally sparsely pilose and densely pilose towards the apex.

Goeppertia squarrosa is morphologically related to *G. ovata* (Nees & Mart.) Borchs. & S. Suárez., which has wider obovate-elliptic leaf blades, and completely glabrous blades and sheath.

This species was collected in Open Rain Forest and Tropical Rain Forest, on alluvial formation, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [392939, 9647712 UTM 22], 02.V.2013 (fl.), *F.A. Raul 1292* (MG); *ibid.*, 25.IV.2013 (fl.), *J.S. Prado 1160* (MG).

Hylaeanth A.M.E. Jonker & Jonker, Acta Bot. Neerl. 4: 172. 1955.

The genus is characterized by rosulate herbs with soft-textured foliage, terminal synflorescence of (1)2–6 floescences, and asymmetric flowers with showy petaloid staminodes (Andersson, 1981b; Andersson, *et al.*, 2001)

This genus comprises five species distributed in Central and South America. In the Volta Grande do Xingu only one species was collected, which is newly recorded in the state of Pará.

Hylaeanth* *unilateralis (Poepp.& Endl.) A.M.E.Jonker & Jonker. Fig. 8 C.

Plants rosulate, 0.5–1.2 m. Rhizome soft, herbaceous 3-10 cm long, 0.4-0.7 cm wide. Stem glabrous. Cataphylls linear, green, membranaceous, 12-17 cm long, 0.4-0.8 cm wide, acute, glabrous. Leaf sheath oblong, green, chartaceous, 5-28 cm long, 0.9-1.4 cm wide, glabrous, margins prematurely decaying, leaving a network of persistent fibers; petiole absent or up to 1 cm long, glabrous; pulvinus inconspicuous, fusiform, green, 1-2 mm long, adaxially pilose; leaf blade narrowly to widely oblong-elliptic, chartaceous, green, 13- 42 cm long, 7-20 cm wide, nearly symmetrical, apex obtuse, glabrous, glabrous; pulvinus and blade as in the

basal leaves. Inflorescence a terminal synflorescence simple or with 2-6 florescences but provided with a single leaf much shorter than of the basal leaves, scape terete, glabrous, 20-29 cm long; florescence uniseriate, 5-8 cm long, 3-5 cm wide, peduncle 1-3 cm long. Bracts broadly ovate to suborbicular, green, 12-18 mm long, 10-14 mm wide, distichous, membranaceous, glabrous. Flowers green and yellow or purplish and yellow, pedicelate, pedicels 1-3 mm long, sepals oblong membranaceous, 5-7 mm long, 4-5 mm wide, apex obtuse; corolla tube 6-9 mm long; petals oblanceolate, membranaceous, 6-8 mm long, 2-3 mm wide. Staminodes yellow; outer staminode spatulate, yellow, 9-11 mm long, 6-6 mm wide, petaloid with rounded apex; the minor clavate, 7-10 mm long, 0.4-0.5 mm wide, with rounded apex; callose staminode rectangular, 5-6 mm long, 5-6 mm wide, with a rounded apex; cucullate staminode 5-6 mm long; fertile stamen 3-4 mm long, petaloid appendage 5-7 mm long, 3-4 mm wide. Style 5-10 mm long. Capsule not seen.

Distribution: Brazil (AC, AM), Bolivia, Colombia, Ecuador, French Guiana, Guyana, Suriname and Venezuela (Braga, 2013a; TROPICOS, 2013). This specie is now first recorded to the state of Pará.

Hylaeante unilateralis is easy to identify by its uniseriate florescences, with distichous, membranaceous, broadly ovate to suborbicular bracts.

This species was collected in Open Rain Forest and Tropical Rain Forest, on lower montane formation.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [416025, 9633218 UTM 22], 09.VI.2012 (fl.), L.C. Antônio 505 (MG); *ibid.*, coordinates [418617, 9639300 UTM 22], 29.IV.2013, J.S. Prado 1274 (MG); *ibid.*, coordinates [395158, 9632986 UTM 22], 30.IV.2013 (fl.), F.A. Raul 1153 (MG); *ibid.*, coordinates [395147, 9633027 UTM 22], 30.IV.2013 (fl.), F.A. Raul 1154 (MG); *ibid.*, coordinates [416339, 9647928 UTM 22], 01.V.2013 (fl.), F.A. Raul 1282 (MG).

Ischnosiphon Körn., Nouv. Mém. Soc. Imp. Naturalistes Moscou 11: 346.1859.

The genus is characterized by low and rosulate to tall and shrub-, tree- or liana-like herbs, inflorescences usually clustered into terminal synflorescences, but synflorescences grading into simple, lateral inflorescences, assymetric flowers, linear or sublinear sepals, corolla tube 10–30 times longer than wide, solitary outer staminode petaloid and showy (Andersson, 1977; Andersson, 1981b)

Ischnosiphon comprises 35 species distributed in Central and South America. Two species were recorded in the Volta Grande do Xingu.

Ischnosiphon gracilis (Rudge) Körn. Bull. Soc. Imp. Naturalistes Moscou 35(1): 94. 1862. Type: French Guiana, Martin, s.n. (holotype BM (photo!)). Fig. 8 D.

Plants bambusoid with mostly rather dense branch. Rizome stiff, woody, 8-20 cm long, 1-1.5 cm wide. Stem canoid, green, verruculose and pilose, 1-6 m long. Leaf sheaths lanceolate, green, 3.1-8.6 cm long, 2-2.8 cm wide. abaxially smooth and glabrous, when eventually disintegrating, not leaving a network of fibers; petiole 0.8-1.5 cm; pulvinus, fusiform, green, 0.3-0.5 cm long, adaxially hirtellous; leaf blade narrowly ovate, green, chartaceous, 12-20 cm long, 4.6-6.1 cm wide, acuminate at apex, rounded at base, adaxially and abaxially pilose on midrib and at apex; epidermis papilose. Inflorescence simple on leafy shoot; florescence with 6-9 spathes, 10.1-18.2 cm long; spathes, obovate, green, 18-24 mm long, 6-9 mm wide, hirtellous, scarious margins; florescence componente with 1-flowering cymule; first prophyll pilose on the carinae, 17-21 mm, intercarinal part 2-3 mm broad; bracteoles obovate, greenish-white, 16-22 mm long, pilose abaxially. Flowers asymmetric; sepals, lanceolate, 16-20 mm long, 6-3 mm wide, abaxially pilose; corolla tube 42-50 mm long, externally villous on distal half, 27-32 mm; lobes 12-19 cm long, 2-4 mm wide,

abaxially pilose. Staminodes whitish violet or yellow; outer staminode obovate, violet, 16-20 mm long, 7-11 mm wide; calose staminode, yellowish, 11-13 mm long, 2-4 mm wide; cucullate staminode, 7-11 mm long, the appendage 1.9-2.8 mm long. Style 7-11 mm long. Capsule not seen.

Distribution: Brazil (AC, AM, AP, PA, BA, MA, PE, MT, ES), Bolivia, French Guiana, Guyana, Peru, Suriname and Venezuela (Braga, 2013a; TROPICOS, 2013).

Ischnosiphon gracilis can be identified by the leaf sheath abaxially glabrous, pulvinus adaxially hirtellous, leaf blade adaxially and abaxially pilose on midrib and at the apex, and a simple inflorescence on leafy shoot. Its general habit resembles the one of *Ischnosiphon killipii* J.F. Macbr., but in *I. gracilis* the outer staminode is violet, while *I. killip* flowers are entirely yellow.

This species was collected in Open Rain Forest and Tropical Rain Forest, on lower montane formation, and secondary forest.

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [417538, 9642028 UTM 22], 29.IV.2013 (fl.), *J.S. Prado* 1279 (MG); *ibid.*, coordinates [393668, 9631257 UTM 22], 22.V.2013 (fl.), *R.B. Santos* 1358(MG).

Ischnosiphon obliquus (Rudge) Körn., Nouv. Mém. Soc. Imp. Naturalistes Moscou. 11: 341. 1859. Type: French Guiana, Martin, s.n. (holotype BM (photo!)). Fig. 8 E.

Plants aerial shoot system usually palm-like, sometimes branched distally with a number of distichous leaf aggregates at top of the same stem; growing together in large, dense thickets. Rhizome stiff, woody, 5-16 cm long, 1-2.5 cm wide. Stem canoid, smooth and glabrous to scabrous and pilose, 2- 4m long. Leaf sheaths narrowly oblong, green, chartaceous, 9-45 cm long, 4-7 cm wide, abaxially glabrescent to puberulous, when eventually disintegrating, not leaving a network of fibers; petiole green, 5.4-25 cm long,

glabrous; pulvinus, fusiform green, 0.8-5.1 cm long, puberulous adaxially; leaf blade ovate to elliptical, green, 13-41 cm long, 8.4-17.5 cm wide, strongly excentric, rounded at base, acuminate at apex, adaxially pilose on proximal parts of midrib and the extreme apex, abaxially glabrous, papillose and often with a whitish, waxy coating. Peduncle, green, 9-24 cm long, glabrous. Inflorescence a distinct 1-2-nodate synflorescence with 3-7 florescences; florescence 4.5-6.4 cm long, 0.6-1.2 cm wide, with 12-24 distichous spathes, more or less spreading at flowering; spathes obovates, green, chartaceous, 2.5-5.2 cm long, 2-3.5 cm wide, acute at apex, sparsely puberulous, with a white waxy coating; florescence component with 8-14 flowering cymules; first prophyll glabrous to glabrescent at apex and on carinae, 2.8-4.2 cm; second and subsequent prophylls 2-3carinate; bracteoles 2 per cymule, clavicate, 33-45 mm long, puberulous abaxially at the base,; clavicula 4-8 mm long. Flowers with reddish corolla lobes; sepals lanceolates, 19-21 mm long, 1-4 mm wide abaxially pilose on distal half; corolla tube 47-63 mm long, sparsely puberulous externally; lobes 16-25 mm long, 3-5 mm wide, abaxially pilose on distal half. Staminodes bright yellow; outer staminode obovate, yellow, 19-29 mm long, 8-14 mm wide; callose staminode distally petaloid, narrowly obovate, 17-28 mm long, 4-8 mm wide; cucullate staminode 8-16 mm; the appendage narrowly elliptical or oblong, 5-6 mm. Style 9-15 mm. Capsule not seen.

