MURILO MENCK GUIMARÃES

PLANT-POLLINATOR INTERACTIONS IN THE CERRADO: PATTERNS AND LANDSCAPE EFFECTS

LAVRAS – MG
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Tese apresentada à Universidade Federal de Lavras, como parte das exigências do Programa de Pós-Graduação em Ecologia Aplicada, área de concentração em Ecologia Conservação de Recursos em Paisagens Fragmentadas e Agrossistemas, para a obtenção do título de Doutor.

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INTERAÇÕES PLANTA-POLINIZADOR NO CERRADO: PADRÕES E EFEITOS DA PAISAGEM

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À minha família, Sandra e José, por tudo que cativou em mim e pelo amor que torna cada conquista possível.

Dedico

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“...não é nosso papel dominar todas as marés do mundo, e sim fazer o que está em nós para socorro dos anos em que fomos postos, extirpando o mal nos campos que conhecemos, para que os que viverem depois tenham terra limpa para cultivar”

Gandalf, o Branco

RESUMO

As alterações na cobertura vegetal e a intensificação das atividades humanas estão entre as principais causas da perda de biodiversidade em ecossistemas tropicais. No Cerrado, essas transformações modificam a estrutura da vegetação e a oferta de recursos florais, afetando a dinâmica das interações planta-polinizador e, consequentemente, os mecanismos ecológicos que regulam a estrutura, a organização e o funcionamento das redes de interação, fundamentais para a reprodução vegetal e a estabilidade dos ecossistemas. Apesar de avanços recentes, ainda faltam sínteses abrangentes sobre essas interações, especialmente em abordagens que integrem aspectos funcionais e estruturais. Nesta tese, investiguei como variações ambientais e antrópicas influenciam a diversidade, estrutura e funcionamento das interações planta-polinizador no Cerrado, por meio de análises de revisão sistemática, diversidade funcional e diversidade beta de interações. No primeiro capítulo, a partir de uma revisão sistemática, identifiquei lacunas geográficas, taxonômicas e funcionais das interações planta-polinizador, com registros concentrados em poucas regiões e espécies, refletindo a escassez de informações sobre certos traços florais e visitantes específicos. No segundo capítulo, avaliei a relação entre diversidade funcional e modularidade em uma metarrede abrangente, mostrando que combinações particulares de traços florais e grupos de visitantes moldam os módulos e que espécies centrais exercem papel desproporcional na coesão e resiliência das redes. No terceiro capítulo, analisei a diversidade beta de interações ao longo de um gradiente de paisagens savânicas no sul de Minas Gerais e observei alta dissimilaridade entre áreas e tendência à homogeneização estrutural em ambientes mais antropizados. Em conjunto, os resultados evidenciam que a heterogeneidade ambiental e as pressões humanas moldam fortemente as redes de interação do Cerrado. A modularidade e a especialização conferem resiliência local, mas também maior vulnerabilidade à perda de espécies centrais e à simplificação da paisagem. Concluo que a conservação das interações planta-polinizador no Cerrado depende da manutenção da diversidade funcional e da heterogeneidade de habitats, uma vez que a perda de combinações específicas leva à reorganização das interações e à homogeneização estrutural das redes, comprometendo a estabilidade dos processos de polinização.

Palavras-chave: diversidade beta; diversidade funcional; gradiente de cobertura de vegetação; papel das espécies; redes de interação.

ABSTRACT

Changes in vegetation cover and the intensification of human activities are among the main drivers of biodiversity loss in tropical ecosystems. the Cerrado, these transformations alter vegetation structure and floral resource availability, affecting plant-pollinator interaction dynamics and, consequently, the ecological mechanisms governing the structure, organization, and functioning of interaction networks that underpin plant reproduction and ecosystem stability. Despite recent advances, comprehensive syntheses of these interactions remain scarce, particularly those integrating functional and structural dimensions. In this thesis, I investigated how environmental and anthropogenic variation influence the diversity, structure, and functioning of plant-pollinator interactions in the Cerrado, using systematic review analyses, functional diversity metrics, and interaction beta-diversity. In the first chapter, based on a systematic review, I identified geographic, taxonomic, and functional knowledge gaps in plant-pollinator interactions, with records concentrated in few regions and species, reflecting a lack of information on certain floral traits and specific visitor groups. In the second chapter, I evaluated the relationship between functional diversity and modularity in a comprehensive metanetwork, showing that particular combinations of floral traits and visitor groups shape modules, and that central species play a disproportionate role in network cohesion and resilience. In the third chapter, I analyzed the interaction beta-diversity along a gradient of savanna landscapes in southern Minas Gerais and observed high dissimilarity among sites, as well as a trend toward structural homogenization in more human-modified environments. Together, the results demonstrate that environmental heterogeneity and human pressures strongly shape interaction networks in the Cerrado. While modularity and specialization confer local resilience, they also increase vulnerability to the loss of central species and to landscape simplification. I conclude that conserving plant-pollinator interactions in the Cerrado requires maintaining functional diversity and habitat heterogeneity, because the loss of specific functional combinations drives interaction reorganization and network structural homogenization, undermining the stability of pollination processes.

Keywords: beta diversity; functional diversity; vegetation cover gradient; species roles; interaction networks.

INDICADORES DE IMPACTO

Esta tese apresenta contribuições científicas e sociais relevantes para a compreensão dos efeitos ambientais e antrópicos sobre as interações planta-polinizador no Cerrado, um dos principais *hotspots* de biodiversidade do planeta. Os resultados obtidos ampliam o conhecimento ecológico sobre a estrutura e o funcionamento das redes de interação, oferecendo subsídios para a conservação da biodiversidade e o manejo sustentável das paisagens naturais e agrícolas. A partir de análises de revisão sistemática da literatura, diversidade funcional e diversidade beta de interações planta-polinizador, a pesquisa evidenciou que as mudanças no uso e na cobertura da terra alteram de forma significativa a composição de espécies e a complexidade estrutural das redes, reduzindo sua resiliência e potencial de manutenção de serviços ecossistêmicos. A compilação e a padronização de dados de interações planta-polinizador disponibilizados em repositório de acesso livre apresenta potencial de aplicação por pesquisadores, gestores ambientais e formuladores de políticas públicas. Os resultados também fortalecem a formação acadêmica e científica em ecologia funcional, promovendo o diálogo entre ciência e sociedade por meio da valorização do Cerrado e da importância dos polinizadores para a reprodução vegetal e o equilíbrio ecológico. Embora de caráter essencialmente científico, a tese apresenta potencial extensionista, podendo subsidiar ações de educação ambiental, restauração ecológica e monitoramento participativo em comunidades locais do sul de Minas Gerais e de outras regiões do Cerrado. As contribuições da pesquisa se inserem nas áreas temáticas de Meio Ambiente, Educação e Cultura, conforme a Política Nacional de Extensão Universitária, e estão alinhadas a diferentes Objetivos de Desenvolvimento Sustentável (ODS) da Organização das Nações Unidas, especialmente o ODS 15 (Vida terrestre) e o ODS 17 (Parcerias e Meios de Implementação), demonstrando que a conservação das interações ecológicas é um componente essencial para o funcionamento dos ecossistemas e o bem-estar humano em longo prazo.

IMPACT INDICATORS

This thesis provides significant scientific and societal contributions to understanding the environmental and anthropogenic effects on plant-pollinator interactions in the Cerrado, one of the world's major biodiversity hotspots. The results expand ecological knowledge on the structure and functioning of interaction networks, offering valuable insights for biodiversity conservation and the sustainable management of natural and agricultural landscapes. Through systematic literature review analyses, assessments of functional diversity, and evaluations of beta diversity in plant–pollinator interactions, the research shows that changes in land use and land cover substantially alter species composition and the structural complexity of interaction networks, reducing their resilience and their ability to support ecosystem services. The compilation and standardization of plant–pollinator interaction data, made available in an open-access repository, holds strong potential for use by researchers, environmental managers, and policymakers. The results also strengthen academic and scientific training in functional ecology, fostering dialogue between science and society by highlighting the ecological value of the Cerrado and the importance of pollinators for plant reproduction and ecosystem balance. Although primarily scientific in nature, the thesis also presents extension potential, as it may underpin environmental education initiatives, ecological restoration efforts, and participatory monitoring in local communities in southern Minas Gerais and other regions of the Cerrado. The contributions of this research align with the thematic areas of Environment, Education, and Culture established by the National University Extension Policy and correspond to multiple United Nations Sustainable Development Goals (SDGs), particularly SDG 15 (Life on Land) and SDG 17 (Partnerships for the Goals). Collectively, the findings demonstrate that conserving ecological interactions is an essential component for sustaining ecosystem functioning and long-term human well-being.

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FAPEMIG	Fundação de Amparo à Pesquisa do Estado de Minas Gerais
HPI	Indice de Presença Humana
INPol	Instituto Nacional de Ciência e Tecnologia Polinização: conhecimentos, conservação e uso sustentável de polinizadores
RESE	Rede de Estudos de Serviços Ecossistêmicos
PESBE	Parque Estadual da Serra de Boa Espeça
UFLA	Universidade Federal de Lavras

SUMÁRIO

INTRODUÇÃO GERAL

As mudanças de uso e cobertura do solo promovidas por atividades humanas são as principais ameaças à biodiversidade em ecossistemas tropicais, incluindo o Cerrado, um dos biomas mais biodiversos e com alto grau de endemismo (Klink & Machado, 2005; Strassburg *et al.*, 2017; Sano *et al.*, 2019; Françoso *et al.,* 2020). A redução e perda de habitats naturais resultam em alterações drásticas na estrutura da vegetação e na disponibilidade de recursos para diversas espécies, afetando diretamente a riqueza, composição e funcionamento das comunidades biológicas (Kevan & Viana, 2003; Mitchell *et al.*, 2015). Isso ocorre porque a diversidade é mais do que a coleção de espécies, de modo que suas interações interespecíficas devem ser consideradas para a conservação da biodiversidade, pois conectam as espécies em diferentes escalas e habitats na paisagem, determinando sua coexistência e persistência, e influenciando a resiliência das comunidades (Montoya, 2008; Alroy, 2018).

Entre essas interações ecológicas, a polinização se destaca, pois além de ser crítica para a conservação da fauna e flora e funções ecossistêmica, fornece um importante serviço ecossistêmico para o bem estar humano ao assegurar a produtividade de espécies vegetais amplamente utilizadas na alimentação em todo o mundo (Kevan & Viana, 2003; Klein *et al.*, 2007). As interações planta-polinizador são essenciais para o ciclo de vida da maioria das espécies de angiospermas, e ao ofertarem recursos florais essenciais para a sobrevivência de seus polinizadores, garantem que estes transfiram o pólen para os estigmas coespecíficos enquanto forrageiam a flor (Moreira-Henández & Muchhala, 2019). Assim, torna-se fundamental compreender a dinâmica dessas interações frente às mudanças ambientais que colocam em risco não apenas as espécies interagentes, mas também põe em risco à manutenção dos serviços ecossistêmicos dos quais dependem ecossistemas naturais (Giannini *et al.*, 2012).

A ecologia da conservação moderna deve ir além da simples avaliação da presença de espécies, incorporando abordagens que considerem também como essas espécies interagem entre si (Kevan & Viana, 2003; Bascompte & Jordano, 2007; Tylianakis *et al.*, 2010; Ollerton *et al.*, 2011). Nesse contexto, a abordagem de redes complexas constitui uma ferramenta valiosa para a conservação das espécies, pois permite identificar padrões estruturais da comunidade (Bascompte & Scheffer, 2023), bem como o papel funcional de cada espécie dentro dessas redes (Jordano *et al.*, 2003; Bascompte & Jordano, 2007; Olesen *et al.*, 2007; Martín-González *et al.*, 2020). Dessa forma, a análise da estrutura das redes de interações fornece informações fundamentais sobre a coesão da comunidade e os processos ecológicos que sustentam o funcionamento dos ecossistemas, incluindo a manutenção de serviços ecossistêmicos essenciais, como a polinização (Kevan & Viana, 2003; Ollerton *et al*., 2011).

Nas redes planta-polinizador, as interações frequentemente se organizam em subgrupos, nos quais espécies generalistas conectam espécies especialistas (Bascompte *et al*., 2003; Martín-González *et al*., 2020). Esse padrão reflete o *continuum* especialização-generalização, em que espécies especialistas, caracterizadas por atributos florais específicos (e.g., recursos incomuns, coloração, simetria ou tipo floral), coexistem com espécies mais generalistas (Armbruster, 2017). Em ecossistemas tropicais, entretanto, evidências recentes indicam que a elevada riqueza de espécies e a alta diversidade funcional tendem a favorecer não apenas padrões de aninhamento, mas também uma maior modularidade das redes, com subgrupos estruturados por similaridade funcional e restrições ecológicas associadas aos traços das espécies (Vizentin-Bugoni *et al*., 2018; Cardoso *et al*., 2025). Nesse contexto, a organização das redes resulta de um *continuum* de processos que varia desde mecanismos neutros, associados à estocasticidade, abundância e disponibilidade de espécies, até processos fortemente baseados em nicho, mediados pela compatibilidade funcional (*trait-matching*) que restringem o estabelecimento de determinadas interações (Bascompte *et al*., 2003; Jordano *et al*., 2003; Vizentin-Bugoni *et al*., 2018). Assim, em sistemas megadiversos como o Cerrado, a maior diversidade funcional tende a desempenhar papel central na organização das interações**,** reforçando a formação de módulos funcionalmente coerentes, nos quais conjuntos específicos de traços moldam padrões de conexão, o que pode ter implicações diretas para a estabilidade e a resiliência das redes mutualísticas (Bascompte, 2010).

Com o avanço dos estudos em redes complexas, diferentes métricas de rede foram desenvolvidas para caracterizar padrões emergentes da organização das interações, como o aninhamento, que quantifica até que ponto interações mais específicas são subconjuntos de interações mais generalistas, que, por sua vez, são subconjuntos de interações ainda mais generalistas (Bascompte *et al*., 2003; Almeida-Neto & Ulrich, 2011). Outro padrão estrutural comumente observado em redes mutualísticas é a formação de grupos de espécies que interagem mais intensamente entre si do que com outras espécies, criando compartimentos de interação (Olesen *et al*., 2007). Esses grupos correspondem aos módulos da rede, que podem ser identificados por meio da análise de modularidade, uma métrica de rede que descreve a compartimentalização estrutural do sistema (Olesen *et al*., 2007). Geralmente, os módulos refletem características compartilhadas pelas espécies que os compõem, incluindo acoplamento morfológico, fenológico ou espacial, comportamento de visita e até relações filogenéticas (Olesen *et al*., 2007; Vázquez *et al*., 2009; Vizentin-Bugoni *et al*., 2018). Além das métricas de rede, métricas de nó permitem identificar o papel funcional das espécies individuais dentro da estrutura da rede, destacando aquelas que exercem funções centrais para a coesão e a estabilidade da comunidade, como espécies altamente conectadas ou que conectam diferentes módulos (Olesen *et al*., 2007).

Assim, torna-se fundamental avaliar a dinâmica estrutural das redes de interações planta-polinizador, uma vez que a heterogeneidade em um gradiente de cobertura de vegetação influencia não apenas a riqueza de espécies, mas também o número e a complexidade das interações de polinização, comprometendo os serviços ecossistêmicos que delas derivam (Kevan & Viana, 2003; Blüthgen & Staab, 2024). A compreensão da estrutura das redes é, portanto, essencial para avaliar a estabilidade das comunidades e a sensibilidade das espécies a perturbações (Harvey *et al*., 2017). No entanto, grande parte do conhecimento atual sobre redes mutualísticas é predominantemente estático, desconsiderando que alterações ambientais e mudanças na composição de espécies podem restringir ou reorganizar as interações, modificando os fatores que permitem ou impedem o acoplamento entre espécies interagentes (Burkle *et al*., 2016).

Estudos recentes indicam que mudanças na diversidade de espécies, ou diversidade beta, devem ser consideradas devido à sua relevância para demonstrar a variação na dinâmica das interações em diferentes escalas (Koleff *et al*., 2003; Gaston *et al*., 2007; Trøjelsgaard & Olesen, 2016). Isso ocorre porque a dissimilaridade de uma comunidade de plantas e polinizadores pode ser relativamente previsível ao longo de gradientes ambientais, enquanto a dissimilaridade de suas interações (*turnover* das interações) muitas vezes não é facilmente explicada (Burkle & Alarcón, 2011; Poisot *et al*., 2012; Carstensen *et al*., 2014; Trøjelsgaard *et al*., 2015). As interações podem ser limitadas temporalmente quando as fenologias das espécies interagentes estão dessincronizadas, além de apresentarem restrições espaciais (Olesen *et al*., 2011). Essa variação pode ocorrer tanto pela substituição de espécies, refletindo a rotatividade das interações em função de mudanças na composição da comunidade, quanto pelo rearranjo (*rewiring*) das interações, que se altera espacial ou temporalmente (Poisot *et al*., 2012; CaraDonna *et al*., 2017; Tylianakis & Morris, 2017; Peralta *et al*., 2024;

Sprayberry *et al.*, 2025). Além disso, interações especializadas demonstram ser mais vulneráveis a alterações na paisagem, enquanto as interações envolvendo espécies generalistas centrais tendem a ser mais estáveis espacialmente (Aizen *et al.*, 2012). Assim, torna-se fundamental avaliar a dinâmica estrutural do *continuum* especialização-generalização e sobre a relação entre a diversidade de interações e a composição de espécies, especialmente em diferentes tipos de ambientes naturais.

A expansão de atividades agrícolas tem sido um dos principais fatores de modificação da paisagem no Cerrado, o segundo maior bioma brasileiro, que sofreu intensa redução de sua cobertura natural (Klink & Machado, 2005; Strassburg *et al.*, 2017). A conservação do Cerrado torna-se ainda mais urgente devido à limitação de incentivos e à fraca proteção legal do bioma (Strassburg *et al.*, 2017). Essas transformações no uso e na cobertura da terra promovem a simplificação da paisagem, alterando a disponibilidade de recursos florais e a composição das comunidades de polinizadores, com efeitos diretos sobre a estrutura das redes de interação planta–polinizador (Assunção *et al.*, 2022; Aguiar *et al.*, 2024). Estudos recentes realizados no Cerrado indicam que gradientes de intensificação do uso do solo estão associados à reorganização das interações, com mudanças estruturais das redes de interações planta-polinizador, como especialização e modularidade, frequentemente mediadas pela dominância de espécies generalistas (Assunção *et al.*, 2022; Aguiar *et al.*, 2024). Apesar disso, nosso conhecimento sobre a dinâmica espacial das interações entre plantas e polinizadores em relação a alterações na paisagem ainda é escasso, especialmente considerando a estrutura dessas comunidades. Em particular, ainda são limitados os estudos que avaliam como a substituição de espécies e interações ao longo de gradientes das paisagens contribui para padrões de diversidade beta de interações no Cerrado. Dessa forma, torna-se necessário ampliar os esforços para compreender as interações entre espécies no Cerrado, cuja alta diversidade e elevado grau de endemismo o tornam um hotspot global de biodiversidade (Myers et al., 2000; Klink & Machado, 2005; Strassburg et al., 2017). Compreender os padrões das redes planta-polinizador e sua resposta a heterogeneidade das paisagens do Cerrado constitui, portanto, um passo fundamental para avaliar a resiliência ecológica do bioma e subsidiar estratégias de conservação em paisagens cada vez mais antropizadas, constituindo um passo fundamental para a ecologia da conservação.

Diante desse contexto, esta tese foi estruturada em três capítulos complementares, com o objetivo de compreender as interações planta-polinizador no

Cerrado, de modo a quantificar o conhecimento atual acerca do tema, avaliar o efeito da diversidade funcional sobre a organização das interações no Cerrado, e avaliar como a heterogeneidade de paisagens de Cerrado influencia a diversidade beta e as redes de interações planta-polinizador no Cerrado. No primeiro capítulo, foi realizado uma revisão sistemática das interações planta-polinizador registradas no bioma, identificando lacunas de conhecimento em nível geográfico, taxonômico e funcional, com a maioria dos registros concentrados em poucas regiões e espécies. No segundo capítulo, foi avaliado a relação entre diversidade funcional e modularidade das interações em uma metarrede abrangente, demonstrando que a composição funcional das espécies molda a estrutura modular das redes e que espécies centrais, como *hubs* e conectores, desempenham papel desproporcional na coesão e resiliência das interações. No terceiro capítulo, foi avaliado a variação da diversidade beta de interações ao longo de um gradiente de paisagens savânicas no sul de Minas Gerais, evidenciando alta dissimilaridade entre áreas, principalmente devido ao *turnover* de espécies, enquanto regiões mais antropizadas apresentaram homogeneização da estrutura das redes e perda de complexidade ecológica. Dessa forma, a tese integra diferentes abordagens (revisão sistemática, análise funcional e avaliação em um gradiente de cobertura de vegetação de redes de interações) para fornecer uma visão abrangente dos padrões e processos que estruturam as interações planta–polinizador no Cerrado, contribuindo para estratégias de conservação que considerem tanto a diversidade de espécies quanto a heterogeneidade das paisagens.

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CAPÍTULO 1 - MAPPING THE KNOWLEDGE STATUS OF BRAZILIAN CERRADO POLLINATION: A SYSTEMATIC REVIEW

Abstract

Understanding plant–pollinator interactions is fundamental for biodiversity conservation, provisioning of essential ecosystem services and ecological restoration, particularly in hotspots increasingly threatened by habitat loss and land-use change. In this study, we compiled and standardized data on plant–pollinator interactions in the Cerrado, a global hotspot under intense anthropogenic pressure, through a systematic review of published (1993-2024) literature and unpublished datasets. Using a framework based on Darwin Core standards, we assessed trends in data collection, phylogenetic composition, species-level interaction patterns, and key ecological descriptors essential for understanding pollination communities. By building a biome-wide database encompassing 4,073 interactions between 694 plant species and 947 pollinator species, our results show that, despite increasing data availability in recent decades, current knowledge on pollination in the Cerrado remains geographically, phylogenetically, and functionally biased. Specifically, we identified three major shortfalls: (1) limited information on the geographic distribution of interactions, with studies concentrated in a few well-sampled sites; (2) phylogenetic biases in sampled species, with studies focused on overrepresented lineages such as Asteraceae and Apidae; and (3) scarcity of data on functional traits related to morphology, behavior, and reproductive strategies of plants. Overcoming these knowledge gaps is necessary to improve our understanding of ecological interactions, evaluate ecosystem resilience, and inform conservation and restoration strategies. The standardized and comprehensive dataset presented here provides a valuable foundation for large-scale ecological assessments and serves as a call to action for more integrative, trait-based, and spatially inclusive research across this threatened biome.

Key-words: Brazilian savannah, floral visitors, hotspot, knowledge shortfalls, systematic review.

Introduction

Plant-pollinator interactions are central to plant reproduction, biodiversity maintenance, and ecosystem functioning, particularly in tropical regions where most angiosperm species depend on animal-mediated pollination (Klein *et al*., 2007; Ollerton *et al*., 2011). Despite their ecological importance, our understanding of how these interactions are documented and characterized across biodiversity-rich tropical biomes remains fragmented and uneven, with strong biases in spatial coverage, taxonomic focus, and methodological approaches (Winfree *et al*., 2011; Vanbergen, 2014; Porto *et al*., 2020). Systematic syntheses of pollination studies are therefore essential to diagnose knowledge gaps, assess trends in data collection, and provide a coherent framework for large-scale ecological analyses and conservation planning, especially in threatened biomes such as the Brazilian Cerrado, a global biodiversity hotspot undergoing rapid land-use change (Myers *et al*., 2000; Klink & Machado, 2005; Strassburg *et al*., 2017).

This is because the Cerrado is a vast tropical savanna biome characterized by high biodiversity, including a rich diversity of flowering plants and pollinators, elevated levels of endemism, and pronounced environmental heterogeneity, structured as a mosaic of distinct vegetation formations across the landscape (Oliveira & Marquis, 2002; Klink & Machado, 2005; Sano *et al*., 2019; Françoso *et al*., 2020). These formations differ markedly in floristic composition, vegetation structure, and resource availability, which are key factors influencing species distributions and ecological interactions. Over recent decades, the Cerrado has undergone intense land-use conversion driven mainly by agricultural expansion, resulting in widespread habitat loss, fragmentation, and degradation, with profound consequences for biodiversity and ecosystem processes (Klink & Machado, 2005; Strassburg *et al*., 2017; Sano *et al*., 2019; Françoso *et al*., 2020). However, this biome has been intensively modified by agricultural expansion, resulting in the loss and fragmentation of natural habitats, with potential impacts on species composition and the ecological interactions that sustain plant reproduction (Klink & Machado, 2005; Sano *et al*., 2019). Despite its recognized ecological importance, the literature on plant-pollinator interactions in the Cerrado is largely based on local evidence, suggesting heterogeneity in the approaches used to evaluate these interactions and potential biases in sampling effort and knowledge production, which hinder integrated assessments at the biome scale (Silva *et al*., 2012; Porto *et al*., 2020).

Increasing the availability of plant–pollinator interaction datasets becomes especially significant for conservation efforts in regions with high species diversity and endemism, such as the Cerrado (Myers *et al*., 2000). This biome is recognized as a critical conservation hotspot due to severe threats to its biodiversity, primarily resulting from agricultural expansion and inadequate public policies that intensify habitat fragmentation and loss (Myers *et al*., 2000; Klink, 2014; Strassburg *et al*., 2017; Bispo *et al*., 2024), further compounded by climate change (Martins et al., 2025a). The Cerrado has shrunk from approximately 2,031,990 km² to 438,910 km², making it one of the most threatened ecosystems worldwide (Hance, 2020). Research on plant reproductive systems in the Cerrado indicates that more than 85% of angiosperm species depend on pollinators for reproductive success (Oliveira *et al*., 2004; Gottsberger & Silberbauer-Gottsberger, 2006, 2018; Cardoso *et al*., 2025). Specifically, these species require animal vectors to transfer pollen from anthers to stigmas (Oliveira *et al*., 2004; Porto *et al*., 2020), highlighting the need to protect these interactions. In addition, these species may be particularly vulnerable to climate change, as climate-induced shifts in temperature and precipitation can disrupt flowering phenology and its temporal matching with pollinator activity, especially in plants reliant on biotic pollination (Vilela *et al*., 2018; Martins *et al*., 2025a). Therefore, the integrity of plant-pollinator interactions is essential for maintaining plant reproduction and ecosystem functioning in the Cerrado, and their disruption through habitat loss and climate change poses a significant threat to the persistence of both plant and pollinator communities, reinforcing the need for conservation strategies that explicitly consider these interactions (Oliveira & Gibbs, 2000).

Here, we compiled data on plant-pollinator interactions in the Cerrado following a data model based on the Darwin Core standard (Salim *et al*., 2022), aiming to: (1) assess trends in ecological data collection (spatio-temporal distribution, methodological approaches, sampling effort, and species diversity); (2) identify the taxonomic composition of these interactions; (3) assess interaction degree (i.e., number of interaction partners); and (4) identify knowledge gaps in plant-pollinator interactions in the Cerrado. Our comprehensive dataset is expected to facilitate large-scale pollination studies in this biome.

Methodology

We conducted a systematic literature review to compile studies published from 1990 to June 2024 on plant-pollinator interactions across the Cerrado (Martins & Cavararo, 2012; Vieira *et al*., 2022). Additionally, we used unpublished datasets provided by the authors. To search for articles more comprehensively, we selected two distinct and curated databases were selected due to their reproducibility and structured indexing of peer-reviewed literature (Singh *et al*., 2020): the Web of Science (https://login.webofknowledge.com/; 1945-2024) and Dimensions (https://www.dimensions.ai/) databases. We searched for articles within titles and/or abstracts containing exact words without wildcard expansion in English and Portuguese related to plant–pollinator interactions in the Cerrado: ("pollination" OR "polinização" OR "pollinator" OR "polinizador" OR "floral visitor" OR "visitante floral") AND ("Cerrado" OR "Brazilian savanna"). We considered only studies reporting original empirical information on interacting species pairs identified to a resolved taxonomic level, excluding records based on informal or functional categories (e.g., "large bees", "yellow bees"). Interactions referring either to floral visitation or effective pollination were included and later classified using standardized descriptors (see below). We excluded studies lacking original interaction data, duplicates, gray literature (e.g., theses and dissertations), and experimental settings conducted under controlled conditions, such as monocultures in university facilities.

In total, we selected 44 descriptors proposed by Salim *et al.* (2022) to assess data related to taxonomic groups, plant morphological and reproductive traits, and interactions, including record level, location, and time of the event (Table S1). These descriptors were systematically extracted from each study whenever the information was explicitly reported, and the absence of information was recorded when descriptors were not available. Of these, ten descriptors are related to the taxonomy of interacting plants and animals, six descriptors describe plant traits (one describing floral attributes, three related to reproductive success, and two addressing nectar dynamics), four descriptors characterize the interactions, two descriptors provide record-level metadata, seven descriptors refer to geographic location, and four descriptors to the temporal context of the event. Given that not all descriptors were consistently reported across studies, we quantified the frequency with which each descriptor was available in the original literature, enabling an evaluation of data completeness and knowledge gaps.

To minimize potential errors due to taxonomic synonymization, all taxonomic descriptors were updated before analysis. For taxonomic harmonization in plants, we consulted Flora e Funga do Brasil (http://floradobrasil.jbrj.gov.br/reflora) and Plants of the World (https://powo.science.kew.org/). Animals, taxonomic harmonization was updated using the Moure Bee Catalogue (http://moure.cria.org.br/), Catálogo Taxonômico da Fauna do Brasil (http://fauna.jbrj.gov.br/), and the Catalogue of Life (https://www.catalogueoflife.org/).

Trends in ecological plant-pollinator data

To evaluate how studies on plant-pollinator interactions have been conducted in the Cerrado, we analyzed temporal, spatial, methodological, and sampling-effort descriptors extracted from the reviewed literature. Temporal patterns were assessed using the year of data collection, rather than the year of publication, to more accurately reflect when ecological information was generated, particularly given the inclusion of unpublished datasets and potential delays between data collection and publication. Spatial patterns were evaluated based on locality descriptors, allowing the identification of Brazilian states with the highest concentration of sampled interaction records. Methodological approaches were characterized according to the type of data collection employed, and sampling effort was assessed using reported total sampling time and species richness per study, enabling the identification of potential biases in study design and sampling focus.

The temporal distribution of interactions was evaluated based on the date of ecological data collection, given that the original data were incorporated into the dataset. To assess whether research efforts increased over time, we fitted generalized linear models (GLMs) with a quasi-Poisson distribution, using the number of studies as the response variable and the year of data collection as the explanatory variable (Zuur *et* *al*., 2009). This approach accounted for potential overdispersion in the count data. Spatial descriptors were used to evaluate which states had the highest number of sampled areas with plant-pollinator interactions.

To evaluate how plant-pollinator interactions have been sampled in the Cerrado, we used the descriptors "basis of record" and "sampling protocol" to determine whether (1) interactions were recorded through direct field observations, or (2) whether they were obtained using alternative methods, if they were obtained using alternative methods, such as pollen identification on the visitors' bodies or the use of video recording. To assess the sampling effort across the reviewed studies, we considered the total sampling time (in hours) reported by each study as a proxy for sampling effort. Finally, we assessed the species richness recorded per study as an indicator of whether the sampling effort was directed toward specific populations or at the community-level.

Taxonomic composition of plant-pollinator interactions

The taxonomic composition of plant-pollinator interactions in the Cerrado was estimated using taxonomic descriptors, aiming to identify the clades represented in the documented interactions. To explore potential patterns between species' interaction breadth and their taxonomic affiliations, we assessed the interaction degree of each interacting species by estimating the number of interaction partners per species (Bascompte *et al*., 2003). As knowledge of plant-pollinator interactions may be influenced not only by the pollination ecological specialization, that is, species with few interaction partners (Ollerton *et al*., 2011), but also by the accumulation of research effort targeting those species (e.g., number of published studies reporting their interactions) (e.g. Nascimento *et al.*, 2020; Guimarães *et al.*, 2021), we fitted a generalized linear model (GLM) with a quasi-Poisson distribution to evaluate whether the degree of interaction of each species (response variable) is associated with the number of studies in which it was cited (fixed factor) (Zuur *et al*., 2009). This approach allows us to disentangle potential ecological patterns from research biases in the available interaction data for the Cerrado. All analyses were performed in the software R (R Development Core Team, 2025).

Descriptors of plant-pollinator interactions

To assess antagonistic-mutualistic *continuum*, we used the descriptor “interaction type”, which classifies the nature of interactions between species pairs as pollination, robbery, flower visiting or nesting. When the original studies did not specify the nature of the interaction, records were categorized as floral visits.

Additionally, we recorded the availability of descriptors related to contact locations between floral structures and animal body parts during interactions, as such information may provide valuable insights into the outcomes of the interactions (Olesen *et al.*, 2011). In addition to the standardized vocabulary adopted for these descriptors according to Salim *et al*. (2022), we included records classified as “other body parts” when studies specified animal regions involved in floral contact, as well as specific floral structures (nectaries, stamens, anthers, and stigmas), given their functional importance in floral resource provisioning. We also documented the type of floral resource collected (pollen, nectar, oil, fragrance, or not available) during visits, as this information is critical for understanding the establishment of plant–pollinator interactions. Additionally, we recorded descriptors related to nectar dynamics, including the total volume of nectar accumulated per flower (µL) and the sugar concentration of the accumulated nectar (%), given their functional importance for floral resource provisioning.

Plant and floral descriptors were used to assess the morphological traits of the plant taxa. Finally, we also recorded descriptors related to the reproductive success of these taxa in the Cerrado, including seed mass (mg), seed set, and fruit mass (g), as reported in the original studies, given their importance for assessing plant reproductive output.

Results

Trends in ecological plant-pollinator data

The literature review on plant-pollinator interactions in the Cerrado initially identified 294 references. After excluding studies that did not provide interaction data according to our selection criteria (Figure 1), information was compiled from 111 studies published in scientific journals between 1990 and 2024. Additionally, 21 unpublished datasets were provided by the authors (Table S2). The oldest published study dates back to 1990, but the earliest data collection began in 1980. Although 19 studies (10.4%) did not report the date of data collection, information on plant-pollinator interactions has been increasing in the Cerrado ($\chi 2$ = 28.41, *d.f.* = 1, $p < 0.001$; Figure 2).

Regarding the spatial distribution of studies on interactions in the Cerrado, ecological data collection primarily occurred in Minas Gerais state (41.3%), followed by Goiás state (15.3%) and the Distrito Federal (14.3%). The remaining states accounted for less than 10% of the data collection each (Figure 3).

Plant-pollinator interactions were mostly recorded through direct focal observation (64.1%). Among these studies, only two reported using cameras to photograph or film the plant-pollinators interaction. Additionally, ten studies (7.6%) documented interactions based on pollen analyses from the animal bodies. Only one study (0.8%) combined both approaches: human observation of focal species and pollen analysis. The remaining studies (27.5%) did not specify how the interactions were recorded (Table S2).

Studies on interactions between plants and their floral visitors reported an average sampling time of 144:51 hours (standard deviation ± 341:31 hours), with the shortest sampling time being 2:55 hours and the longest 2,644:00 hours. However, 70 studies (53.4%) did not specify the total sampling effort. Among the 61 studies that reported sampling effort, 46 (75.4%) had efforts below the average. On average, seven plant taxa were reported per study (standard deviation ± 19.2), with 60.6% focusing on a single species (Figure 4a). Regarding animal taxa, an average of 19 animal species was recorded (standard deviation ± 29.4), with 7.6% recording a single species (Figure 4b).

Taxonomic composition of plant-pollinator interactions

A total of 694 plant taxa were recorded, most of which were identified at the species level (85.7%), with fewer identified at the genus (12.5%), tribe (0.1%), and family (1.6%) levels. These taxa are distributed across 104 botanical families, with Asteraceae being the most studied plant family (14.1%), followed by Fabaceae (13.3%), Rubiaceae (5.9%), Malpighiaceae (4.8%), Malvaceae (4.2%), and other families, each representing less than 4% in the compiled and standardized database (Table S3). For floral visitors, 947 animal taxa interacting with flowers were recorded. Most of these were identified at the species level (62.8%), with fewer identified at the genus (23.0%), tribe (1.9%), subfamily (2.1%), family (8.4%), superfamily (0.3%), and order (1.4%) levels (Table S4). Apidae was the family with the highest number of recorded taxa (36.0%), followed by Sphingidae (5.1%), Vespidae (5.0%), and Curculionidae (4.5%). The remaining families represented less than 4% of the taxa reported in studies of plant and floral visitor interactions (Table S4).