Distribution: Brazil (AC, AM, PA, RR, MA, GO), Caribbians, Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname and Venezuela (Braga, 2013a; TROPICOS, 2013).

Ischnosiphon obliquus is readily recognized by the broad excentric leaf blades, papillose on abaxial surface and by the stout florescences with markedly distichous spreading spathes. This species is close related to *Ischnosiphon arouma* (Aubl.) Körn., on which abaxial leaf surface is not papillose and flowers are pinkish-purple.

This species was collected in Open Rain Forest and Tropical Rain Forest, on alluvial formation.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [413512, 9634450 UTM 22], 25.IV.2013 (fl.), *J.S. Prado 1158* (MG); *ibid.*, coordinates [402295, 9623770 UTM 22], 08.V.2013 (fl.), *T.C.S. Silva 1365* (MG); *ibid.*, coordinates [393879, 9631028 UTM 22], 22.VI.2013, *R.B. Santos 1468* (MG); *ibid.*, coordinates [414009, 9652488 UTM 22], 23.VII.2013, *R.B. Santos 1652*(MG).

Additional specimens: BRAZIL. Pará: Altamira, basin of rio Xingu, gleba Bacajá, lote 88, genipapo trail, just bellow mouth of rio Bacajá, 28.XI.1980.(fl.), *D. Dalt & U. Maciel*. (US [NMNH-Botany_BR])

Ischnosiphon petiolatus (Rudge) L. Andersson, *Opera Bot.* 43: 43. 1977. Type: French Guiana, Martin, s.n. (holotype BM (photo!)). Fig. 8 F.

Plants palmoid, the elongate internode sometimes very short or the leaf cluster at the ground. Rhizome stiff, woody, 5-12 cm. Stem cannoïd, green, up to 1m, 1-2 cm wide, slightly scabrous and sparsely pilose. Leaf sheaths lanceolate, green, chartaceous, 15-24 cm long, abaxial inconspicuously verruculose and pilose, when eventually disintegrating, not leaving a network of fibers; petiole, green, 15-21 cm long; pulvinus, fusiform, green, 0.9-2.1 cm long, adaxially pilose; leaf blade narrowly subelliptical, green, chartaceous, 26-34 cm long, 8-12 cm wide, excentric, acute to acuminate at apex, apex displacement 0.7-1.2 cm, cuneate at base, on both sides pilose on midrib and apex. Peduncle green, 25-36 cm long. Inflorescence 1-3- nodate, each synflorescence 1-3-florescences; florescence 12-19 cm long, spiral spathes, imbricated; 27-33 cm; spathe acute, apically and marginally sparsely puberulous, often with a white waxy coating, 23-32 mm; florescence component with up to 3 flowering cymules; first prophyll pilose on the carinae, 24-28 mm; bracteoles acute, 2.5-3.4 mm long, 2 per cymule, abaxially puberulous. Flower purple; sepals lanceolates, 18-21 mm long, 1-3 mm wide, adaxially pilose; corolla tube 32-42 mm long, glabrous, lobes abaxially pilose. Staminodes

purple; outer staminode obovate, 16-18 mm long, 7-10 mm wide; callose staminode, narrowly obovate, petaloid, 15-19 mm long, 4-7 mm wide, longer than corolla lobes,; cucullate staminode, 5-10 mm. Staminal appendage oblong, 5-7 mm long. Style 5-8 mm. Capsule not seen.

Distribution: Brazil (AM, AP, PA), Guiana, Guyana, and Suriname (Braga, 2013a; TROPICOS, 2013).

Ischnosiphon petiolatus is very distinct and easily circumscribed by its leaf cluster at the ground (up to 1 m), leaf blade excentric and narrowly subelliptical, the midrib and apex pilose, and purple flowers. One of the closest relative species seem to be *I. martianus* Eichler ex Petersen, which is distinguished by the more crowded leaf cluster, narrow leaves, shorter synflorescence peduncle and hairy flowers.

This species was collected in Tropical Rain Forest, on lower montane formation.

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [392840, 9647881 UTM 22], 02.V.2013 (fl.), *F.A. Raul 1290* (MG).

Monotagma K. Schum. in Engl., Pflanzenr. IV. 48(Heft 11): 166. 1902.

The genus is characterized by rosulate herbs, usually a richly branched terminal synflorescence, sometimes congested, assymetric flowers, membranaceous sepals, with obtuse to truncate apex, corolla tube long and narrow, outer staminode solitary, petaloid and showy but sometimes rudimentary or absent. (Andersson, 1981b; Hagberg, 1990).

This genus comprises 37 species distributed in Central and South America. In Brazil, 10 species were recorded, of which two occurs in the Volta Grande do Xingu.

Monotagma plurispicatum (Körn.) K.Schum. Pflanzenr. IV. 48(Heft 11): 169. 1902.

Type: Brazil, Riedel 517 (type K (photo!)). Fig. 8 G.

Plants caespitose, 0.8-1.7 m long. Rhizomes stiff, woody, supported by “stilt” roots, Leaf sheaths lanceolate, brown, chartaceous, 28-56 cm long, appressed-hirsute, the sheath margins tapering to petiole, when eventually disintegrating, not leaving a network of fibers; petiole green, 36-65 cm long, laterally flattened, with an adaxial groove, puberulent; pulvinus fusiform, brownish, 3.4-4.2 cm long, laterally flattened, a prominent hirtellous annulus present at transition to petiole; blade elliptic, green, coriaceous, 29-53.2 cm long, 9.4-20 cm wide, apex acuminate, base obovate, puberulous on abaxial face and along midrib and ciliate on margins of adaxial face. Peduncle terete, 10-24 cm long. Inflorescence 1-2-nodate with 4-16 florescences, laxa, each node with a elliptic bladeless sheath with acute apice, lowermost 1.2-2.6 cm long, first internode 4-10 cm long, glabrescent; florescences 4.2-18.5 cm long, bending, with 3-21 bracts, first internode 4-6 mm long, peduncle 12-15 mm long; lowermost bract 9-14 mm long, 4-6 mm wide, coriaceous, puberulent throughout; bracteole 7-12 mm long, puberulent, ecarinate. Flowers 3-5 per bract; pedicel 1-3 mm long; sepals 12-14 mm long, 2-4 mm wide, brownish; corolla tube 16-21 mm long, 1-2 mm wide, brownish, glabrous, lobes 3-4 mm long, 2-3 mm wide, brownish; outer staminode 5-7 mm long, 2-4 mm wide, obovate, whitish, apex entire; stamen 3-4 mm long, appendage tapering to base of theca, theca 1-2 mm long; inner staminodes whitish to brownish; callose staminode 3-4 mm long, 3-4 mm wide, fleshy throughout, with a shelf-shaped callus at 2-3 mm from apex; cucullate staminode 4-5 mm long, appendage 1-2 mm long; style 2-5 mm long. Capsule not seen.

Distribution: Brazil (AC, AM, AP, PA, RR, BA, MA, PE, MT), French Guiana, Guyana, Peru and Venezuela (Braga, 2013a; TROPICOS, 2013).

Monotagma plurispicatum is distinguished by its elliptic and coriaceous blade, midrib surface abaxially puberulous, and leaf margins adaxially ciliate, besides 1-2-nodate synflorescence with 4-16 florescences. *Monotagma laxum* (Poepp. & Endl.) Schum. is a close

relative, differing by glabrous blade except on the puberulous apex, and much longer and pendent synflorescences.

This species was collected in Open Rain Forest, on lower montane formation, and secondary forest.

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [417538, 9642028 UTM 22], 29.IV.2013 (fl.), *J.S. Prado 1271* (MG); *ibid.*, coordinates [411158, 9653582 UTM 22], 11.V.2013 (fl.), *F.A. Raul 1362* (MG); *ibid.*, coordinates [411317, 9648968 UTM 22], 02.X.2013, *E.A.Menezes-Júnior s/nº.* (MG); *ibid.*, coordinates [411178, 9653579 UTM 22], 03.V.2013, *F.A. Raul 1401*(MG); *ibid.*, coordinates [411545, 9656410 UTM 22], 02.VII.2013, *T.C.S. Silva 1516*(MG); *ibid.*, coordinates [392939, 9647712 UTM 22], 02.V.2013, *F.A. Raul 1196*(MG); *ibid.*, [417538, 9642028 UTM 22], 29.IV.2013 (fl.), *J.S. Prado 1155* (MG).