Our dataset compiled 4,073 interactions between plants and floral visitors, with the interaction degree of plant species ranging 1 to 98 (5.71 ± 9.04). Among these taxa, 33.7% had interactions with only one flower visitor. *Matayba guianensis* showed the highest interaction degree (98), followed by *Caryocar brasiliense* (Caryocaraceae, 95), *Inga vera* (Fabaceae, 54), *Curatella americana* (Dilleniaceae, 50), while all other species individually interacted with fewer than 50 floral visitors. This variation was positively associated with the number of studies reporting each plant taxon: the more frequently a species appeared in the literature, the higher its recorded interaction degree ($\chi^2 = 121.27$, *d.f.* = 1, $p < 0.001$; Figure 5a).

Animal taxa exhibited interaction degrees ranging from 1 to 192, with a mean of 4.18 and a standard deviation of 9.78. Notably, 504 floral visitors (53.2%) were recorded interacting with only one plant species. *Apis mellifera* (Apidae) had the highest degree among animals (192 plant partners), followed by *Trigona spinipes* (Apidae, 86), *Eupetomena macroura* (Trochilidae, 57), *Partamona rustica* (Apidae, 54), and *Thalurania furcata* (Trochilidae, 52). At the genus level, high interaction degrees were also recorded for *Ceratina* (Apidae, 80) and *Augochloropsis* (Apidae, 61), while all other species each engaged with fewer than 50 interaction partners. As observed for plants, the interaction degree of animal species was significantly associated with the number of studies in which they were recorded ($\chi^2 = 613.48$, *d.f.* = 1, $p < 0.001$; Figure 5b).

Descriptors of plant-floral visitor interactions

We identified substantial data gaps across the 16 standardized descriptors of plant-floral visitor interactions used in this review, as none were reported in more than 50% of the original studies.

Regarding interaction type, most animals (65.9%) were categorized as floral visitors based on observed interactions, followed by mutualistic interactions (pollination) (25.5%), antagonistic interactions (floral resource robbery) (8.5%), and only one nesting interaction (0.1%) (Figure 6). Among the animal taxa reported interacting with flowers, 17.4% exhibited dual roles, i.e., they were classified as both pollinators and robbers (Table S5). Furthermore, the original studies did not describe the contact location between animals and flowers during interactions in 27.2% and 24.7% of cases, respectively (Figures 7a and 7b), highlighting a lack of information that impedes the understanding of the antagonistic-mutualistic *continuum* of plant-pollinator interactions in the Cerrado.

The floral resource collected was the most frequently reported descriptor during interactions (41.4%) (Figure 5), with nectar (59.9%) and pollen (47.4%) accounting for nearly all available knowledge on plant-pollinator interactions in the Cerrado. Oil, plant tissue and fragrance represented less than 8% of the recorded plant species (Figure 7c). Descriptors related to nectar dynamics were reported for less than 10% of the plant species in the studies.

Regarding plant and floral descriptors, growth form was the second most frequently reported descriptor (28.0%), with most taxa described as bush (44.0%), followed by trees (38.2%), herbs (14.1%), and climbers (8.9%) (Figure 7d). Ten plant taxa exhibited two types of habits. This was followed by corolla color (22.8%), floral shape (19.0%), floral symmetry (14.6%), and other descriptors reported in less than 10% of the studies (Figure 8).

Discussion

Trends in ecological plant-pollinator data

The results indicate that studies on interactions between plants and their floral visitors in the Cerrado have shown a gradual increase over time, with a significant expansion in scientific production in recent years (Figure 2). This pattern corroborates findings from previous studies that synthesized information on plant-pollinator interactions (e.g., Nascimento *et al.*, 2020; Guimarães *et al.*, 2021; Monteiro *et al.*; 2021), aligning with the trend observed in biodiversity research both in the Cerrado and the broader Brazilian context (Cross *et al.*, 2017; Colli *et al.*, 2020). However, even during the period of greatest expansion, scientific output exhibits temporal fluctuations, suggesting that its continuity still relies on non-systematic efforts. The decline observed since 2018, for example, reflects not only a reduction in field efforts but also exogenous factors such as limitations imposed by the pandemic, which significantly affected the conduct of scientific activities globally (Corlett *et al.*, 2020). These patterns underscore the urgency of implementing robust, long-term monitoring strategies to ensure the continuity and standardization of sampling, a key limitation highlighted in recent assessments of pollinator declines in Brazil, which emphasize the scarcity of consistent temporal data needed to detect population trends and long-term changes (Potts *et al.*, 2010; Giannini *et al.*, 2017; Lewinsohn *et al.*, 2022).

Regarding sampling locations, Minas Gerais was the state with the largest volume of information on interactions between plants and floral visitors (Figure 3), which can be partly explained by its large territorial extent and the presence of highly biodiverse Cerrado areas, which cover approximately one third of the state (Scolforo, 2008; Terra *et al.*, 2017). However, another factor that may contribute to the concentration of studies in southeastern Brazil is the greater availability of academic institutions and research groups focused on pollination research in this region (Ramos *et al.*, 2020). Consequently, although biodiversity sampling is spatially uneven, with some states being more frequently surveyed than others (Meyer *et al.*, 2015), the remaining Brazilian states account for only about half of the studies conducted in the Cerrado, revealing substantial spatial gaps in current knowledge. A similar pattern of spatial bias has been identified in previous syntheses of pollination interactions in the biome, in which data availability was strongly associated with specific biogeographic districts and research hubs, rather than reflecting a homogeneous coverage of the Cerrado (Aguiar *et* *al.*, 2024). These results indicate a limitation in biome-scale representativeness, constraining our understanding of how plant-pollinator interactions vary across the environmental heterogeneity of the Cerrado and reinforcing the need for targeted sampling efforts in historically underrepresented regions.

This limited sampling coverage accentuates the magnitude of the spatial deficit, which poses important limitations for a comprehensive understanding of ecological interactions in the Cerrado (Meyer *et al.,* 2015). These biases illustrate a classic case of the Eltonian shortfall, which refers to our limited knowledge about species' ecological interactions and their functional roles within communities (Hortal *et al.*, 2015; Poisot *et al.*, 2016; Carvalheiro *et al.*, 2025). In the context of ecological interactions, this gap manifests as uncertainty regarding where and how such interactions occur within the biome, as interactions are spatially structured and may vary according to regional species pools and environmental conditions (Hortal *et al.*, 2015; Carvalheiro *et al.*, 2025). Therefore, these spatial gaps limit our ability to generalize ecological patterns in the Cerrado, especially when available data are concentrated in a few well-sampled locations. To advance conservation efforts in the biome, it is essential to expand sampling efforts to include regions that are still poorly or entirely unexplored (Hortal *et al.*, 2015), thereby improving biome-scale representativeness and enabling a more robust assessment of how plant-pollinator interactions respond to the environmental heterogeneity of the Cerrado.

Although most interactions were recorded through direct human observation of focal species, some studies have explored alternative methods for sampling interactions in the Cerrado. However, direct observations often do not allow researchers to capture the details of flower–visitor interactions (Ollerton *et* al., 2011; King *et al.*, 2013). For instance, when visits are too brief, it may be difficult to determine whether the visitors actually contacted the reproductive structures of the flowers or collected nectar or pollen, which can lead to underestimations or misinterpretations of the type and effectiveness of the interaction (King *et al.*, 2013). One such method that helps overcome these limitations is pollen analysis, a zoocentric approach that identifies interactions by examining pollen found on the bodies of floral visitors (Jordano, 2016; Gonçalves *et al.*, 2022). While this method can detect rare interactions (Vizentin-Bugoni *et al.*, 2018), studies synthesizing data on plant–floral visitor interactions indicate that zoocentric approaches are less frequently used (Vizentin-Bugoni *et al.*, 2018; Nascimento *et al*., 2020; Guimarães *et al*., 2021). This pattern likely reflects the high laboratory demands of this technique, which involves preparing slides and identifying pollen grains from floral visitors (Vizentin-Bugoni *et al*., 2018). Additionally, financial constraints significantly influence the choice of data collection methods, especially when access to equipment such as cameras or laboratory infrastructure is limited (Meek & Pittet, 2012).

Despite the importance of documenting sampling effort, slightly more than half of the studies did not report total sampling efforts, which limits comparability across studies and hinders large-scale ecological syntheses. This gap highlights a persistent challenge in the standardization and completeness of ecological data recording protocols (Robinson *et al.*, 2011; Meek & Pittet, 2012; Hortal *et al*., 2015). Considerable variation in sampling effort was observed among studies, with most reporting values below the mean, revealing pronounced heterogeneity in the intensity and duration of applied efforts. The need for standardized and detailed documentation of sampling effort is widely acknowledged in the literature, as inconsistent or incomplete data compromises meta-analyses and comparative studies, potentially leading to misrepresentations of biodiversity (Meek & Pittet, 2012; Hortal *et al*., 2015). These findings underscore the importance of documenting detailed and standardized sampling efforts to enhance comparability and synthesis in future research (Hortal *et al*., 2015). They further emphasize the urgency of adopting uniform guidelines and best practices for sampling design and reporting, including precise quantification of effort metrics such as duration and frequency of each animal visits in the flower, and employed methods for observation (Salim *et al*., 2022). Enhancing these aspects is essential to increase the reproducibility and comparability of ecological studies in the Cerrado and other biomes, thereby enabling more robust assessments of ecological dynamics and supporting effective conservation strategies (Vizentin-Bugoni *et al*., 2018).

Also, our results reveal that a notable feature of studies on plant–floral visitor interaction in the Cerrado is the predominant focus on a limited number of focal species (Figure 4). This pattern reflects a long-standing tradition of natural history and population-level studies in pollination ecology, in which focusing on a few species has been fundamental for advancing detailed knowledge on floral biology, pollination mechanisms, and species-specific interaction dynamics. While this approach is appropriate for addressing questions at the population level (e.g., Gribel & Hay, 1993;

Yamamoto *et al.*, 2012; Potascheff *et al.*, 2014; Siqueira *et al.*, 2018), and provides high-resolution ecological and mechanistic insights, it imposes significant limitations on the broader understanding of ecological interactions within the biome. By concentrating on a few focal species, these studies often provide detailed insights into the interaction patterns and pollination ecology of specific taxa. However, this focus may overlook a substantial portion of plant-pollinator interactions occurring at the community level, where multiple species and interaction types coexist. Conversely, although community-level studies increase taxonomic coverage and help reduce sampling biases, they often generate comparatively shallow information for each species. This trade-off between depth and breadth may result in an underestimation of the importance and variability of plant–pollinator relationships in the Cerrado, thus restricting our understanding of the ecological processes that sustain local biodiversity (Vizentin-Bugoni *et al.*, 2018; Colli *et al.*, 2020).

Taxonomic composition of plant-pollinator interactions

Although most taxa have been identified to the species level, the lack of knowledge regarding taxonomic identification highlights an important gap in our understanding (Dayrat, 2005; Hebert & Gregory, 2005; Mora *et al.*, 2011; Hortal *et al.*, 2015). This gap underestimates the biodiversity involved in plant–floral visitor interactions in the Cerrado, a biodiversity hotspot where pollination data remain scarce and habitat loss may lead to species extinction even before they are known (Oliveira *et al.*, 1998; Colli *et al.*, 2020). Furthermore, the lack of species-level identification compromises our understanding of these taxa in the Cerrado, making it impossible to develop appropriate management and conservation plans (Fonseca *et al.*, 2008; Carvalheiro *et al.,* 2025).

However, this issue is not limited to taxonomic identification. Our findings suggest that the knowledge gap extends to the ecological dimension of interactions, particularly regarding the frequency and range of interaction partners. This is evidenced by our results, which demonstrate that current knowledge of species-level interactions is associated with the number of studies reporting the same species (Figure 5). For example, Caryocaraceae was represented by a single species in studies on interactions in the Cerrado (*Caryocar brasiliense*). Yet, it was the most frequently cited species in the reviewed studies, with the most recorded interaction partners (Table S3). Other examples include *Byrsonima intermedia* (Malpighiaceae) and *Inga vera* (Fabaceae), which also had a high number of interaction partners and were cited in several studies (Table S3).

Although the systematic review identified species with a high number of interaction partners based on just a single record (e.g., *Collaea cipoensis* and *Butia paraguayensis*), the 215 plant taxa with only one interaction partner highlight that as the number of studies increases, so does the number of known interaction partners (Figure 5). Thus, despite the growing number of biodiversity studies in the Cerrado, significant gaps remain, particularly regarding interactions involving Cerrado plants. This is especially relevant, considering that the systematic review presented here represents only a small fraction of the estimated 13,000 angiosperm species occurring in this biome (Forzza *et al*., 2010).

Regarding the animals evaluated in studies on Cerrado interactions, most taxa belong to the bee family Apidae. This group of pollinators plays a critical role in the reproductive success of plants, including those found in the Cerrado (Ballantyne *et al.*, 2017; Oliveira & Gibbs, 2000; Martins *et al*., 2025b; Valadao-Mendes *et al*., 2025), and has the highest number of interaction partners in the biome. This result reinforces patterns observed in other biomes and smaller-scale studies in the Cerrado, where social and generalist bees, such as the exotic *Apis mellifera* and the native *Trigona spinipes*, are the most frequent floral visitors (Oliveira & Gibbs, 2000). Moreover, our findings highlight the diversity of interaction types beyond pollination, such as floral resource robbing and nesting-related behaviors, although most floral visitors in the Cerrado are still broadly categorized as "floral visitors" due to the lack of specific interaction records (Figure 6). This diversity reinforces that not all floral visits equally contribute to reproductive success, as some may have neutral or even antagonistic effects (Hargreaves *et al*., 2009; Irwin *et al*., 2010; Torreta *et al.*, 2022).

Furthermore, the absence of descriptors detailing the specific contact sites between floral structures and animal body parts limits our understanding of pollination effectiveness and the functional outcomes of visits. Similarly, although nectar and pollen are the most frequently reported floral resources reflecting generalist foraging strategies typical of many Cerrado floral visitors (Rosas-Guerrero *et al*., 2014;

Dellinger, 2020), the lack of detailed information on the collected resources suggests a bias toward those that are more easily observable in the field (Salim *et al*., 2022). Taken together, these patterns indicate that both methodological constraints and observational biases may influence how plant–floral visitor interactions are characterized and interpreted in the Cerrado (Hortal *et al*., 2015).

The species richness of other taxonomic groups reported in the studies highlights the high diversity of floral visitors in the biome, including commonly studied functional groups (e.g., hummingbirds, wasps) and less-represented groups (e.g., beetles, moths) (Table 2), demonstrating the importance of other animals beyond bees for the ecological dynamics of Cerrado angiosperms (Fenster *et al*., 2004, Monteiro *et al*, 2021). However, as with plants, the species richness of floral visitors is associated with the number of studies in which they are cited (Figure 5), revealing persistent knowledge gaps in faunal interactions.

Thus, our findings suggest that the high number of taxa recorded with a single interaction partner is more likely a consequence of insufficient sampling than ecological specialization (Hortal *et al*., 2015). Moreover, the uneven representation of taxonomic groups, such as the dominance of Apidae among animals and a few overrepresented angiosperm families among plants, highlights persistent research biases that hinder a comprehensive understanding of biodiversity in this biome. Such gaps not only obscure the ecological roles of lesser-known species but also compromise the development of effective conservation strategies, limiting our capacity to preserve the complex plant–pollinator interactions that sustain Cerrado ecosystems (Fonseca *et al*., 2008; Colli *et al*., 2020).

Descriptors of plant-pollinator interactions

The descriptors analyzed in this study highlight additional knowledge gaps regarding the functional traits of species involved in plant–pollinator interactions in the Cerrado (Figure 8). These gaps correspond to the Raunkiæran shortfall, which reflects the lack of information on traits that directly mediate ecological interactions, affecting the functional roles species play within their communities (Hortal *et al*., 2015; Carvalho *et al*., 2025).

These descriptors are essential for understanding how species interact, as they often determine coupling or decoupling between species pairs along a *continuum* of specialization and generalization (Rosas-Guerrero *et al*., 2014; Dellinger, 2020; Keasar & Wajnberg, 2025). Specialist species are associated with specific morphological or behavioral traits that restrict their potential partners (e.g., uncommon floral resources, floral symmetry, shape, or color) while generalist species interact through broader, less restrictive traits (Fenster *et al.*, 2004; Danieli-Silva *et al*., 2011; Armbruster, 2017; Oleques et al., 2020).

For example, tubular or closed corollas can act as morphological filters, requiring specific adaptations from visitors, while open corollas allow easier access to floral rewards (Machado & Lopes, 2004). The floral resource itself may also signal specialization. Floral oils, for instance, is considered a highly specialized reward. Such trait is critical to understanding the establishment of specific interaction partnerships (Oleques *et al.*, 2020; Ramírez-Burbano *et al*., 2022).

Even pollen, a widely offered floral resource, can present functional restrictions depending on the mode of anther dehiscence. Poricidal anthers require vibration (buzz collection or buzz pollination), a behavior performed only by certain bee groups (Luca & Vallejo-Marín, 2013; Vallejo-Marín, 2019). Nectar is another common floral resource, but it can be offered with some kind of restriction, as when it is presented inside long and narrow spurs able to restrict visitors due to its size and morphology (Nilsson, 1998; Tamar & Wajnberg, 2025). Despite the ecological importance of these features, descriptors such as nectar dynamics, contact location, and floral morphology were reported for less than half of the species and interactions documented. This scarcity of trait data limits our ability to interpret interaction mechanisms and pollination effectiveness across the Cerrado.

Conclusion

This study provides a comprehensive synthesis based on currently available and accessible literature on plant-pollinator interactions in the Brazilian savanna, the Cerrado. By compiling and standardizing data within a reproducible framework guided by ecological descriptors, and focusing on studies that met explicit inclusion criteria, we identified geographic, taxonomic, and functional biases that reflect meaningful progress while also exposing persistent gaps, particularly concerning the geographic distribution of interactions, the phylogenetic diversity of taxa involved, and the availability of functional trait data. These findings should be interpreted in the context of the studies included in the review, but they nonetheless point to structural limitations that hinder a full understanding of the dynamics and resilience of ecological interactions in this biodiversity hotspot.

Our results highlight the importance of expanding geographic coverage, diversifying sampling approaches, and incorporating trait-based methods to improve ecological inference in future research efforts. Addressing these gaps is critical not only for advancing basic ecological knowledge, but also for informing conservation planning, restoration initiatives, and the management of ecosystem services. Moreover, even with the current limitations in data coverage, understanding plant-pollinator interactions is essential for anticipating the impacts of climate change and land-use change on ecological networks, and for guiding evidence-based public policies aimed at preserving biodiversity in the Cerrado.

The standardized dataset provided here represents a flexible and expandable resource for future research, and underscores the need for a more integrative and collaborative research agenda capable of incorporating new data, filling historical knowledge gaps, and supporting the long-term sustainability of this ecologically and economically important biome.

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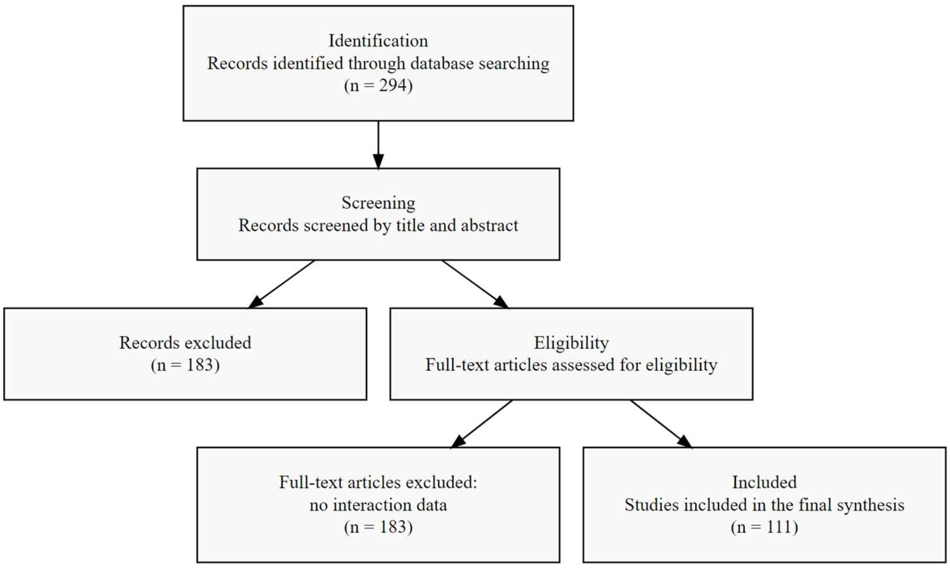

Figure 1. PRISMA flow diagram illustrating the literature screening and selection process used to compile studies on plant-pollinators interactions in the Brazilian Cerrado. The diagram shows the number of records identified, screened, and excluded, resulting in the final dataset of studies containing ecological descriptors of plant-pollinators interactions.

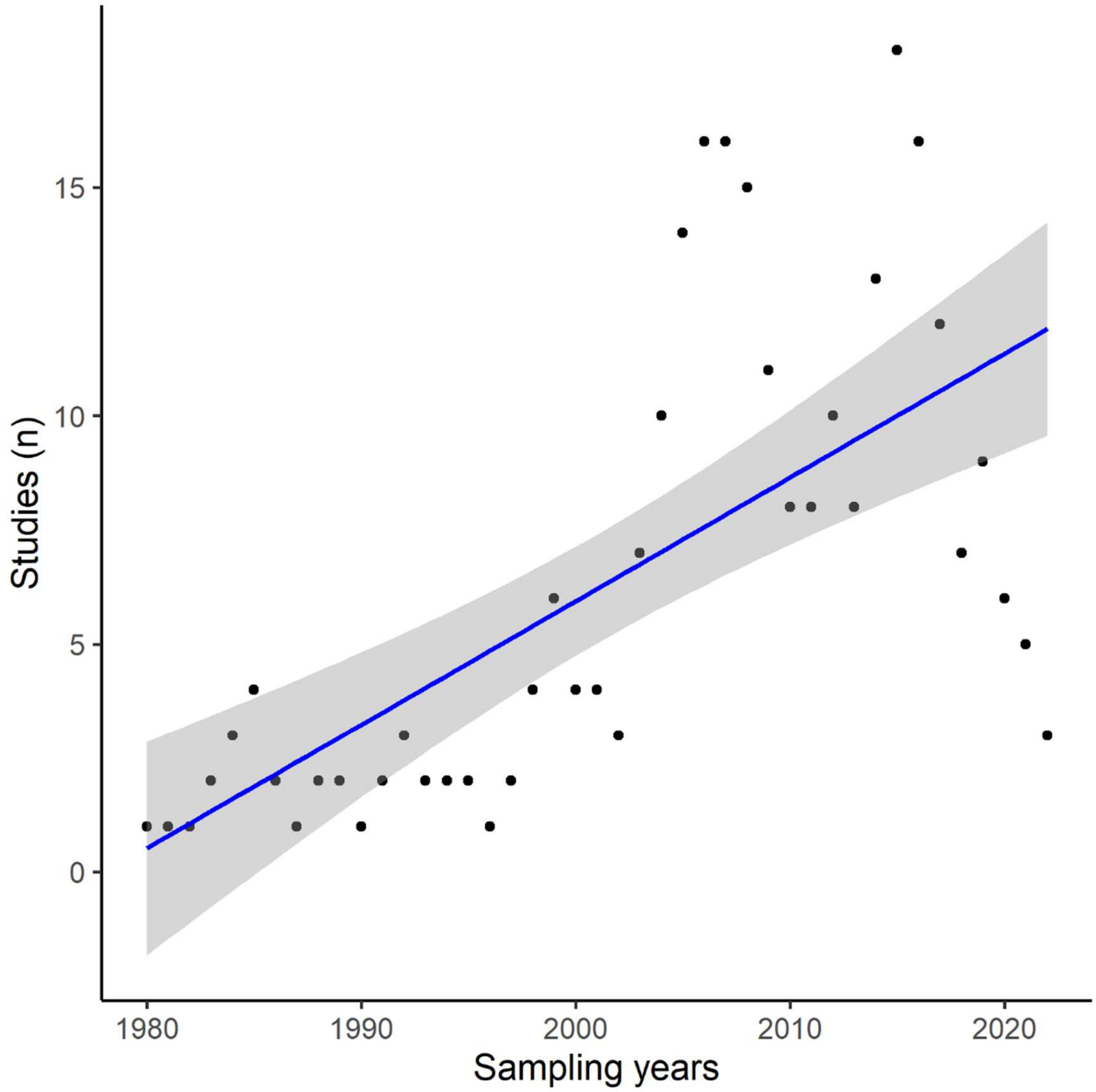

Figure 2. Trend in the distribution of plant-floral visitor interaction studies in the Cerrado relative to the year of data collection.

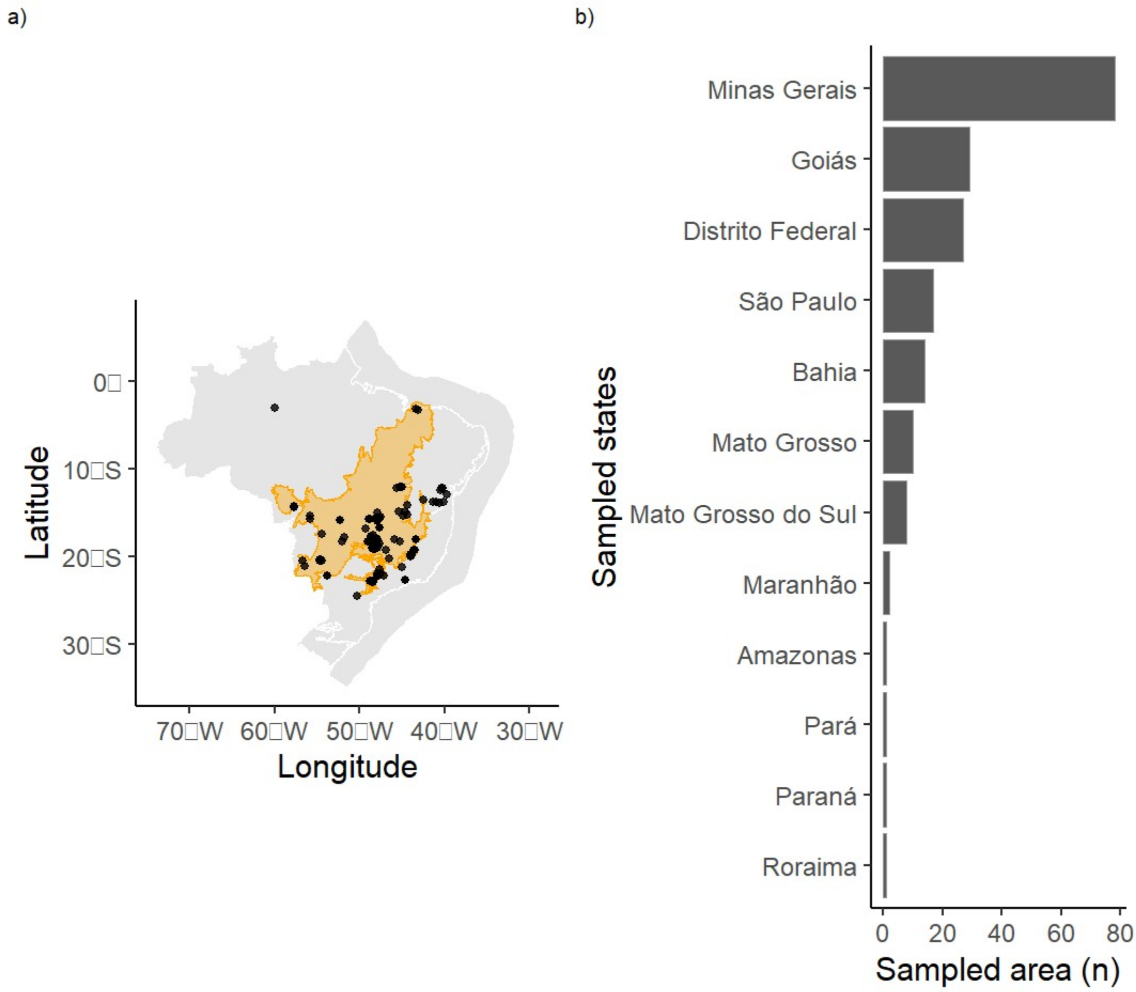

Figure 3. Trend in the distribution of plant–pollinator interaction studies in the Cerrado relative to data collection areas by Brazilian state, where (a) shows a map of Brazil highlighting the Cerrado biome with points representing the coordinates of reported interactions, and (b) a bar plot showing the number of studies conducted in each Brazilian state.

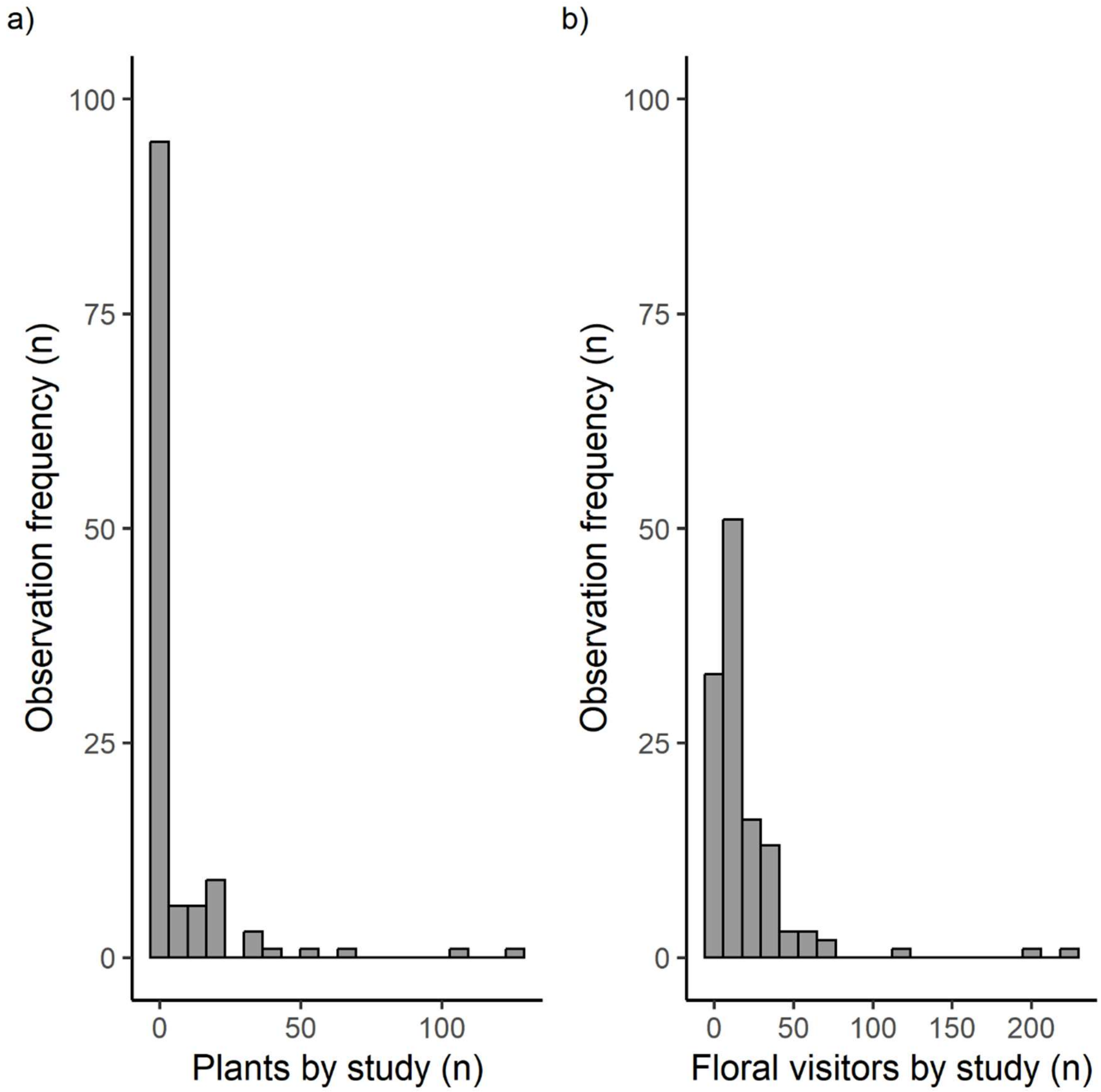

Figure 4. Trend in species records per study of plant–floral visitor interactions in the Cerrado, where (a) shows the number of plant taxa reported per study, and (b) the number of floral visitor taxa reported per study.

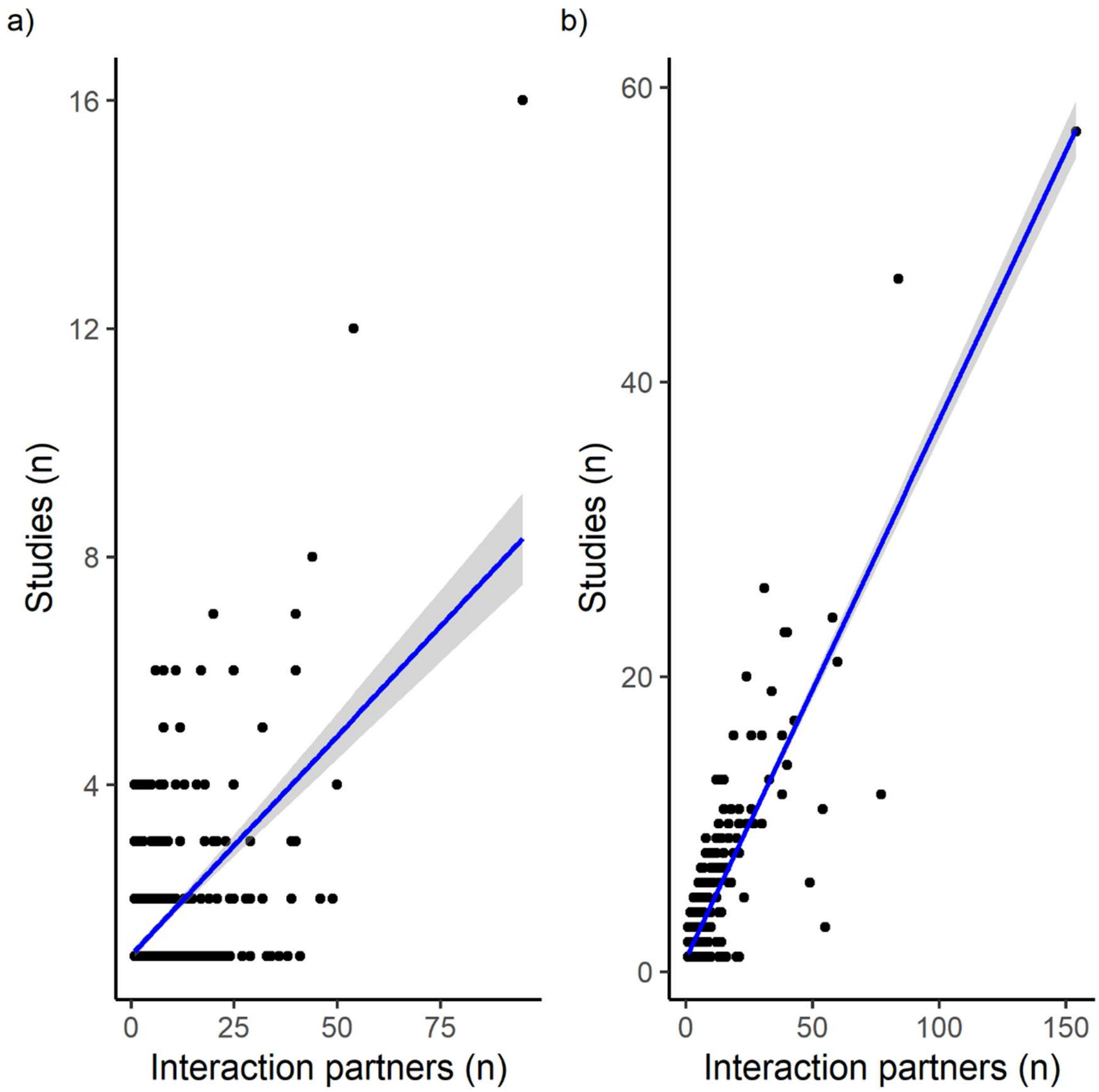

Figure 5. Relationship between the number of interaction partners of each taxon and the number of references in which it was cited for (a) plant taxa and (b) animal taxa.