Monotagma spicatum (Aubl.) J.F.Macbr. Publ. Field Mus. Nat. Hist., Bot. Ser. 11(1): 14. 1931. Type: French Guiana, Aublet, F. s.n. (type BM (photo!)). Fig. 8 H.

Plants caespitose, 0.4-1.5 m long. Rhizomes stiff, woody, supported by “stilt” roots. Leaf sheaths lanceolate, green, chartaceous, 25-36 cm long, appressed-hirsute, margins tapering to petiole, when eventually disintegrating, not leaving a network of fibers; petiole green, 22-35 cm long, laterally flattened, with an adaxial groove, puberulent; pulvinus fusiform, green, 2.4-3.6 cm long, laterally flattened, puberulent, a prominent hirtellous annulus present at transition to petiole; blade narrowly ovate to elliptic, chartaceous to coriaceous, 31-47 cm long, 7-12 cm wide, base cuneate, apex acuminate, hirtellous along midrib. Peduncle terete, 4-10 cm long. Inflorescence 2-5-nodate with 7-15 florescences, each node with a bladeless sheath, lanceolate, lowermost 4.2-5.6 cm long, first internode 4.0-4.7 cm long, peduncle 6-9 cm long, hirtellous; florescences 2.2-9.5 cm long, with 9-19

unilaterally arranged bracts, first internode 4-8 mm long, peduncle 5-9 mm long; lowermost bract 24-28 mm long, 4-6 mm long, subcoriaceous, puberulent throughout; bracteole 14-18 mm long, puberulent, ecarinate. Flowers 4-6 per bract; pedicel 2-4 mm long; sepals 12-17 mm long, 2-4 mm, white; corolla tube 21-25 mm long, 1-2 mm wide, whitish, outside glabrous, inside hirsute, lobes 4-6 mm long, 2-3 mm wide, whitish; outer staminode 5-7 mm long, 2-3 mm wide, narrowly obovate, purplish, apex entire; stamen 4-5 mm long, appendage tapering to base of theca, theca 1-2 mm long; inner staminodes whitish to purplish; callose staminode 4-5 mm long, 3-5 mm wide, fleshy throughout, with a shelf-shaped callus at 2-3 mm from apex; cucullate staminode 4-5 mm long, appendage 1-2 mm long; style 5 mm long. Capsule not seen.

Distribution: Brazil (AM, PA, RO, MA), French Guiana, Guyana, Peru and Venezuela (Braga, 2013a; TROPICOS, 2013).

Monotagma spicatum is easily distinguished by its narrowly ovate to elliptic blade, hirtellous only along both surfaces of the midrib, and densely congested inflorescence. This species is morphologically similar to *M. grallatum* Hagberg & R. Erikss., from which it differs by having shorter florescence internodes, and shorter corolla tubes.

This species was collected in Tropical Rain Forest, on alluvial formation.

Specimen examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, Coordinates [392099, 9647753 UTM 22], 01.05.2013 (fl.), *F.A. Raul* 1293 (MG).

Thalia L., Sp. Pl. 1193. 1753.

The genus is characterized by rosulate aquatic plants usually with a tall and branched synflorescence small and spike-like in active portion, assymetric flowers, very small sepals and corolla tube, and outer staminode solitary, petaloid and showy (Andersson, 1981b; Andersson, *et al.*, 2001).

The genus comprises seven species, of which 4 occurs in Brazil. In the Volta Grande do Xingu, only one species was registered.

***Thalia geniculata* L., Sp. Pl. 2: 1193. 1753. Fig. 8 I.**

Plants musoid, 1-2 m long. Rhizome 3-7 cm long, 1-1,7 cm wide. Leaf sheaths bladeless; leaf blades oblong-ovate, glabrous, 19-43 cm long, 15-26 cm wide, pulvinus 0.5-2.4 cm. Peduncle 0.5-2.5 m tall. Inflorescence a much branched, lax, panicle-like synflorescence with spreading to pendent branches; florescences before flowering compact and spiciform with overlapping spathes; spathes caducous, glabrous to densely hirsute or villous, 10-34 mm; rachis flexuose with very conspicuous scars, glabrous to rather densely villous or hirsute, rachis internodes 5-17 mm, subsequent ones gradually shorter; bracts green, narrowly ovate, 1.5-2.4 cm, herbaceous, sparsely to densely puberulous. Flower purple; sepals greenish with a broad scarious margin, glabrous to densely setose, 1-2 mm long; petals glabrous, 6-13 mm; outer staminode petaloid and showy, purple, 15-20 mm long, 5-10 mm wide; callose staminode largely firm and fleshy but with a narrow, reflexed petaloid rim. Capsule not seen.

Distribution: Brazil (AC, AM, AP, PA, BA, CE, MA, DF, GO, MS, MT, ES, MG, RJ, SP, PR), Argentina, Belize, Bolivia, Caribbean, Colombia, Costa rica, Ecuador, El Salvador, French Guiana, Guatemala, Guyana, Honduras, Mexico and also African continent (Braga, 2013a; TROPICOS, 2013).

Thalia geniculata complex includes *Thalia geniculata* s.s, *T. trichocalyx* Gagnep., and the African species *T. welwitschii* Ridl., and although the distinctive features of those species are clearly stated in the literature, herbarium plants are notoriously difficult to identify according to Andersson (1981c).

Thalia geniculata is identified by it branched, lax, panicle-like synflorescence with spreading to pendent branches with purple flowers.

This species was collected in Tropical Rain Forest, on alluvial formation having aquatic habit.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [395608, 9633820 UTM 22], 29.05.2013 (fl.), *T.C.S.Silva 1371* (MG).

Strelitziaceae Hutch., Fam. Fl. Pl., Monocot. 2: 72. 1934.

The family is characterized by arborescent suckering plants or acaulescent plants with dichotomously branched stem, with alternate leaves distichously arranged, terminal or lateral thyrsoid inflorescence, bearing cincinnate flower clusters in axils of spatheaceous bracts on an indeterminate main axis, trimerous and 5-cyclic flowers subtended by carinate bracteoles, 5 or 6 stamens and no staminodes present. (Andersson, 1998c)

In Brazil the family has one species restricted to the Amazon. In Volta grande do Xingu this species was found. (Fig. 3).

Phenakospermum Endl.

Phenakospermum guyannense (Rich.) Endl. Fig. 5 I.

Plant palm-like, 3-10m long. Leaf sheaths amplexicaulis; petiole green to whitish-green, 0.4-1.9 cm long, 2-3 cm in diameter; leaf blades oblong, distichous with blades lying in a single plane, deciduous, adaxially green, abaxially whitish-green, 1-3 m long, 50-70 cm wide, central midrib and lateral venation present, base usually cordate, apex obtuse, glabrous. Peduncle whitish-green, 1-2 m long, 7-20 cm in diameter. Inflorescence terminal on leafy shoot, erect; rachis 1-2.5m, 10-20 cm wide, internodes 6-20 cm long; bracts boat shaped, distichous, 3-10 per inflorescence, green to yellowish-green with a waxy coating, 20-40 cm long, 20-30 cm wide, each bract subtending a cincinnus of up to 25 flowers, bracteoles triangular, persistent, becoming papery at fruit maturity, opaque, cream-colored, 17-30 cm

long, 6-8.5 cm wide, apex acuminate, covered with mucilaginous secretions. Flowers brownish-white; pedicel brownish, 1 cm long; perianth ca. 28 cm long, consisting of two whorls united at the base into a prolonged, solid tube above the ovary, tube bicarinate, white, 10 cm long, 2 cm wide; calyx creamy white, with one free abaxial sepal, 15 cm long, 3 cm wide, and two free, slightly imbricate, adaxial sepals, 18 cm long, 3 cm wide; corolla creamy white with thin dark green margins, with two connate abaxial petals, overlapping but free at base, fused from the middle to the apex, 15 cm long, 3 cm wide, margins becoming revolute, and one free adaxial petal, 12 cm long, 3 cm wide. Stamens five, abaxial stamen of inner whorl absent, filaments long, linear, geniculate, basally attached to the apex of the perianth tube and distally to apex of fused sepals, 8 cm long, 0.5 cm wide, anthers tetra-loculate, linear, dehiscence longitudinal, 7 cm long. Ovary inferous, bicarinate, white, 3.5 cm long, 2 cm wide, three-celled, placentation axial, the ovules numerous in 4 rows per locule. Style filiform, erect, lax, 5 cm long. Stigma conical, 1.5 cm long, 0.5 cm wide. Capsule loculicidal, woody, 15 cm long, 8 cm wid. Seeds arillate, aril composed of bright red orange threads, 8-10 mm long, 6-8 mm wide.

Distribution: Brazil (AC, AM, PA, TO, MT) (Sobral, 2013b), Bolivia, Ecuador, French Guiana, Guyana, Suriname and Venezuela (TROPICOS, 2013).