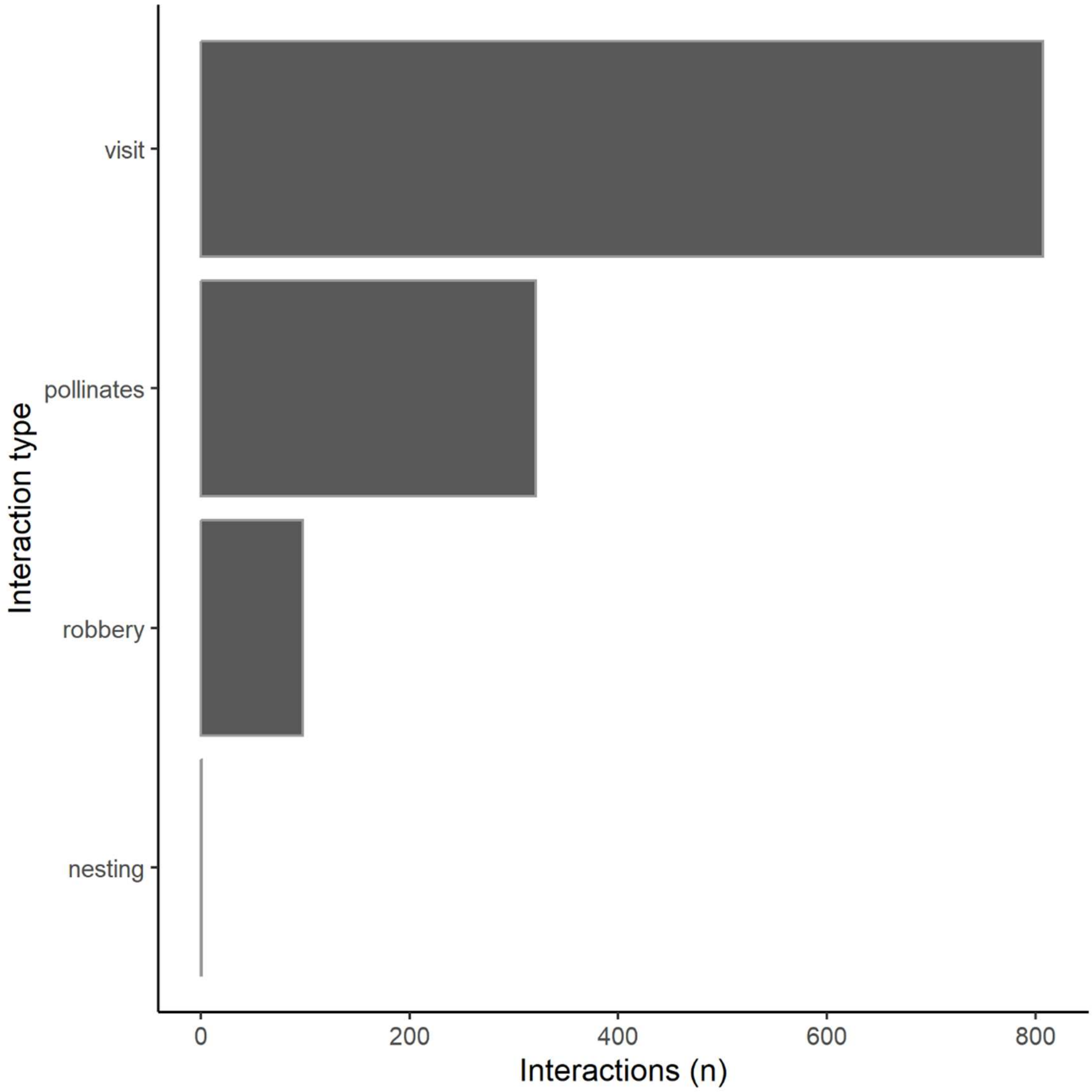

Figure 6. Types of interactions between plants and animals reported in the reviewed studies from the Cerrado.

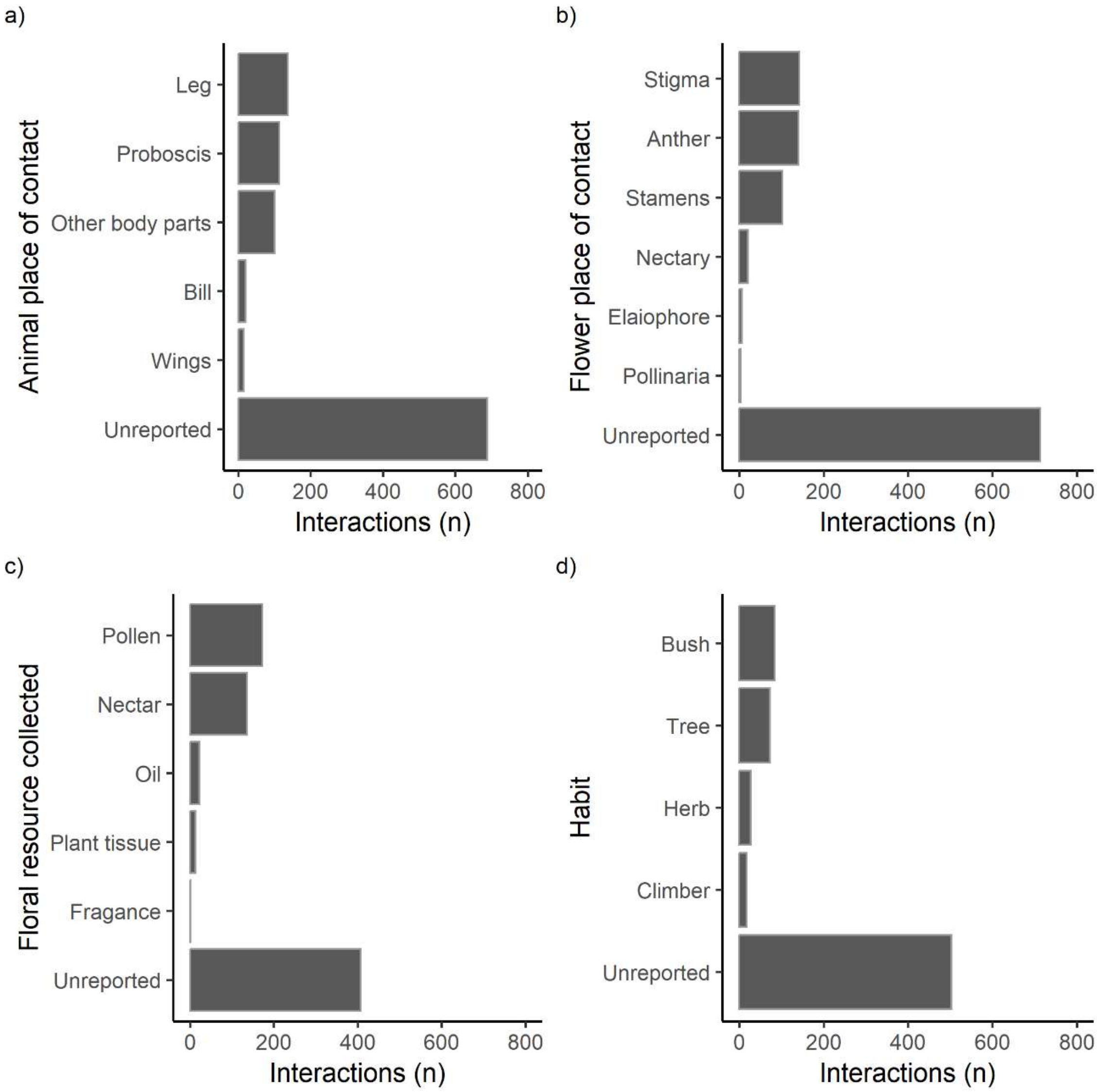

Figure 7. Standardized vocabulary of the main descriptors reported in the studies, according to Salim *et al.* (2022), where (a) represents the animal body part of contact during the interaction, (b) the floral structure of contact during the interaction, (c) the floral resource collected, and (d) the habit of plant taxa.

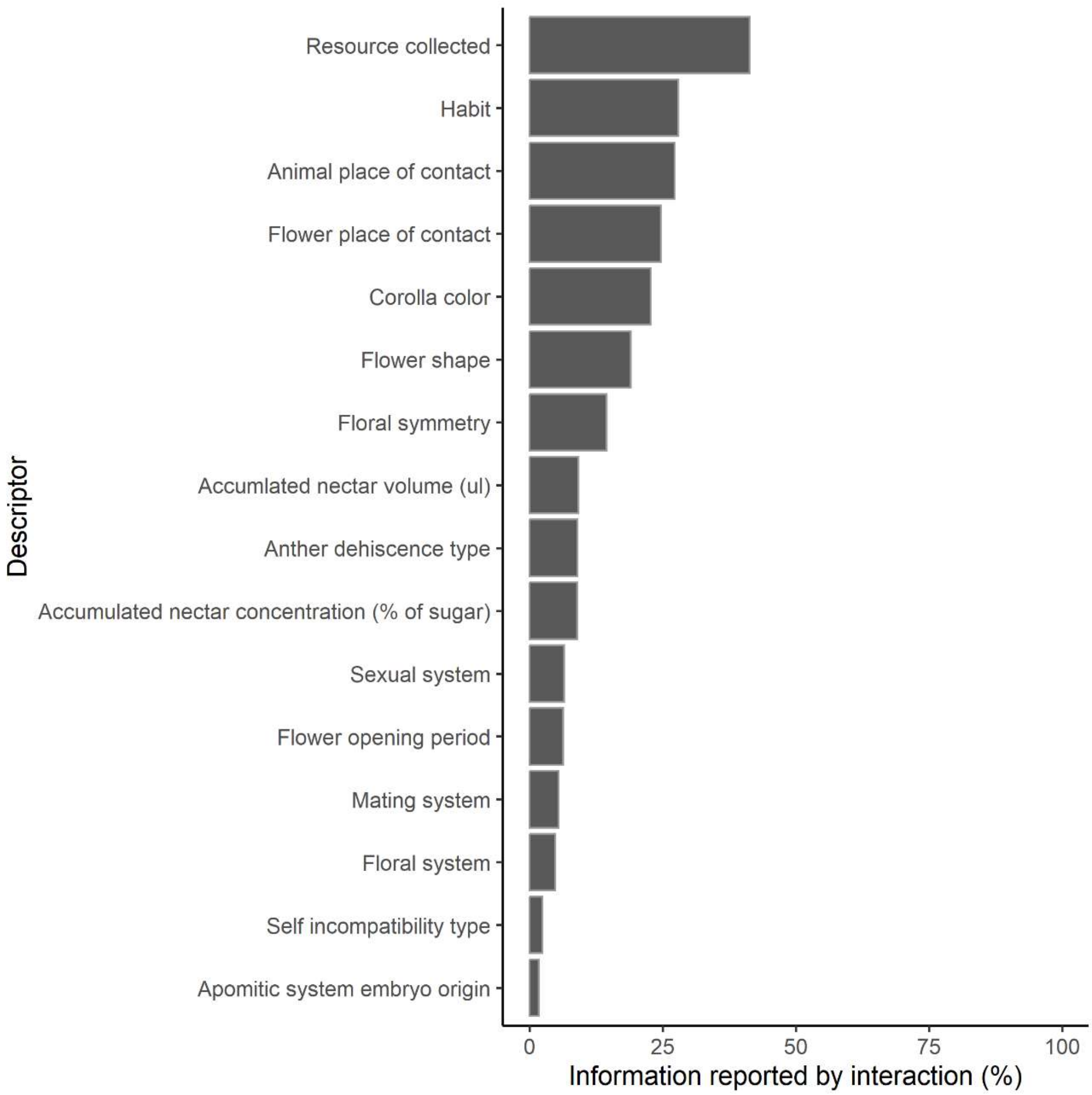

Figure 8. Descriptors of flowers, interactions, nectar dynamics, reproductive success, and plants, as reported and reviewed according to Salim *et al.* (2022). For more details see Tables S5 and S6.

Table S1 – List of plant-pollinators interactions’ descriptors according to Salim *et al.* (2022) selected to extract from the reviewed studies of plant-pollinator interactions in the Cerrado.

Descritor Term	**Descritor Class**	**Vocabulary**
Class	Taxon	Scientific class
Order	Taxon	Scientific order
Superfamily	Taxon	Scientific superfamily
Family	Taxon	Scientific family
Subfamily	Taxon	Scientific subfamily
Tribe	Taxon	Scientific tribe
Genus	Taxon	Scientific genus
Subgenus	Taxon	Scientific subgenus
Specific epithet	Taxon	Scientific specific epithet
Verbatim name	Taxon	Verbatim name
Anther dehiscence type	Plants	Longitudinal; poricidal; transverse; valvar
Apomitic system embryo origin	Plants	Gametophytic or sporophytic
Floral symmetry	Plants	Actinomorphic; zygomorphic; asymmetric
Floral system	Plants	Cleistogamy; dichogamy; enantiostyly; flexistyly or movements of floral whorls; heteranthery; heterodichogamy; heterostyly; herkogamy; resupinate dimorphy; stylar dimorphism
Flower shape	Plants	Bell-funnel; brush; dish; flag; gullet; trumpet; tube
Flower opening period	Plants	The time or interval during which a flower opens
Functional flower life span in hours	Plants	The total amount of hours during which a flower is sexually functional
Plant habit	Plants	Bush; climber; herb; tree
Mating system	Plants	Autogamy; geitonogamy; xenogamy
Self incompatibility type	Plants	Gametophytic; late-acting; sporophytic heteromorphic; sporophytic homomorphic
Sexual system	Plants	Androdioecy; andromonoecy; cosexuality; dioecy; gynodioecy; gynomonoecy; monoecy; trimonoecy
Seed mass (mg)	Reproductive success	The total mass in miligrams of the seeds of mature fruit(s)
Seed set	Reproductive success	The total number of seeds of mature fruit(s)
Fruit mass (g)	Reproductive success	The total mass in grams of the fruit(s)

Accumulated nectar volume (ul)	Nectar dynamics	The total volume in microliters of nectar accumulated by the flower(s)
Accumulated nectar concentration (% of sugar)	Nectar dynamics	The concentration of the nectar accumulated by the flower(s)
Animal place of contact	Interaction	Bill; leg; proboscis; wings
Flower color	Flower	Blue; indigo; orange; pink; purple; red; violet; white; yellow
Flower place of contact	Interaction	Anther; stamens; stigma
Resource collected	Interaction	Extrafloral nectar; fragrance; nectar; oil; ovule; plant tissue; pollen; resin; shelter; stigma exudates
Interaction type	Interaction	Biotically interacts with; has flowers used as nest by; has flowers robbed by; has flowers visited by; nest in flowers; pollinated by; pollinates; rob flowers of; visited by; visits; visits flowers of
References	Record level	Dataset reference
Basis of record	Record level	The specific nature of the data record
Country code	Location	The country code where the interaction was recorded
State or Province	Location	The State or Province where the interaction was recorded
Municipality	Location	The Municipality where the interaction was recorded
Decimal latitude	Location	The decimal latitude where the interaction was recorded
Decimal longitude	Location	The decimal longitude where the interaction was recorded
Verbatim latitude	Location	The verbatim latitude where the interaction was recorded
Verbatim longitude	Location	The verbatim longitude where the interaction was recorded
Event date	Event	The event date where the interaction was recorded
Event time	Event	The event time where the interaction was recorded
Sampling protocol	Event	The sampling protocol where the interaction was recorded
Sampling effort	Event	The sampling effort where the interaction was recorded

Table S2. Descriptors of the spatial-temporal distribution and records of the studies included in the systematic review of plant-pollinator interactions in the Cerrado (132 publications from 1990 to June 2024).

References	**Sampled years**	**Sampled areas**	**Basis of Record**	**Sampling Effort**	**Plants (n)**	**Floral visitors (n)**
Adler, 2000	2014 to 2015	São Paulo (1)	Human observation		1	6
Aguiar & Diniz (personal communication, 2022)		Distrito Federal (1)	Pollen collected on bats	47 hours 20 minutes	1	1
Almeida et al., 2020		Mato Grosso (1)	Human observation		1	47
Almeida-Anacleto *et al*., 2012		São Paulo (2)	Pollen analysis		39	1
Almeida-Soares et al. (personal communication, 2022)	2004	Minas Gerais (1)			1	35
Amorim & Oliveira, 2006	2003 to 2004	Minas Gerais (1)	Human observation	40 hours	1	5
Amorim et al., 2011	2006	Goias (1)	Human observation		1	4
Amorim et al., 2022	2003 to 2020	Minas Gerais (1)	Pollen analysis		23	42
Anselmo & Maruyama (personal communication, 2022)		Minas Gerais (1)	Human observation	249 hours 30 minutes	17	4
Aragão et al., 2019	2015 to 2017	Bahia (1)	Human observation	48 hours	1	8
Aranguren *et al*., 2018	2012 and 2015 to 2016	Minas Gerais (2)	Human observation	279 hours	1	8
Araújo & Rocha-Filho, 2019	2001 to 2003	Minas Gerais (1)	Human observation	42 hours	1	25

Araujo (personal communication, 2022a)		Mato Grosso (1)	Human observation		12	3
Araujo (personal communication, 2022b)		Minas Gerais (1)			1	5
Araújo *et al*., 2013	2007 to 2008	Minas Gerais (1)	Human observation	258 hours	34	8
Araujo *et al*., 2020	2013 to 2018	Minas Gerais (1)		60 hours	1	11
Araújo *et al*., 2021	2012 to 2018	Minas Gerais (1)	Pollen analysis		22	2
Assunção *et al*., 2022	2019 to 2020	Distrito Federal (1)	Human observation	41 hours	11	11
Ballarin & Amorin (personal communication, 2022)					15	27
Ballarin et al., 2022		São Paulo (1)	Human observation		1	7
Barbosa & Franco-Assis, 2018	2016	Bahia (1)		4 hours 15 minutes	1	4
Barbosa et al., 2020	2016	Bahia (1)		14 hours 45 minutes	1	12
Barbosa, 1999	1991	Minas Gerais (1)	Human observation		1	15
Barônio & Torezan-Silingardi (personal communication, 2022)	2011 to 2012	Minas Gerais (1)		27 hours 30 minutes	3	32
Barros, 2002	1985 to 1986	Distrito Federal (1)	Human observation		2	14
Boas et al., 2013	2007 to 2009	Mato Grosso do Sul (1)	Human observation	60 hours	2	13
Bosenbecker & Maruyama (personal communication, 2022)	2022	Minas Gerais (9)			38	8
Cabral & Pansarin, 2016	2011 to 2011	São Paulo (1)	Human observation	94 hours	1	3
Cappellari et al., 2011	2008 to 2009	Distrito Federal (1)	Human observation	33 hours	1	13

Cappellari *et al.,* 2012	2003 to 2010	Distrito Federal (1), Minas Gerais (1) and Paraná (1)	Pollen analysis		7	3
Carvalho & Oliveira, 2010	2005 to 2006	Minas Gerais (3)	Human observation	198 hours	1	105
Clemente *et al*., 2017	2007 to 2008	Minas Gerais (1)	Human observation	240 hours	15	27
Coelho et al., 2017	2011 to 2013	Goias (1)	Human observation	50 hours	1	3
Coelho et al., 2020		Goias (1)	Human observation	80 hours	1	11
Coelho et al., 2021		Goias (2)	Human observation	60 hours	1	11
Consolaro et al. (personal communication, 2022)	2014	Goias (1)		40 hours	1	4
Costa et al., 2017	2005 to 2006	Mato Grosso (1)	Human observation	91 hours	1	5
Cunha (personal communication, 2022)	2007 to 2008, and 2013	Goias (1) and Mato Grosso do Sul (2)			4	6
Damascena et al., 2017	2014 to 2016	Minas Gerais (1)	Human observation		1	15
Del-Claro et al. (personal communication, 2022)	2014	Minas Gerais (1)			1	18
Del-Claro *et al.,* 2019	2014 to 2014	Distrito Federal (1)	Human observation	35 hours	1	18
Diniz & Aguiar, 2022	2021 to 2021	Distrito Federal (1)	Pollen analysis	47 hours 20 minutes	1	8
Diniz & Aguiar, 2022	2019 to 2020	Distrito Federal (1)	Human observation		31	13
Diniz & Aguiar, 2023a	2019 to 2021	Distrito Federal (1)	Pollen analysis		22	12
Diniz & Aguiar, 2023b	2019 to 2020	Distrito Federal (1)	Pollen analysis		31	13
Diniz et al., 2022		Distrito Federal (1)	Pollen analysis		22	10
Duarte et al., 2014	2008 to 2010	Minas Gerais (2)			1	12
Elias et al., 2012	2009 to 2010	Goias (1)	Human observation		1	1

Faria *et al.*, 2022	2018 to 2019	Minas Gerais (1)	Human observation	126 hours	1	5
Farinasso & Consolaro (personal communication, 2022)	2017	Distrito Federal (1) and Goias (1)		40 hours	1	7
Ferreira & Torezan-Silingardi (personal communication, 2022)	2012	Minas Gerais (1)			2	6
Ferreira et al., 2016		Minas Gerais (1)	Human observation	40 hours	3	6
Freitas & Sazima, 2006	1997 to 2000	São Paulo (3)	Human observation	2644 hours	103	196
Freitas et al., 2011		São Paulo (1)	Human observation	31 hours	1	22
Gaglianone, 2001	1998 to 1999	São Paulo (1)	Human observation		11	1
Galdino et al., 2023	2005 to 2006	Minas Gerais (1)	Human observation	20 hours	2	22
Gélvez-Zúñiga et al., 2018	2015 to 2016	Minas Gerais (1)		300 hours	1	41
Gladiano et al., 2023	2015 to 2016	Minas Gerais (1)	Human observation		1	20
Gottsberger & Webber, 2018		Amazonas (1)	Human observation		7	4
Gribel & Hay, 1993	1983 to 1985	Distrito Federal (1)	Human observation		1	28
Guimarães et al., 2008	2004 to 2006	São Paulo (2)	Human observation	180 hours	1	13
Guimarães et al., 2015		Minas Gerais (1)			1	6
Hachuy-Filho et al., 2020	2016 to 2018	São Paulo (1)			16	5
Hughes et al., 2021	2010 to 2011	Minas Gerais (1)	Human observation		2	4
Ibarra-Isassi & Oliveira, 2018	2015	São Paulo (1)	Human observation	15 hours	1	8
Lenza et al., 2008	1998 to 2000	Distrito Federal (2)	Human observation		1	18

Lira et al., 2024	2021 to 2022	Mato Grosso (2)	Human observation, photographs and video-recording		1	1
Machado et al., 2010	1995	Minas Gerais (1)	Human observation		1	30
Maia *et al*., 2021	2015	Mato Grosso do Sul (2)	Human observation		1	25
Maianne et al., 2022	2018 to 2019	Minas Gerais (1)	Human observation	308 hours	21	9
Marcelo et al., 2021	2017	Goias (3)		60 hours	1	34
Maruyama *et al*., 2010	2003 to 2008	Minas Gerais (1)		64 hours	1	10
Maruyama *et al*., 2012	2007 to 2010	Minas Gerais (1)	Human observation	33 hours	1	12
Maruyama *et al*., 2013	2009 to 2011	Minas Gerais (2)	Human observation	40 hours	23	8
Maruyama *et al*., 2016	2008 to 2008	Goias (1) and Minas Gerais (1)	Human observation		1	4
Matias *et al*., 2016		Goias (1)	Human observation	325 hours	11	6
Matias et al., 2016	2012 to 2015	Goias (1)	Human observation		3	17
Matias et al., 2021	2015 to 2016	Goias (1)	Human observation	80 hours	4	64
Melazzo & Oliveira, 2012		Minas Gerais (1)	Human observation	100 hours	1	5
Mendes *et al*., 2011	2005 to 2007	Maranhão (1)	Human observation		2	31
Miranda *et al*., 2015	2012 to 2014	Bahia (10) and Minas Gerais (1)	Human observation		52	1
Montesinos & Oliveira, 2015	2001	Minas Gerais (1)	Human observation	21 hours	1	3
Morais *et al*., 2020a	2015 to 2017	Distrito Federal (2) and Goias (3)	Pollen analysis		2	38
Morais et al., 2020b	2015 to 2017	Distrito Federal (2) and Goias (3)	Human observation	40 hours	1	7
Moura et al., 2023	2018 to 2021	Minas Gerais (1)	Human observation		1	2
Munin et al., 2008	2002 to 2005	Mato Grosso (1)	Human observation		1	1

Nascimento et al. (personal communication, 2022)		Minas Gerais (1)			67	56
Oliveira & Gibs, 1994	1988 to 1989	Distrito Federal (1)	Human observation		6	20
Oliveira & Sazima, 1990	1984 to 1985	Distrito Federal (2)	Human observation, photographs and video-recording		2	36
Oliveira et al., 1992		Distrito Federal (1) and Minas Gerais (1)	Human observation		2	8
Oliveira *et al*., 2004	1992 to 1999	Minas Gerais (1)	Human observation		1	7
Paulino-Neto, 2014	2006 to 2007	São Paulo (1)	Human observation		1	10
Paz et al. (personal communication, 2022)	2017	Distrito Federal (3)	Human observation, photographs	26 hours	2	33
Polatto & Chaud-Neto, 2013	2010 to 2011	Mato Grosso do Sul (1)	Human observation		19	74
Potascheff *et al*., 2014		Mato Grosso (1)		227 hours	1	24
Rabelo et al., 2012	2008 to 2009	Minas Gerais (2)	Pollen analysis		14	1
Ramos et al., 2007	2005 to 2008	Maranhão (1)	Human observation, pollen analysis and video-recording		2	1
Ramos et al., 2018	2016 to 2017	Distrito Federal (1) and Goias (2)	Human observation		1	35
Ranieri et al., 2013	2004	Minas Gerais (1)		24 hours	1	5
Raupp et al. (personal communication, 2022)	2016 to 2017	Goias (2)			1	16
Rech et al., 2018	2015	Goiás (1), Mato Grosso (1), Pará (1) and Roraima (1)	Human observation		1	50

Ribeiro et al., 2023	2023	Distrito Federal (1)			1	16
Sá et al. (personal communication, 2022)	2016 to 2017	Distrito Federal (1)		144 hours	1	3
Sá et al., 2016	2011 to 2013	Goias (1)	Human observation	24 hours	4	118
Sampaio, 2016	2006 to 2009	Minas Gerais (2)		29 hours 15 minutes	2	30
Santos et al., 1997	1992 to 1994	Minas Gerais (1)	Human observation		1	13
Santos et al., 2014	2012 to 2012	Minas Gerais (3)	Human observation	120 hours	1	13
Saravy et al., 2021	2019 to 2019	Mato Grosso (1)	Human observation		1	12
Saravy et al., 2022	2019 to 2020	Mato Grosso (1)	Human observation		1	8
Sigrist (personal communication, 2022)	2002 to 2003	Mato Grosso do Sul (1)			17	59
Silberbauer-Gottsberger *et al.,* 2010	1980 to 1990	São Paulo (1)	Human observation		2	65
Silva et al., 2014	2005 to 2007	Minas Gerais (1)	Human observation		1	34
Silva et al., 2015	2005 to 2007	Minas Gerais (1)	Human observation		1	6
Silva et al., 2015	2005 to 2007	Minas Gerais (1)	Human observation		1	7
Silva et al., 2024	2021 to 2022	Minas Gerais (3)	Human observation	90 hours	1	26
Silveira et al., 2015	2004 to 2005	Minas Gerais (1)			1	4
Siqueira, 2021	2014 to 2015	Minas Gerais (1)	Human observation		1	21
Soares & Morellato, 2018	2014 to 2015	Minas Gerais (1)		363 hours	1	17
Soares et al. (personal communication, 2022)	2014 and 2018	Minas Gerais (1)		310 hours	2	14
Soares et al., 2021	2014 to 2015	Minas Gerais (2)		363 hours	1	8
Sousa-Lopes *et al.,* 2016		Minas Gerais (1)	Human observation		1	33

Souza et al., 2018a	2012 to 2013	Goiás (1) and Mato Grosso do Sul (1)	Human observation		127	225
Souza et al., 2018b		Bahia (1)	Human observation	12 hours	1	3
Stahl et al., 2012	2008 to 2009	São Paulo (1)	Human observation	60 hours	1	7
Stefani *et al.,* 2017	2015 to 2015	Minas Gerais (1)	Human observation	40 hours	1	5
Stehmann & Semir, 2001		Minas Gerais (1)			1	1
Torezan-Silingardi & Del-Claro (personal communication, 2022)	1991 to 1992	São Paulo (1)		32 hours	1	6
Torezan-Silingardi & Oliveira (personal communication, 2022)	1999 to 2001	Minas Gerais (1)			2	8
Torezan-Silingardi & Oliveira, 2004	1999 to 2001	Minas Gerais (2)	Human observation	2 hours 55 minutes	2	8
Vilhena *et al*., 2012	2006 to 2008	Minas Gerais (1)	Human observation	108 hours	20	22
Yamamoto *et al*., 2012	2004 to 2007	Minas Gerais (4)	Human observation	183 hours	1	27

Table S3. List of plant taxa documented in studies on plant-pollinator interactions across the Cerrado, including taxonomic family, accepted names and synonyms, number of host plants, and citation frequency, based on a systematic review of 132 studies conducted from 1990 to June 2024.

Family	Plant species	Synonyms	Floral visitors (n)	Citations (n)
Acanthaceae	*Aphelandra longiflora*	*Geissomeria longiflora, Geissomeria pubescens*	2	3
Acanthaceae	*Dicliptera squarrosa*		2	3
Acanthaceae	*Eranthemum pulchellum*		2	1
Acanthaceae	*Geissomeria tetragona*		1	1
Acanthaceae	*Justicia*		1	2
Acanthaceae	*Justicia brandegeeana*		5	1
Acanthaceae	*Justicia monticola*		4	1
Acanthaceae	*Lepidagathis floribunda*		2	1
Acanthaceae	*Megaskepasma erythrochlamys*		3	2
Acanthaceae	*Pachystachys lutea*		2	1
Acanthaceae	*Ruellia*		1	1
Acanthaceae	*Ruellia brevifolia*		2	3
Acanthaceae	*Ruellia geminiflora*	*Ruellia humilis*	2	1
Acanthaceae	*Ruellia incomta*		1	1
Acanthaceae	*Sanchezia nobilis*		5	1
Acanthaceae	*Sanchezia oblonga*		2	1
Acanthaceae	*Thunbergia erecta*		2	1
Acanthaceae	*Thunbergia mysorensis*		1	1

Alismataceae	*Echinodorus longipetalus*	1	1
Alismataceae	*Sagittaria rhombifolia*	8	1
Amaranthaceae	*Chamissoa*	1	1
Amaranthaceae	*Gomphrena macrocephala*	1	1
Amaryllidaceae	*Hippeastrum glaucescens*	2	4
Anacardiaceae	*Anacardium*	3	3
Anacardiaceae	*Anacardium occidentale*	2	1
Anacardiaceae	*Tapirira guianensis*	1	1
Annonaceae	*Annona*	1	1
Annonaceae	*Annona coriacea*	11	4
Annonaceae	*Annona cornifolia*	3	2
Annonaceae	*Annona crassiflora*	8	1
Annonaceae	*Annona dioica*	1	1
Annonaceae	*Annona montana*	1	1
Annonaceae	*Annona tomentosa*	1	1
Annonaceae	*Cardiopetalum calophyllum*	1	1
Annonaceae	*Cymbopetalum euneurum*	1	1
Annonaceae	*Duguetia furfuracea*	4	2
Annonaceae	*Duguetia riparia*	1	1
Annonaceae	*Duguetia ulei*	1	1
Annonaceae	*Malmea manausensis*	1	1
Annonaceae	*Xylopia aromatica*	18	3
Apiaceae	*Eryngium canaliculatum*	2	1
Apiaceae	*Eryngium ebracteatum*	1	1
Apiaceae	*Eryngium horridum*	7	1
Apocynaceae	*Aspidosperma macrocarpon*	4	1
Apocynaceae	*Hancornia speciosa*	4	1

Apocynaceae	*Mandevilla emarginata*		1	1
Apocynaceae	*Mandevilla hirsuta*		2	1
Apocynaceae	*Mandevilla illustris*		3	1
Apocynaceae	*Mandevilla pohliana*		1	1
Apocynaceae	*Orthosia scoparia*	*Tassadia subulata*	3	1
Apocynaceae	*Oxypetalum appendiculatum*		1	1
Apocynaceae	*Oxypetalum sublanatum*		1	1
Apocynaceae	*Peplonia organensis*	*Gonioanthela hilariana*	2	1
Apocynaceae	*Prestonia coalita*		1	1
Apocynaceae	*Rauvolfia weddelliana*		1	1
Apocynaceae	*Schubertia grandiflora*		2	1
Aquifoliaceae	*Ilex affinis*		18	1
Aquifoliaceae	*Ilex dumosa*	*Ilex amara*	8	1
Araliaceae	*Didymopanax vinosus*	*Schefflera vinosa*	8	1
Arecaceae	*Allagoptera campestris*		8	1
Arecaceae	*Attalea phalerata*		21	1
Arecaceae	*Butia paraguayensis*		38	1
Arecaceae	*Cocos nucifera*		1	1
Arecaceae	*Syagrus*		2	2
Arecaceae	*Syagrus petraea*		29	1
Asparagaceae	*Cordyline fruticosa*		1	1
Asteraceae	*Achyrocline alata*		1	1
Asteraceae	*Achyrocline satureioides*		29	2
Asteraceae	*Aldama grandiflora*	*Viguiera grandiflora*	5	1
Asteraceae	*Aspilia*		2	1
Asteraceae	Asteraceae		1	1

Asteraceae	*Baccharis*		12	3
Asteraceae	*Baccharis aphylla*		3	1
Asteraceae	*Baccharis curitybensis*		1	1
Asteraceae	*Baccharis dracunculifolia*		9	1
Asteraceae	*Baccharis intermixta*		2	1
Asteraceae	*Baccharis linearifolia*	*Baccharis leptocephala*	2	1
Asteraceae	*Baccharis platypoda*		8	1
Asteraceae	*Baccharis sessiliflora*	*Baccharis pentziifolia*	6	1
Asteraceae	*Baccharis tarchonanthoides*		5	1
Asteraceae	*Barrosa betonicaeformis*		4	1
Asteraceae	*Bidens*		1	1
Asteraceae	*Calea*		1	1
Asteraceae	*Calea cuneifolia*		1	1
Asteraceae	*Campuloclinium megacephalum*	*Eupatorium megacephalum*	19	2
Asteraceae	*Chaptalia integerrima*		9	1
Asteraceae	*Chaptalia piloselloides*	*Chaptalia runcinata var. graminifolia*	10	1
Asteraceae	*Chromolaena*		7	1
Asteraceae	*Chromolaena decumbens*		1	1
Asteraceae	*Chromolaena leucocephala*		3	1
Asteraceae	*Chromolaena maximiliani*		14	2
Asteraceae	*Chromolaena squalida*		13	1
Asteraceae	*Chrysolaena desertorum*		1	1
Asteraceae	*Chrysolaena obovata*	*Vernonia herbacea*	2	1
Asteraceae	*Conyza bonariensis*		3	1

Asteraceae	*Cosmos sulphureus*		1	1
Asteraceae	*Dimerostemma*		2	1
Asteraceae	*Dimerostemma lippioides*	*Dimerostemma asperatum*	1	1
Asteraceae	*Elephantopus micropappus*		2	1
Asteraceae	*Elephantopus palustris*		1	1
Asteraceae	*Erechtites hieracifolius*		2	1
Asteraceae	*Eremanthus*		1	1
Asteraceae	*Eremanthus erythropappus*		11	1
Asteraceae	*Eremanthus mattogrossensis*		3	1
Asteraceae	*Erigeron*		19	1
Asteraceae	*Eupatorium*		2	2
Asteraceae	*Grazielia dimorpholepis*		6	1
Asteraceae	*Grazielia gaudichaudeana*		8	1
Asteraceae	*Helianthus annuus*		36	1
Asteraceae	*Hololepis pedunculata*		4	1
Asteraceae	*Hypochaeris lutea*	*Hypochaeris gardneri*	3	1
Asteraceae	*Ichthyothere*		2	1
Asteraceae	*Lepidaploa salzmannii*		6	1
Asteraceae	*Leptostelma maximum*	*Erigeron maximus*	4	1
Asteraceae	*Lessingianthus*		2	1
Asteraceae	*Lessingianthus bardanoides*		3	1
Asteraceae	*Lessingianthus grandiflorus*		2	1
Asteraceae	*Lessingianthus roseus*	*Vernonia rosea*	2	1
Asteraceae	*Lessingianthus tomentellus*	*Vernonia tomentella*	12	1
Asteraceae	*Lessingianthus venosissimus*		3	1
Asteraceae	*Lessingianthus virgulatus*		1	1