Phenakospermum guyannense can hardly be confused with other species of *Zingiberales* in the study area because of its arborescent habit, palm-like pseudostem, large distichous leaves with blades lying in a single plane, and terminal, erect inflorescence developing above the leaves.

This species was collected in Open Rain Forest, on alluvial and lower montane formations, and secondary forest.

Specimen examined: BRASIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [393817, 9630005 UTM 22], 02.V.2013 (fl.), *E.Takanohashi* 1330 (MG).

Zingiberaceae Martinov., Tekhno-Bot. Slovar. 682. 1820

This family is characterized by perennial, aromatic herbs, sympodially branched rhizome, distichous leaves, terminal inflorescence on the leafy shoot or on short separate leafless shoot, zygomorphic flowers, 3-lobes tubular calix and corolla 3-lobes, and the 2 stamens of the inner whorl sterile and connate to form the petaloid labellum. (Larson *et al.*, 1998).

In Brazil, the family is represented by *Renealmia* with 21 species (Maas & Maas, 2013b), of which two were collected in the Volta Grande do Xingu (Fig. 5).

Renealmia L. f., Suppl. Pl. 7. 1781[1782].

This genus is characterized by unbranched, aromatic, perennial herbs with sympodial, subterranean rhizomes with distichous leaves, inflorescence a thyse, raceme or very rarely a spike, terminating a separate leafless, sometimes terminal on a leafy shoot, tubular calyx and corolla, basal part of labellum with two very small lateral staminodes; apical part composed of two rounded lateral lobes and a middle lobe with an entire to two-lobed apex (Maas, 1977).

Key to the taxa of Zingiberaceae recorded in the Volta Grande do Xingu:

1. Inflorescence a basal raceme, cincinni 1-flowered, erect*Renealmia alpinia*
2. Inflorescence a basal thyrse, cincinni many-flowered, prostrate*Renealmia guianensis*

Renealmia alpinia (Rottb.) Maas, Act. Bot. Neerl. 24 (5-6): 474. 1975 [1976]. Fig. 4

H. Type: Suriname, Rollander, D. s.n. (holotype SBT (photo!))

Plant zingiberoid, 1.5-3 m tall. Rhizomes 10-38 mm thick. Leaf sheaths smooth, 8.5-20 mm wide, up to 50 mm at the base of the plant, glabrous; ligule 1-2 mm long, glabrous; petiole 20-35 mm long, glabrous; leaf blades narrowly elliptic, acuminate at the apex, cuneate at the base, 28-74 cm long, 8.5-18 cm wide, upper and lower side glabrous. Peduncle erect, reddish, 37-60 cm tall, 1-1.5 cm thick, beset with sheaths 2-11 cm long, 1-3.0 cm wide. Inflorescence a basal raceme, 14-30 cm long, 3-5 cm wide, with 1-flowered cincinni; indument of inflorescence: rachis, peduncles, bracteoles, pedicels, calyx, ovary, and young capsule densely covered with erect, simple hairs, sheaths, bracts, and mature capsule less densely so; corolla glabrous; bracts pink to red, membranaceous, soon withering and then becoming brown, narrowly ovate-triangular, 20-80 mm long, 5-10 mm wide; bracteoles pink to red, 15-25 mm long; pedicels pink to red, 4-8 mm long. Flowers redish; sepals pink to red, tubular, membranaceous, soon circumscissile to just above the base, 15-20 mm long, 5-8 mm wide. petals orange or red, 27-30 mm long, the tube 15-18 mm long, the lobes 13-15 mm long, 8-10 mm wide; labellum pinkish-orange, 10-12 mm long and 6-10 mm wide when spread out, basal part opposite the anther densely covered with simple (and stalked, furcate) hairs (up to 0.5 mm long), limb erect, 5-6 mm long, 6-8 mm wide, lateral lobes involute, rounded, 3-4 mm long, 2-3 mm wide, middle lobe entire and rounded, basal claw 5-6 mm long, 3-5 mm wide, lateral staminodes ca 2 mm long. Anther 8-10 mm long, 3-4 mm wide, its back, sides, and the groove between the thecae with the same indument as the labellum. Style 18-23 mm long. Nectarial glands multilobulate, completely surrounding the style base, 1.5-2 mm long. Ovary ellipsoid, red. Capsule red, maturing black-purple, ellipsoid, crowned by the circumscissile calyx, 14-19 mm long, 7-11 mm wide, aril orange.

Distribution: Brazil (AM, PA, RO, RR, BA, CE, DF, GO, MG, ES, MG) (Maas & Maas, 2013b), Belize, Bolivia, Caribbean, Colombia, Costa Rica, Ecuador, French Guiana,

Guatemala, Guyana, Honduras, Mexico, Nicaragua, Panama, Peru, Suriname and Venezuela (TROPICOS, 2013).

Renealmia alpinia can hardly be confused with any other species of the genus. The main diagnostic character are the stout plant, with membranaceous calyx circumscissile a few milimeters above the base. It recembles *R. thyrsoides* (Ruiz & Pav.) Poepp. & Endl. which is a broadly circuncribed species, with calyx not circumscissile.

This species was collected in Open Rain Forest and Tropical Rain Forest, on alluvial and lower montane formations, and secondary forest.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [417538, 9642028 UTM 22], 29.IV.2013 (fl,fr.), J.S. Prado (*Biota*) 1206 (MG); *ibid.*, coordinates [404390, 9635967 UTM 22], 18.IX.2013 (fl.), R.A.S. Fonseca (*Biota*) s/nº. (MG) ; *ibid.*, coordinates [402655, 9622560 UTM 22] 13.I.2012 (fr.), E. Takanohashi (*Biota*) s/nº. (MG).

Renealmia guianensis Maas, Acta Bot. Neerl. 24: 477. 1976. Type: French Guiana, Richard, L.C. s.n. (holotype P (photo!)). Fig. 4 I.

Plants zingiberoid, 1.2-2.5 m tall. Rhizomes 10-13 mm thick. Leaf sheaths reticulate, often greenish-brown when dry, 3-7 mm wide to 10 mm at the base of the plant, densely covered with simple or furcate prickles and mainly towards the reticulations with black needle-like hairs; ligule 2-3 mm long, densely covered with simple, needle-like hairs; petiole 13-40 mm long, hairy like the sheaths but less densely so; leaf blade narrowly elliptic, acuminate at the apex, cuneate at the base, 20-35 cm long, 2.5-5.6 cm wide, upper side glabrous, lower side sparsely covered with simple hairs (up to 0.5 mm long) particularly along the midrib. Peduncle prostrate, 29-40 cm long, up to 3-6 mm thick, beset with purplish-red, deciduous sheaths up to 6-10 cm long and 0.5-1 cm wide. Inflorescence a basal thyrses 40-51

cm long and 2-7 cm wide, with 1-4 flowered cincinni; indument of inflorescence: sheaths, rhachis bracts, peduncles, bracteoles, pedicels, calyx, and ovary sparsely to densely covered with simple and furcate hairs, capsule glabrescent; corolla glabrous; bracts dark red to purple-red, membranaceous, very soon deciduous, narrowly triangular-ovate, 25-50 mm long, 5-10 mm wide; bracteoles 12-18 mm long; pedicels 5-26 mm long. Sepals pinkish-red, tubular, 5-8 mm long, 2-4 mm wide; petals yellow, 10-13 mm long, the tube 5 mm long, the lobes 6-8 mm long, 4-6 mm wide; labellum yellow, 11 mm long and 10-12 mm wide when spread out, basal part opposite stamen with simple hairs, the limb horizontally spreading, 8-10 mm long, 10-12 mm wide, lateral lobes rounded, 8-10 mm long, 4-5 mm wide, middle lobe with two lobules 2-3 mm long and wide, basal claw 3 mm long, 2-3 mm wide, lateral staminodes 1 mm long. Anther red, 4-5 mm long, 2 mm wide, glabrous. Style 9-10 mm long. Nectarial glands only partly surrounding the style base, 1-2 mm long. Capsule red, brownish when dry, ellipsoid to globose, 6-10 mm wide, 7-14 mm long, its wall 0.1-0.2 mm thick when dry, aril orange to yellow.

Distribution: Brazil (AM, AP, PA, BA, PE), French Guiana, Guyana, Suriname and Venezuela (Maas & Maas, 2013b; TROPICOS, 2013).

Renealmia guianensis is closely related to *R. floribunda* K.Schum., sharing with it the leaf size, reticulate leaf sheaths, and most of the floral characters, but *R. guianensis* can be distinguished by the deciduous calyx during fructification. *Renealmia floribunda* fruit is crowned with a persistent calyx.

This species was collected in Tropical Rain Forest, on alluvial formation.

Specimens examined: BRAZIL. Pará: Altamira, rio Xingu, Volta Grande do Xingu, coordinates [394455, 9630005 UTM 22], 02.V.2013 (fl., fr.), *E. Takanohashi* 1205 (MG).