Asteraceae	*Lucilia lycopodioides*		2	1
Asteraceae	*Lychnophora*		2	1
Asteraceae	*Mikania cordifolia*		5	1
Asteraceae	*Mikania lundiana*		8	1
Asteraceae	*Mikania nummularia*		4	1
Asteraceae	*Mikania sessilifolia*		8	1
Asteraceae	*Moquiniastrum paniculatum*	*Gochnatia paniculata*	5	1
Asteraceae	*Piptocarpha rotundifolia*		4	2
Asteraceae	*Praxelis clematidea*		1	1
Asteraceae	*Praxelis kleinioides*		3	1
Asteraceae	*Riencourtia oblongifolia*		8	1
Asteraceae	*Senecio oleosus*		6	1
Asteraceae	*Stenocephalum megapotamicum*	*Vernonia megapotamica*	7	1
Asteraceae	*Stenocephalum tragiifolium*	*Vernonia tragiaefolia*	2	1
Asteraceae	*Stevia myriadenia*		13	1
Asteraceae	*Syagrus*		1	1
Asteraceae	*Symphyopappus compressus*		12	1
Asteraceae	*Trichogonia attenuata*		1	1
Asteraceae	*Trixis antimenorrhoea*		2	1
Asteraceae	*Vernonanthura polyanthes*	*Vernonia polyanthes*	9	2
Asteraceae	*Vernonanthura westiniana*	*Vernonia westiniana*	22	1
Asteraceae	*Vernonia*		4	2
Asteraceae	Vernoniae		1	2
Bignoniaceae	*Adenocalymma bracteatum*		46	2
Bignoniaceae	*Adenocalymma nodosum*		25	2
Bignoniaceae	*Adenocalymma peregrinum*	*Memora peregrina*	17	2

Bignoniaceae	*Amphilophium elongatum*	*Distictella elongata*	4	2
Bignoniaceae	*Anemopaegma acutifolium*		3	1
Bignoniaceae	Bignoniaceae		1	1
Bignoniaceae	*Cuspidaria convoluta*		4	1
Bignoniaceae	*Fridericia chica*		15	1
Bignoniaceae	*Fridericia florida*		14	2
Bignoniaceae	*Handroanthus*		1	1
Bignoniaceae	*Handroanthus albus*		2	1
Bignoniaceae	*Handroanthus heptaphyllus*		2	2
Bignoniaceae	*Handroanthus impetiginosus*		4	1
Bignoniaceae	*Handroanthus ochraceus*	*Tabebuia ochracea*	14	1
Bignoniaceae	*Handroanthus serratifolis*		2	1
Bignoniaceae	*Jacaranda brasiliana*		2	1
Bignoniaceae	*Jacaranda caroba*		8	1
Bignoniaceae	*Jacaranda oxyphylla*		12	1
Bignoniaceae	*Pyrostegia venusta*		9	2
Bignoniaceae	*Spathodea campanulata*		3	2
Bignoniaceae	*Tabebuia aurea*		18	4
Bignoniaceae	*Tabebuia roseoalba*		3	1
Bignoniaceae	*Zeyheria montana*		2	1
Bixaceae	*Cochlospermum regium*		1	1
Bombacaceae	*Pachira aquatica*		1	1
Brassicaceae	*Capparis flexuosa*		1	1
Bromeliaceae	*Aechmea aquilega*		1	1
Bromeliaceae	*Aechmea bromeliifolia*		4	2
Bromeliaceae	*Ananas ananassoides*		12	5
Bromeliaceae	*Bromelia balansae*		6	2

Bromeliaceae	*Bromelia plumieri*	3	1
Bromeliaceae	*Dyckia leptostachya*	1	1
Bromeliaceae	*Dyckia minarum*	2	1
Bromeliaceae	*Dyckia tuberosa*	1	1
Bromeliaceae	*Vriesea friburgensis*	3	1
Burseraceae	*Protium ovatum*	10	1
Cactaceae	*Cipocereus crassisepalus*	1	1
Calophyllaceae	*Kielmeyera abdita*	17	1
Calophyllaceae	*Kielmeyera coriacea*	50	4
Calophyllaceae	*Kielmeyera speciosa*	39	2
Calophyllaceae	*Kielmeyera variabilis*	21	2
Campanulaceae	*Lobelia camporum*	4	1
Campanulaceae	*Wahlenbergia brasiliensis*	4	1
Cannabaceae	*Trema micranthum*	1	1
Cannaceae	*Canna indica*	1	1
Caryocaraceae	*Caryocar brasiliense*	95	16
Celastraceae	*Plenckia populnea*	2	2
Celastraceae	*Salacia crassifolia*	1	1
Celastraceae	*Tontelea micrantha*	1	1
Chloranthaceae	*Hedyosmum brasiliense*	2	1
Chrysobalanaceae	*Hirtella gracilipes*	1	1
Clethraceae	*Clethra scabra*	19	1
Clusiaceae	*Calophyllum brasiliense*	1	1
Cochlospermaceae	*Cochlospermum*	1	1
Combretaceae	*Combretum fruticosum*	5	4
Combretaceae	*Combretum leprosum*	1	1
Commelinaceae	*Commelina erecta*	2	2

Connaraceae	*Connarus suberosus*	24	2
Connaraceae	*Rourea induta*	32	2
Convolvulaceae	*Convolvulus crenatifolius*	2	1
Convolvulaceae	*Evolvulus*	2	1
Convolvulaceae	*Ipomoea*	5	3
Convolvulaceae	*Ipomoea hederifolia*	4	1
Convolvulaceae	*Ipomoea procumbens*	4	4
Convolvulaceae	*Ipomoea purpurea*	1	1
Convolvulaceae	*Ipomoea ramosissima*	2	1
Convolvulaceae	*Jacquemontia*	3	1
Convolvulaceae	*Jacquemontia grandiflora*	7	1
Convolvulaceae	*Jacquemontia montana*	1	1
Convolvulaceae	*Merremia*	1	1
Convolvulaceae	*Merremia tomentosa*	3	4
Cordiaceae	*Cordia*	1	1
Costaceae	*Costus spiralis*	3	2
Cunoniaceae	*Lamanonia ternata*	5	3
Cunoniaceae	*Weinmannia organensis*	2	1
Cyperaceae	*Ascolepis brasiliensis*	1	1
Cyperaceae	*Rhynchospora globosa*	5	1
Cyperaceae	*Rhynchospora nervosa*	1	1
Cyperaceae	*Rhynchospora robusta*	2	1
Dilleniaceae	*Curatella americana*	49	2
Dilleniaceae	*Davilla*	1	1
Dilleniaceae	*Davilla elliptica*	2	1
Droseraceae	*Drosera montana*	2	1
Ebenaceae	*Diospyros hispida*	1	1

Ericaceae	*Agarista hispidula*	2	1
Ericaceae	*Gaylussacia brasiliensis*	3	1
Ericaceae	*Gaylussacia chamissonis*	5	1
Ericaceae	*Gaylussacia jordanensis*	10	1
Ericaceae	*Gaylussacia reticulata*	3	1
Eriocaulaceae	*Eriocaulon magnum*	11	1
Eriocaulaceae	*Paepalanthus lundii*	15	2
Eriocaulaceae	*Paepalanthus paulensis*	10	1
Eriocaulaceae	*Paepalanthus polyanthus*	5	1
Eriocaulaceae	*Syngonanthus xeranthemoides*	12	1
Erythroxylaceae	*Erythroxylum*	2	2
Erythroxylaceae	*Erythroxylum amazonicum*	7	1
Erythroxylaceae	*Erythroxylum campestre*	24	2
Erythroxylaceae	*Erythroxylum cuneifolium*	1	1
Erythroxylaceae	*Erythroxylum deciduum*	24	1
Erythroxylaceae	*Erythroxylum microphyllum*	8	1
Erythroxylaceae	*Erythroxylum suberosum*	29	3
Erythroxylaceae	*Erythroxylum tortuosum*	11	1
Escalloniaceae	*Escallonia farinacea*	1	1
Euphorbiaceae	*Croton*	6	3
Euphorbiaceae	*Croton agoensis*	1	1
Euphorbiaceae	*Croton dichrous*	9	1
Euphorbiaceae	*Croton megaponticus*	6	1
Euphorbiaceae	*Croton siderophyllus*	4	1
Euphorbiaceae	*Euphorbia potentilloides*	1	1
Euphorbiaceae	*Euphorbia pulcherrima*	2	1
Euphorbiaceae	*Joanesia*	1	1

Euphorbiaceae	*Manihot tripartita*	9	1
Euphorbiaceae	*Manihot violacea*	7	1
Euphorbiaceae	*Maprounea guianensis*	1	1
Euphorbiaceae	*Microstachys serrulata*	5	1
Fabaceae	*Acacia mangium*	39	3
Fabaceae	*Acacia polyphylla*	1	1
Fabaceae	*Acosmium dasycarpum*	7	2
Fabaceae	*Acosmium subelegans*	1	1
Fabaceae	*Anadenanthera colubrina*	1	1
Fabaceae	*Andira*	2	1
Fabaceae	*Andira cujabensis*	1	1
Fabaceae	*Bauhinia*	1	1
Fabaceae	*Bauhinia brevipes*	11	4
Fabaceae	*Bauhinia curvula*	1	1
Fabaceae	*Bauhinia dumosa*	1	1
Fabaceae	*Bauhinia forficata*	1	1
Fabaceae	*Bauhinia goyazensis*	3	4
Fabaceae	*Bauhinia holophylla*	8	5
Fabaceae	*Bauhinia longifolia*	1	1
Fabaceae	*Bauhinia pulchella*	3	1
Fabaceae	*Bauhinia rufa*	8	6
Fabaceae	*Bauhinia ungulata*	8	4
Fabaceae	*Bauhinia variegata*	3	2
Fabaceae	*Bionia coriacea*	5	1
Fabaceae	*Bowdichia virgilioides*	2	1
Fabaceae	*Caesalpinia gardneriana*	1	1
Fabaceae	*Caesalpinia peltophoroides*	4	1

Fabaceae	*Caesalpinia pulcherrima*	1	1
Fabaceae	*Calliandra dysantha*	5	1
Fabaceae	*Camptosema coriaceum*	6	2
Fabaceae	*Canavalia palmeri*	1	1
Fabaceae	*Cenostigma nordestinum*	1	1
Fabaceae	*Centrosema brasilianum*	2	1
Fabaceae	*Cerradicola elliptica*	1	1
Fabaceae	*Chamaecrista*	1	1
Fabaceae	*Chamaecrista debilis*	1	1
Fabaceae	*Chamaecrista flexuosa*	2	1
Fabaceae	*Chamaecrista nictitans*	1	1
Fabaceae	*Chamaecrista orbiculata*	1	1
Fabaceae	*Chamaecrista punctulifera*	1	1
Fabaceae	*Chamaecrista zygophylloides*	5	1
Fabaceae	*Collaea cipoensis*	41	1
Fabaceae	*Copaifera langsdorffii*	2	2
Fabaceae	*Copaifera luetzelburgii*	2	1
Fabaceae	*Crotalaria*	1	1
Fabaceae	*Crotalaria breviflora*	3	1
Fabaceae	*Dalbergia cuiabensis*	4	1
Fabaceae	*Dalbergia miscolobium*	4	1
Fabaceae	*Deguelia hatschbachii*	1	1
Fabaceae	*Delonix regia*	1	1
Fabaceae	*Desmodium barbatum*	1	1
Fabaceae	*Dioclea*	2	1
Fabaceae	*Dioclea coriacea*	1	1
Fabaceae	*Dipteryx alata*	1	1

Fabaceae	*Erythrina speciosa*	2	3
Fabaceae	Fabaceae	5	3
Fabaceae	*Galactia martii*	5	1
Fabaceae	*Harpalyce brasiliana*	1	1
Fabaceae	*Hymenaea courbaril*	3	4
Fabaceae	*Hymenaea stigonocarpa*	8	5
Fabaceae	*Inga*	3	3
Fabaceae	*Inga edulis*	3	4
Fabaceae	*Inga laurina*	2	4
Fabaceae	*Inga vera*	54	12
Fabaceae	*Leucaena leucocephala*	13	1
Fabaceae	*Libidibia ferrea*	1	1
Fabaceae	*Lupinus velutinus*	5	1
Fabaceae	*Machaerium*	1	1
Fabaceae	*Machaerium opacum*	18	1
Fabaceae	*Mimosa*	3	1
Fabaceae	*Mimosa caesalpiniaefolia*	1	1
Fabaceae	*Mimosa claussenii*	1	1
Fabaceae	*Mimosa debilis*	1	1
Fabaceae	*Mimosa dichroa*	2	1
Fabaceae	*Mimosa dolens*	3	2
Fabaceae	*Mimosa gemmulata*	1	1
Fabaceae	*Mimosa hebecarpa*	5	1
Fabaceae	*Mimosa quadrivalvis*	1	1
Fabaceae	*Mimosa setosa*	1	4
Fabaceae	*Mimosa tenuiflora*	1	1
Fabaceae	*Mimosa xanthocentra*	1	1

Fabaceae	*Parkia platycephala*	2	1
Fabaceae	*Periandra mediterranea*	3	1
Fabaceae	*Phaseolus vulgaris*	34	1
Fabaceae	*Pityrocarpa moniliformis*	1	1
Fabaceae	*Plathymenia reticulata*	5	1
Fabaceae	*Sclerolobium aureum*	2	1
Fabaceae	*Sclerolobium paniculatum*	1	1
Fabaceae	*Senegalia*	10	2
Fabaceae	*Senegalia polyphylla*	10	1
Fabaceae	*Senna*	2	2
Fabaceae	*Senna cana*	2	1
Fabaceae	*Senna obtusifolia*	4	1
Fabaceae	*Senna rugosa*	2	2
Fabaceae	*Senna silvestris*	3	2
Fabaceae	*Strongylodon macrobotrys*	3	1
Fabaceae	*Stryphnodendron obovatum*	4	1
Gentianaceae	*Deianira nervosa*	1	1
Gentianaceae	*Deianira pallescens*	2	1
Gentianaceae	*Zygostigma australe*	2	1
Gesneriaceae	*Sinningia allagophylla*	4	1
Gesneriaceae	*Sinningia elatior*	25	2
Heliconiaceae	*Heliconia bihai*	2	1
Heliconiaceae	*Heliconia collinsiana*	1	1
Heliconiaceae	*Heliconia psittacorum*	5	4
Heliconiaceae	*Heliconia rostrata*	3	1
Hypericaceae	*Hypericum brasiliense*	4	1
Iridaceae	*Alophia*	2	1

Iridaceae	*Alophia geniculata*	10	1
Iridaceae	*Calydorea campestris*	4	1
Iridaceae	*Sisyrinchium micranthum*	2	1
Iridaceae	*Sisyrinchium vaginatum*	6	2
Lamiaceae	*Aegiphila integrifolia*	4	1
Lamiaceae	*Holmskioldia sanguinea*	4	1
Lamiaceae	*Hypenia reticulata*	1	1
Lamiaceae	*Hypti suaveolens*	1	1
Lamiaceae	*Hyptis*	5	2
Lamiaceae	*Hyptis alutacea*	2	1
Lamiaceae	*Hyptis caprariifolia*	2	1
Lamiaceae	*Hyptis ferruginosa*	1	1
Lamiaceae	*Hyptis lippioides*	7	1
Lamiaceae	*Hyptis plectranthoides*	4	1
Lamiaceae	*Hyptis villosa*	11	1
Lamiaceae	*Peltodon pusillus*	1	1
Lamiaceae	*Peltodon radicans*	1	1
Lamiaceae	*Rhabdocaulon stenodontum*	4	1
Lamiaceae	*Salvia cerradicola*	2	1
Lamiaceae	*Salvia scabrida*	1	1
Lauraceae	*Ocotea*	1	1
Lecythidaceae	*Eschweilera nana*	20	1
Lentibulariaceae	*Genlisea violacea*	8	1
Loganiaceae	*Spigelia sellowiana*	1	1
Loganiaceae	*Strychnos pseudoquina*	1	1
Loganiaceae	*Strychnos pseudoquina*	2	1
Loranthaceae	*Psittacanthus robustus*	17	6

Loranthaceae	*Struthanthus polyanthus*	16	1
Lythraceae	*Cuphea*	2	1
Lythraceae	*Cuphea glutinosa*	14	1
Lythraceae	*Cuphea linarioides*	1	1
Lythraceae	*Cuphea melvilla*	5	2
Lythraceae	*Lafoensia pacari*	20	7
Malpighiaceae	*Banisteriopsis*	3	3
Malpighiaceae	*Banisteriopsis adenopoda*	1	1
Malpighiaceae	*Banisteriopsis argyrophylla*	1	1
Malpighiaceae	*Banisteriopsis campestris*	23	3
Malpighiaceae	*Banisteriopsis laevifolia*	4	1
Malpighiaceae	*Banisteriopsis malifolia*	25	6
Malpighiaceae	*Banisteriopsis oxyclada*	1	1
Malpighiaceae	*Banisteriopsis variabilis*	6	1
Malpighiaceae	*Byrsonima*	8	2
Malpighiaceae	*Byrsonima basiloba*	1	1
Malpighiaceae	*Byrsonima brachybotrya*	1	1
Malpighiaceae	*Byrsonima coccolobifolia*	8	3
Malpighiaceae	*Byrsonima crassifolia*	4	1
Malpighiaceae	*Byrsonima intermedia*	44	8
Malpighiaceae	*Byrsonima pachyphylla*	11	2
Malpighiaceae	*Byrsonima rotunda*	15	1
Malpighiaceae	*Byrsonima umbellata*	28	2
Malpighiaceae	*Byrsonima variabilis*	9	1
Malpighiaceae	*Byrsonima verbascifolia*	3	2
Malpighiaceae	*Bysonima pachyphylla*	14	2
Malpighiaceae	*Diplopterys pubipetala*	6	2

Malpighiaceae	*Heteropterys*	8	2
Malpighiaceae	*Heteropterys byrsonimifolia*	2	1
Malpighiaceae	*Heteropterys campestris*	1	1
Malpighiaceae	*Heteropterys lomentosa*	1	1
Malpighiaceae	*Heteropterys pteropetala*	1	1
Malpighiaceae	*Heteropterys tomentosa*	2	1
Malpighiaceae	*Malpighia emarginata*	23	1
Malpighiaceae	*Peixotoa*	1	1
Malpighiaceae	*Peixotoa goiana*	1	1
Malpighiaceae	*Peixotoa reticulata*	11	2
Malpighiaceae	*Peixotoa tomentosa*	10	1
Malpighiaceae	*Pterandra pyroidea*	13	1
Malpighiaceae	*Stigmaphyllon lalandianum*	1	1
Malpighiaceae	*Verrucularia*	2	1
Malvaceae	*Abutilon striatum*	1	1
Malvaceae	*Ceiba pentandra*	3	4
Malvaceae	*Ceiba speciosa*	2	2
Malvaceae	*Corchorus hirtus*	3	1
Malvaceae	*Desmanthus*	1	1
Malvaceae	*Eriotheca gracilipes*	9	3
Malvaceae	*Eriotheca pubescens*	5	1
Malvaceae	*Helicteres*	1	1
Malvaceae	*Helicteres brevispira*	7	3
Malvaceae	*Helicteres sacarolha*	3	2
Malvaceae	*Hibisco*	4	1
Malvaceae	*Luehea divaricata*	7	1
Malvaceae	*Luehea grandiflora*	4	2

Malvaceae	*Luehea paniculata*	1	1
Malvaceae	*Machaerium*	1	1
Malvaceae	*Malvaviscus arboreus*	3	2
Malvaceae	*Melochia*	1	1
Malvaceae	*Pachira aquatica*	2	1
Malvaceae	*Pavonia kleinii*	1	1
Malvaceae	*Pseudobombax longiflorum*	11	6
Malvaceae	*Pseudobombax tomentosum*	6	6
Malvaceae	*Sida*	2	1
Malvaceae	*Sida cordifolia*	1	1
Malvaceae	*Triumfetta rhomboidea*	1	1
Malvaceae	*Waltheria*	2	1
Malvaceae	*Waltheria americana*	2	1
Malvaceae	*Waltheria communis*	1	1
Marcgraviaceae	*Schwartzia adamantium*	1	1
Melastomataceae	*Acisanthera quadrata*	1	1
Melastomataceae	*Cambessedesia*	1	1
Melastomataceae	*Miconia albicans*	6	3
Melastomataceae	*Miconia burchellii*	1	1
Melastomataceae	*Miconia chamissois*	22	1
Melastomataceae	*Miconia tococa*	5	1
Melastomataceae	*Microlicia laniflora*	23	3
Melastomataceae	*Microlicia parviflora*	6	1
Melastomataceae	*Mouriri elliptica*	1	1
Melastomataceae	*Siphanthera cordata*	1	1
Melastomataceae	*Tibouchina frigidula*	5	1
Melastomataceae	*Tibouchina martialis*	2	1

Melastomataceae	*Tibouchina minor*	4	1
Melastomataceae	*Tococa guianensis*	1	1
Melastomataceae	*Trembleya parviflora*	1	1
Melastomataceae	*Trembleya phlogiformis*	2	1
Meliaceae	*Guarea*	1	1
Minispermaceae	*Cissampelos ovalifolia*	2	1
Moraceae	*Brosimum gaudichaudii*	1	1
Moraceae	*Ficus obtusifolia*	1	1
Moraceae	Moraceae	2	1
Myrtaceae	*Blepharocalyx salicifolius*	1	1
Myrtaceae	*Callistemon rigidus*	5	2
Myrtaceae	*Campomanesia*	1	1
Myrtaceae	*Campomanesia adamantium*	1	1
Myrtaceae	*Campomanesia pubescens*	7	2
Myrtaceae	*Campomanesia sessiliflora*	2	1
Myrtaceae	*Eucalyptus*	2	3
Myrtaceae	*Eugenia*	1	1
Myrtaceae	*Myrcia*	6	6
Myrtaceae	*Myrcia bella*	5	2
Myrtaceae	*Myrcia eriocalyx*	1	1
Myrtaceae	*Myrcia multiflora*	1	1
Myrtaceae	*Myrcia rostrata*	7	2
Myrtaceae	*Myrcia splendens*	1	1
Myrtaceae	*Myrcia tomentosa*	4	2
Myrtaceae	*Myrcia torta*	1	1
Myrtaceae	Myrtaceae	2	3
Myrtaceae	*Psidium*	2	2

Myrtaceae	*Sysygium*	1	1
Myrtaceae	*Syzygium jambos*	1	1
Nyctaginaceae	*Bougainvillea glabra*	3	1
Nyctaginaceae	*Guapira noxia*	1	1
Nyctaginaceae	*Neea theifera*	4	1
Ochnaceae	*Ouratea*	1	1
Ochnaceae	*Ouratea floribunda*	1	1
Ochnaceae	*Ouratea semiserrata*	3	1
Ochnaceae	*Ouratea spectabilis*	2	1
Onagraceae	*Ludwigia nervosa*	15	1
Onagraceae	*Ludwigia octovalvis*	3	1
Orchidaceae	*Campylocentrum micranthum*	3	1
Orchidaceae	*Oncidium barbaceniae*	1	1
Orobanchaceae	*Buchnera lavandulacea*	1	1
Orobanchaceae	*Esterhazya macrodonta*	1	1
Orobanchaceae	*Esterhazya splendida*	7	4
Oxalidaceae	*Oxalis sellowii*	4	1
Passifloraceae	*Passiflora*	2	1
Passifloraceae	*Passiflora amethystina*	1	1
Passifloraceae	*Passiflora cincinnata*	7	1
Passifloraceae	*Passiflora edulis*	27	1
Passifloraceae	*Passiflora suberosa*	2	1
Passifloraceae	*Passiflora tenuifila*	3	1
Passifloraceae	*Passiflora tricuspis*	1	1
Peraceae	*Pera glabrata*	19	2
Plantaginaceae	*Russelia equisetiformis*	5	1
Poaceae	*Brachiaria*	1	1

Poaceae	Poaceae	1	1
Polygalaceae	*Polygala brasiliensis*	1	1
Polygalaceae	*Polygala cneorum*	1	1
Polygalaceae	*Polygala rhodoptera*	1	1
Polygalaceae	*Polygala violacea*	1	1
Polygalaceae	*Polygonum*	1	1
Proteaceae	*Grevillea banksii*	2	1
Proteaceae	*Roupala montana*	4	1
Rhamnaceae	*Gouania latifolia*	12	1
Rhamnaceae	*Rhamnidium elaeocarpum*	1	1
Rosaceae	*Prunus sellowii*	1	1
Rubiaceae	*Amaioua guianensis*	5	1
Rubiaceae	*Borreria capitata*	10	2
Rubiaceae	*Borreria poaya*	2	1
Rubiaceae	*Borreria tenella*	4	1
Rubiaceae	*Borreria verticillata*	1	1
Rubiaceae	*Cordiera humilis*	6	1
Rubiaceae	*Coussarea hydrangeifolia*	1	1
Rubiaceae	*Declieuxia cordigera var. angustifolia*	6	1
Rubiaceae	*Declieuxia fruticosa*	33	1
Rubiaceae	*Diodella radula*	2	1
Rubiaceae	*Emmeorhiza umbellata*	8	1
Rubiaceae	*Faramea cyanea*	10	2
Rubiaceae	*Faramea multiflora*	3	1
Rubiaceae	*Galianthe angustifolia*	17	1
Rubiaceae	*Galianthe brasiliensis*	16	1
Rubiaceae	*Galianthe lanceifolia*	16	1

Rubiaceae	*Galium hypocarpium*	2	1
Rubiaceae	*Guettarda viburnoides*	22	1
Rubiaceae	*Manettia cordifolia*	1	1
Rubiaceae	*Mussaenda alicia*	2	1
Rubiaceae	*Mussaenda erythrophylla*	1	1
Rubiaceae	*Palicourea coriacea*	6	2
Rubiaceae	*Palicourea crocea*	11	1
Rubiaceae	*Palicourea macrobotrys*	1	1
Rubiaceae	*Palicourea marcgravii*	1	1
Rubiaceae	*Palicourea officinalis*	2	1
Rubiaceae	*Palicourea rigida*	40	7
Rubiaceae	*Psychotria capitata*	11	1
Rubiaceae	*Psychotria deflexa*	8	1
Rubiaceae	*Psychotria hoffmannseggiana*	6	1
Rubiaceae	*Psychotria nitidula*	13	2
Rubiaceae	*Psychotria prunifolia*	14	2
Rubiaceae	*Psychotria tenerior*	2	1
Rubiaceae	*Psychotria trichophoroides*	8	1
Rubiaceae	*Richardia grandiflora*	1	1
Rubiaceae	Rubiaceae	1	1
Rubiaceae	*Sipanea hispida*	1	1
Rubiaceae	*Sipanea pratensis*	2	1
Rubiaceae	*Spermacoce*	4	1
Rubiaceae	*Tocoyena formosa*	10	1
Rutaceae	*Citrus limonia*	1	1
Rutaceae	*Hortia*	1	1
Rutaceae	*Hortia brasiliana*	15	1

Salicaceae	*Casearia decandra*	2	1
Sapindaceae	*Matayba guianensis*	40	3
Sapindaceae	*Serjania*	5	1
Sapindaceae	*Serjania caracasana*	7	2
Sapindaceae	*Serjania erecta*	11	2
Sapindaceae	*Serjania laruotteana*	4	1
Sapindaceae	*Serjania reticulata*	1	1
Sapotaceae	*Chrysophyllum marginatum*	10	1
Sapotaceae	*Pouteria*	1	2
Sapotaceae	*Pouteria ramiflora*	18	1
Sapotaceae	*Pouteria torta*	6	2
Simaroubaceae	*Simarouba versicolor*	2	1
Smilacaceae	*Smilax*	1	3
Solanaceae	*Calibrachoa elegans*	1	1
Solanaceae	*Cestrum megalophyllum*	2	1
Solanaceae	*Cestrum schlechtendalii*	2	1
Solanaceae	*Lycopersicon esculentum*	13	1
Solanaceae	Solanaceae	1	1
Solanaceae	*Solanum*	1	1
Solanaceae	*Solanum aculeatissimum*	1	1
Solanaceae	*Solanum americanum*	1	1
Solanaceae	*Solanum lycocarpum*	25	4
Solanaceae	*Solanum melissarum*	3	1
Solanaceae	*Solanum paniculatum*	6	2
Solanaceae	*Solanum pseudocapsicum*	2	1
Solanaceae	*Solanum swartzianum*	1	1
Solanaceae	*Solanum viarum*	1	1

Strelitziaceae	*Strelitzia reginae*	2	1
Styracaceae	*Styrax camporum*	1	1
Styracaceae	*Styrax ferrugineus*	13	4
Styracaceae	*Styrax pohlii*	2	1
Theaceae	*Laplacea fruticosa*	2	1
Turneraceae	*Piriqueta*	1	1
Turneraceae	*Turnera*	1	1
Turneraceae	*Turnera subulata*	1	1
Urticaceae	*Cecropia*	1	1
Urticaceae	*Cecropia saxatilis*	1	2
Urticaceae	*Cecropia pachystachya*	1	1
Velloziaceae	*Barbacenia lymansmithii*	1	1
Verbenaceae	*Lantana camara*	4	1
Verbenaceae	*Lippia*	1	1
Verbenaceae	*Stachytarpheta gesnerioides*	3	2
Verbenaceae	*Verbena hirta*	15	1
Violaceae	*Viola cerasifolia*	3	1
Vitaceae	*Cissus erosa*	2	1
Vochysiaceae	*Qualea cordata*	4	1
Vochysiaceae	*Qualea grandiflora*	21	3
Vochysiaceae	*Qualea multiflora*	32	5
Vochysiaceae	*Qualea parviflora*	40	6
Vochysiaceae	*Salvertia convallariodora*	12	3
Vochysiaceae	*Vochysia cinnamomea*	20	3
Vochysiaceae	*Vochysia elliptica*	5	1
Vochysiaceae	*Vochysia pumila*	2	1
Vochysiaceae	*Vochysia pyramidalis*	5	1

Vochysiaceae	*Vochysia rufa*	3	2
Vochysiaceae	*Vochysia thyrsoidea*	20	3
Vochysiaceae	*Vochysia tucanorum*	16	4
Xyridaceae	*Abolboda egleri*	1	1
Xyridaceae	*Xyris asperula*	5	1
Xyridaceae	*Xyris jupicai*	14	1
Xyridaceae	*Xyris tortula*	3	1
Zingiberaceae	*Hedychium coronarium*	3	1

Table S4. List of animal taxa recorded in studies on plant-pollinator interactions in the Cerrado, including taxonomic classification (class, order, family), accepted names and synonyms, number of host plants, and citation frequency, based on a systematic review of 132 studies conducted from 1990 to June 2024.

Class	Order	Family	Animal species	Synonyms	Host plants (n)	Citations (n)
Arachnida	Araneae	Araneidae	Araneidae		1	1
Arachnida	Araneae	Oxyopidae	*Oxyopes salticus*		1	1
Arachnida	Araneae	Salticidae	*Aphirape uncifera*		1	1
Arachnida	Araneae	Thomisidae	Thomisidae		2	1
Arachnida	Araneae		Araneae		1	1
Aves	Apodiformes	Trochilidae	*Amazilia*		1	1
Aves	Apodiformes	Trochilidae	*Chionomesa fimbriata*	*Amazilia fimbriata*	27	10
Aves	Apodiformes	Trochilidae	*Anthracotanthracothorax nigricollis*		1	1
Aves	Apodiformes	Trochilidae	*Anthracothorax nigricollis*		4	4
Aves	Apodiformes	Trochilidae	*Calliphlox amethystina*		5	4
Aves	Apodiformes	Trochilidae	*Chionomesa lactea*	*Amazilia lactea*	49	6
Aves	Apodiformes	Trochilidae	*Chlorostilbon lucidus*	*Chlorostilbon aureoventris*	43	17
Aves	Apodiformes	Trochilidae	*Chrysolampis mosquitus*		2	2
Aves	Apodiformes	Trochilidae	*Clytolaema rubricauda*		1	1
Aves	Apodiformes	Trochilidae	*Colibri serrirostris*		40	14
Aves	Apodiformes	Trochilidae	*Eupetomena macroura*		60	21
Aves	Apodiformes	Trochilidae	*Florisuga fusca*		3	2
Aves	Apodiformes	Trochilidae	*Heliactin bilophus*		1	1
Aves	Apodiformes	Trochilidae	*Heliomaster furcifer*		1	1
Aves	Apodiformes	Trochilidae	*Heliomaster squamosus*		14	7

Aves	Apodiformes	Trochilidae	*Hylocharis chrysura*		18	6
Aves	Apodiformes	Trochilidae	*Leucochloris albicollis*		5	2
Aves	Apodiformes	Trochilidae	*Lophornis*		1	1
Aves	Apodiformes	Trochilidae	*Lophornis magnificus*		4	1
Aves	Apodiformes	Trochilidae	*Phaethornis pretrei*		38	12
Aves	Apodiformes	Trochilidae	*Polytmus guainumbi*		3	2
Aves	Apodiformes	Trochilidae	*Stephanoxis lalandi*		1	1
Aves	Apodiformes	Trochilidae	*Thalurania furcata*		54	11
Aves	Apodiformes	Trochilidae	*Thalurania glaucopis*		3	2
Aves	Apodiformes	Trochilidae	Trochilidae		5	3
Aves	Columbiformes	Columbidae	*Columbina squammata*		1	1
Aves	Columbiformes	Columbidae	*Leptotila verreauxi*		1	1
Aves	Columbiformes	Columbidae	*Patagioenas picazuro*		1	1
Aves	Columbiformes	Columbidae	*Zenaida auriculata*		1	1
Aves	Coraciiformes	Momotidae	*Momotus momota*		1	1
Aves	Passeriformes	Fringillidae	*Euphonia chlorotica*		1	1
Aves	Apodiformes	Fringillidae	Fringillidae		1	1
Aves	Passeriformes	Icteridae	*Molothrus bonariensis*		1	1
Aves	Passeriformes	Mimidae	*Mimus saturninus*		1	1
Aves	Passeriformes	Parulidae	*Myiothlypis flaveola*	*Basileuterus flaveolus*	1	1
Aves	Passeriformes	Passerellidae	*Zonotrichia capensis*		1	1
Aves	Passeriformes	Pipridae	*Antilophia galeata*		1	1
Aves	Passeriformes	Thraupidae	*Coereba flaveola*		3	3
Aves	Passeriformes	Thraupidae	*Coryphospingus cucullatus*		1	1
Aves	Passeriformes	Thraupidae	*Cyanerpes cyaneus*		1	1
Aves	Passeriformes	Thraupidae	*Dacnis cayana*		1	1
Aves	Passeriformes	Thraupidae	*Lanio cucullatus*		1	1

Aves	Passeriformes	Thraupidae	*Ramphocelus carbo*		1	1
Aves	Passeriformes	Thraupidae	*Saltatricula atricollis*	*Saltator atricollis*	1	1
Aves	Passeriformes	Thraupidae	*Schistochlamys ruficapillus*		1	1
Aves	Passeriformes	Thraupidae	*Stilpnia cayana*	*Tangara cayana*	1	1
Aves	Passeriformes	Thraupidae	*Tersida viridis*		2	2
Aves	Passeriformes	Thraupidae	*Thraupis palmarum*	*Tangara palmarum*	2	2
Aves	Passeriformes	Thraupidae	*Thraupis sayaca*	*Tangara sayaca*	2	2
Aves	Passeriformes	Thraupidae	*Volatinia jacarina*		1	1
Aves	Passeriformes	Turdidae	*Turdus amaurochalinus*		1	1
Aves	Passeriformes	Turdidae	*Turdus leucomelas*		1	1
Aves	Passeriformes	Turdidae	*Turdus rufiventris*		1	1
Aves	Passeriformes	Tyrannidae	*Elaenia*		1	1
Aves	Passeriformes	Tyrannidae	*Empidonomus varius*		1	1
Aves	Passeriformes	Tyrannidae	*Griseotyrannus aurantioatrocristatus*		1	1
Aves	Passeriformes	Tyrannidae	*Myiarchus ferox*		1	1
Aves	Passeriformes	Tyrannidae	*Myiarchus swainsoni*		1	1
Aves	Passeriformes	Tyrannidae	*Myiarchus tyrannulus*		1	1
Aves	Passeriformes	Tyrannidae	*Tyrannus melancholicus*		1	1
Aves	Passeriformes	Tyrannidae	*Tyrannus savana*		1	1
Aves	Passeriformes	Tyrannidae	*Xolmis velatus*		1	1
Aves	Passeriformes	Vireonidae	*Cyclarhis gujanensis*		1	1
Aves	Piciformes	Ramphastidae	*Pteroglossus castanotis*		1	1
Aves	Piciformes	Ramphastidae	*Ramphastos toco*		1	1
Aves	Trogoniformes	Trogonidae	*Trogon curucui*		1	1
Insecta	Blattodea	Blattidae	Blattidae		2	1
Insecta	Blattodea		*Blattodea*		1	1
Insecta	Coleoptera	Brentidae	*Apion*		1	1

Insecta	Coleoptera	Bruchidae	Bruchidae	1	1
Insecta	Coleoptera	Buprestidae	*Conognatha*	1	1
Insecta	Coleoptera	Cantharidae	Cantharidae	13	2
Insecta	Coleoptera	Cantharidae	*Discodon*	1	1
Insecta	Coleoptera	Cantharidae	*Discodon tucumanum*	1	1
Insecta	Coleoptera	Cantharidae	*Maronius*	2	1
Insecta	Coleoptera	Carabidae	*Lebiini*	1	1
Insecta	Coleoptera	Cerambycidae	Cerambycidae	1	1
Insecta	Coleoptera	Cerambycidae	*Paratenthras martinsi*	1	1
Insecta	Coleoptera	Cerambycidae	*Rhinotragus festivus*	1	1
Insecta	Coleoptera	Cerambycidae	*Trachyderes*	1	1
Insecta	Coleoptera	Cetoniidae	*Hoplopyga*	1	1
Insecta	Coleoptera	Chrysomelidae	Alticinae	1	1
Insecta	Coleoptera	Chrysomelidae	Alticini	1	1
Insecta	Coleoptera	Chrysomelidae	Chrysomelidae	5	5
Insecta	Coleoptera	Chrysomelidae	Chrysomelinae	1	1
Insecta	Coleoptera	Chrysomelidae	Cryptocephalinae	1	1
Insecta	Coleoptera	Chrysomelidae	*Cryptocephalus*	1	1
Insecta	Coleoptera	Chrysomelidae	*Diabrotica*	3	2
Insecta	Coleoptera	Chrysomelidae	*Diabrotica speciosa*	2	2
Insecta	Coleoptera	Chrysomelidae	*Imatidium*	1	1
Insecta	Coleoptera	Chrysomelidae	*Longitarsus*	1	1
Insecta	Coleoptera	Chrysomelidae	*Megalostomis*	4	1
Insecta	Coleoptera	Chrysomelidae	*Megalostomis gigas*	1	1
Insecta	Coleoptera	Chrysomelidae	*Megalostomis glossa*	1	1
Insecta	Coleoptera	Chrysomelidae	*Metallactus*	1	1
Insecta	Coleoptera	Cleridae	Cleridae	1	1

Insecta	Coleoptera	Coccinellidae	Coccinellidae	3	3
Insecta	Coleoptera	Coccinellidae	*Cycloneda sanguinea*	1	1
Insecta	Coleoptera	Corylophidae	Corylophidae	1	1
Insecta	Coleoptera	Cucujidae	Cucujidae	1	1
Insecta	Coleoptera	Curculionidae	*Anchylorhynchus bicolor*	1	1
Insecta	Coleoptera	Curculionidae	*Anchylorhynchus campestris*	1	1
Insecta	Coleoptera	Curculionidae	*Anchylorhynchus camposi*	1	1
Insecta	Coleoptera	Curculionidae	*Andranthobius*	1	1
Insecta	Coleoptera	Curculionidae	*Anthonomus*	7	3
Insecta	Coleoptera	Curculionidae	Baridinae	1	1
Insecta	Coleoptera	Curculionidae	*Baris*	1	1
Insecta	Coleoptera	Curculionidae	*Belopoeus*	1	1
Insecta	Coleoptera	Curculionidae	*Celetes*	1	1
Insecta	Coleoptera	Curculionidae	*Centrinaspis*	1	1
Insecta	Coleoptera	Curculionidae	*Chalcodermus*	1	1
Insecta	Coleoptera	Curculionidae	*Coelosternus*	1	1
Insecta	Coleoptera	Curculionidae	*Conotrachelus*	2	4
Insecta	Coleoptera	Curculionidae	*Cryptobaris sulcata*	1	1
Insecta	Coleoptera	Curculionidae	Curculionidae	6	7
Insecta	Coleoptera	Curculionidae	Derelomini	1	1
Insecta	Coleoptera	Curculionidae	*Dialomia*	2	1
Insecta	Coleoptera	Curculionidae	*Groatus roticollis*	1	1
Insecta	Coleoptera	Curculionidae	*Groatus rufipennis*	1	1
Insecta	Coleoptera	Curculionidae	*Heilus*	1	1
Insecta	Coleoptera	Curculionidae	*Hustachea campestris*	1	1
Insecta	Coleoptera	Curculionidae	*Ladustes speciosus*	1	1
Insecta	Coleoptera	Curculionidae	Madarini	2	1

Insecta	Coleoptera	Curculionidae	*Microstrates*	2	1
Insecta	Coleoptera	Curculionidae	*Microstrates cocoscampestris*	1	1
Insecta	Coleoptera	Curculionidae	*Microstrates rufus*	1	1
Insecta	Coleoptera	Curculionidae	Molytinae	1	1
Insecta	Coleoptera	Curculionidae	*Nicentrus*	2	1
Insecta	Coleoptera	Curculionidae	*Palmocentrinus lucidulus*	1	1
Insecta	Coleoptera	Curculionidae	*Pantomorus*	1	1
Insecta	Coleoptera	Curculionidae	*Parapantomorus flexuosus*	1	1
Insecta	Coleoptera	Curculionidae	*Parisoschoenus*	2	2
Insecta	Coleoptera	Curculionidae	*Parisoschoenus plagiatus*	1	1
Insecta	Coleoptera	Curculionidae	*Peloconusus*	1	1
Insecta	Coleoptera	Curculionidae	*Petalochilus lineolatus*	1	1
Insecta	Coleoptera	Curculionidae	*Phytotribus*	2	2
Insecta	Coleoptera	Curculionidae	*Revena rubiginosa*	1	1
Insecta	Coleoptera	Curculionidae	*Rhinochenus brevicollis*	1	1
Insecta	Coleoptera	Curculionidae	*Telemus*	1	1
Insecta	Coleoptera	Curculionidae	*Tripusus leiospathae*	1	1
Insecta	Coleoptera	Curculionidae	*Udeus cerradensis*	1	1
Insecta	Coleoptera	Curculionidae	*Lydamis*	1	1
Insecta	Coleoptera	Dermestidae	*Cryptorhopalum*	1	1
Insecta	Coleoptera	Elateridae	*Cardiorhinus*	1	1
Insecta	Coleoptera	Eucnemidae	Eucnemidae	1	1
Insecta	Coleoptera	Eumolpinae	*Nodonota*	1	1
Insecta	Coleoptera	Lampyridae	Lampyridae	1	1
Insecta	Coleoptera	Meloidae	Meloidae	1	1
Insecta	Coleoptera	Melolonthidae	*Arriguttia brevissima*	1	1
Insecta	Coleoptera	Melolonthidae	*Cyclocephala atricapilla*	2	3

Insecta	Coleoptera	Melolonthidae	*Cyclocephala bicolor*	1	1
Insecta	Coleoptera	Melolonthidae	*Cyclocephala celata*	1	1
Insecta	Coleoptera	Melolonthidae	*Cyclocephala octopunctata*	2	2
Insecta	Coleoptera	Melolonthidae	*Cyclocephala ohausiana*	1	1
Insecta	Coleoptera	Melolonthidae	*Cyclocephala quatuordecimpunctata*	2	2
Insecta	Coleoptera	Melolonthidae	*Cyclocephala undata*	6	2
Insecta	Coleoptera	Melolonthidae	*Macraspis morio*	3	1
Insecta	Coleoptera	Melolonthidae	*Macrodactylus*	1	1
Insecta	Coleoptera	Melolonthidae	*Pelidnota*	1	1
Insecta	Coleoptera	Melyridae	*Astylus sexmaculatus*	1	1
Insecta	Coleoptera	Melyridae	*Astylus variegatus*	1	1
Insecta	Coleoptera	Nitidulidae	Carpophilinae	1	1
Insecta	Coleoptera	Nitidulidae	*Carpophilus*	1	1
Insecta	Coleoptera	Nitidulidae	Cillaeinae	1	1
Insecta	Coleoptera	Nitidulidae	*Colopterus*	2	2
Insecta	Coleoptera	Nitidulidae	*Colopterus niger*	1	1
Insecta	Coleoptera	Nitidulidae	*Conotelus*	1	1
Insecta	Coleoptera	Nitidulidae	*Lobiopa*	1	1
Insecta	Coleoptera	Nitidulidae	*Lobiopa insularis*	2	2
Insecta	Coleoptera	Nitidulidae	Meligethinae	1	1
Insecta	Coleoptera	Nitidulidae	*Mystrops*	3	2
Insecta	Coleoptera	Nitidulidae	*Mystrops palmarum*	1	1
Insecta	Coleoptera	Nitidulidae	Nitidulidae	1	1
Insecta	Coleoptera	Nitidulidae	Nitidulinae	1	1
Insecta	Coleoptera	Papilionidae	*Heraclides*	1	1
Insecta	Coleoptera	Papilionidae	Papilioninae	1	1
Insecta	Coleoptera	Scarabaeidae	*Pelidnota sumptuosa*	1	1

Insecta	Coleoptera	Scarabaeidae	Scarabaeidae	2	3
Insecta	Coleoptera	Silvanidae	*Silvanus*	2	1
Insecta	Coleoptera	Staphylinidae	*Aleochara*	1	1
Insecta	Coleoptera	Staphylinidae	Aleocharinae	1	1
Insecta	Coleoptera	Staphylinidae	*Atheta*	1	1
Insecta	Coleoptera	Staphylinidae	Staphylinidae	1	1
Insecta	Coleoptera	Staphylinidae	*Xenopygus*	1	1
Insecta	Coleoptera	Tenebrionidae	*Lagria villosa*	1	1
Insecta	Coleoptera	Tenebrionidae	*Prostenus cyaneus*	1	1
Insecta	Coleoptera	Tenebrionidae	Tenebrionidae	1	1
Insecta	Coleoptera	Zopheridae	*Bitoma palmarum*	2	1
Insecta	Coleoptera		Coleoptera	8	8
Insecta	Diptera	Agromyzidae	Agromyzidae	1	1
Insecta	Diptera	Asilidae	Asilidae	1	1
Insecta	Diptera	Bibionidae	*Plecia*	1	1
Insecta	Diptera	Bombyliidae	Bombyliidae	8	3
Insecta	Diptera	Bombyliidae	Euprepina	1	1
Insecta	Diptera	Bombyliidae	*Exoprosopa*	1	1
Insecta	Diptera	Bombyliidae	*Hemipenthes*	1	1
Insecta	Diptera	Bombyliidae	*Paravilla*	4	1
Insecta	Diptera	Bombyliidae	*Poecilognathus*	2	1
Insecta	Diptera	Bombyliidae	*Tmemophlebia*	6	1
Insecta	Diptera	Bombyliidae	*Villa*	1	1
Insecta	Diptera	Calliphoridae	Calliphoridae	1	1
Insecta	Diptera	Calliphoridae	*Chloroprocta idioidea*	1	1
Insecta	Diptera	Calliphoridae	*Chrysomya albiceps*	3	2
Insecta	Diptera	Calliphoridae	*Chrysomya megacephala*	4	3

Insecta	Diptera	Calliphoridae	*Chrysomya putoria*	1	1
Insecta	Diptera	Calliphoridae	*Hemilucilia*	1	1
Insecta	Diptera	Calliphoridae	*Lucilia eximia*	3	2
Insecta	Diptera	Calliphoridae	*Phaenicia eximia*	1	1
Insecta	Diptera	Chloropidae	Chloropidae	2	2
Insecta	Diptera	Cryptochetidae	Cryptochetidae	1	1
Insecta	Diptera	Culicidae	Culicidae	1	1
Insecta	Diptera	Curtonotidae	Curtonotidae	4	1
Insecta	Diptera	Dolichopodidae	Dolichopodidae	1	1
Insecta	Diptera	Drosophilidae	*Drosophila*	2	3
Insecta	Diptera	Drosophilidae	*Drosophila melanogaster*	1	1
Insecta	Diptera	Drosophilidae	Drosophilidae	3	3
Insecta	Diptera	Empididae	*Empis*	1	1
Insecta	Diptera	Ephydridae	Ephydridae	1	1
Insecta	Diptera	Fanniidae	Fanniidae	1	1
Insecta	Diptera	Limoniidae	*Limonia*	1	1
Insecta	Diptera	Limoniidae	*Toxorhina*	1	1
Insecta	Diptera	Lygistorrhinidae	Lygistorrhinidae	1	1
Insecta	Diptera	Milichiidae	Milichiidae	1	1
Insecta	Diptera	Muscidae	*Musca*	1	1
Insecta	Diptera	Muscidae	*Musca domestica*	1	1
Insecta	Diptera	Muscidae	Muscidae	8	8
Insecta	Diptera	Oestridae	Oestridae	2	1
Insecta	Diptera	Phoridae	Phoridae	1	1
Insecta	Diptera	Sarcophagidae	*Blaesoxipha*	1	1
Insecta	Diptera	Sarcophagidae	*Blaesoxipha hunteri*	1	1
Insecta	Diptera	Sarcophagidae	*Dexosarcophaga*	1	1

Insecta	Diptera	Sarcophagidae	*Dexosarcophaga transita*		5	1
Insecta	Diptera	Sarcophagidae	*Fletcherimyia*		3	1
Insecta	Diptera	Sarcophagidae	*Helicobia*		5	1
Insecta	Diptera	Sarcophagidae	*Helicobia alvarengai*		1	1
Insecta	Diptera	Sarcophagidae	*Helicobia borgmeieri*		1	1
Insecta	Diptera	Sarcophagidae	*Microcerella*		1	1
Insecta	Diptera	Sarcophagidae	*Oxysarcodexia*		1	1
Insecta	Diptera	Sarcophagidae	Sarcophagidae		12	5
Insecta	Diptera	Sciaridae	Sciaridae		3	1
Insecta	Diptera	Stratiomyidae	Stratiomyidae		1	1
Insecta	Diptera	Syrphidae	*Allograpta exotica*		8	3
Insecta	Diptera	Syrphidae	*Argentinomyia*		1	1
Insecta	Diptera	Syrphidae	*Baccha*		5	1
Insecta	Diptera	Syrphidae	*Copestylum*		1	1
Insecta	Diptera	Syrphidae	*Episyrphus balteatus*		2	2
Insecta	Diptera	Syrphidae	*Eristalinus aeneus*		3	1
Insecta	Diptera	Syrphidae	*Eristalinus taeniops*		1	1
Insecta	Diptera	Syrphidae	*Ocyptamus*		4	2
Insecta	Diptera	Syrphidae	*Ornidia*		3	1
Insecta	Diptera	Syrphidae	*Ornidia obesa*		8	3
Insecta	Diptera	Syrphidae	*Palpada*		1	1
Insecta	Diptera	Syrphidae	*Palpada pusio*		1	1
Insecta	Diptera	Syrphidae	*Palpada rufipedes*		2	2
Insecta	Diptera	Syrphidae	*Palpada vinetorum*		3	2
Insecta	Diptera	Syrphidae	*Pseudodoros*	*Pseudodorus*	4	2
Insecta	Diptera	Syrphidae	*Pseudodoros clavatus*		3	2
Insecta	Diptera	Syrphidae	*Quichuana*		1	1

Insecta	Diptera	Syrphidae	*Salpingogaster*		1	1
Insecta	Diptera	Syrphidae	Syrphidae		21	10
Insecta	Diptera	Syrphidae	*Syrphus*		1	1
Insecta	Diptera	Syrphidae	*Syrphus phaeostigma*		1	1
Insecta	Diptera	Syrphidae	*Toxomerus*		13	4
Insecta	Diptera	Syrphidae	*Toxomerus lacrymosus*		1	1
Insecta	Diptera	Syrphidae	*Toxomerus musicus*		1	1
Insecta	Diptera	Syrphidae	*Toxomerus politus*		2	1
Insecta	Diptera	Syrphidae	*Toxomerus virgulatus*		1	1
Insecta	Diptera	Syrphidae	*Toxomerus watsoni*		21	1
Insecta	Diptera	Syrphidae	*Xanthandrus*		1	1
Insecta	Diptera	Tabanidae	*Stonemyia*		2	1
Insecta	Diptera	Tabanidae	Tabanidae		1	1
Insecta	Diptera	Tabanidae	*Tabanus*		1	1
Insecta	Diptera	Tachinidae	*Archytas*		1	1
Insecta	Diptera	Tachinidae	*Cylindromyia*		1	1
Insecta	Diptera	Tachinidae	*Cylindromyia dorsalis*		2	1
Insecta	Diptera	Tachinidae	Exoristinae		1	1
Insecta	Diptera	Tachinidae	Goniini		1	1
Insecta	Diptera	Tachinidae	*Jurinella corpulenta*		4	1
Insecta	Diptera	Tachinidae	Tachinidae		23	5
Insecta	Diptera	Tachinidae	*Trichopoda*		1	1
Insecta	Diptera	Tephritidae	*Trupanea*		1	1
Insecta	Diptera	Ulidiidae	*Euxesta*		3	3
Insecta	Diptera		Diptera		14	9
Insecta	Hemiptera	Aetalionidae	*Aetalion reticulatum*	*Aethalion reticulatum*	2	3
Insecta	Hemiptera	Anthocoridae	*Xylocoris*		1	1

Insecta	Hemiptera	Aphididae	*Aphis*	1	1
Insecta	Hemiptera	Cercopidae	*Mahanarva posticata*	2	2
Insecta	Hemiptera	Cicadellidae	*Dalbulus maidis*	2	2
Insecta	Hemiptera	Cicadellidae	*Ferrariana trivittata*	1	1
Insecta	Hemiptera	Coreidae	Coreidae	3	5
Insecta	Hemiptera	Coreidae	*Crinocerus sanctus*	1	1
Insecta	Hemiptera	Cydnidae	Cydnidae	1	1
Insecta	Hemiptera	Largidae	*Largus*	2	1
Insecta	Hemiptera	Lygaeidae	Lygaeidae	1	1
Insecta	Hemiptera	Membracidae	Membracidae	1	1
Insecta	Hemiptera	Miridae	Miridae	2	1
Insecta	Hemiptera	Pentatomidae	*Euschistus heras*	1	1
Insecta	Hemiptera	Pentatomidae	Pentatomidae	3	3
Insecta	Hemiptera	Podisus	*Podisus*	1	1
Insecta	Hemiptera	Pyrrhocoridae	*Dysdercus honestus*	1	1
Insecta	Hemiptera	Reduviidae	*Apiomerus*	1	1
Insecta	Hemiptera	Reduviidae	Reduviidae	2	1
Insecta	Hemiptera	Rhopalidae	*Harmostes*	1	1
Insecta	Hemiptera	Scutelleridae	Scutelleridae	1	1
Insecta	Hemiptera	Tingidae	Tingidae	1	1
Insecta	Hemiptera		Fulgoroidea	1	1
Insecta	Hemiptera		Hemiptera	5	4
Insecta	Hymenoptera	Apidae	*Acamptopoeum prinii*	1	1
Insecta	Hymenoptera	Apidae	*Acanthopus excellens*	1	1
Insecta	Hymenoptera	Apidae	*Acanthopus superba*	1	1
Insecta	Hymenoptera	Apidae	*Agapostemon*	2	2
Insecta	Hymenoptera	Apidae	*Alepidosceles imitatriz*	2	1

Insecta	Hymenoptera	Apidae	*Ancyloscelis romeroi*		1	1
Insecta	Hymenoptera	Apidae	Andreninae	*Andrenidae*	1	1
Insecta	Hymenoptera	Apidae	*Angelocentris schubarti*		1	1
Insecta	Hymenoptera	Apidae	*Anthidium latum*		1	1
Insecta	Hymenoptera	Apidae	*Anthidium sertanicola*		2	1
Insecta	Hymenoptera	Apidae	*Anthodioctes megachiloides*		3	3
Insecta	Hymenoptera	Apidae	*Anthrenoides*		1	1
Insecta	Hymenoptera	Apidae	Apidae		12	8
Insecta	Hymenoptera	Apidae	*Apis*		2	2
Insecta	Hymenoptera	Apidae	*Apis mellifera*		154	57
Insecta	Hymenoptera	Apidae	*Arhysoceble*		1	1
Insecta	Hymenoptera	Apidae	*Augochlora*		30	16
Insecta	Hymenoptera	Apidae	*Augochlora caerulior*		1	1
Insecta	Hymenoptera	Apidae	*Augochlora esox*		4	2
Insecta	Hymenoptera	Apidae	*Augochlora semiramis*		2	2
Insecta	Hymenoptera	Apidae	*Augochlora smithiana*		1	1
Insecta	Hymenoptera	Apidae	*Augochlora thalia*		2	1
Insecta	Hymenoptera	Apidae	*Augochlorella*		1	1
Insecta	Hymenoptera	Apidae	*Augochlorella ephyra*		2	2
Insecta	Hymenoptera	Apidae	*Augochlorella michaelis*		1	1
Insecta	Hymenoptera	Apidae	Augochlorini		1	2
Insecta	Hymenoptera	Apidae	*Augochlorodes turrifaciens*		1	1
Insecta	Hymenoptera	Apidae	*Augochloropsis*		58	24
Insecta	Hymenoptera	Apidae	*Augochloropsis aphrodite*		4	1
Insecta	Hymenoptera	Apidae	*Augochloropsis aurifluens*		4	2
Insecta	Hymenoptera	Apidae	*Augochloropsis brachycephala*		1	1
Insecta	Hymenoptera	Apidae	*Augochloropsis callichroa*		5	3

Insecta	Hymenoptera	Apidae	*Augochloropsis cleopatra*		1	1
Insecta	Hymenoptera	Apidae	*Augochloropsis cognata*		14	2
Insecta	Hymenoptera	Apidae	*Augochloropsis cupreola*		7	5
Insecta	Hymenoptera	Apidae	*Augochloropsis cyanea*		16	1
Insecta	Hymenoptera	Apidae	*Augochloropsis euphrosyne*		1	1
Insecta	Hymenoptera	Apidae	*Augochloropsis heterochroa*		5	1
Insecta	Hymenoptera	Apidae	*Augochloropsis iris*		2	1
Insecta	Hymenoptera	Apidae	*Augochloropsis patens*		6	1
Insecta	Hymenoptera	Apidae	*Augochloropsis semele*		14	1
Insecta	Hymenoptera	Apidae	*Augochloropsis smithiana*		10	4
Insecta	Hymenoptera	Apidae	*Austrostelis silveirai*		1	1
Insecta	Hymenoptera	Apidae	*Bombus*		24	10
Insecta	Hymenoptera	Apidae	*Bombus brasiliensis*		6	2
Insecta	Hymenoptera	Apidae	*Bombus brevivillus*		6	5
Insecta	Hymenoptera	Apidae	*Bombus morio*		39	23
Insecta	Hymenoptera	Apidae	*Bombus pauloensis*	*Bombus atratus*	38	16
Insecta	Hymenoptera	Apidae	*Camargoia nordestina*		1	1
Insecta	Hymenoptera	Apidae	Centridini		3	3
Insecta	Hymenoptera	Apidae	*Centris*		26	16
Insecta	Hymenoptera	Apidae	*Centris aenea*		21	11
Insecta	Hymenoptera	Apidae	*Centris albopilosa*		2	1
Insecta	Hymenoptera	Apidae	*Centris rhodoprocta*	*Centris analis, Centris minuta*	19	8
Insecta	Hymenoptera	Apidae	*Centris bicolor*		8	5
Insecta	Hymenoptera	Apidae	*Centris burgdorfi*		2	1
Insecta	Hymenoptera	Apidae	*Centris collaris*		4	3
Insecta	Hymenoptera	Apidae	*Centris decolorata*		1	1

Insecta	Hymenoptera	Apidae	*Centris dentata*		1	1
Insecta	Hymenoptera	Apidae	*Centris denudans*		4	4
Insecta	Hymenoptera	Apidae	*Centris discolor*		4	2
Insecta	Hymenoptera	Apidae	*Centris dorsata*		2	2
Insecta	Hymenoptera	Apidae	*Centris flavifrons*		17	6
Insecta	Hymenoptera	Apidae	*Centris fuscata*		15	11
Insecta	Hymenoptera	Apidae	*Centris insularis*		1	1
Insecta	Hymenoptera	Apidae	*Centris klugii*		7	1
Insecta	Hymenoptera	Apidae	*Centris longimana*		9	5
Insecta	Hymenoptera	Apidae	*Centris lutea*		2	2
Insecta	Hymenoptera	Apidae	*Centris machadoi*		2	2
Insecta	Hymenoptera	Apidae	*Centris maranhensis*		3	2
Insecta	Hymenoptera	Apidae	*Centris mocsaryi*		1	1
Insecta	Hymenoptera	Apidae	*Centris nitens*		6	4
Insecta	Hymenoptera	Apidae	*Centris obsoleta*		1	1
Insecta	Hymenoptera	Apidae	*Centris poecila*		1	1
Insecta	Hymenoptera	Apidae	*Centris rupestris*		1	1
Insecta	Hymenoptera	Apidae	*Centris scopipes*		24	10
Insecta	Hymenoptera	Apidae	*Centris similis*		2	1
Insecta	Hymenoptera	Apidae	*Centris spilopoda*		12	5
Insecta	Hymenoptera	Apidae	*Centris sponsa*		5	4
Insecta	Hymenoptera	Apidae	*Centris tarsata*		18	11
Insecta	Hymenoptera	Apidae	*Centris trigonoides*		1	1
Insecta	Hymenoptera	Apidae	*Centris varia*	*Centris inermis, Centris segregata*	14	7
Insecta	Hymenoptera	Apidae	*Centris violacea*		3	2
Insecta	Hymenoptera	Apidae	*Centris vittata*		1	1

Insecta	Hymenoptera	Apidae	*Centris xanthomelaena*	1	1
Insecta	Hymenoptera	Apidae	*Cephalotrigona capitata*	1	1
Insecta	Hymenoptera	Apidae	*Ceratalictus*	10	1
Insecta	Hymenoptera	Apidae	*Ceratalictus clonius*	20	1
Insecta	Hymenoptera	Apidae	*Ceratalictus theius*	1	1
Insecta	Hymenoptera	Apidae	*Ceratina*	77	12
Insecta	Hymenoptera	Apidae	*Ceratina asuncionis*	8	3
Insecta	Hymenoptera	Apidae	*Ceratina gossypii*	1	1
Insecta	Hymenoptera	Apidae	*Ceratina maculifrons*	1	1
Insecta	Hymenoptera	Apidae	*Ceratina morrensis*	1	1
Insecta	Hymenoptera	Apidae	*Coelioxys*	4	2
Insecta	Hymenoptera	Apidae	*Coelioxys simillimus*	1	1
Insecta	Hymenoptera	Apidae	*Colletes*	4	3
Insecta	Hymenoptera	Apidae	*Colletes meridionalis*	1	1
Insecta	Hymenoptera	Apidae	Colletinae	2	2
Insecta	Hymenoptera	Apidae	*Ctenioschelus goryi*	1	1
Insecta	Hymenoptera	Apidae	*Dialictus*	21	8
Insecta	Hymenoptera	Apidae	*Dialictus opacus*	1	1
Insecta	Hymenoptera	Apidae	*Dialictus pabulator*	1	1
Insecta	Hymenoptera	Apidae	Emphorini	2	1
Insecta	Hymenoptera	Apidae	*Epanthidium*	1	1
Insecta	Hymenoptera	Apidae	*Epanthidium anisitsi*	1	1
Insecta	Hymenoptera	Apidae	*Epanthidium aureocinctum*	1	1
Insecta	Hymenoptera	Apidae	*Epanthidium autumnale*	1	1
Insecta	Hymenoptera	Apidae	*Epicharis*	10	8
Insecta	Hymenoptera	Apidae	*Epicharis affinis*	1	1
Insecta	Hymenoptera	Apidae	*Epicharis albofasciata*	1	1

Insecta	Hymenoptera	Apidae	*Epicharis analis*	*Epicharis schrottkyi*	13	10
Insecta	Hymenoptera	Apidae	*Epicharis bicolor*		12	9
Insecta	Hymenoptera	Apidae	*Epicharis cockerelli*		8	6
Insecta	Hymenoptera	Apidae	*Epicharis dejeanii*	*Epicharis melanoxantha*	3	2
Insecta	Hymenoptera	Apidae	*Epicharis flava*	*Epicharis rustica*	40	23
Insecta	Hymenoptera	Apidae	*Epicharis iheringi*		3	4
Insecta	Hymenoptera	Apidae	*Epicharis maculata*		3	1
Insecta	Hymenoptera	Apidae	*Epicharis nigrita*		1	1
Insecta	Hymenoptera	Apidae	*Epicharis xanthogastra*		2	2
Insecta	Hymenoptera	Apidae	*Eufriesea auriceps*		2	2
Insecta	Hymenoptera	Apidae	*Eufriesea nordestina*		1	1
Insecta	Hymenoptera	Apidae	*Eufriesea violascens*		5	2
Insecta	Hymenoptera	Apidae	*Euglossa*		10	7
Insecta	Hymenoptera	Apidae	*Euglossa cordata*		4	4
Insecta	Hymenoptera	Apidae	*Euglossa imperialis*		1	1
Insecta	Hymenoptera	Apidae	*Euglossa melanotricha*		8	6
Insecta	Hymenoptera	Apidae	*Euglossa townsendi*		3	2
Insecta	Hymenoptera	Apidae	Euglossini		1	1
Insecta	Hymenoptera	Apidae	*Eulaema*		1	1
Insecta	Hymenoptera	Apidae	*Eulaema cingulata*		2	2
Insecta	Hymenoptera	Apidae	*Eulaema nigrita*		31	26
Insecta	Hymenoptera	Apidae	*Eurytis funereus*		1	1
Insecta	Hymenoptera	Apidae	*Exaerete*		1	1
Insecta	Hymenoptera	Apidae	*Exomalopsis*		15	11
Insecta	Hymenoptera	Apidae	*Exomalopsis analis*		10	8
Insecta	Hymenoptera	Apidae	*Exomalopsis auropilosa*		6	2
Insecta	Hymenoptera	Apidae	*Exomalopsis campestris*		7	2

Insecta	Hymenoptera	Apidae	*Exomalopsis collaris*		1	1
Insecta	Hymenoptera	Apidae	*Exomalopsis fulvofasciata*		24	10
Insecta	Hymenoptera	Apidae	*Exomalopsis tomentosa*		2	1
Insecta	Hymenoptera	Apidae	*Frieseomelitta*		3	3
Insecta	Hymenoptera	Apidae	*Frieseomelitta doederleini*		2	2
Insecta	Hymenoptera	Apidae	*Frieseomelitta flavicornis*		3	2
Insecta	Hymenoptera	Apidae	*Frieseomelitta portoi*		1	1
Insecta	Hymenoptera	Apidae	*Frieseomelitta silvestrii*		1	1
Insecta	Hymenoptera	Apidae	*Frieseomelitta varia*		6	5
Insecta	Hymenoptera	Apidae	*Gaesischia nigra*		1	1
Insecta	Hymenoptera	Apidae	*Geotrigona*		2	2
Insecta	Hymenoptera	Apidae	*Geotrigona mombuca*		9	6
Insecta	Hymenoptera	Apidae	*Geotrigona subterranea*		1	1
Insecta	Hymenoptera	Apidae	Halictinae		17	10
Insecta	Hymenoptera	Apidae	Halictini		5	1
Insecta	Hymenoptera	Apidae	*Hexantheda missionica*		1	1
Insecta	Hymenoptera	Apidae	*Hopliophora superba*		2	1
Insecta	Hymenoptera	Apidae	*Hylaeus*		1	1
Insecta	Hymenoptera	Apidae	*Larocanthidium fasciatum*		1	1
Insecta	Hymenoptera	Apidae	*Lasioglossum*		7	4
Insecta	Hymenoptera	Apidae	*Leurotrigona muelleri*		2	1
Insecta	Hymenoptera	Apidae	*Lophopedia nigrispinis*		1	1
Insecta	Hymenoptera	Apidae	*Lophopedia pygmaea*		6	5
Insecta	Hymenoptera	Apidae	*Lophopedia savanicola*		2	1
Insecta	Hymenoptera	Apidae	*Megachile*		13	7
Insecta	Hymenoptera	Apidae	*Megachile maculata*	*Megachile anthidioides*	2	1
Insecta	Hymenoptera	Apidae	*Megachile brethesi*		1	1

Insecta	Hymenoptera	Apidae	*Megachile diasi*		3	1
Insecta	Hymenoptera	Apidae	*Megachile frankieana*		3	2
Insecta	Hymenoptera	Apidae	*Megachile iheringi*		5	1
Insecta	Hymenoptera	Apidae	*Megachile laeta*		6	2
Insecta	Hymenoptera	Apidae	*Megachile rubricata*		2	2
Insecta	Hymenoptera	Apidae	*Megachile terrestris*		2	1
Insecta	Hymenoptera	Apidae	*Megachile verrucosa*		2	2
Insecta	Hymenoptera	Apidae	*Megachile zaptlana*		1	1
Insecta	Hymenoptera	Apidae	Megachilinae		1	1
Insecta	Hymenoptera	Apidae	*Megalopta aegis*		2	2
Insecta	Hymenoptera	Apidae	*Megalopta amoena*		2	2
Insecta	Hymenoptera	Apidae	*Megascirtetica mephistophelica*		1	1
Insecta	Hymenoptera	Apidae	*Melipona*		2	3
Insecta	Hymenoptera	Apidae	*Melipona bicolor*		13	1
Insecta	Hymenoptera	Apidae	*Melipona fasciculata*	*Melipona compressipes*	1	1
Insecta	Hymenoptera	Apidae	*Melipona fuliginosa*		1	1
Insecta	Hymenoptera	Apidae	*Melipona mandacaia*		1	1
Insecta	Hymenoptera	Apidae	*Melipona marginata*		1	1
Insecta	Hymenoptera	Apidae	*Melipona melanoventer*		1	1
Insecta	Hymenoptera	Apidae	*Melipona quadrifasciata*		7	3
Insecta	Hymenoptera	Apidae	*Melipona quinquefasciata*		7	7
Insecta	Hymenoptera	Apidae	*Melipona rufiventris*		2	2
Insecta	Hymenoptera	Apidae	*Melipona seminigra*		1	1
Insecta	Hymenoptera	Apidae	*Melipona trinofaciata*		1	1
Insecta	Hymenoptera	Apidae	Meliponini		10	3
Insecta	Hymenoptera	Apidae	*Melissodes nigroaenea*		1	1
Insecta	Hymenoptera	Apidae	*Melissoptila*		2	2

Insecta	Hymenoptera	Apidae	*Melissoptila aureocincta*		1	1
Insecta	Hymenoptera	Apidae	*Melissoptila minarum*		2	1
Insecta	Hymenoptera	Apidae	*Melitoma*		1	1
Insecta	Hymenoptera	Apidae	*Mesonychium*		1	1
Insecta	Hymenoptera	Apidae	*Mesonychium coerulescens*	*Mesonychium caerulescens*	4	1
Insecta	Hymenoptera	Apidae	*Mesoplia*		1	1
Insecta	Hymenoptera	Apidae	*Mesoplia friesei*		2	2
Insecta	Hymenoptera	Apidae	*Mesoplia rufipes*		1	1
Insecta	Hymenoptera	Apidae	*Monoeca*		5	4
Insecta	Hymenoptera	Apidae	*Monoeca brasiliensis*		2	1
Insecta	Hymenoptera	Apidae	*Nannotrigona melanocera*		1	1
Insecta	Hymenoptera	Apidae	*Nannotrigona testaceicornis*		1	1
Insecta	Hymenoptera	Apidae	*Neophasiphae*		1	1
Insecta	Hymenoptera	Apidae	*Oxaea*		1	3
Insecta	Hymenoptera	Apidae	*Oxaea austera*		1	1
Insecta	Hymenoptera	Apidae	*Oxaea flavescens*		24	20
Insecta	Hymenoptera	Apidae	*Oxaea mourei*		1	1
Insecta	Hymenoptera	Apidae	*Oxytrigona*		1	1
Insecta	Hymenoptera	Apidae	*Oxytrigona flaveola*		1	1
Insecta	Hymenoptera	Apidae	*Paratetrapedia*		12	9
Insecta	Hymenoptera	Apidae	*Paratetrapedia flaveola*		2	1
Insecta	Hymenoptera	Apidae	*Paratetrapedia iheringii*		3	1
Insecta	Hymenoptera	Apidae	*Paratetrapedia larocai*		1	1
Insecta	Hymenoptera	Apidae	*Paratetrapedia leucostoma*		1	1
Insecta	Hymenoptera	Apidae	*Paratetrapedia lugubris*		1	1
Insecta	Hymenoptera	Apidae	*Paratetrapedia punctata*		1	1