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FIGURAS

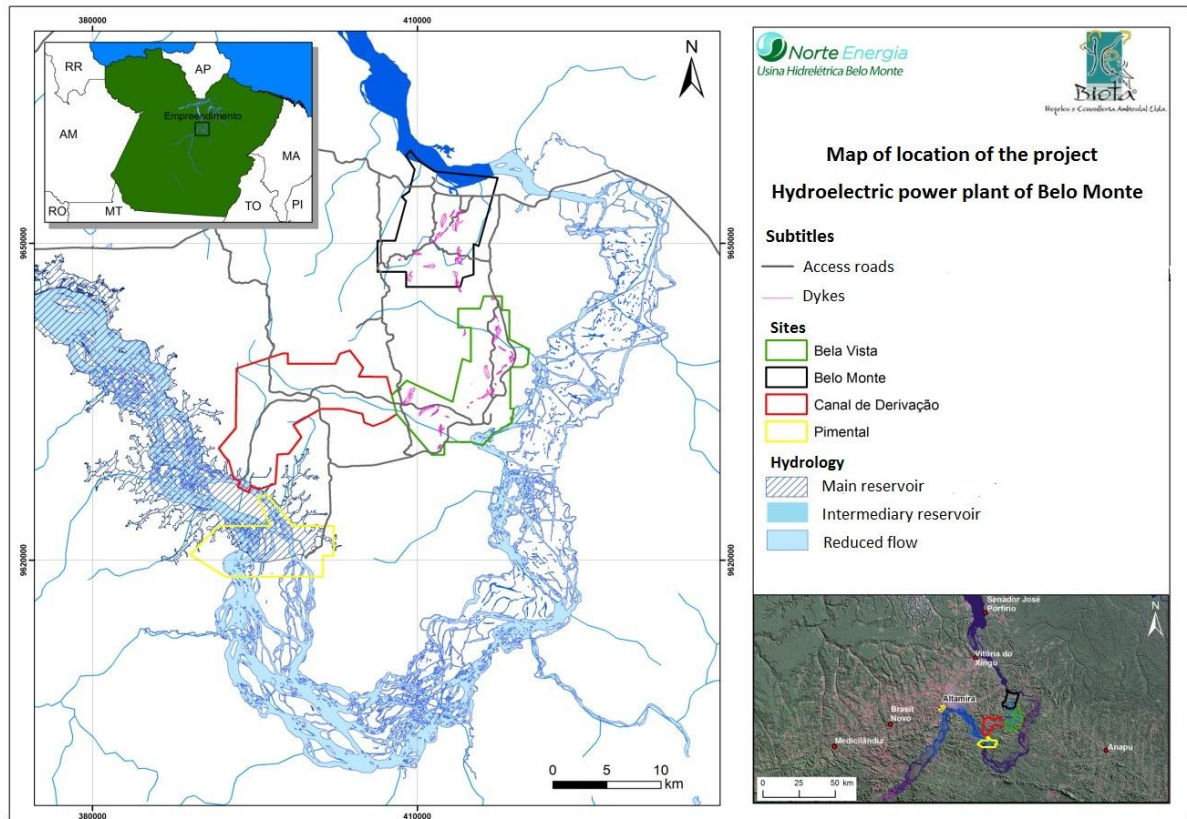


Fig. 1. Study area in the Volta Grande do Xingu with the delimitation of the collections sites.

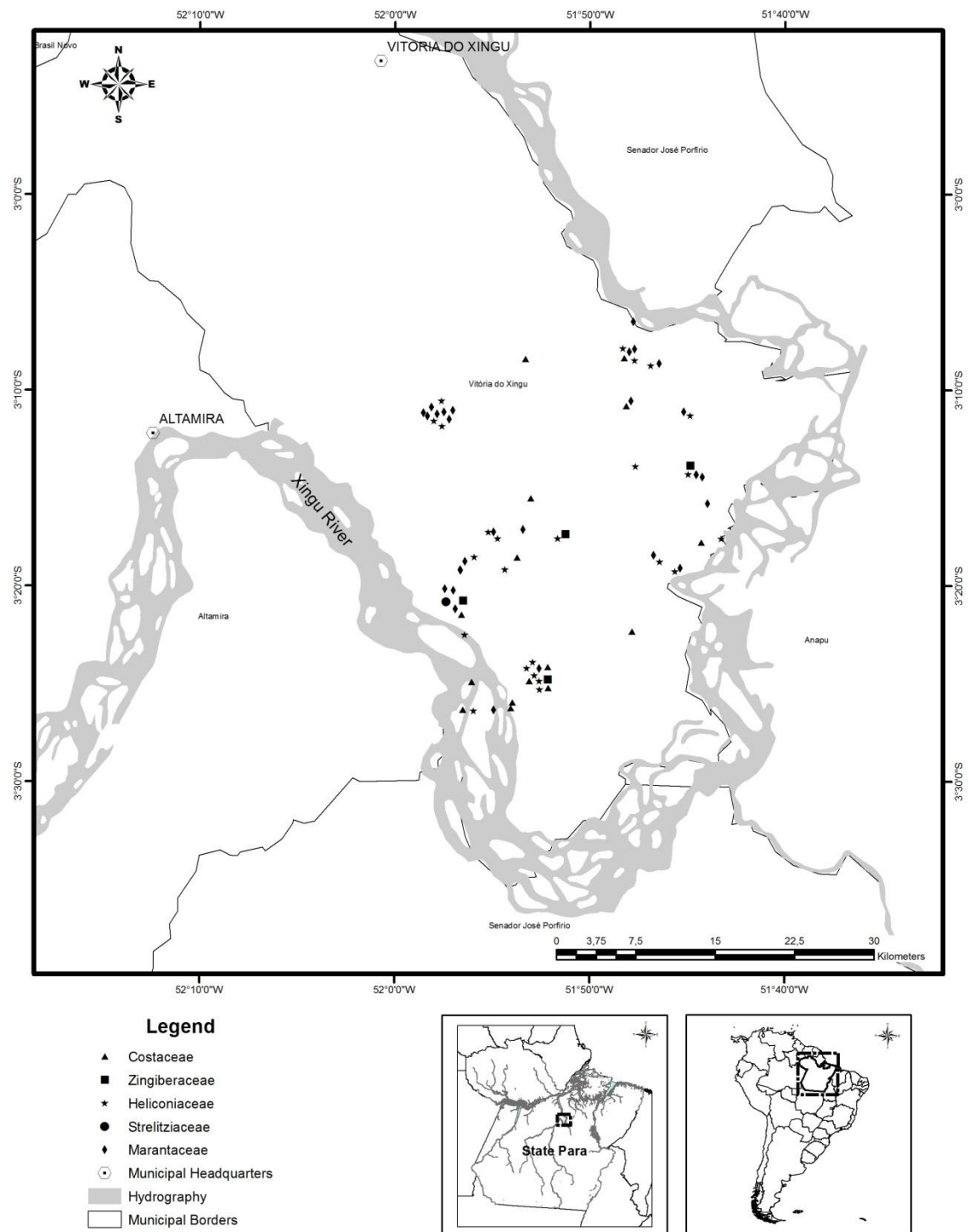


Fig. 2 - Distribution of the collected families in the Volta Grande do Xingu.

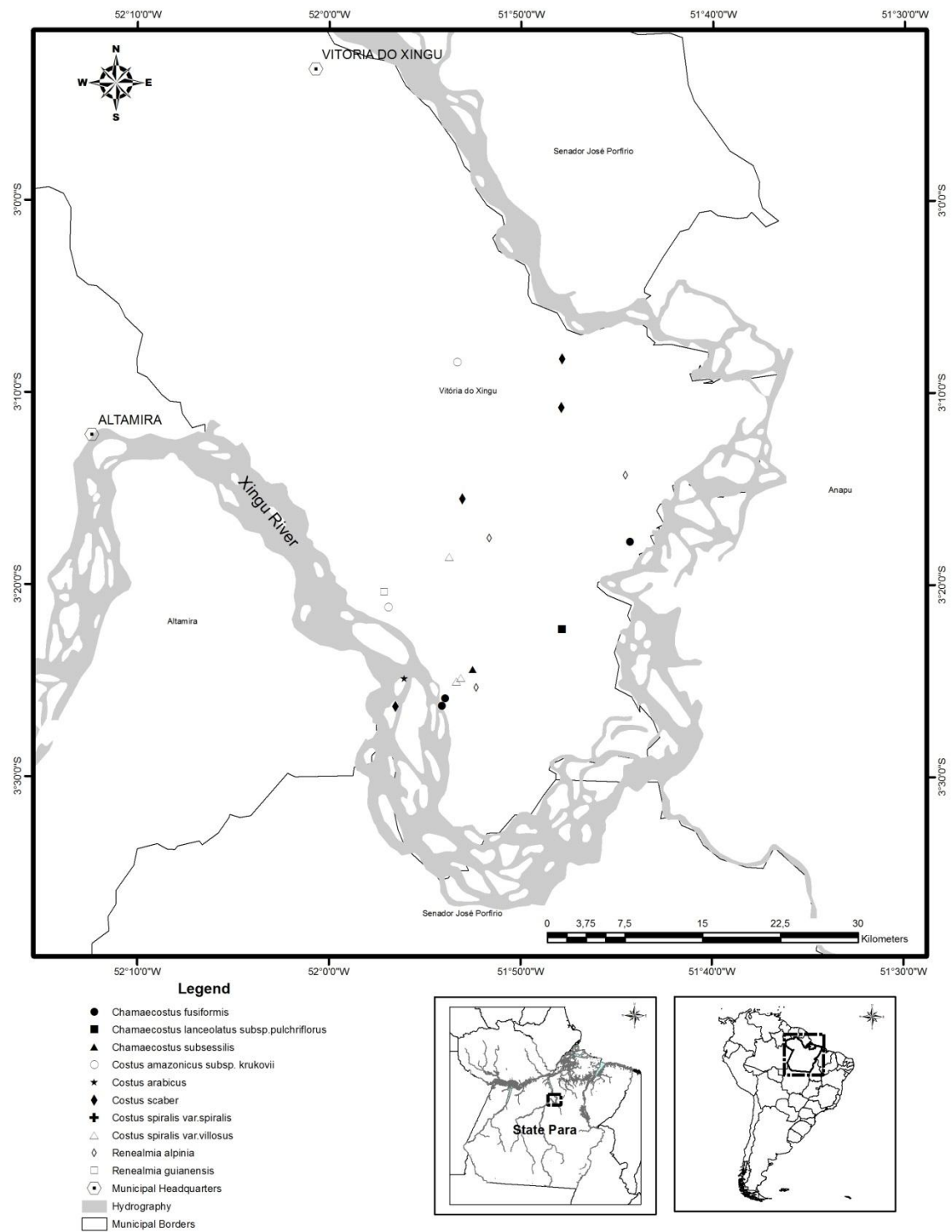


Fig. 3 - Distribution of *Costaceae* and *Zingiberaceae* collected species in the Volta Grande do Xingu.