Insecta	Hymenoptera	Apidae	*Paratetrapedia pygmaea*	2	1
Insecta	Hymenoptera	Apidae	*Paratetrapedia testacea*	1	1
Insecta	Hymenoptera	Apidae	*Paratetrapedia xanthopoda*	4	1
Insecta	Hymenoptera	Apidae	*Paratrigona*	4	3
Insecta	Hymenoptera	Apidae	*Paratrigona lineata*	34	19
Insecta	Hymenoptera	Apidae	*Paratrigona subnuda*	3	1
Insecta	Hymenoptera	Apidae	*Paroxystoglossa*	2	2
Insecta	Hymenoptera	Apidae	*Paroxystoglossa jocasta*	1	1
Insecta	Hymenoptera	Apidae	*Partamona*	1	1
Insecta	Hymenoptera	Apidae	*Partamona ailyae*	1	1
Insecta	Hymenoptera	Apidae	*Partamona auripenis*	1	1
Insecta	Hymenoptera	Apidae	*Partamona cupira*	3	2
Insecta	Hymenoptera	Apidae	*Partamona rustica*	55	3
Insecta	Hymenoptera	Apidae	*Partamona vicina*	1	1
Insecta	Hymenoptera	Apidae	*Perditomorpha*	1	1
Insecta	Hymenoptera	Apidae	*Pereirapis*	1	1
Insecta	Hymenoptera	Apidae	*Plebeia*	3	3
Insecta	Hymenoptera	Apidae	*Plebeia droryana*	3	3
Insecta	Hymenoptera	Apidae	*Plebeia remota*	1	1
Insecta	Hymenoptera	Apidae	*Plebeia saiqui*	8	1
Insecta	Hymenoptera	Apidae	*Pseudagapostemon*	1	1
Insecta	Hymenoptera	Apidae	*Pseudagapostemon cyaneus*	2	1
Insecta	Hymenoptera	Apidae	*Pseudaugochlora*	3	2
Insecta	Hymenoptera	Apidae	*Pseudaugochlora flammula*	1	1
Insecta	Hymenoptera	Apidae	*Pseudaugochlora graminea*	3	3
Insecta	Hymenoptera	Apidae	*Pseudaugochlora pandora*	2	1
Insecta	Hymenoptera	Apidae	*Pseudaugochloropsis graminea*	5	2

Insecta	Hymenoptera	Apidae	*Ptiloglossa*	6	7
Insecta	Hymenoptera	Apidae	*Ptiloglossa latecalcarata*	1	1
Insecta	Hymenoptera	Apidae	*Ptiloglossa matutina*	1	1
Insecta	Hymenoptera	Apidae	*Ptiloglossa pretiosa*	1	1
Insecta	Hymenoptera	Apidae	*Ptiloglossa stafuzzai*	1	1
Insecta	Hymenoptera	Apidae	*Ptiloglossa xanthotricha*	1	1
Insecta	Hymenoptera	Apidae	*Rhathymus*	2	2
Insecta	Hymenoptera	Apidae	*Rhathymus bicolor*	1	1
Insecta	Hymenoptera	Apidae	*Rhinocorynura*	2	1
Insecta	Hymenoptera	Apidae	*Rhinocorynura vernoniae*	1	1
Insecta	Hymenoptera	Apidae	*Sarocolletes*	1	1
Insecta	Hymenoptera	Apidae	*Scaptotrigona*	5	4
Insecta	Hymenoptera	Apidae	*Scaptotrigona bipunctata*	2	2
Insecta	Hymenoptera	Apidae	*Scaptotrigona depilis*	3	3
Insecta	Hymenoptera	Apidae	*Scaptotrigona polysticta*	1	2
Insecta	Hymenoptera	Apidae	*Scaptotrigona postica*	5	3
Insecta	Hymenoptera	Apidae	*Schwarziana quadripunctata*	7	1
Insecta	Hymenoptera	Apidae	*Schwarzula timida*	3	1
Insecta	Hymenoptera	Apidae	Tapinotaspidini	2	1
Insecta	Hymenoptera	Apidae	*Temnosoma*	1	1
Insecta	Hymenoptera	Apidae	*Tetraglossula*	1	1
Insecta	Hymenoptera	Apidae	*Tetragona*	6	4
Insecta	Hymenoptera	Apidae	*Tetragona clavipes*	10	7
Insecta	Hymenoptera	Apidae	*Tetragona quadrangula*	2	1
Insecta	Hymenoptera	Apidae	*Tetragonisca*	1	1
Insecta	Hymenoptera	Apidae	*Tetragonisca angustula*	19	16
Insecta	Hymenoptera	Apidae	*Tetragonisca fiebrigi*	2	1

Insecta	Hymenoptera	Apidae	*Tetrapedia*	9	6
Insecta	Hymenoptera	Apidae	*Tetrapedia angustula*	1	1
Insecta	Hymenoptera	Apidae	*Tetrapedia curvitarsis*	4	2
Insecta	Hymenoptera	Apidae	*Tetrapedia diversipes*	7	4
Insecta	Hymenoptera	Apidae	*Tetrapedia imitatrix*	5	2
Insecta	Hymenoptera	Apidae	*Tetrapedia peckoltii*	5	2
Insecta	Hymenoptera	Apidae	*Tetrapedia rugulosa*	6	2
Insecta	Hymenoptera	Apidae	*Thalestria spinosa*	4	2
Insecta	Hymenoptera	Apidae	*Thectochlora alaris*	5	5
Insecta	Hymenoptera	Apidae	*Thygater analis*	2	2
Insecta	Hymenoptera	Apidae	*Thygater palliventris*	1	1
Insecta	Hymenoptera	Apidae	*Trichocerapis*	2	1
Insecta	Hymenoptera	Apidae	*Trigona*	13	13
Insecta	Hymenoptera	Apidae	*Trigona amalthea*	2	2
Insecta	Hymenoptera	Apidae	*Trigona amazonensis*	1	1
Insecta	Hymenoptera	Apidae	*Trigona branneri*	2	2
Insecta	Hymenoptera	Apidae	*Trigona braueri*	1	1
Insecta	Hymenoptera	Apidae	*Trigona chanchamayoensis*	1	1
Insecta	Hymenoptera	Apidae	*Trigona dallatorreana*	1	1
Insecta	Hymenoptera	Apidae	*Trigona fulviventris*	2	1
Insecta	Hymenoptera	Apidae	*Trigona fuscipennis*	2	2
Insecta	Hymenoptera	Apidae	*Trigona guianae*	1	1
Insecta	Hymenoptera	Apidae	*Trigona hyalinata*	8	9
Insecta	Hymenoptera	Apidae	*Trigona meridionalis*	1	1
Insecta	Hymenoptera	Apidae	*Trigona pallens*	3	2
Insecta	Hymenoptera	Apidae	*Trigona recursa*	7	3
Insecta	Hymenoptera	Apidae	*Trigona spinipes*	84	47

Insecta	Hymenoptera	Apidae	*Trigonisca*		10	6
Insecta	Hymenoptera	Apidae	*Trigonisca intermedia*		2	2
Insecta	Hymenoptera	Apidae	*Trigonisca pediculana*		1	1
Insecta	Hymenoptera	Apidae	*Trigonisca pseudogreaffii*		1	1
Insecta	Hymenoptera	Apidae	*Trigonisca vitrifrons*		1	1
Insecta	Hymenoptera	Apidae	*Tropidopedia carinata*		1	1
Insecta	Hymenoptera	Apidae	*Tropidopedia flavolineata*		3	2
Insecta	Hymenoptera	Apidae	*Tropidopedia nigrocarinata*		1	1
Insecta	Hymenoptera	Apidae	*Tropidopedia punctifrons*		1	1
Insecta	Hymenoptera	Apidae	*Trypoxylon*		1	1
Insecta	Hymenoptera	Apidae	*Xanthopedia*		2	1
Insecta	Hymenoptera	Apidae	*Xanthopedia globulosa*		1	1
Insecta	Hymenoptera	Apidae	*Xanthopedia larocai*		2	2
Insecta	Hymenoptera	Apidae	*Xylocopa*		12	13
Insecta	Hymenoptera	Apidae	*Xylocopa bimaculata*		1	2
Insecta	Hymenoptera	Apidae	*Xylocopa bruesi*	*Xylocopa brasilianorum*	14	4
Insecta	Hymenoptera	Apidae	*Xylocopa cearensis*		1	1
Insecta	Hymenoptera	Apidae	*Xylocopa frontalis*		10	8
Insecta	Hymenoptera	Apidae	*Xylocopa grisescens*		11	6
Insecta	Hymenoptera	Apidae	*Xylocopa hirsutissima*		21	11
Insecta	Hymenoptera	Apidae	*Xylocopa muscaria*		1	1
Insecta	Hymenoptera	Apidae	*Xylocopa nogueirai*		1	1
Insecta	Hymenoptera	Apidae	*Xylocopa ordinaria*		3	3
Insecta	Hymenoptera	Apidae	*Xylocopa subcyanea*		7	5
Insecta	Hymenoptera	Apidae	*Xylocopa suspecta*		5	4
Insecta	Hymenoptera	Apidae	*Xylocopa truxali*		1	2
Insecta	Hymenoptera	Braconidae	*Bassus*		2	1

Insecta	Hymenoptera	Braconidae	Braconidae	2	2
Insecta	Hymenoptera	Chalcididae	*Conura*	1	1
Insecta	Hymenoptera	Chrysididae	Chrysididae	1	1
Insecta	Hymenoptera	Crabronidae	Bembicini	1	1
Insecta	Hymenoptera	Crabronidae	*Bembix*	5	2
Insecta	Hymenoptera	Crabronidae	*Bicyrtes paranae*	1	1
Insecta	Hymenoptera	Crabronidae	Cercerini	2	1
Insecta	Hymenoptera	Crabronidae	Crabronidae	6	2
Insecta	Hymenoptera	Crabronidae	Larrinae	1	1
Insecta	Hymenoptera	Eumenidae	*Minixi*	1	1
Insecta	Hymenoptera	Eurytomidae	Eurytomidae	1	1
Insecta	Hymenoptera	Formicidae	*Atta*	1	1
Insecta	Hymenoptera	Formicidae	*Brachymyrmex*	2	2
Insecta	Hymenoptera	Formicidae	*Brachymyrmex cordemoyi*	1	1
Insecta	Hymenoptera	Formicidae	*Camponotus*	8	9
Insecta	Hymenoptera	Formicidae	*Camponotus crassus*	7	6
Insecta	Hymenoptera	Formicidae	*Camponotus melanoticus*	1	1
Insecta	Hymenoptera	Formicidae	*Camponotus novogranadensis*	1	1
Insecta	Hymenoptera	Formicidae	*Camponotus rufipes*	1	1
Insecta	Hymenoptera	Formicidae	*Cephalotes*	2	2
Insecta	Hymenoptera	Formicidae	*Cephalotes angustus*	1	1
Insecta	Hymenoptera	Formicidae	*Cephalotes atratus*	1	2
Insecta	Hymenoptera	Formicidae	*Cephalotes pusillus*	1	1
Insecta	Hymenoptera	Formicidae	*Crematogaster*	2	2
Insecta	Hymenoptera	Formicidae	*Crematogaster curvispinosa*	1	1
Insecta	Hymenoptera	Formicidae	*Crematogaster erecta*	1	2
Insecta	Hymenoptera	Formicidae	*Dorymyrmex*	1	2

Insecta	Hymenoptera	Formicidae	*Dorymyrmex goetschi*		1	1
Insecta	Hymenoptera	Formicidae	*Ectatomma*		1	2
Insecta	Hymenoptera	Formicidae	*Ectatomma planindens*		1	1
Insecta	Hymenoptera	Formicidae	*Ectatomma tuberculatum*	*Ectatomma tuberculata*	4	3
Insecta	Hymenoptera	Formicidae	Formicidae		11	8
Insecta	Hymenoptera	Formicidae	*Linepithema anathema*		1	1
Insecta	Hymenoptera	Formicidae	*Linepithema fuscum*		1	1
Insecta	Hymenoptera	Formicidae	*Myrmelachista rudolphi*		1	1
Insecta	Hymenoptera	Formicidae	*Pheidole*		2	2
Insecta	Hymenoptera	Formicidae	*Pheidole megacephala*		1	1
Insecta	Hymenoptera	Formicidae	*Pseudomyrmex*		3	2
Insecta	Hymenoptera	Formicidae	*Pseudomyrmex acanthobius*		1	1
Insecta	Hymenoptera	Formicidae	*Pseudomyrmex flavidulus*	*Pseudomyrmex flavidulis*	1	2
Insecta	Hymenoptera	Formicidae	*Pseudomyrmex gracilis*		5	5
Insecta	Hymenoptera	Formicidae	*Pseudomyrmex pallidus*		2	3
Insecta	Hymenoptera	Formicidae	*Pseudomyrmex unicolor*		2	1
Insecta	Hymenoptera	Formicidae	*Solenopsis*		1	1
Insecta	Hymenoptera	Gasteruptiidae	Gasteruptiinae		1	1
Insecta	Hymenoptera	Gasteruptiidae	*Gasteruption*		1	1
Insecta	Hymenoptera	Ichneumonidae	Ichneumonidae		3	3
Insecta	Hymenoptera	Leucospidae	Leucospidae		1	1
Insecta	Hymenoptera	Philanthidae	*Trachypus*		1	1
Insecta	Hymenoptera	Pompilidae	*Entypus*		1	1
Insecta	Hymenoptera	Pompilidae	*Pepsis*		7	6
Insecta	Hymenoptera	Pompilidae	Pompilidae		12	2
Insecta	Hymenoptera	Pompilidae	Pompilinae		1	1
Insecta	Hymenoptera	Scoliidae	*Campsomeris*		3	3

Insecta	Hymenoptera	Scoliidae	*Scolia*	2	1
Insecta	Hymenoptera	Scoliidae	Scoliidae	2	1
Insecta	Hymenoptera	Sphecidae	*Eremnophila*	1	1
Insecta	Hymenoptera	Sphecidae	*Prionyx*	1	1
Insecta	Hymenoptera	Sphecidae	*Pryonyx thomaz*	1	1
Insecta	Hymenoptera	Sphecidae	Sphecidae	13	6
Insecta	Hymenoptera	Sphecidae	*Sphecini*	1	1
Insecta	Hymenoptera	Sphecidae	*Sphex dorsalis*	1	1
Insecta	Hymenoptera	Sphecidae	*Sphex opacus*	1	1
Insecta	Hymenoptera	Tenthredinidae	Tenthredinidae	1	1
Insecta	Hymenoptera	Tiphiidae	Tiphiidae	1	1
Insecta	Hymenoptera	Vespidae	*Agelaia*	2	1
Insecta	Hymenoptera	Vespidae	*Agelaia pallipes*	1	1
Insecta	Hymenoptera	Vespidae	*Agelaia vicina*	2	1
Insecta	Hymenoptera	Vespidae	*Ancistroceroides*	2	1
Insecta	Hymenoptera	Vespidae	*Brachygastra*	4	5
Insecta	Hymenoptera	Vespidae	*Brachygastra lecheguana*	7	5
Insecta	Hymenoptera	Vespidae	*Chartergellus*	1	1
Insecta	Hymenoptera	Vespidae	*Cyphomenes*	1	1
Insecta	Hymenoptera	Vespidae	*Hypalastoroides*	1	1
Insecta	Hymenoptera	Vespidae	*Mischocyttarus*	4	1
Insecta	Hymenoptera	Vespidae	*Mischocyttarus cerberus*	1	1
Insecta	Hymenoptera	Vespidae	*Mischocyttarus drewseni*	13	1
Insecta	Hymenoptera	Vespidae	*Montezumia*	1	1
Insecta	Hymenoptera	Vespidae	*Pachodynerus*	4	1
Insecta	Hymenoptera	Vespidae	*Pachymenes*	2	2
Insecta	Hymenoptera	Vespidae	*Parachartergus*	1	1

Insecta	Hymenoptera	Vespidae	*Parancistrocerus*	3	1
Insecta	Hymenoptera	Vespidae	*Polistes*	17	9
Insecta	Hymenoptera	Vespidae	*Polistes billardieri*	9	2
Insecta	Hymenoptera	Vespidae	*Polistes cinerascens*	3	1
Insecta	Hymenoptera	Vespidae	*Polistes lanio*	1	1
Insecta	Hymenoptera	Vespidae	*Polistes subsericeus*	1	1
Insecta	Hymenoptera	Vespidae	*Polistes versicolor*	1	1
Insecta	Hymenoptera	Vespidae	*Polistes vibex*	1	1
Insecta	Hymenoptera	Vespidae	*Polybia*	26	11
Insecta	Hymenoptera	Vespidae	*Polybia chrysothorax*	1	1
Insecta	Hymenoptera	Vespidae	*Polybia dimidiata*	1	1
Insecta	Hymenoptera	Vespidae	*Polybia fastidiosuscula*	4	1
Insecta	Hymenoptera	Vespidae	*Polybia ignobilis*	5	4
Insecta	Hymenoptera	Vespidae	*Polybia minarum*	2	1
Insecta	Hymenoptera	Vespidae	*Polybia occidentalis*	1	1
Insecta	Hymenoptera	Vespidae	*Polybia paulista*	2	2
Insecta	Hymenoptera	Vespidae	*Polybia scutellaris*	2	1
Insecta	Hymenoptera	Vespidae	*Polybia sericea*	5	2
Insecta	Hymenoptera	Vespidae	*Protonectarina sylveirae*	1	1
Insecta	Hymenoptera	Vespidae	*Protopolybia*	1	1
Insecta	Hymenoptera	Vespidae	*Protopolybia sedula*	1	1
Insecta	Hymenoptera	Vespidae	*Synoeca cyanea*	1	1
Insecta	Hymenoptera	Vespidae	*Synoeca surinama*	3	3
Insecta	Hymenoptera	Vespidae	Vespidae	33	13
Insecta	Hymenoptera	Vespidae	*Zeta argillaceum*	1	1
Insecta	Hymenoptera	Vespidae	*Zethus*	1	1
Insecta	Hymenoptera		Apoidea	2	2

Insecta	Hymenoptera		Hymenoptera	30	10
Insecta	Hymenoptera		Vespoidea	1	1
Insecta	Lepidoptera	Amatidae	Amatidae	1	1
Insecta	Lepidoptera	Crambidae	*Diaphania*	1	1
Insecta	Lepidoptera	Crambidae	*Syngamia florella*	1	1
Insecta	Lepidoptera	Ctenuchidae	Ctenuchidae	1	1
Insecta	Lepidoptera	Erebidae	Arctiinae	2	2
Insecta	Lepidoptera	Erebidae	*Cyclopis caecutiens*	1	1
Insecta	Lepidoptera	Erebidae	*Epidromia zetophora*	2	1
Insecta	Lepidoptera	Erebidae	*Melipotis fasciolaris*	2	1
Insecta	Lepidoptera	Erebidae	*Thysania zenobia*	1	1
Insecta	Lepidoptera	Erebidae	*Utetheisa*	1	1
Insecta	Lepidoptera	Geometridae	*Hymenomina cogigaria*	2	1
Insecta	Lepidoptera	Hesperiidae	*Aguna albistria*	1	1
Insecta	Lepidoptera	Hesperiidae	*Aguna asander*	1	1
Insecta	Lepidoptera	Hesperiidae	*Aides epitus*	1	1
Insecta	Lepidoptera	Hesperiidae	*Chioides catillus*	1	1
Insecta	Lepidoptera	Hesperiidae	*Chiomara*	1	1
Insecta	Lepidoptera	Hesperiidae	*Cymaenes gisca*	1	1
Insecta	Lepidoptera	Hesperiidae	*Drephalys oriander*	1	1
Insecta	Lepidoptera	Hesperiidae	*Heliopetes omrina*	1	1
Insecta	Lepidoptera	Hesperiidae	Hesperiidae	20	9
Insecta	Lepidoptera	Hesperiidae	*Hylephila*	1	1
Insecta	Lepidoptera	Hesperiidae	*Hylephila phyleus*	1	1
Insecta	Lepidoptera	Hesperiidae	*Mimoniades*	1	1
Insecta	Lepidoptera	Hesperiidae	*Nyctelius nyctelius*	1	1
Insecta	Lepidoptera	Hesperiidae	*Panoquina lucas*	1	1

Insecta	Lepidoptera	Hesperiidae	*Pyrrhopyge charybdes*	1	1
Insecta	Lepidoptera	Hesperiidae	Pyrrhopyginae	2	1
Insecta	Lepidoptera	Hesperiidae	*Sarbia damippe*	2	1
Insecta	Lepidoptera	Hesperiidae	*Sarbia xanthippe*	1	1
Insecta	Lepidoptera	Hesperiidae	*Thespieus*	1	1
Insecta	Lepidoptera	Hesperiidae	*Urbanus*	7	6
Insecta	Lepidoptera	Hesperiidae	*Urbanus dorantes*	2	2
Insecta	Lepidoptera	Hesperiidae	*Urbanus proteus*	4	4
Insecta	Lepidoptera	Lycaenidae	*Calycopis*	2	2
Insecta	Lepidoptera	Lycaenidae	*Chlorostrymon simaethis*	1	1
Insecta	Lepidoptera	Lycaenidae	*Electrostrymon endymion*	1	1
Insecta	Lepidoptera	Lycaenidae	*Hemiargus*	1	1
Insecta	Lepidoptera	Lycaenidae	*Leptotes cassius*	4	3
Insecta	Lepidoptera	Lycaenidae	Lycaenidae	4	3
Insecta	Lepidoptera	Lycaenidae	*Ministrymon*	1	1
Insecta	Lepidoptera	Lycaenidae	*Panthiades*	1	1
Insecta	Lepidoptera	Lycaenidae	*Paryphthimoides phronius*	1	1
Insecta	Lepidoptera	Lycaenidae	*Sofrasta*	1	1
Insecta	Lepidoptera	Lycaenidae	*Strephonota*	2	1
Insecta	Lepidoptera	Lycaenidae	*Thecla*	5	2
Insecta	Lepidoptera	Megalopygidae	*Podalia*	1	1
Insecta	Lepidoptera	Noctuidae	*Helicoverpa zea*	1	1
Insecta	Lepidoptera	Noctuidae	*Heliothis virescens*	1	1
Insecta	Lepidoptera	Noctuidae	Noctuidae	1	1
Insecta	Lepidoptera	Noctuidae	*Sameodes phyllisalis*	2	1
Insecta	Lepidoptera	Nymphalidae	*Agraulis vanillae*	2	2
Insecta	Lepidoptera	Nymphalidae	*Dryas iulia alcionea*	2	1

Insecta	Lepidoptera	Nymphalidae	*Euptoieta hegesia*	3	1
Insecta	Lepidoptera	Nymphalidae	*Hamadryas februa*	1	1
Insecta	Lepidoptera	Nymphalidae	*Heliconius erato*	3	3
Insecta	Lepidoptera	Nymphalidae	*Junonia*	1	1
Insecta	Lepidoptera	Nymphalidae	*Junonia evarete*	1	1
Insecta	Lepidoptera	Nymphalidae	Nymphalidae	2	1
Insecta	Lepidoptera	Nymphalidae	*Paryphthimoides*	1	1
Insecta	Lepidoptera	Nymphalidae	*Temenis*	1	1
Insecta	Lepidoptera	Nymphalidae	*Vanessa*	5	1
Insecta	Lepidoptera	Nymphalidae	*Vanessa myrinna*	3	1
Insecta	Lepidoptera	Nymphalidae	*Yphthimoides ochracea*	2	1
Insecta	Lepidoptera	Pieridae	*Ascia monuste*	1	1
Insecta	Lepidoptera	Pieridae	*Eurema*	1	1
Insecta	Lepidoptera	Pieridae	*Eurema elathea*	1	1
Insecta	Lepidoptera	Pieridae	*Eurema nise*	2	1
Insecta	Lepidoptera	Pieridae	*Hesperocharis erota*	1	1
Insecta	Lepidoptera	Pieridae	*Phoebis sennae*	3	3
Insecta	Lepidoptera	Pieridae	Pieridae	3	3
Insecta	Lepidoptera	Pieridae	*Pyrisitia leuce*	1	1
Insecta	Lepidoptera	Pyralidae	Pyralidae	1	1
Insecta	Lepidoptera	Riodinidae	*Apodemia*	1	1
Insecta	Lepidoptera	Riodinidae	*Emesis*	2	2
Insecta	Lepidoptera	Riodinidae	Riodininae	1	1
Insecta	Lepidoptera	Riodinidae	*Stalachtis phlegia*	1	1
Insecta	Lepidoptera	Sphingidae	*Aellopos*	2	2
Insecta	Lepidoptera	Sphingidae	*Aellopos fadus*	6	3
Insecta	Lepidoptera	Sphingidae	*Aellopos titan*	5	6

Insecta	Lepidoptera	Sphingidae	*Aellopos ulan*	1	1
Insecta	Lepidoptera	Sphingidae	*Agrius cingulata*	9	5
Insecta	Lepidoptera	Sphingidae	*Aleuron chloroptera*	1	1
Insecta	Lepidoptera	Sphingidae	*Callionima parce*	6	1
Insecta	Lepidoptera	Sphingidae	*Cocytius antaeus*	6	2
Insecta	Lepidoptera	Sphingidae	*Cocytius lucifer*	9	1
Insecta	Lepidoptera	Sphingidae	*Enyo ocypete*	7	1
Insecta	Lepidoptera	Sphingidae	*Erinnyis*	1	1
Insecta	Lepidoptera	Sphingidae	*Erinnyis alope*	5	1
Insecta	Lepidoptera	Sphingidae	*Erinnyis ello*	9	3
Insecta	Lepidoptera	Sphingidae	*Erinnyis obscura*	5	1
Insecta	Lepidoptera	Sphingidae	*Erinnyis oenotrus*	4	1
Insecta	Lepidoptera	Sphingidae	*Eristalis*	6	1
Insecta	Lepidoptera	Sphingidae	*Eumorpha adamsi*	4	1
Insecta	Lepidoptera	Sphingidae	*Eumorpha anchemolus*	6	1
Insecta	Lepidoptera	Sphingidae	*Eumorpha labruscae*	2	1
Insecta	Lepidoptera	Sphingidae	*Eumorpha vitis*	3	1
Insecta	Lepidoptera	Sphingidae	*Eupyrrhoglossum sagra*	2	2
Insecta	Lepidoptera	Sphingidae	*Isognathus allamandae*	1	1
Insecta	Lepidoptera	Sphingidae	*Isognathus caricae*	8	1
Insecta	Lepidoptera	Sphingidae	*Isognathus menechus*	3	1
Insecta	Lepidoptera	Sphingidae	*Macroglossum*	1	1
Insecta	Lepidoptera	Sphingidae	*Madoryx plutonius*	1	1
Insecta	Lepidoptera	Sphingidae	*Manduca albiplaga*	3	1
Insecta	Lepidoptera	Sphingidae	*Manduca contracta*	2	1
Insecta	Lepidoptera	Sphingidae	*Manduca diffissa*	6	1
Insecta	Lepidoptera	Sphingidae	*Manduca florestan*	5	1

Insecta	Lepidoptera	Sphingidae	*Manduca hannibal*	1	1
Insecta	Lepidoptera	Sphingidae	*Manduca lefeburii*	3	1
Insecta	Lepidoptera	Sphingidae	*Manduca manducoides*	2	1
Insecta	Lepidoptera	Sphingidae	*Manduca plutonius*	1	1
Insecta	Lepidoptera	Sphingidae	*Manduca rustica*	2	1
Insecta	Lepidoptera	Sphingidae	*Manduca sexta*	9	1
Insecta	Lepidoptera	Sphingidae	*Neogene dynaeus*	2	1
Insecta	Lepidoptera	Sphingidae	*Pachylia ficus*	4	1
Insecta	Lepidoptera	Sphingidae	*Perigonia pallida*	1	1
Insecta	Lepidoptera	Sphingidae	*Protambulyx astygonus*	2	1
Insecta	Lepidoptera	Sphingidae	*Protambulyx strigilis*	15	1
Insecta	Lepidoptera	Sphingidae	*Pseudosphinx tetrio*	3	2
Insecta	Lepidoptera	Sphingidae	Sphingidae	1	1
Insecta	Lepidoptera	Sphingidae	*Xylophanes anubus*	1	1
Insecta	Lepidoptera	Sphingidae	*Xylophanes chiron*	3	1
Insecta	Lepidoptera	Sphingidae	*Xylophanes pistacina*	3	1
Insecta	Lepidoptera	Sphingidae	*Xylophanes tersa*	10	1
Insecta	Lepidoptera	Sphingidae	*Xylophanes tyndarus*	4	1
Insecta	Lepidoptera		Lepidoptera	15	13
Insecta	Mantodea	Mantidae	Mantidae	2	1
Insecta	Mantodea	Mantidae	*Mantis religiosa*	2	2
Insecta	Mantodea		Mantodea	1	1
Insecta	Neuroptera	Chrysopidae	*Chrysoperla externa*	1	1
Insecta	Neuroptera	Chrysopidae	Chrysopidae	1	1
Insecta	Neuroptera		Neuroptera	1	1
Insecta	Orthoptera	Acrididae	Acrididae	3	2
Insecta	Orthoptera	Acrididae	*Baeacris pseudopunctulata*	1	1

Insecta	Orthoptera	Acrididae	*Dichromatos*		1	1
Insecta	Orthoptera	Gryllacrididae	Gryllacrididae		1	1
Insecta	Orthoptera	Gryllidae	Gryllidae		1	1
Insecta	Orthoptera	Proscopiidae	Proscopiidae		1	1
Insecta	Orthoptera	Romaleidae	*Tropidacris collaris*		2	2
Insecta	Orthoptera	Tettigoniidae	*Dasyscelus*		1	1
Insecta	Orthoptera	Tettigoniidae	*Homotoicha*		1	1
Insecta	Orthoptera	Tettigoniidae	Tettigoniidae		2	2
Insecta	Orthoptera		Orthoptera		8	6
Insecta	Phasmida	Diapheromeridae	*Phibalosoma phyllinum*		1	1
Insecta	Psittaciformes	Psittacidae	*Alipiopsitta xanthops*		1	1
Insecta	Psittaciformes	Psittacidae	*Amazona aestiva*		1	1
Insecta	Psittaciformes	Psittacidae	*Amazona amazonica*		1	1
Insecta	Psittaciformes	Psittacidae	*Ara ararauna*		1	1
Insecta	Psittaciformes	Psittacidae	*Ara chloropterus*		1	1
Insecta	Psittaciformes	Psittacidae	*Brotogeris chiriri*		1	1
Insecta	Psittaciformes	Psittacidae	*Diopsittaca nobilis*		1	1
Insecta	Psittaciformes	Psittacidae	*Eupsittula aurea*		1	1
Insecta	Psittaciformes	Psittacidae	*Psittacara leucophthalmus*		1	1
Insecta	Strepsiptera		Strepsiptera		1	1
Insecta	Thysanoptera	Thripidae	*Frankliniella*		1	1
Insecta	Thysanoptera		Thysanoptera		6	5
Mammalia	Chiroptera	Molossidae	*Molossops temminckii*		1	1
Mammalia	Chiroptera	Phyllostomidae	*Anoura caudifer*		16	7
Mammalia	Chiroptera	Phyllostomidae	*Anoura geoffroyi*		9	5
Mammalia	Chiroptera	Phyllostomidae	*Artibeus cinereus*	*Dermanura cinerea*	3	1
Mammalia	Chiroptera	Phyllostomidae	*Artibeus concolor*		1	2

Mammalia	Chiroptera	Phyllostomidae	*Artibeus lituratus*		7	4
Mammalia	Chiroptera	Phyllostomidae	*Artibeus planirostris*		7	5
Mammalia	Chiroptera	Phyllostomidae	*Carollia perspicillata*		12	7
Mammalia	Chiroptera	Phyllostomidae	*Artibeus anderseni*	*Dermanura anderseni*	2	3
Mammalia	Chiroptera	Phyllostomidae	*Artibeus cinereus*	*Dermanura cinerea*	4	4
Mammalia	Chiroptera	Phyllostomidae	*Glossophaga soricina*		15	8
Mammalia	Chiroptera	Phyllostomidae	*Lonchophylla dekeyseri*		11	6
Mammalia	Chiroptera	Phyllostomidae	*Micronycteris schmidtorum*		3	3
Mammalia	Chiroptera	Phyllostomidae	*Phyllostomus discolor*		4	2
Mammalia	Chiroptera	Phyllostomidae	*Platyrrihnus lineatus*		11	7
Mammalia	Chiroptera	Phyllostomidae	*Sturnira lilium*		3	4
Mammalia	Chiroptera	Phyllostomidae	*Platyrrihnus lineatus*		1	1

Table S5. Standardized descriptors per animal taxa with animal and flower place of contact, floral resources collected, and interaction type according Salim *et al.* (2022) for the reviewed studies of plant-pollinators interactions in the Cerrado.

Animal taxa	Animal place of contact	Flower place of contact	Resource collected	Interaction type
Acamptopoeum prinii				visit
Acanthopus excellens				pollinates
Acanthopus superba			nectar	visit
Acrididae	leg | wings	stamens		visit
Aellopos			nectar	visit
Aellopos fadus		stigma	nectar	visit
Aellopos titan		anther | stamens	nectar	pollinates | visit
Aellopos ulan		stigma		visit
Aetalion reticulatum			plant tissue	visit
Agapostemon				pollinates | visit
Agelaia				visit
Agelaia pallipes			plant tissue	robbery
Agelaia vicina				pollinates
Agraulis vanillae	proboscis		nectar	pollinates | robbery
Agrius cingulata	other body parts | proboscis	anther | stamens	nectar | pollen	pollinates | visit
Agromyzidae	proboscis	stamens	nectar	robbery
Aguna albistria			nectar	visit
Aguna asander				pollinates
Aides epitus	proboscis	anther	nectar	visit
Aleochara				pollinates
Aleocharinae		stigma	pollen	visit

Alepidosceles imitatriz				visit
Aleuron chloroptera				visit
Alipiopsitta xanthops				visit
Allograpta exotica				pollinates | visit
Alticinae	proboscis		plant tissue	robbery
Alticini				visit
Amatidae				visit
Amazilia			nectar	visit
Amazona aestiva				visit
Amazona amazonica				visit
Anchylorhynchus bicolor			nectar | pollen	visit
Anchylorhynchus campestris			nectar | pollen	visit
Anchylorhynchus camposi			nectar | pollen	visit
Ancistroceroides				visit
Ancyloscelis romeroi				visit
Andranthobius				pollinates
Andreninae				visit
Angelocentris schubarti			nectar | pollen	visit
Anoura caudifer	other body parts	anther | stigma	nectar | pollen	pollinates | visit
Anoura geoffroyi	other body parts | wings	stamens	nectar | pollen	pollinates | visit
Anthidium latum				visit
Anthidium sertanicola				pollinates
Anthodioctes megachiloides	proboscis	anther | stamens	pollen	visit
Anthonomus			nectar | pollen	visit
Anthracotanthracothorax nigricollis	bill		nectar	visit
Anthracothorax nigricollis	bill	anther | stigma	nectar	pollinates | visit

Anthrenoides				pollinates
Antilophia galeata				visit
Aphirape uncifera				visit
Aphis	proboscis		nectar	visit
Apidae	proboscis	nectary | stamens | stigma	nectar	pollinates | visit
Apiomerus			pollen	robbery
Apion	proboscis		plant tissue	robbery
Apis				visit
Apis mellifera	leg | other body parts | proboscis	anther | stigma	nectar | pollen	pollinates | robbery | visit
Apodemia				visit
Apoidea			nectar | pollen	visit
Ara ararauna				visit
Ara chloropterus				visit
Araneae				visit
Araneidae				visit
Archytas			pollen	robbery
Arctiinae			pollen	pollinates
Argentinomyia			pollen	robbery
Arhysoceble				visit
Arriguttia brevissima			pollen	visit
Artibeus anderseni				visit
Artibeus cinereus	other body parts	stamens	nectar	pollinates | visit
Artibeus cinereus			nectar	visit
Artibeus concolor				visit
Artibeus lituratus	other body parts	stamens		pollinates | visit
Artibeus planirostris	other body parts	stamens	nectar	pollinates | visit

Ascia monuste			nectar | pollen	pollinates
Asilidae	proboscis	nectary	nectar	visit
Astylus sexmaculatus				pollinates
Astylus variegatus				visit
Atheta				pollinates
Atta				visit
Augochlora	leg | other body parts | proboscis	anther | stamens | stigma	nectar | pollen	pollinates | robbery | visit
Augochlora caerulior				visit
Augochlora esox				visit
Augochlora semiramis	leg | proboscis	anther | stigma	nectar	visit
Augochlora smithiana	proboscis	anther | stigma	nectar	visit
Augochlora thalia				visit
Augochlorella				visit
Augochlorella ephyra				visit
Augochlorella michaelis			nectar | pollen	visit
Augochlorini			nectar | pollen	pollinates
Augochlorodes turrifaciens				pollinates
Augochloropsis	leg | other body parts | proboscis	anther | stamens	nectar | pollen	pollinates | robbery | visit
Augochloropsis aphrodite				visit
Augochloropsis aurifluens			nectar | pollen	visit
Augochloropsis brachycephala	proboscis	stamens | stigma		visit
Augochloropsis callichroa	leg | proboscis	anther | stigma	nectar | pollen	visit
Augochloropsis cleopatra			nectar | pollen	visit
Augochloropsis cognata	leg | proboscis	anther | stigma	nectar | pollen	pollinates | robbery
Augochloropsis cupreola	leg | other body parts	stamens	pollen	pollinates | visit

Augochloropsis cyanea				pollinates
Augochloropsis euphrosyne	proboscis	anther | stigma	nectar	visit
Augochloropsis heterochroa				visit
Augochloropsis iris				pollinates
Augochloropsis patens				visit
Augochloropsis semele				visit
Augochloropsis smithiana	leg	stigma	pollen	pollinates | visit
Austrostelis silveirai				visit
Baccha				visit
Baeacris pseudopunctulata	proboscis		plant tissue	robbery
Baridinae				visit
Baris				visit
Bassus				visit
Belopoeus				pollinates
Bembicini				visit
Bembix			pollen	robbery | visit
Bicyrtes paranae				pollinates
Bitoma palmarum			nectar | pollen	visit
Blaesoxipha			nectar	visit
Blaesoxipha hunteri				visit
Blattidae				visit
Blattodea			nectar | pollen	visit
Bombus	leg | other body parts | proboscis	anther | stigma	nectar | pollen	pollinates | visit
Bombus brasiliensis	proboscis	stamens | stigma		pollinates | visit
Bombus brevivillus	leg	anther | stigma	pollen	pollinates | visit

Bombus morio	leg l other body parts | proboscis	anther | stigma	nectar | pollen	pollinates | robbery | visit
Bombus pauloensis	leg | other body parts | proboscis	anther | stigma	nectar | pollen	pollinates | visit
Bombyliidae	proboscis	nectary	nectar	pollinates | visit
Brachygastra	proboscis	stamens	nectar	visit
Brachygastra lecheguana			pollen	pollinates | robbery | visit
Brachymyrmex				visit
Brachymyrmex cordemoyi	proboscis		nectar	visit
Braconidae				pollinates | visit
Brotogeris chiriri				visit
Bruchidae	leg | wings	stamens		visit
Callionima parce				visit
Calliphlox amethystina	bill	stigma	nectar	visit
Calliphoridae			nectar | pollen	visit
Calycopis				pollinates | robbery
Camargoia nordestina				visit
Camponotus	leg | proboscis	nectary	nectar	robbery | visit
Camponotus crassus	leg | other body parts | proboscis	anther	nectar | pollen	pollinates | robbery
Camponotus melanoticus	proboscis	stamens	pollen	robbery
Camponotus novogranadensis	proboscis		nectar	robbery
Camponotus rufipes	proboscis	stamens	nectar	robbery
Campsomeris	other body parts	anther | stamens	nectar | pollen	pollinates | visit
Cantharidae				pollinates | visit
Cardiorhinus				pollinates

Carollia perspicillata	other body parts | wings	stamens	nectar | pollen	pollinates | visit
Carpophilinae		stigma	pollen	visit
Carpophilus				visit
Celetes				pollinates
Centridini	proboscis	stigma	nectar | pollen	pollinates
Centrinaspis			nectar | pollen	visit
Centris	other body parts | proboscis	stamens | stigma	nectar | pollen	pollinates | visit
Centris aenea	leg	stigma	nectar | oil | pollen	pollinates | visit
Centris albopilosa				pollinates
Centris bicolor	leg	stigma	nectar | oil | pollen	pollinates | visit
Centris burgdorfi				pollinates
Centris collaris			nectar | oil | pollen	pollinates | visit
Centris decolorata	leg		oil | pollen	pollinates
Centris dentata			oil | pollen	pollinates
Centris denudans	leg	stamens	nectar | oil | pollen	pollinates | visit
Centris discolor				pollinates
Centris dorsata		stamens	oil | pollen	pollinates
Centris flavifrons	leg | other body parts	anther | stigma	nectar | oil | pollen	pollinates | visit
Centris fuscata	leg		nectar | oil | pollen	pollinates | visit
Centris insularis				pollinates
Centris klugii				pollinates
Centris longimana	leg	stamens	nectar | oil | pollen	pollinates | visit
Centris lutea			nectar	pollinates | visit
Centris machadoi			oil | pollen	pollinates | visit
Centris maranhensis	leg		oil | pollen	pollinates | visit
Centris mocsaryi				visit

Centris nitens			nectar	visit
Centris obsoleta				visit
Centris poecila				visit
Centris rhodoprocta	leg | proboscis		oil | pollen	pollinates | visit
Centris rupestris				visit
Centris scopipes	leg | other body parts | proboscis	anther l stigma	nectar | oil | pollen	pollinates | robbery | visit
Centris similis			nectar	visit
Centris spilopoda	leg		nectar | oil | pollen	pollinates | visit
Centris sponsa	leg		oil | pollen	pollinates | visit
Centris tarsata	leg	stigma	nectar | oil | pollen	pollinates | visit
Centris trigonoides	leg		oil | pollen	pollinates
Centris varia	other body parts	anther | stamens | stigma	oil | pollen	pollinates | visit
Centris violacea			nectar	pollinates | visit
Centris vittata				visit
Centris xanthomelaena				visit
Cephalotes			nectar	robbery | visit
Cephalotes angustus	leg	anther | stamens | stigma		visit
Cephalotes atratus	leg	anther | stamens | stigma		visit
Cephalotes pusillus	proboscis		nectar	robbery
Cephalotrigona capitata				visit
Cerambycidae				visit
Ceratalictus				pollinates
Ceratalictus clonius				visit
Ceratalictus theius			nectar | pollen	visit
Ceratina	proboscis	pollinaria | stamens	nectar | pollen	pollinates | visit
Ceratina asuncionis		anther | stigma	pollen	pollinates | visit

Ceratina gossypii	leg | other body parts	anther | stigma	pollen	visit
Ceratina maculifrons	leg | other body parts	anther | stigma	nectar	visit
Ceratina morrensis	leg	anther | stigma	pollen	visit
Cercerini				pollinates
Chalcodermus	proboscis		plant tissue	robbery
Chartergellus				visit
Chioides catillus				pollinates
Chiomara	proboscis	anther | stigma	nectar	visit
Chionomesa fimbriata	bill	anther | stamens | stigma	nectar | pollen	pollinates | visit
Chionomesa lactea	bill	anther | stamens | stigma	nectar	pollinates | robbery | visit
Chloropidae				pollinates | visit
Chloroprocta idioidea	proboscis	anther | stigma	nectar	visit
Chlorostilbon lucidus	bill	anther l stamens | stigma	nectar | pollen	pollinates | robbery | visit
Chlorostrymon simaethis	leg | proboscis	anther | stigma	nectar	visit
Chrysididae				pollinates
Chrysolampis mosquitus	proboscis	nectary	nectar	visit
Chrysomelidae	leg | proboscis	nectary | stamens | stigma	nectar | pollen	visit
Chrysomelinae		stigma	pollen	visit
Chrysomya albiceps	leg | proboscis	anther | stigma	nectar	visit
Chrysomya megacephala	leg | proboscis	anther | stigma	nectar | pollen	robbery | visit
Chrysomya putoria			nectar	pollinates
Chrysoperla externa				visit
Chrysopidae				visit
Cillaeinae		stigma	pollen	visit
Cleridae			nectar | pollen	visit

Clytolaema rubricauda				pollinates
Coccinellidae	leg | wings	stamens	pollen	robbery | visit
Cocytius antaeus				visit
Cocytius lucifer				visit
Coelioxys				pollinates | visit
Coelioxys simillimus				visit
Coelosternus			nectar | pollen	visit
Coereba flaveola			nectar	visit
Coleoptera	proboscis		nectar | plant tissue	visit
Colibri serrirostris	bill | other body parts | proboscis	nectary | stigma	nectar	pollinates | robbery | visit
Colletes	leg | proboscis	anther | stigma	nectar | pollen	pollinates | visit
Colletes meridionalis			nectar | pollen	visit
Colletinae				visit
Colopterus				visit
Colopterus niger				visit
Columbina squammata				visit
Conognatha				pollinates
Conotelus		stigma	pollen	visit
Conotrachelus			nectar | plant tissue | pollen	visit
Conura				visit
Copestylum			nectar	visit
Coreidae	leg | other body parts	anther	nectar | pollen	robbery | visit
Corylophidae			nectar | pollen	visit
Coryphospingus cucullatus	bill | leg | other body parts | wings	anther | stigma	nectar	pollinates

Crabronidae				visit
Crematogaster	proboscis		nectar	visit
Crematogaster curvispinosa				visit
Crematogaster erecta	leg | other body parts	anther		visit
Crinocerus sanctus	proboscis			visit
Cryptobaris sulcata			nectar | pollen	visit
Cryptocephalinae	proboscis		plant tissue	robbery
Cryptocephalus				visit
Cryptochetidae				visit
Cryptorhopalum				visit
Ctenioschelus goryi				visit
Ctenuchidae				visit
Cucujidae			nectar | pollen	visit
Culicidae				pollinates
Curculionidae	leg | wings	stamens | stigma	pollen	pollinates | robbery | visit
Curtonotidae				pollinates
Cyanerpes cyaneus				visit
Cyclarhis gujanensis				visit
Cyclocephala atricapilla		stamens | stigma	plant tissue | pollen	pollinates | visit
Cyclocephala bicolor		anther | stigma	plant tissue	robbery
Cyclocephala celata				visit
Cyclocephala octopunctata			pollen	visit
Cyclocephala ohausiana			pollen	visit
Cyclocephala quatuordecimpunctata		stamens | stigma	plant tissue | pollen	pollinates
Cyclocephala undata			plant tissue | pollen	pollinates | visit

Cycloneda sanguinea				visit
Cyclopis caecutiens	proboscis	stamens	nectar	visit
Cydnidae			nectar | pollen	visit
Cylindromyia				visit
Cylindromyia dorsalis				pollinates
Cymaenes gisca	proboscis	nectary	nectar	visit
Cyphomenes				visit
Dacnis cayana				visit
Dalbulus maidis				visit
Dasyscelus	proboscis		plant tissue	robbery
Derelomini				visit
Dexosarcophaga				visit
Dexosarcophaga transita				visit
Diabrotica				pollinates | visit
Diabrotica speciosa				pollinates | visit
Dialictus	proboscis	anther | nectary | stamens	nectar | pollen	pollinates | robbery | visit
Dialictus opacus				visit
Dialictus pabulator				visit
Dialomia			nectar | pollen	visit
Diaphania				robbery
Dichromatos	proboscis		plant tissue	robbery
Diopsittaca nobilis				visit
Diptera			nectar | pollen	pollinates | visit
Discodon				visit
Discodon tucumanum				pollinates
Dolichopodidae				visit

Dorymyrmex	leg | other body parts	anther		visit
Dorymyrmex goetschi	proboscis		nectar	robbery
Drephalys oriander				visit
Drosophila	leg | other body parts	anther		visit
Drosophila melanogaster				visit
Drosophilidae				pollinates | visit
Dryas iulia alcionea	proboscis	anther | stigma	nectar	visit
Dysdercus honestus				visit
Ectatomma	leg | other body parts	anther		visit
Ectatomma planindens				visit
Ectatomma tuberculatum				visit
Elaenia			nectar	visit
Electrostrymon endymion	leg | proboscis	anther | stigma	nectar	visit
Emesis	other body parts	anther | stigma	nectar	visit
Emphorini				pollinates
Empidonomus varius				visit
Empis			nectar	pollinates
Entypus			pollen	visit
Enyo ocypete				visit
Epanthidium				visit
Epanthidium anisitsi				visit
Epanthidium aureocinctum			pollen	visit
Epanthidium autumnale				pollinates
Ephydridae				visit
Epicharis	leg | other body parts | proboscis	anther | stamens | stigma	oil | pollen	pollinates | visit
Epicharis affinis				visit

Epicharis albofasciata				visit
Epicharis analis	leg	anther | stigma	nectar | pollen	pollinates | visit
Epicharis bicolor	leg		nectar | oil | pollen	pollinates | visit
Epicharis cockerelli	other body parts	anther | stigma	nectar | oil | pollen	visit
Epicharis dejeanii			pollen	visit
Epicharis flava	leg | other body parts	anther | stigma	nectar | oil | pollen	pollinates | visit
Epicharis iheringi			nectar | oil | pollen	pollinates | visit
Epicharis maculata				visit
Epicharis nigrita				visit
Epicharis xanthogastra			pollen	visit
Epidromia zetophora			nectar | pollen	pollinates
Episyrphus balteatus				visit
Eremnophila				visit
Erinnyis				visit
Erinnyis alope				visit
Erinnyis ello		stamens | stigma	nectar | pollen	pollinates | visit
Erinnyis obscura				visit
Erinnyis oenotrus				visit
Eristalinus aeneus	leg | proboscis	anther | stigma	nectar	visit
Eristalinus taeniops	leg | proboscis	anther | stigma	nectar	visit
Eristalis				visit
Eucnemidae				pollinates
Eufriesea auriceps	leg	stigma	nectar | pollen	pollinates
Eufriesea nordestina				visit
Eufriesea violascens				pollinates | visit
Euglossa	leg | other body parts	anther | stigma	nectar	visit

Euglossa cordata	leg | other body parts | proboscis		fragance	pollinates | visit
Euglossa imperialis				visit
Euglossa melanotricha				pollinates | visit
Euglossa townsendi	leg | other body parts	anther | stigma	nectar | pollen	visit
Euglossini				visit
Eulaema			nectar | pollen	pollinates
Eulaema cingulata		stamens	nectar	pollinates | visit
Eulaema nigrita	leg | other body parts | proboscis	anther | nectary | stamens | staminoide | stigma	nectar | pollen	pollinates | visit
Eumorpha adamsi				visit
Eumorpha anchemolus				visit
Eumorpha labruscae				visit
Eumorpha vitis				visit
Eupetomena macroura	bill	anther | stamens | stigma	nectar | pollen	pollinates | robbery | visit
Euphonia chlorotica				visit
Euprepina				pollinates
Eupsittula aurea				visit
Euptoieta hegesia				visit
Eupyrrhoglossum sagra			nectar	visit
Eurema	proboscis	nectary	nectar	visit
Eurema elathea				pollinates
Eurema nise				pollinates
Eurytis funereus				visit
Eurytomidae				pollinates
Euschistus heras				robbery

Euxesta			plant tissue	pollinates | visit
Exaerete				pollinates
Exomalopsis	leg | proboscis	anther | stamens | staminode | stigma	nectar | pollen	robbery | visit
Exomalopsis analis	leg	anther	nectar | pollen	pollinates | visit
Exomalopsis auropilosa			pollen	visit
Exomalopsis campestris			pollen	visit
Exomalopsis collaris	leg	anther	pollen	visit
Exomalopsis fulvofasciata	leg	anther	nectar | pollen	visit
Exomalopsis tomentosa				visit
Exoprosopa				pollinates
Exoristinae				visit
Fanniidae				visit
Ferrariana trivittata			plant tissue	visit
Fletcherimyia				visit
Florisuga fusca	bill	stigma	nectar	visit
Formicidae	proboscis	nectary	nectar | plant tissue | pollen	robbery | visit
Frankliniella				visit
Frieseomelitta				visit
Frieseomelitta doederleini				visit
Frieseomelitta flavicornis	leg	anther	pollen	visit
Frieseomelitta portoi				visit
Frieseomelitta silvestrii	leg		pollen	visit
Frieseomelitta varia	leg	stigma	nectar | pollen	pollinates | robbery | visit
Fringillidae	leg | other body parts	nectary | stamens | stigma	nectar	visit

Fulgoroidea				visit
Gaesischia nigra				pollinates
Gasteruptiinae				pollinates
Gasteruption				visit
Geotrigona		anther | stigma		pollinates | visit
Geotrigona mombuca	leg | proboscis	anther | stigma	nectar | pollen	visit
Geotrigona subterranea				visit
Glossophaga soricina	other body parts | wings	stamens | stigma	nectar | pollen	pollinates | visit
Goniini				visit
Griseotyrannus aurantioatrocristatus				visit
Groatus roticollis				visit
Groatus rufipennis				visit
Gryllacrididae				visit
Gryllidae	leg | wings	stamens		visit
Halictinae			fragance | nectar | pollen	pollinates | visit
Halictini				pollinates
Hamadryas februa			nectar	visit
Harmostes				visit
Heilus			nectar | pollen	visit
Heliactin bilophus			nectar	visit
Helicobia				visit
Helicobia alvarengai				visit
Helicobia borgmeieri				visit
Heliconius erato			nectar	visit
Helicoverpa zea				pollinates

Heliomaster furcifer				visit
Heliomaster squamosus	bill	anther | stigma	nectar	pollinates | visit
Heliopetes omrina				robbery
Heliothis virescens				pollinates
Hemiargus				visit
Hemilucilia	proboscis	anther | stigma	nectar	visit
Hemipenthes				visit
Hemiptera	proboscis		plant tissue	visit
Heraclides			pollen	pollinates
Hesperiidae	leg | proboscis	anther | stigma	nectar	pollinates | visit
Hesperocharis erota				pollinates
Hexantheda missionica	leg	anther		nesting
Homotoicha	proboscis		plant tissue	robbery
Hopliophora superba				visit
Hoplopyga				visit
Hustachea campestris			nectar | pollen	visit
Hylaeus	proboscis	stamens	nectar	visit
Hylephila			pollen	robbery
Hylephila phyleus				pollinates
Hylocharis chrysura	bill	anther | stigma	nectar	pollinates | visit
Hymenomina cogigaria			nectar | pollen	pollinates
Hymenoptera	proboscis	anther	oil | pollen	pollinates | visit
Hypalastoroides				visit
Ichneumonidae				visit
Imatidium			nectar | pollen	visit
Isognathus allamandae				visit
Isognathus caricae				visit

Isognathus menechus				visit
Junonia			pollen	robbery
Junonia evarete				visit
Jurinella corpulenta				pollinates
Ladustes speciosus			nectar | pollen	visit
Lagria villosa			plant tissue	visit
Lampyridae				visit
Lanio cucullatus				visit
Largus				visit
Larocanthidium fasciatum				visit
Larrinae				pollinates
Lasioglossum			nectar | pollen	visit
Lebiini				visit
Lepidoptera	leg | other body parts | proboscis	anther | stigma	nectar | plant tissue	pollinates | robbery | visit
Leptotes cassius	proboscis	anther | nectary | stamens | stigma	nectar	robbery | visit
Leptotila verreauxi				visit
Leucochloris albicollis			nectar	pollinates
Leucospidae				pollinates
Leurotrigona muelleri	leg | proboscis	anther | stigma	nectar | pollen	visit
Limonia			nectar	visit
Linepithema anathema	proboscis		nectar	visit
Linepithema fuscum	leg	anther | stamens | stigma		visit
Lobiopa				visit
Lobiopa insularis				pollinates | visit
Lonchophylla dekeyseri	other body parts	stamens	nectar	pollinates | visit

Longitarsus				visit
Lophopedia nigrispinis	proboscis	pollinaria	nectar	pollinates
Lophopedia pygmaea	proboscis	pollinaria	nectar | oil | pollen	pollinates | visit
Lophopedia savanicola				visit
Lophornis			nectar	visit
Lophornis magnificus				visit
Lucilia eximia	leg | proboscis	anther | stigma	nectar	visit
Lycaenidae				pollinates | visit
Lydamis				visit
Lygaeidae				visit
Lygistorrhinidae				visit
Macraspis morio				visit
Macrodactylus		stamens	pollen	visit
Macroglossum				robbery
Madarini				visit
Madoryx plutonius				visit
Mahanarva posticata			plant tissue	visit
Manduca albiplaga				visit
Manduca contracta				visit
Manduca diffissa				visit
Manduca florestan				visit
Manduca hannibal				visit
Manduca lefeburii				visit
Manduca manducoides				visit
Manduca plutonius				visit
Manduca rustica				visit
Manduca sexta				visit

Mantidae				visit
Mantis religiosa				visit
Mantodea				visit
Maronius				visit
Megachile	proboscis	stamens	nectar | pollen	pollinates | visit
Megachile brethesi				visit
Megachile diasi				visit
Megachile frankieana				visit
Megachile iheringi				pollinates
Megachile laeta				pollinates | visit
Megachile maculata				pollinates
Megachile rubricata			nectar | pollen	visit
Megachile terrestris				pollinates
Megachile verrucosa				visit
Megachile zaptlana				visit
Megachilinae				visit
Megalopta aegis			nectar | pollen	visit
Megalopta amoena			nectar | pollen	visit
Megalostomis				visit
Megalostomis gigas		stamens	pollen	visit
Megalostomis glossa		stamens	pollen	visit
Megascirtetica mephistophelica				visit
Meligethinae		stigma	pollen	visit
Melipona	leg | other body parts	anther	pollen	pollinates
Melipona bicolor				pollinates
Melipona fasciculata	proboscis	stamens	nectar	visit
Melipona fuliginosa				visit

Melipona mandacaia				visit
Melipona marginata	proboscis	stamens	nectar	visit
Melipona melanoventer				visit
Melipona quadrifasciata	leg | other body parts	stamens	pollen	pollinates | visit
Melipona quinquefasciata	leg | proboscis	anther | stigma | stamens	nectar | pollen	pollinates | visit
Melipona rufiventris				visit
Melipona seminigra				visit
Melipona trinofaciata				visit
Meliponini			pollen	pollinates | visit
Melipotis fasciolaris			nectar | pollen	pollinates
Melissodes nigroaenea				visit
Melissoptila			nectar	visit
Melissoptila aureocincta				pollinates
Melissoptila minarum				visit
Melitoma				visit
Meloidae			pollen	visit
Membracidae				visit
Mesonychium				visit
Mesonychium coerulescens				pollinates
Mesoplia				visit
Mesoplia friesei				pollinates | visit
Mesoplia rufipes				pollinates
Metallactus				visit
Microcerella				visit
Micronycteris schmidtorum				visit
Microstrates			nectar | pollen	visit
Microstrates cocoscampestris			nectar | pollen	visit

Microstrates rufus			nectar | pollen	visit
Milichiidae				visit
Mimoniades			pollen	robbery
Mimus saturninus	bill | leg | other body parts | wings	anther | stigma	nectar	pollinates
Ministrymon				visit
Minixi				visit
Miridae				visit
Mischocyttarus	proboscis	stamens	nectar	robbery | visit
Mischocyttarus cerberus				visit
Mischocyttarus drewseni				pollinates
Mollosops temminckii				visit
Molothrus bonariensis			nectar	visit
Molytinae				visit
Momotus momota				visit
Monoeca				pollinates | visit
Monoeca brasiliensis			oil | pollen	pollinates | robbery
Montezumia				visit
Musca				visit
Musca domestica				visit
Muscidae	leg | other body parts | proboscis	anther | nectary	nectar | pollen	pollinates | visit
Myiarchus ferox				visit
Myiarchus swainsoni				visit
Myiarchus tyrannulus				visit
Myiothlypis flaveola				visit
Myrmelachista rudolphi	leg	anther | stamens | stigma		visit

Mystrops			nectar | pollen	pollinates | visit
Mystrops palmarum			nectar | pollen	visit
Nannotrigona melanocera				visit
Nannotrigona testaceicornis	leg	stigma	pollen	visit
Neogene dynaeus				visit
Neophasiphae				visit
Neuroptera				visit
Nicentrus				visit
Nitidulidae		stigma	pollen	visit
Nitidulinae		stigma	pollen	visit
Noctuidae				visit
Nodonota				visit
Nyctelius nyctelius				visit
Nymphalidae				pollinates
Ocyptamus			nectar	visit
Oestridae				visit
Ornidia	leg | proboscis	anther | stigma	nectar	visit
Ornidia obesa			nectar	visit
Orthoptera	proboscis		plant tissue | pollen	robbery | visit
Oxaea			nectar | pollen	pollinates | visit
Oxaea austera				pollinates
Oxaea flavescens	leg | proboscis	anther | stigma | stamens	nectar | pollen	pollinates | robbery | visit
Oxaea mourei				visit
Oxyopes salticus				visit
Oxysarcodexia			nectar	pollinates
Oxytrigona				visit

Oxytrigona flaveola				visit
Pachodynerus				visit
Pachylia ficus				visit
Pachymenes			pollen	robbery | visit
Palmocentrinus lucidulus			nectar | pollen	visit
Palpada			nectar	visit
Palpada pusio				visit
Palpada rufipedes				pollinates | visit
Palpada vinetorum				pollinates | visit
Panoquina lucas				pollinates
Panthiades	other body parts	anther | stigma	nectar	visit
Pantomorus	proboscis		nectar	robbery
Papilioninae	leg | proboscis	anther | stigma	nectar	visit
Parachartergus				visit
Parancistrocerus				visit
Parapantomorus flexuosus	proboscis		plant tissue	robbery
Paratenthras martinsi				visit
Paratetrapedia	leg | other body parts	elaiophore	oil | pollen	pollinates | robbery | visit
Paratetrapedia flaveola				visit
Paratetrapedia iheringii	leg | other body parts | proboscis	anther | elaiophore | stigma	nectar | oil	visit
Paratetrapedia larocai	leg | other body parts	anther | elaiophore | stigma	oil | pollen	visit
Paratetrapedia leucostoma	leg		oil | pollen	pollinates
Paratetrapedia lugubris	leg	anther	pollen	visit
Paratetrapedia punctata				visit

Paratetrapedia pygmaea				pollinates
Paratetrapedia testacea	leg		oil | pollen	pollinates
Paratetrapedia xanthopoda				visit
Paratrigona			pollen	visit
Paratrigona lineata	leg | other body parts | proboscis	anther | stamens | stigma	nectar | oil | pollen	pollinates | robbery | visit
Paratrigona subnuda				pollinates
Paravilla				pollinates
Parisoschoenus			nectar | pollen	pollinates | visit
Parisoschoenus plagiatus			nectar | pollen	visit
Paroxystoglossa	leg	anther | stigma	pollen	pollinates | visit
Paroxystoglossa jocasta				pollinates
Partamona	leg		pollen	visit
Partamona ailyae				visit
Partamona auripenis				visit
Partamona cupira				pollinates | visit
Partamona rustica			pollen	visit
Partamona vicina				visit
Paryphthimoides	proboscis	stamens	nectar	robbery
Paryphthimoides phronius	leg | proboscis	anther | stigma	nectar	visit
Patagioenas picazuro				visit
Pelidnota				visit
Pelidnota sumptuosa	leg | proboscis	anther	nectar | pollen	robbery | visit
Peloconusus				visit
Pentatomidae	leg | wings	stamens | stigma		robbery | visit
Pepsis			pollen	pollinates | robbery | visit

Perditomorpha				visit
Pereirapis				visit
Perigonia pallida				visit
Petalochilus lineolatus			nectar | pollen	visit
Phaenicia eximia			nectar	visit
Phaethornis pretrei	bill	anther | stigma	nectar	pollinates | visit
Pheidole	leg			visit
Pheidole megacephala	leg	anther | stamens | stigma		visit
Phibalosoma phyllinum			nectar	visit
Phoebis sennae	proboscis	anther	nectar	visit
Phoridae			nectar | pollen	visit
Phyllostomus discolor	leg | other body parts		pollen	visit
Phytotribus			nectar | pollen	pollinates | visit
Pieridae	leg | proboscis	anther | stigma	nectar	pollinates | visit
Platyrrhinus lineatus	other body parts	stamens | stigma	nectar	visit
Plebeia			nectar | pollen	visit
Plebeia droryana	leg | proboscis	anther | stigma	nectar | pollen	pollinates | visit
Plebeia remota	leg | proboscis	anther | stigma	nectar	visit
Plebeia saiqui				pollinates
Plecia				visit
Podalia				visit
Podisus				visit
Poecilognathus				visit
Polistes	proboscis	nectary | stamens	nectar	robbery | visit
Polistes billardieri				pollinates | visit
Polistes cinerascens				pollinates
Polistes lanio				visit

Polistes subsericeus				visit
Polistes versicolor				visit
Polistes vibex				visit
Polybia	proboscis	stamens	nectar	pollinates | visit
Polybia chrysothorax				visit
Polybia dimidiata				robbery
Polybia fastidiosuscula				pollinates
Polybia ignobilis			nectar	pollinates | robbery | visit
Polybia minarum				pollinates
Polybia occidentalis			nectar	visit
Polybia paulista	proboscis	nectary	nectar	visit
Polybia scutellaris				pollinates
Polybia sericea				pollinates | visit
Polytmus guainumbi	bill	anther | stigma	nectar	pollinates | visit
Pompilidae				pollinates | visit
Pompilinae				visit
Prionyx				visit
Proscopiidae			nectar | pollen	visit
Prostenus cyaneus			nectar | pollen	visit
Protambulyx astygonus				visit
Protambulyx strigilis				visit
Protonectarina sylveirae				pollinates
Protopolybia	proboscis	nectary	nectar	visit
Protopolybia sedula				pollinates
Pryonyx thomaz				pollinates
Pseudagapostemon	leg | proboscis	anther | stigma	nectar	visit

Pseudagapostemon cyaneus				pollinates
Pseudaugochlora				visit
Pseudaugochlora flammula			nectar	visit
Pseudaugochlora graminea				pollinates | visit
Pseudaugochlora pandora				visit
Pseudaugochloropsis graminea			nectar	visit
Pseudodoros				robbery | visit
Pseudodoros clavatus				pollinates | visit
Pseudomyrmex	leg			visit
Pseudomyrmex acanthobius	leg	anther | stamens | stigma		visit
Pseudomyrmex flavidulus	leg | other body parts	anther		visit
Pseudomyrmex gracilis	leg | other body parts | proboscis	anther	nectar	visit
Pseudomyrmex pallidus	leg | other body parts | proboscis	anther	nectar	visit
Pseudomyrmex unicolor				visit
Pseudosphinx tetrio		stamens | stigma		visit
Psittacara leucophthalmus				visit
Pteroglossus castanotis				visit
Ptiloglossa			pollen	pollinates | visit
Ptiloglossa latecalcarata		stamens | stigma	nectar | pollen	visit
Ptiloglossa matutina				visit
Ptiloglossa pretiosa				visit
Ptiloglossa stafuzzai	leg	anther	pollen	visit
Ptiloglossa xanthotricha	leg	anther	pollen	visit
Pyralidae	other body parts	anther | stigma	nectar	visit
Pyrisitia leuce	proboscis	stamens	nectar	robbery

Pyrrhopyge charybdes				visit
Pyrrhopyginae				pollinates
Quichuana				visit
Ramphastos toco				visit
Ramphocelus carbo			nectar	visit
Reduviidae				visit
Revena rubiginosa			nectar | pollen	visit
Rhathymus			nectar	pollinates | visit
Rhathymus bicolor				visit
Rhinochenus brevicollis				visit
Rhinocorynura				visit
Rhinocorynura vernoniae				visit
Rhinotragus festivus				pollinates
Riodininae				pollinates
Salpingogaster			nectar	visit
Saltatricula atricollis	bill | leg | other body parts | wings	anther | stigma	nectar	pollinates
Sameodes phyllisalis			nectar | pollen	pollinates
Sarbia damippe				pollinates
Sarbia xanthippe				pollinates
Sarcophagidae	proboscis	nectary | stamens	nectar | pollen	robbery | visit
Sarocolletes				visit
Scaptotrigona	proboscis	anther | stamens | stigma	nectar | pollen	pollinates | robbery | visit
Scaptotrigona bipunctata				pollinates | visit
Scaptotrigona depilis	proboscis	anther | stamens	pollen	pollinates | visit
Scaptotrigona polysticta	proboscis	anther | stamens	pollen	pollinates | visit

Scaptotrigona postica	leg | other body parts | proboscis	anther | elaiophore | stamens	nectar | oil	visit
Scarabaeidae	leg | other body parts	anther		visit
Schistochlamys ruficapillus	bill | leg | other body parts | wings	anther | stigma	nectar	pollinates
Schwarziana quadripunctata				pollinates
Schwarzula timida				visit
Sciaridae				pollinates
Scolia				visit
Scoliidae				pollinates
Scutelleridae				visit
Silvanus			nectar | pollen	visit
Sofrasta	other body parts	anther | stigma	nectar	visit
Solenopsis				visit
Sphecidae			pollen	pollinates | visit
Sphecini				visit
Sphex dorsalis				pollinates
Sphex opacus				pollinates
Sphingidae				pollinates
Stalachtis phlegia			pollen	robbery
Staphylinidae				visit
Stephanoxis lalandi				pollinates
Stilpnia cayana				visit
Stonemyia				visit
Stratiomyidae				visit
Strephonota				visit
Strepsiptera			nectar | pollen	visit

Sturnira lilium	other body parts	stamens	nectar	pollinates | visit
Syngamia florella				robbery
Synoeca cyanea				pollinates
Synoeca surinama				visit
Syrphidae	leg | other body parts | proboscis	anther | nectary	nectar | pollen	robbery | visit
Syrphus			nectar	visit
Syrphus phaeostigma				pollinates
Tabanidae	proboscis	anther | stamens | stigma	nectar | pollen	pollinates
Tabanus	leg | proboscis	anther | stigma	nectar	visit
Tachinidae			nectar	pollinates | visit
Tapinotaspidini				pollinates
Telemus			plant tissue	visit
Temenis	other body parts	anther | stigma	nectar	visit
Temnosoma				visit
Tenebrionidae			pollen	visit
Tenthredinidae				pollinates
Tersida viridis			nectar	visit
Tetraglossula				visit
Tetragona	proboscis	anther | stamens	nectar | pollen	visit
Tetragona clavipes		anther | stamens	nectar | pollen	visit
Tetragona quadrangula	leg		pollen	visit
Tetragonisca				visit
Tetragonisca angustula	leg | proboscis	anther | stamens | stigma	nectar | pollen	pollinates | robbery | visit
Tetragonisca fiebrigi				visit
Tetrapedia			oil	robbery | visit

Tetrapedia angustula				visit
Tetrapedia curvitarsis	leg		oil	pollinates | robbery | visit
Tetrapedia diversipes	leg		oil | pollen	pollinates | robbery | visit
Tetrapedia imitatrix	leg | other body parts | proboscis	anther | elaiophore | stigma	nectar | oil | pollen	visit
Tetrapedia peckoltii	leg			visit
Tetrapedia rugulosa				visit
Tettigoniidae				visit
Thalestria spinosa				visit
Thalurania furcata	bill	anther | stamens | stigma	nectar	pollinates | robbery | visit
Thalurania glaucopis	bill	stigma	nectar	pollinates | visit
Thecla	other body parts	anther | stigma	nectar	pollinates | visit
Thectochlora alaris	proboscis	anther | stamens	nectar | pollen	pollinates | visit
Thespieus				pollinates
Thomisidae				visit
Thraupis palmarum			nectar	visit
Thraupis sayaca			nectar	visit
Thygater analis			nectar	visit
Thygater palliventris	proboscis	stamens | stigma		visit
Thysania zenobia	proboscis	stamens	nectar	visit
Thysanoptera	proboscis	stigma	plant tissue | pollen	visit
Tingidae	leg | wings	anther | stamens | stigma		visit
Tiphiidae				pollinates
Tmemophlebia				visit

Toxomerus			pollen	pollinates | visit
Toxomerus lacrymosus				visit
Toxomerus musicus	proboscis	stamens	nectar	robbery
Toxomerus politus				visit
Toxomerus virgulatus				visit
Toxomerus watsoni				pollinates
Toxorhina			nectar	visit
Trachyderes				visit
Trachypus				visit
Trichocerapis				visit
Trichopoda				visit
Trigona	other body parts | proboscis	anther | stamens | stigma	nectar | pollen	pollinates | robbery | visit
Trigona amalthea			nectar	pollinates | visit
Trigona amazonensis				visit
Trigona branneri			nectar | plant tissue | pollen	robbery | visit
Trigona braueri				visit
Trigona chanchamayoensis				visit
Trigona dallatorreana				visit
Trigona fulviventris	leg		pollen	pollinates | visit
Trigona fuscipennis	leg		pollen	visit
Trigona guianae			nectar	visit
Trigona hyalinata	leg | proboscis	anther | stamens	nectar | plant tissue | pollen	pollinates | robbery | visit
Trigona meridionalis				visit
Trigona pallens	leg		pollen	pollinates | visit

Trigona recursa	leg	elaiophore	oil	visit
Trigona spinipes	leg | other body parts | proboscis	anther | stamens | stigma	nectar | oil | pollen	pollinates | robbery | visit
Trigonisca	proboscis	anther | stamens | stigma	nectar | pollen	robbery | visit
Trigonisca intermedia	leg		pollen	visit
Trigonisca pediculana				visit
Trigonisca pseudogreaffii			nectar | pollen	visit
Trigonisca vitrifrons				visit
Tripusus leiospathae			nectar | pollen	visit
Trochilidae	bill | leg | other body parts	nectary | stamens | stigma	nectar	robbery | visit
Trogon curucui				visit
Tropidacris collaris			plant tissue	visit
Tropidopedia carinata			oil	robbery
Tropidopedia flavolineata			oil	robbery | visit
Tropidopedia nigrocarinata			oil	robbery
Tropidopedia punctifrons			oil	robbery
Trupanea				pollinates
Trypoxylon	proboscis	stamens	nectar	visit
Turdus amaurochalinus				visit
Turdus leucomelas				visit
Turdus rufiventris				visit
Tyrannus melancholicus				visit
Tyrannus savana				visit
Udeus cerradensis				visit
Urbanus				pollinates | visit
Urbanus dorantes	proboscis	anther | stigma	nectar	pollinates | visit

Urbanus proteus			pollen	pollinates | visit
Utetheisa				visit
Vampyrops lineatus	leg | other body parts		pollen	visit
Vanessa				pollinates
Vanessa myrinna				pollinates
Vespidae	proboscis	stamens | stigma	nectar | pollen	pollinates | robbery | visit
Vespoidea				visit
Villa				visit
Volatinia jacarina	bill | leg | other body parts | wings	anther | stigma	nectar	pollinates
Xanthandrus			pollen	robbery
Xanthopedia				visit
Xanthopedia globulosa	leg		oil	pollinates
Xanthopedia larocai			pollen	visit
Xenopygus				visit
Xolmis velatus				visit
Xylocopa	other body parts | proboscis		nectar | pollen	pollinates | visit
Xylocopa bimaculata			pollen	pollinates
Xylocopa bruesi	leg | proboscis	anther | stamens | stigma	nectar | oil | pollen	pollinates | visit
Xylocopa cearensis				pollinates
Xylocopa frontalis	other body parts | proboscis	stamens | stigma	nectar | pollen	pollinates | visit
Xylocopa grisescens	leg	anther	nectar | pollen	pollinates | visit
Xylocopa hirsutissima	leg | other body parts | proboscis	anther | stamens | stigma	nectar | pollen	pollinates | visit

Xylocopa muscaria				pollinates
Xylocopa nogueirai			pollen	visit
Xylocopa ordinaria	other body parts	anther | elaiophore | stigma	oil | pollen	pollinates | visit
Xylocopa subcyanea	leg	anther | stamens | stigma	pollen	pollinates | visit
Xylocopa suspecta	leg	anther | stigma	nectar | pollen	pollinates | visit
Xylocopa truxali			pollen	pollinates
Xylocoris				visit
Xylophanes anubus				visit
Xylophanes chiron				visit
Xylophanes pistacina				visit
Xylophanes tersa				visit
Xylophanes tyndarus				visit
Yphthimoides ochracea				pollinates
Zenaida auriculata				visit
Zeta argillaceum				visit
Zethus				visit
Zonotrichia capensis	bill | leg | other body parts | wings	anther | stigma	nectar	pollinates

Table S6. Standardized descriptors per plant taxa with anther dehiscence type, floral symmetry, flower shape, habit, colour, nectar dynamics, reproductive success, according to Salim *et al*. (2022) for the reviewed studies of plant-pollinators interactions in the Cerrado.