Fig. 4 - A. *Chamaecostus fusiformis*, B. *Chamaecostus lanceolatus* subsp. *pulchriflorus*, C. *Chamaecostus subsessilis*, D. *Costus amazonicus* subsp. *krukovii*, E. *Costus arabicus*, F. *Costus scaber*, G. *Costus spiralis*, H. *Renealmia alpinia*, I. *Renealmia guianensis*

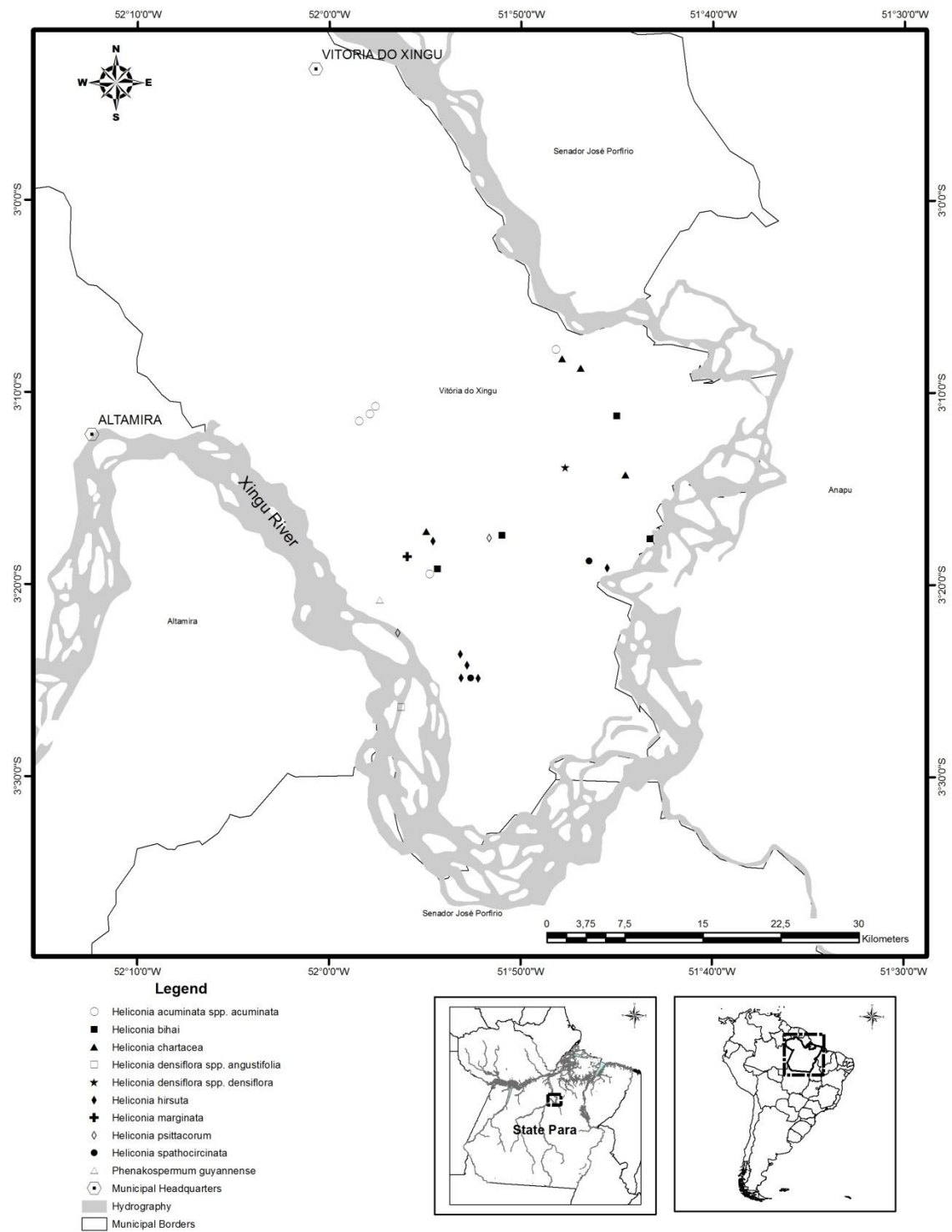


Fig. 5 - Distribution of *Heliconiaceae* and *Strelitziaceae* collected species in the Volta Grande do Xingu.



Fig. 6 - A. *Heliconia acuminata*, B. *Heliconia bihai*, C. *Heliconia chartacea*, D. *Heliconia densiflora* subsp. *angustifolia*, E. *Heliconia hirsuta*, F. *Heliconia marginata*, G. *Heliconia psittacorum*, H. *Heliconia spathocircinata*, I. *Phenakospermum guyannense*.

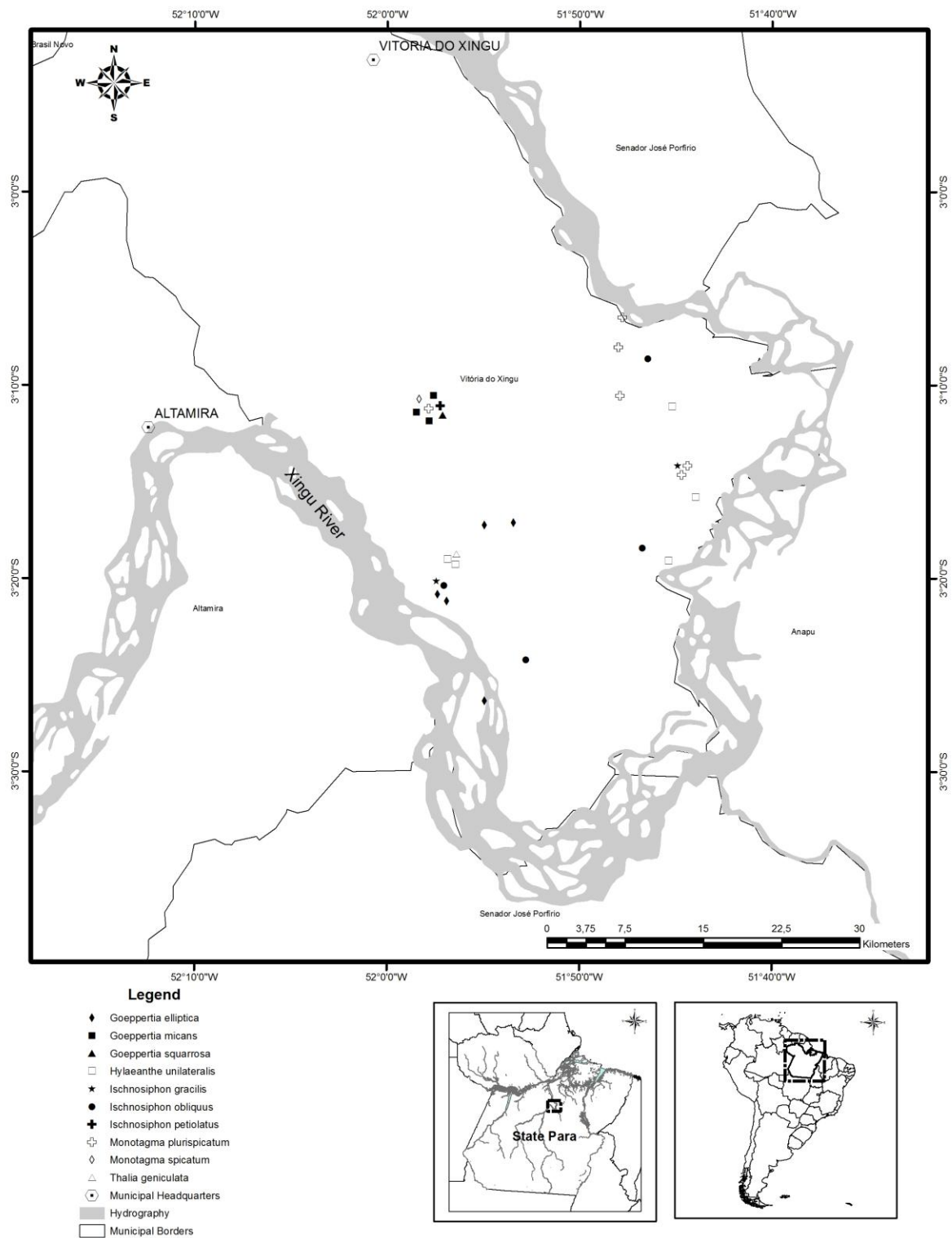


Fig. 7 - Distribution of *Marantaceae* collected species in the Volta Grande do Xingu.

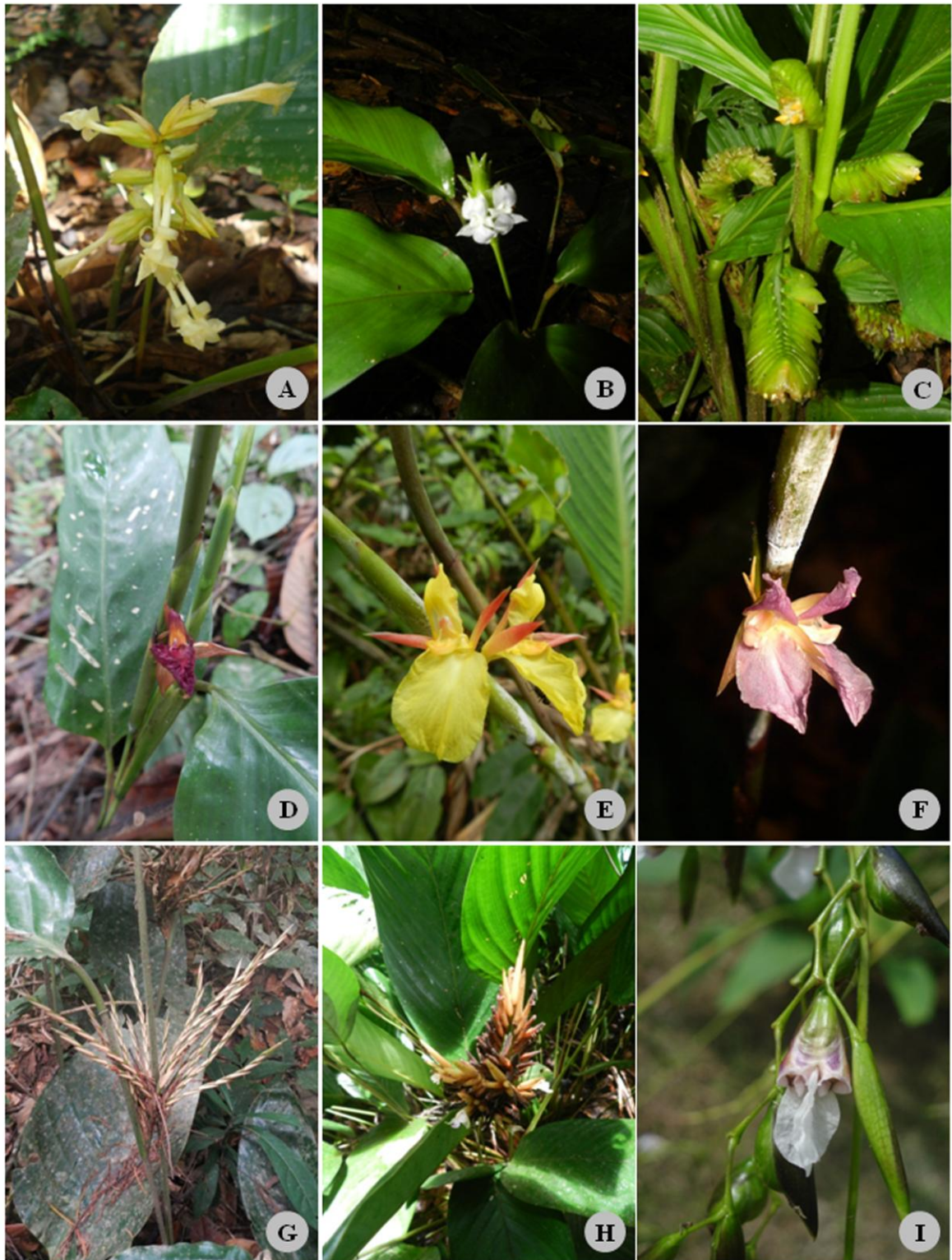


Fig. 8 - A. *Goeppertia elliptica*, B. *Goeppertia micans*, C. *Hylaeanthus unilateralis*, D. *Ischnosiphon gracilis*, E. *Ischnosiphon obliquus*, F. *Ischnosiphon petiolatus*, G. *Monotagma plurispicatum*, H. *Monotagma spicatum*, I. *Thalia geniculata*.

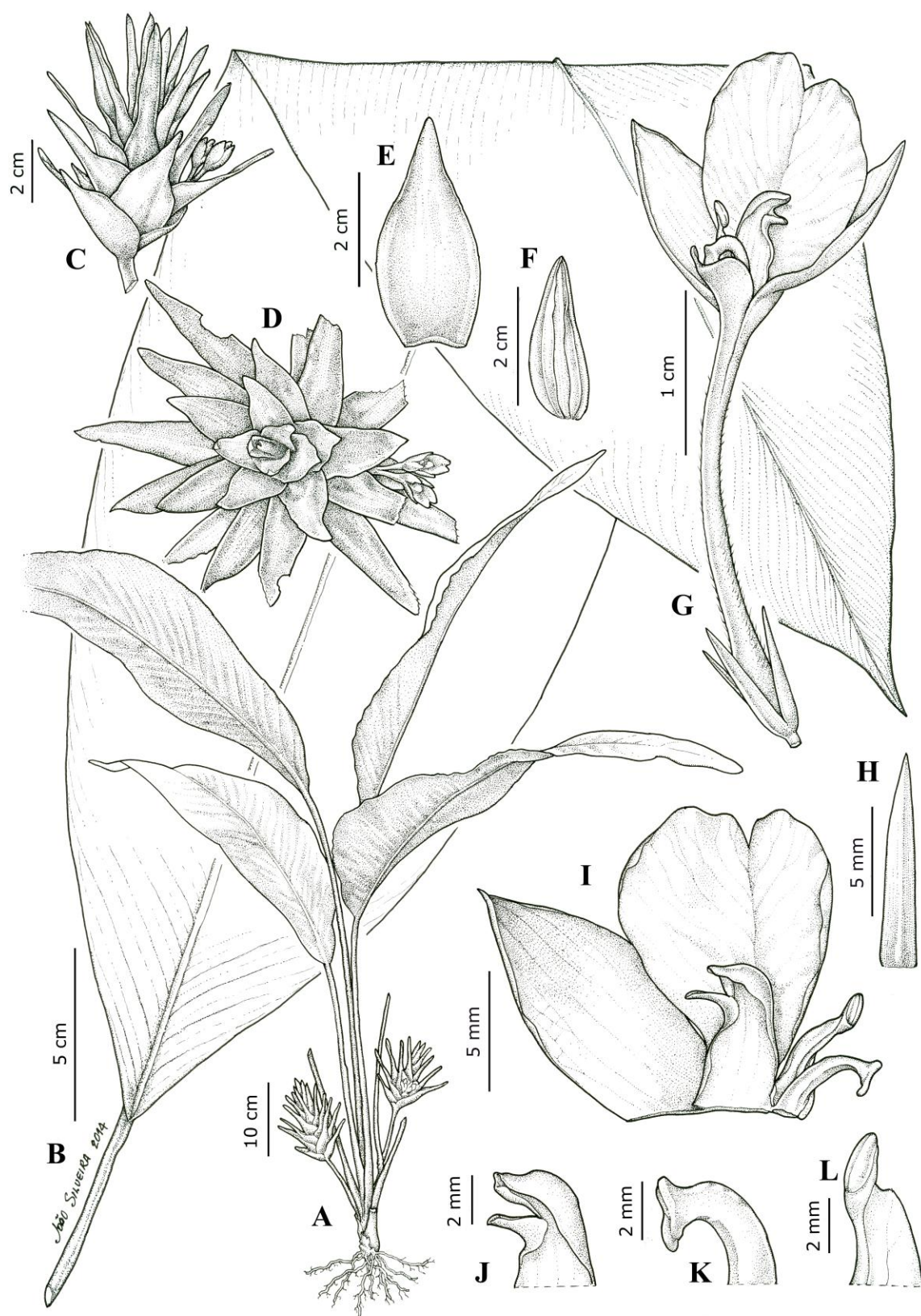


Fig. 9 – *Goeppertia squarrosa*. A habit; B leaf; C inflorescence side view; D inflorescence upper view; E bract; F bicarinate prophyll; G flower; H sepal; I stamen and outer, callose, cucullate staminodes; J stamen; K curved style and stigma; L petaloid filament and anther. All from , F.A. Raul 1292 (MG). DRAWN BY João Barros da Silveira.

ANEXO

Guidelines for manuscripts submission Iheringia, Série Botânica.

Iheringia, Série Botânica, journal edited by the Museu de Ciências Naturais, Fundação Zoobotânica do Rio Grande do Sul, publishes twice a year research articles, reviews and original scientific notes on issues related to different areas of Botany. The manuscripts should be written in Portuguese, Spanish or English, the later has priority of publication. When accepted, they will be evaluated by at least two reviewers and editorial staff.

After the printing all articles will be available in digital format (pdf) on the following web address: www.fzb.rs.gov.br/publicacoes/iheringia-botanica and on the CAPES website. The journal is indexed in Web of Science – ISI.

One printed and one CD-RW copy should be sent to Editor-in- chief, at the address: Museu de Ciências Naturais, Fundação Zoobotânica do RS, Rua Salvador França, 1427, CEP 9060-000, Porto Alegre, RS.

The manuscript should be formatted in Times New Roman, size 12, double- spaced, with numbered pages. The manuscript format (Title, Abstract in Portuguese and English, Introduction, Material and Methods, Results and/or Discussion, Conclusions, Acknowledgments and References) must comply with the format of the latest articles published on the Journal found on the website. Scientific notes (not exceeding six pages), should be communications of original results and do not have to necessarily present all topics of an article.

The authors names must be followed only by the professional address and e-mail. Reference to the article as part of an academic Thesis or Dissertation is indicated by a superscript number, below the title of the manuscript.

The Summary and Abstract, not exceeding 150 words, should contain the same information. No more than five key words, separated by comma are allowed, and they should not be the same words that appear in the title.

Taxonomic names of any category are written in italics. The generic and specific names, when cited for the first time in the text should be followed by their authors. The journals, books and authors abbreviations must be according to The International Plant Names Index (<http://www.ipni.org/index.html>), The Taxonomic Literature (TL-2), Word List of Scientific Periodicals or Journal Title Abbreviations (<http://library.caltech.edu/reference/abbreviations>).

In taxonomic manuscripts, identification Keys should preferably be indented and the authors of the taxa should not be cited. In the text the taxa are to be present in alphabetical order and cited as follows (basonym and synonym are not obligatory).

Bouteloua megapotamica (Spreng.) Kuntze, Revis. Gen., Pl. 3 (3): 341. 1898. *Pappophorum megapotamicum* Spreng., Syst. Veg. 4: 34. 1827. *Eutriana multisetata* Nees, Fl. Bras., 2(1): 413. 1829. *Pappophorum eutrianoides* Trin. ex Nees, Fl. Bras. Enum., Pl. 2(1): 414. 1829. *Bouteloua multisetata* Griseb., Abh. Königl. Ges. Wiss. Göttingen, 24: 303. 1879. (Figs. 31-33)

The material examined may be presented as a table or cited in the following sequence: country, state, city, specific place listed in alphabetical order, then date, collector's name and number and Herbarium's acronym or the Herbarium's registration number when the collectors' number does not exist, according to the following examples.

Examined material: ARGENTINA, MISIONES, Depto. Capital, Posadas, 11.I.1907, C. Spegazzini s/nº (BAB 18962). BRASIL, ACRE, Cruzeiro do Sul, 24.V.1978, S. Winkler 698 (HAS); RIO GRANDE DO SUL, Santa Maria, Reserva Biológica do Ibicuí-Mirim,

10.XII.1992, M.L. *Abruzzi* 2681 (HAS); Uruguiana, 12.III. 1964, *J. Mattos & N. Mattos* 5.345 (HAS, ICN). VENEZUELA, Caracas, 15.III.1989, *J. C. Lindeman* 3657 (VEN).

Examined material: BRASIL, RIO GRANDE DO SUL, Mato Leitão, arroio Sampaio, estação 1, 10.V.1995, lâmina nº 4899 (HAS 34015); arroio Sampaio, estação 2, 5.VIII.1994, lâmina nº 4903 (HAS 34017).

Latin words (*et al.*, *apud*, *in*, *ex*, *in vivo*, *in loco*, *in vitro* ...) must be written in italic and foreign words in quotation marks. References in the text should be in alphabetical and chronological order, such as the following: Crawford (1979) or (Crawford, 1979);

Smith & Browse, 1986) or Smith & Browse (1986); Round *et al.* (1992) or (Round *et al.*, 1992).

The references should contain all the authors, and have to be presented without justifying with simple or double spaces between authors, year, title of the article or book, citing the Journals in full. Dissertations and Thesis citations can be included only in exceptional cases. The style to be used for references is as follows:

Barbosa, D.C.A., Barbosa, M.C.A. & Lima, L.C.M. 2003. Fenologia de espécies lenhosas da Caatinga. In *Ecologia e conservação da Caatinga* (I.R. Leal, M. Tabarelli & J.C.M. Silva, eds.). Universidade Federal de Pernambuco, Recife, p. 657-693.

Barroso, G.M., Morim, M.P., Peixoto, A.L. & Ichaso, C.L.F. 1999. Frutos e Sementes. Morfologia Aplicada à Sistemática de Dicotiledôneas. Universidade Federal de Viçosa, Viçosa. 443 p.

Bentham, G. 1862. Leguminosae. Dalbergiae. In *Flora brasiliensis* (C.F.P. Martius & A.G. Eichler, eds.). F. Fleischer, Lipsiae, v.15, part. 1, p. 1-349.

Döbereiner, J. 1998. Função da fixação de nitrogênio em plantas não leguminosas e sua importância no ecossistema brasileiro. In *Anais do IV Simpósio de Ecossistemas Brasileiros* (S. Watanabe, coord.). Aciesp, São Paulo, p. 1-6.

Förster, K. 1982. Conjugatophyceae: Zygnematales und Desmidiaceae (excl. Zygnemataceae). In *Das Phytoplankton des Süßwassers: Systematik und Biologie* (G. Huber-Pestalozzi, ed.). Schweizerbart'sche Verlagsbuchhandlung, Stuttgart, Band 16, Teil 8, Hälfte 1, p. 1-543.

Guiry, M.D. & Dornoch, E. 2004. AlgaeBase. World electronic publication. <http://www.algaebase.com> (access in 18.02.2005).

Metzeltin, D., Lange-Bertalot, H. & Garcia-Rodriguez, F. 2005. Diatoms of Uruguay. In *Iconographia Diatomologica. Annotated diatom micrographs*. (H. Lange-Bertalot, ed.). Gantner Verlag, Ruggell, v. 15, 736 p.

Nervo, M.H. & Windisch, P.G. 2010. Ocorrência de *Pityrogra mma trifoliata* (L.) R. M. Tryon (*Pteridaceae*) no estado do Rio Grande do Sul, Brasil. *Iheringia. Série Botânica*, 65(2):291-293.

Smith, A.B. 1996. Diatom investigation. In *Proceedings of the Nth International Diatom Symposium* (X.Y. Brown, ed.). Biopress, Bristol, p.1-20.

Werner, V. 2002. Cyanophyceae/Cyanobacteria no sistema de lagoas e lagunas da Planície Costeira do estado do Rio Grande do Sul, Brasil 363 f. Tese de doutorado, Universidade Estadual Paulista Júlio de Mesquita Filho, São Paulo.

Acronyms and abbreviations when first mentioned should be preceded by their meaning in full. As for numerical data, non-integer numbers should be written to the tenth decimal point whenever possible, and abbreviated units of measurement with a space between the number and the unit (eg. 25 km, 3 cm, 2-2.4 mm). Numbers from one to ten must be written in full

(exceptions are for character measurements and quantifications) and numbers higher than one thousand and a full period must follow.

Tables and figures are numbered sequentially with Arabic numerals, and their citations in the text should be abbreviated respectively as (Tab. or Tabs.) and (Fig. or Figs.) or writing out, where appropriate. They should come interspersed in the text and should have their locations listed.

Figures (images and pictures) must be high resolution and saved in TIF format (600 dpi). Plates should be a maximum 23 cm long x 17.2 cm wide for a full page or column size of 23 cm long x 8.1 cm wide, including captions. Scale or bar should be depicted beside the illustrations and their values should be referenced in the caption. The plate captions should be presented on a separate sheet. The citation of the taxon author(s) name(s) is optional. See the examples below:

Figs. 1-6. 1, 2. *Navicula radiosa*: vista interna (MEV); 2. Vista externa (MEV); 3. *Pinnularia borealis* (MO); 4. *P. viridis*; 5. *Surirella ovalis* (MO); 6. *S. tenuis* (MET). Bars: **Figs. 1, 2, 6** = 5 mm; **Figs. 3-5** = 10 mm.

Figs. 1-5. *Paspalum pumilum* Nees. 1. Hábito; 2. Gluma II (vista dorsal); 3. Lema I (vista dorsal); 4. Antécio II (vista dorsal); 5. Antécio II (vista ventral). (Canto-Dorow 24 – ICN).

Figs. 1-3. Padrão de venação dos folíolos. 1. *Lonchocarpus muehlbergianus* (J. A. Jarenkow 2386 - ICN); 2. *L. nitidus* (A. Schultz 529 ICN); 3. *L. torrensis* (N. Silveira *et al.* 1329 - HAS).

Figs. 3 A-C. *Eragrostis guianensis*. A. Hábito; B. Espigueta; C. Antécio inferior reduzido ao lema e semelhante às glumas (Coradin & Cordeiro 772 - CEN). Bars = 1 mm.