Plant taxa	**Anther dehiscence type**	**Floral symmetry**	**Flower shape**	**Habit**	**Colour**	**Floral resource**
Abolboda egleri						
Abutilon striatum						nectar
Acacia mangium				tree		pollen
Acacia polyphylla						
Achyrocline alata						
Achyrocline satureioides						
Acisanthera quadrata	poricidal	actinomorphic	open-disk	herb	violet	pollen
Acosmium dasycarpum						
Acosmium subelegans						
Adenocalymma bracteatum	longitudinal	zygomorphic	trumpet-shaped	climber	yellow	nectar | pollen
Adenocalymma nodosum				bush		nectar | pollen
Adenocalymma peregrinum				bush	yellow	nectar | pollen
Aechmea aquilega						nectar
Aechmea bromeliifolia						
Aegiphila integrifolia						
Agarista hispidula						
Aldama grandiflora						
Allagoptera campestris						
Alophia						
Alophia geniculata						
Amaioua guianensis		actinomorphic			white	

Amphilophium elongatum						nectar | pollen
Anacardium				bush		pollen
Anacardium occidentale						
Anadenanthera colubrina						pollen
Ananas ananassoides	longitudinal	actinomorphic	tube	herb	pink | red | white	nectar | pollen
Andira						
Andira cujabensis				tree		
Anemopaegma acutifolium						
Annona						
Annona coriacea				bush | tree	white	plant tissue | pollen
Annona cornifolia				bush		plant tissue
Annona crassiflora						
Annona dioica				bush		
Annona montana						plant tissue
Annona tomentosa						
Aphelandra longiflora			throat | tube	bush	red	nectar
Ascolepis brasiliensis						
Aspidosperma macrocarpon						nectar | pollen
Aspilia						
Asteraceae						
Attalea phalerata						
Baccharis						
Baccharis aphylla						
Baccharis curitybensis						
Baccharis dracunculifolia						

Baccharis intermixta						
Baccharis linearifolia						
Baccharis platypoda						
Baccharis sessiliflora						
Baccharis tarchonanthoides						
Banisteriopsis						
Banisteriopsis adenopoda						oil | pollen
Banisteriopsis argyrophylla	longitudinal	zygomorphic	open-disk	climber	white	oil | pollen
Banisteriopsis campestris	longitudinal	zygomorphic	open-disk	bush	pink	oil | pollen
Banisteriopsis laevifolia						
Banisteriopsis malifolia	longitudinal	zygomorphic	open-disk	bush	pink	oil | pollen
Banisteriopsis oxyclada						oil | pollen
Banisteriopsis variabilis	longitudinal	zygomorphic	open-disk	bush	white	oil | plant tissue | pollen
Barbacenia lymansmithii						
Barrosa betonicaeformis						
Bauhinia				tree		
Bauhinia brevipes	longitudinal	zygomorphic	brush	bush	white	nectar
Bauhinia curvula		zygomorphic		bush	white	pollen
Bauhinia dumosa	longitudinal		tube			
Bauhinia forficata				tree		
Bauhinia goyazensis	longitudinal		tube			
Bauhinia holophylla	longitudinal		tube			
Bauhinia longifolia	longitudinal		tube			
Bauhinia pulchella						
Bauhinia rufa	longitudinal	zygomorphic	brush | tube	bush	white	
Bauhinia ungulata			brush	bush |	white	nectar

				tree		
Bauhinia variegata						nectar
Bidens						pollen
Bignoniaceae						
Bionia coriacea			tube	bush	red	nectar
Blepharocalyx salicifolius				bush		
Borreria capitata	longitudinal	actinomorphic	bell-shaped	herb	white	pollen
Borreria poaya	longitudinal	actinomorphic	bell-shaped	herb	violet	nectar
Borreria tenella						
Borreria verticillata						pollen
Bougainvillea glabra						nectar
Bowdichia virgilioides				tree	lilac	
Brachiaria						
Bromelia balansae	longitudinal	actinomorphic	tube	herb	red	nectar
Bromelia plumieri	longitudinal	actinomorphic	tube	herb	red	nectar
Brosimum gaudichaudii				bush		
Buchnera lavandulacea						
Butia paraguayensis						nectar | pollen
Byrsonima						
Byrsonima basiloba						oil
Byrsonima brachybotrya					white	oil
Byrsonima coccolobifolia	longitudinal	zygomorphic	open-disk	bush	pink	oil | pollen
Byrsonima crassifolia		zygomorphic		bush		pollen
Byrsonima intermedia	longitudinal	zygomorphic	open-disk	bush	yellow	oil | pollen
Byrsonima pachyphylla	longitudinal	zygomorphic	open-disk	bush	yellow	oil | pollen
Byrsonima rotunda		zygomorphic		bush	white	oil | pollen
Byrsonima umbellata		zygomorphic		bush	white	oil | pollen

Byrsonima variabilis						
Byrsonima verbascifolia				bush		
Bysonima pachyphylla		zygomorphic		tree	yellow	oil | pollen
Caesalpinia gardneriana						
Caesalpinia peltophoroides						
Caesalpinia pulcherrima						nectar
Calea						
Calea cuneifolia						
Calibrachoa elegans	longitudinal	zygomorphic	tube	herb	violet	
Calliandra dysantha						
Callistemon rigidus						nectar
Calophyllum brasiliense				tree		
Calydorea campestris						
Cambessedesia						
Campomanesia						pollen
Campomanesia adamantium						
Campomanesia pubescens	longitudinal	actinomorphic	brush	bush	white	pollen
Campomanesia sessiliflora						
Camptosema coriaceum				herb	red	
Campuloclinium megacephalum						
Campylocentrum micranthum					white	nectar
Canavalia palmeri				climber	blue	nectar
Canna indica			tube	herb	red	
Capparis flexuosa						
Cardiopetalum calophyllum						
Caryocar brasiliense	longitudinal	actinomorphic	brush	bush |	white | yellow	nectar | pollen

				tree		
Casearia decandra						
Cecropia						pollen
Cecropia pachystachya				tree		
Cecropia saxatilis				tree		
Ceiba pentandra		actinomorphic	brush			
Ceiba speciosa						nectar
Cenostigma nordestinum						
Centrosema brasilianum						
Cerradicola elliptica	longitudinal	zygomorphic		bush	white	nectar
Cestrum megalophyllum						
Cestrum schlechtendalii						
Chamaecrista						
Chamaecrista debilis						oil | pollen
Chamaecrista flexuosa						
Chamaecrista nictitans						
Chamaecrista orbiculata						
Chamaecrista punctulifera						
Chamaecrista zygophylloides						
Chamissoa						pollen
Chaptalia integerrima						
Chaptalia piloselloides						
Chromolaena						
Chromolaena decumbens						
Chromolaena leucocephala						
Chromolaena maximiliani						
Chromolaena squalida	longitudinal	actinomorphic	tube	bush	purple | white	nectar

Chrysolaena desertorum						
Chrysolaena obovata						
Chrysophyllum marginatum	longitudinal	actinomorphic		tree	white	nectar
Cipocereus crassisepalus					white	
Cissampelos ovalifolia						
Cissus erosa						
Citrus limonia						pollen
Clethra scabra						
Cochlospermum						
Cochlospermum regium						
Cocos nucifera						pollen
Collaea cipoensis	longitudinal	zygomorphic	tube	bush	red	nectar | plant tissue | pollen
Combretum fruticosum	longitudinal		brush	climber		
Combretum leprosum						pollen
Commelina erecta		zygomorphic	open-disk	herb	yellow	pollen
Connarus suberosus	longitudinal	actinomorphic	open-disk	bush | tree	green	nectar | pollen
Convolvulus crenatifolius						
Conyza bonariensis						
Copaifera langsdorffii				tree		
Copaifera luetzelburgii						
Corchorus hirtus					yellow	nectar
Cordia						pollen
Cordiera humilis	longitudinal	actinomorphic	tube	bush	white	nectar
Cordyline fruticosa						nectar
Cosmos sulphureus		actinomorphic	tube	herb	orange	nectar

Costus spiralis			tube	herb	red	nectar
Coussarea hydrangeifolia						
Crotalaria						
Crotalaria breviflora						
Croton						pollen
Croton agoensis						
Croton dichrous						
Croton megaponticus						
Croton siderophyllus						
Cuphea						
Cuphea glutinosa						
Cuphea linarioides						
Cuphea melvilla	longitudinal	zygomorphic	tube	herb	red	nectar
Curatella americana		actinomorphic	open-disk	tree	white	
Cuspidaria convoluta						
Cymbopetalum euneurum						plant tissue
Dalbergia cuiabensis						
Dalbergia miscolobium		zygomorphic		tree	purple	nectar
Davilla						pollen
Davilla elliptica						
Declieuxia cordigera var. angustifolia						
Declieuxia fruticosa			tube	bush	white	pollen
Deguelia hatschbachii				climber	lilac	
Deianira nervosa						
Deianira pallescens						
Delonix regia						pollen

Desmanthus						pollen
Desmodium barbatum						
Dicliptera squarrosa			throat | tube	bush	red	nectar
Didymopanax vinosus						
Dimerostemma						
Dimerostemma lippioides						
Dioclea						
Dioclea coriacea						
Diodella radula						
Diospyros hispida						
Diplopterys pubipetala	longitudinal	zygomorphic	open-disk	climber	yellow	oil | pollen
Dipteryx alata				tree		
Drosera montana						
Duguetia furfuracea						
Duguetia riparia						plant tissue
Duguetia ulei						plant tissue
Dyckia leptostachya			tube	herb	orange	
Dyckia minarum						
Dyckia tuberosa						
Echinodorus longipetalus						
Elephantopus micropappus						
Elephantopus palustris						
Emmeorhiza umbellata						
Eranthemum pulchellum						nectar
Erechtites hieracifolius						
Eremanthus						
Eremanthus erythropappus						

Eremanthus mattogrossensis					
Erigeron					
Eriocaulon magnum					
Eriotheca gracilipes				red	nectar
Eriotheca pubescens				white	nectar
Eryngium canaliculatum					
Eryngium ebracteatum					
Eryngium horridum					
Erythrina speciosa	zygomorphic	tube	bush	red	nectar
Erythroxylum					pollen
Erythroxylum amazonicum					
Erythroxylum campestre	zygomorphic	open-disk	bush	white	nectar
Erythroxylum cuneifolium	zygomorphic	open-disk	tree	white	nectar
Erythroxylum deciduum				white	
Erythroxylum microphyllum					
Erythroxylum suberosum	zygomorphic	open-disk	bush	white	nectar
Erythroxylum tortuosum				white	
Escallonia farinacea					
Eschweilera nana	zygomorphic		bush | tree		nectar | plant tissue | pollen
Esterhazya macrodonta					
Esterhazya splendida		tube	bush	red	nectar
Eucalyptus					pollen
Eugenia					pollen
Eupatorium					pollen
Euphorbia potentilloides					
Euphorbia pulcherrima					nectar

Evolvulus						
Fabaceae						
Faramea cyanea		actinomorphic	tube	tree	white	
Faramea multiflora	longitudinal	actinomorphic	tube	bush	violet	nectar
Ficus obtusifolia				tree		
Fridericia chica						
Fridericia florida			bell-shaped	climber	white	nectar
Galactia martii						
Galianthe angustifolia						
Galianthe brasiliensis						
Galianthe lanceifolia						
Galium hypocarpium						
Gaylussacia brasiliensis						
Gaylussacia chamissonis						
Gaylussacia jordanensis						
Gaylussacia reticulata						
Geissomeria tetragona			tube	bush	red	nectar
Genlisea violacea		zygomorphic		herb	purple	
Gomphrena macrocephala						
Gouania latifolia						
Grazielia dimorpholepis						
Grazielia gaudichaudeana						
Grevillea banksii						nectar
Guapira noxia				tree		
Guarea						pollen
Guettarda viburnoides						
Hancornia speciosa						

Handroanthus						pollen
Handroanthus albus		zygomorphic	trumpet-shaped	tree	yellow	nectar
Handroanthus heptaphyllus		zygomorphic	trumpet-shaped	tree	pink	nectar
Handroanthus impetiginosus		zygomorphic	trumpet-shaped	tree	purple	nectar
Handroanthus ochraceus				tree	yellow	nectar
Handroanthus serratifolis						nectar
Harpalyce brasiliana						
Hedychium coronarium						
Hedyosmum brasiliense						
Helianthus annuus		actinomorphic	tube	herb	yellow	nectar
Heliconia bihai						nectar
Heliconia collinsiana						
Heliconia psittacorum			tube	herb	orange	nectar
Heliconia rostrata						nectar
Helicteres						
Helicteres brevispira			tube	bush	yellow	nectar
Helicteres sacarolha			tube	herb	orange	
Heteropterys						
Heteropterys byrsonimifolia						
Heteropterys campestris						
Heteropterys lomentosa	longitudinal	zygomorphic	open-disk	bush	yellow	oil | pollen
Heteropterys pteropetala						oil
Heteropterys tomentosa					yellow	oil
Hibisco						nectar

Hippeastrum glaucescens					
Hirtella gracilipes			bush		
Holmskioldia sanguinea					
Hololepis pedunculata					
Hortia					pollen
Hortia brasiliana		bell-shaped	bush	pink	nectar
Hymenaea courbaril					
Hymenaea stigonocarpa	actinomorphic				
Hypenia reticulata					nectar
Hypericum brasiliense					
Hypochaeris lutea					
Hypti suaveolens					pollen
Hyptis					
Hyptis alutacea					
Hyptis caprariifolia					
Hyptis ferruginosa					
Hyptis lippioides					
Hyptis plectranthoides					
Hyptis villosa					
Ichthyothere					
Ilex affinis					
Ilex dumosa					
Inga		brush	tree	white	nectar | pollen
Inga edulis			tree	white	
Inga laurina			tree	white	
Inga vera	actinomorphic | asymmetric	brush | tube	tree	white	nectar | pollen

Ipomoea			bell-shaped	bush	blue	nectar | pollen
Ipomoea hederifolia			tube	climber	red	nectar
Ipomoea procumbens						
Ipomoea purpurea						nectar
Ipomoea ramosissima						
Jacaranda brasiliana						
Jacaranda caroba		zygomorphic	trumpet-shaped	bush	violet	nectar
Jacaranda oxyphylla	longitudinal		tube	bush		nectar | pollen
Jacquemontia						
Jacquemontia grandiflora						
Jacquemontia montana						pollen
Joanesia						pollen
Justicia						
Justicia brandegeeana						nectar
Justicia monticola						
Kielmeyera abdita						pollen
Kielmeyera coriacea	longitudinal	actinomorphic	open-disk	tree	pale pink | white	pollen
Kielmeyera speciosa	longitudinal			tree	pale pink | white	pollen
Kielmeyera variabilis		actinomorphic	open-disk	bush	white	nectar | pollen
Lafoensia pacari			brush	tree	white	nectar
Lamanonia ternata						
Lantana camara						nectar
Laplacea fruticosa						
Lepidagathis floribunda			tube	bush	pink	nectar

Lepidaploa salzmannii					
Leptostelma maximum					
Lessingianthus					
Lessingianthus bardanoides					
Lessingianthus grandiflorus	actinomorphic	tube	bush	purple	nectar | pollen
Lessingianthus roseus					
Lessingianthus tomentellus					
Lessingianthus venosissimus					
Lessingianthus virgulatus					
Leucaena leucocephala		bell-shaped	tree		plant tissue | pollen
Libidibia ferrea					nectar
Lippia					
Lobelia camporum					
Lucilia lycopodioides					
Ludwigia nervosa					
Ludwigia octovalvis					
Luehea divaricata					
Luehea grandiflora		open-disk	tree	green	nectar
Luehea paniculata		open-disk	tree	white	nectar
Lupinus velutinus					
Lychnophora					
Lycopersicon esculentum					pollen
Machaerium					
Machaerium					pollen
Machaerium opacum	zygomorphic		tree	white	nectar | pollen
Malmea manausensis					plant tissue
Malpighia emarginata					

Malvaviscus arboreus						nectar
Mandevilla emarginata		actinomorphic	tube	herb	yellow	nectar
Mandevilla hirsuta			tube	climber	yellow	
Mandevilla illustris						
Mandevilla pohliana						
Manettia cordifolia						
Manihot tripartita						
Manihot violacea	longitudinal	actinomorphic	bell-shaped	bush	purple | yellow	nectar
Maprounea guianensis				tree		
Matayba guianensis	longitudinal	actinomorphic	open-disk	tree	white	nectar | pollen
Megaskepasma erythrochlamys						nectar
Melochia						
Merremia						
Merremia tomentosa						
Miconia albicans	poricidal	actinomorphic		bush	white	pollen
Miconia burchellii				bush		
Miconia chamissois						
Miconia tococa	poricidal	actinomorphic	open-disk	bush	pink	pollen
Microlicia laniflora	poricidal	actinomorphic	open-disk	bush	white	plant tissue | pollen
Microlicia parviflora	poricidal	actinomorphic	open-disk	bush	white	pollen
Microstachys serrulata				bush	yellow	pollen
Mikania cordifolia						
Mikania lundiana						
Mikania nummularia						
Mikania sessilifolia						
Mimosa						

Mimosa caesalpiniaefolia						pollen
Mimosa claussenii						
Mimosa debilis		asymmetric	brush	herb	violet	nectar
Mimosa dichroa						
Mimosa dolens		asymmetric	brush	herb	violet	nectar
Mimosa gemmulata						
Mimosa hebecarpa						
Mimosa quadrivalvis						pollen
Mimosa setosa				tree		
Mimosa tenuiflora						pollen
Mimosa xanthocentra						
Moquiniastrum paniculatum						
Moraceae						
Mouriri elliptica				tree		
Mussaenda alicia						nectar
Mussaenda erythrophylla						nectar
Myrcia						pollen
Myrcia bella		asymmetric	brush	bush	white	nectar | pollen
Myrcia eriocalyx		actinomorphic	brush			
Myrcia multiflora		actinomorphic	brush			
Myrcia rostrata	longitudinal	actinomorphic	open-disk	bush | tree	white	pollen
Myrcia splendens				bush		
Myrcia tomentosa	longitudinal	actinomorphic	open-disk	bush | tree	white	pollen
Myrcia torta						
Myrtaceae						

Neea theifera					green	pollen
Ocotea				tree		
Oncidium barbaceniae						
Orthosia scoparia						
Ouratea						pollen
Ouratea floribunda						
Ouratea semiserrata						
Ouratea spectabilis				tree		pollen
Oxalis sellowii						
Oxypetalum appendiculatum						
Oxypetalum sublanatum						
Pachira aquatica						nectar
Pachira aquatica						nectar
Pachystachys lutea						nectar
Paepalanthus lundii		actinomorphic	tube	bush | herb	white	
Paepalanthus paulensis						
Paepalanthus polyanthus						
Palicourea coriacea	longitudinal	actinomorphic	tube	bush	white	nectar | pollen
Palicourea crocea	longitudinal	zygomorphic	tube	tree	yellow	nectar | pollen
Palicourea macrobotrys			tube	bush	yellow	nectar
Palicourea marcgravii						
Palicourea officinalis			tube	bush	orange	nectar
Palicourea rigida	longitudinal	actinomorphic | zygomorphic	tube	bush	orange | red | yellow	nectar | pollen
Parkia platycephala						
Passiflora						

Passiflora amethystina	longitudinal	zygomorphic	open-disk	climber	purple	nectar
Passiflora cincinnata	longitudinal	zygomorphic	open-disk	climber	violet	nectar
Passiflora edulis						nectar | pollen
Passiflora suberosa	longitudinal	zygomorphic	open-disk	climber	white	nectar
Passiflora tenuifila	longitudinal	zygomorphic	open-disk	climber	white	nectar
Passiflora tricuspis	longitudinal	zygomorphic	open-disk	climber	white	nectar
Pavonia kleinii						
Peixotoa						
Peixotoa goiana						oil
Peixotoa reticulata	longitudinal	zygomorphic	open-disk	bush	yellow	oil | pollen
Peixotoa tomentosa	longitudinal	zygomorphic	open-disk	bush	yellow	oil | pollen
Peltodon pusillus						
Peltodon radicans						
Peplonia organensis						
Pera glabrata				tree	green	nectar
Periandra mediterranea						
Phaseolus vulgaris						
Piptocarpha rotundifolia		zygomorphic	bell-shaped	tree	white	nectar
Piriqueta						
Pityrocarpa moniliformis						pollen
Plathymenia reticulata						
Plenckia populnea				tree		
Poaceae						pollen
Polygala brasiliensis						
Polygala cneorum						
Polygala rhodoptera						
Polygala violacea		zygomorphic	open-disk	herb	violet	nectar

Polygonum						pollen
Pouteria						
Pouteria ramiflora			tube	tree	green	nectar | pollen
Pouteria torta			tube	tree	green	nectar
Praxelis clematidea						
Praxelis kleinioides						
Prestonia coalita			tube	climber	yellow	
Protium ovatum						
Prunus sellowii				tree		
Pseudobombax longiflorum	longitudinal	actinomorphic	brush	tree	white	pollen
Pseudobombax tomentosum		actinomorphic	brush	tree	white	nectar
Psidium				bush		
Psittacanthus robustus	longitudinal	zygomorphic	tube	climber	yellow	nectar | pollen
Psychotria capitata		actinomorphic	tube	bush	white	nectar
Psychotria deflexa		actinomorphic	tube	bush	white	
Psychotria hoffmannseggiana			tube		white	
Psychotria nitidula		actinomorphic	tube	bush	white	
Psychotria prunifolia		actinomorphic	tube	bush	white	
Psychotria tenerior						
Psychotria trichophoroides		actinomorphic	tube	bush	white	
Pterandra pyroidea	longitudinal	zygomorphic		bush	pink	oil
Pyrostegia venusta						
Qualea cordata						
Qualea grandiflora						nectar | pollen
Qualea multiflora				tree	white | yellow	pollen
Qualea parviflora				tree	pink	pollen
Rauvolfia weddelliana						

Rhabdocaulon stenodontum						
Rhamnidium elaeocarpum				tree		
Rhynchospora globosa						
Rhynchospora nervosa						
Rhynchospora robusta						
Richardia grandiflora						pollen
Riencourtia oblongifolia						
Roupala montana						nectar | pollen
Rourea induta	longitudinal	actinomorphic	open-disk	bush	green | white	nectar | plant tissue | pollen
Rubiaceae						
Ruellia						pollen
Ruellia brevifolia			throat | tube	bush	red	nectar
Ruellia geminiflora						
Ruellia incomta		zygomorphic				
Russelia equisetiformis						nectar
Sagittaria rhombifolia						
Salacia crassifolia				tree		
Salvertia convallariodora				tree	white	pollen
Salvia cerradicola						
Salvia scabrida			tube	herb	red	
Sanchezia nobilis						nectar
Sanchezia oblonga						nectar
Schubertia grandiflora						
Schwartzia adamantium						
Sclerolobium aureum						
Sclerolobium paniculatum						

Senecio oleosus				
Senegalia				pollen
Senegalia polyphylla				
Senna				pollen
Senna cana				
Senna obtusifolia				
Senna rugosa				pollen
Senna silvestris				
Serjania				
Serjania caracasana	open-disk	climber	white	nectar
Serjania erecta				
Serjania laruotteana				
Serjania reticulata				pollen
Sida				
Sida cordifolia				pollen
Simarouba versicolor				
Sinningia allagophylla				
Sinningia elatior	tube	herb	orange	nectar | plant tissue | pollen
Sipanea hispida				
Sipanea pratensis				
Siphanthera cordata				
Sisyrinchium micranthum				
Sisyrinchium vaginatum				
Smilax				
Solanaceae				
Solanum				pollen

Solanum aculeatissimum						
Solanum americanum						
Solanum lycocarpum	poricidal	actinomorphic			violet	pollen
Solanum melissarum	poricidal				white	fragance
Solanum paniculatum						
Solanum pseudocapsicum						
Solanum swartzianum						
Solanum viarum						
Spathodea campanulata						nectar
Spermacoce						
Spigelia sellowiana						
Stachytarpheta gesnerioides			tube	herb	blue	
Stenocephalum megapotamicum						
Stenocephalum tragiifolium						
Stevia myriadenia						
Stigmaphyllon lalandianum						oil | pollen
Strelitzia reginae						nectar
Strongylodon macrobotrys						nectar
Struthanthus polyanthus						
Strychnos pseudoquina				tree		
Strychnos pseudoquina						nectar | pollen
Stryphnodendron obovatum						
Styrax camporum						pollen
Styrax ferrugineus			tube		white	nectar | pollen
Styrax pohlii			tube	tree	white	
Syagrus						pollen

Syagrus					pollen
Syagrus petraea					nectar | pollen
Symphyopappus compressus					
Syngonanthus xeranthemoides					
Sysygium					pollen
Syzygium jambos					nectar
Tabebuia aurea		bell-shaped	tree	yellow	nectar
Tabebuia roseoalba	zygomorphic	trumpet-shaped	tree	white	nectar
Tapirira guianensis			tree		
Thunbergia erecta					nectar
Thunbergia mysorensis					nectar
Tibouchina frigidula					
Tibouchina martialis					
Tibouchina minor					
Tococa guianensis			bush		
Tocoyena formosa					
Tontelea micrantha					
Trema micranthum			tree		
Trembleya parviflora					
Trembleya phlogiformis					
Trichogonia attenuata	actinomorphic	tube	herb	purple	pollen
Triumfetta rhomboidea					pollen
Trixis antimenorrhoea					
Turnera					
Turnera subulata					pollen
Verbena hirta					

Vernonanthura polyanthes	longitudinal	actinomorphic	tube	bush	purple	nectar
Vernonanthura westiniana						
Vernonia						pollen
Vernoniae						
Verrucularia						
Viola cerasifolia						
Vochysia cinnamomea		zygomorphic		bush	yellow	nectar
Vochysia elliptica				tree		
Vochysia pumila				bush		
Vochysia pyramidalis				tree		
Vochysia rufa				tree	yellow	pollen
Vochysia thyrsoidea				tree		
Vochysia tucanorum				tree	yellow	
Vriesea friburgensis						
Wahlenbergia brasiliensis						
Waltheria						
Waltheria americana						
Waltheria communis						
Weinmannia organensis						
Xylopia aromatica			chamber-shaped	bush | tree	white	pollen
Xyris asperula						
Xyris jupicai						
Xyris tortula						
Zeyheria montana			tube	bush	yellow	
Zygostigma australe						

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CAPÍTULO 2 – HOW FUNCTIONAL DIVERSITY SHAPES PLANT-POLLINATOR INTERACTIONS IN THE BRAZILIAN SAVANNA

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Abstract

The Cerrado, one of the world's most diverse savannas, harbors an exceptional variety of plant-pollinator interactions shaped by ecological, functional, and evolutionary processes. However, our understanding of how floral and visitor traits influence the organization of these interactions across species remains limited. In this study, we compiled a dataset of plant-floral visitor interactions from the Cerrado, combining field observations and literature records to build a trait-based metanetwork. We classified floral traits related to morphology, color, and resources, as well as the functional groups of visitors, to assess how functional diversity structures network modularity and species roles. The metanetwork exhibited a modular structure, revealing that floral traits and the functional diversity of floral visitors were key predictors of the compartmentalization of interactions. Most species were classified as peripheral, interacting primarily within modules, while a small subset of connectors and hubs linked modules and enhanced overall connectivity. These species likely play a crucial role in maintaining network robustness under environmental disturbances. By integrating trait-based and network approaches, our results demonstrate that functional diversity shapes the modular organization of plant-floral visitor interactions in the Cerrado. Identifying functional links between traits and network structure provides critical insights into how ecological specialization and generalization sustain pollination processes. Such understanding is fundamental for anticipating how ongoing habitat loss and fire may erode the functional integrity and resilience of Cerrado pollination networks.

Keywords: Cerrado, floral visitor, interaction metanetwork, modularity, species roles

Introduction

Interactions between plants and their pollinators are central ecological processes that sustain biodiversity and the stability of terrestrial ecosystems, as they enable the reproduction of most angiosperms and contribute to ecosystems' stability (Oliveira *et al*., 1998; Oliveira & Gibbs, 2000; Oliveira *et al*., 2004; Ollerton *et al*., 2011). In the Cerrado, pollination is particularly important, as most plant species rely on biotic agents for reproduction (Oliveira & Gibbs, 2000), directly influencing ecosystem processes and the resilience of this savanna biome (Ollerton *et al.*, 2011). Moreover, the diversity of floral forms and pollination strategies observed in the Cerrado reflects a complex evolutionary history of plant-floral visitor interactions, shaped by morphofunctional specializations and behavioral adaptations and embedded within a highly heterogeneous vegetation mosaic that may create distinct foraging opportunities and promote interaction diversification across the landscape (Oliveira et al., 1998; Oliveira & Gibbs, 2000; Aguiar et al., 2024; Keasar & Wajnberg, 2025).

The complexity of plant-floral visitor interactions can be better understood through ecological network approaches, in which species are represented as nodes and their interactions as links (Jordano *et al*., 2003). Networks reveal structural patterns that reflect the functional organization of communities (Bascompte & Jordano, 2007; Olesen *et al*., 2007a). Modularity, in particular, indicates groups of species that interact more strongly among themselves than with others, forming functional modules that may reflect morphological compatibility, behavioral preferences, or specialization on specific floral traits (Olesen *et al*., 2007a). Such compartmentalization is crucial for understanding the factors that affect community stability and resilience under environmental disturbances (Olesen *et al.*, 2007a; Thébault & Fontaine, 2010; Cardoso *et al.*, 2025).

Functional diversity may determine patterns of organization in plant-floral visitor interactions, as variation in ecological and behavioral traits influences how species interact and perform their functional roles (Rosas-Guerrero *et al.*, 2014; Dellinger, 2020). Traits such as floral morphology, resource type, and color may act as functional filters, shaping the formation of interaction pairs and contributing to structural patterns in interaction networks, including compartmentalization (Olesen *et al*., 2007a). Understanding how functional trait variation structures patterns of plant-floral visitor interactions is therefore essential to uncover the mechanisms that sustain both species diversity and interaction patterns in the Cerrado, a biome of high biodiversity that is strongly impacted by anthropogenic activities that transform natural landscapes, reducing the richness, abundance, and structural complexity of plant-floral visitor interactions (Myers *et al*., 2000; Klink *et al*., 2005; Strassburg *et al*., 2017; Bispo *et al*., 2024).

Here, we evaluate how functional diversity influences the compartmentalization of plant–floral visitor interactions in the Cerrado, using the database available in Guimarães *et al*. (in preparation). Based on a metanetwork, we (1) assessed the modular structure of plant-floral visitor interactions; (2) analyzed the effect of functional diversity on network compartmentalization; and (3) identified species with key topological roles, including hubs and connectors, in shaping network modularity. We hypothesize that the plant-floral visitor metanetwork of the Cerrado exhibits a modular structure, such that compartmentalization reflects the functional diversity of interacting species. Furthermore, we expect to identify species that play central roles in connectivity both within and among modules, contributing to the stability of plant-floral visitor interactions.

Methodology

Database

To construct the metanetwork, we used the database available in *Guimarães et al.* (in preparation), which compiles literature data on plant–floral visitor interactions in the Cerrado (111 studies) and includes unpublished data from 21 research groups. To avoid taxonomic redundancy, we selected interactions between pairs identified to the species level and excluded records involving predators. The final dataset comprised 2,409 interactions between 536 plant species and 553 floral visitor species, organized into a binary matrix representing the presence (1) or absence (0) of interactions between each pair of plant and floral visitor species.

To assess the functional diversity of plants, we used floral traits commonly associated with pollination (Machado *et al*., 2006; Cordeiro *et al*., 2026), selected because they are directly linked to floral accessibility, resource availability, and morphological compatibility between plants and floral visitors, including: (1) anther dehiscence type, classified as longitudinal, poricidal, valvate, or transversal, which influences pollen release mechanisms and restricts access to specific visitor groups; (2) floral symmetry, classified as actinomorphic, zygomorphic, or asymmetric, a trait that can predict the need for adaptations or the behavior of effective pollinators; (3) floral type, categorized as bell-shaped, brush, gullet, inconspicuous, lantern, open-disk, spherical, trumpet-shaped, or tube, according to Faegri & van der Pijl (1979), reflecting constraints on visitor morphology and foraging behavior; (4) predominant corolla color, grouped into similar color classes such as white (including all white and very pale flowers), yellow, warm colors (including orange, brown, pink, and red), and cool colors (including blue, purple, and green) (e.g., Carvalheiro *et al*., 2014; Souza *et al*., 2018), which may act as sensory filters influencing pollinator attraction; and (5) floral resource available to pollinators, such as pollen, nectar, or oil, a key determinant of visitor identity and interaction type. In addition to the database, we consulted taxonomic descriptions from *Flora do Brasil* (floradobrasil.jbrj.gov.br/) and Souza & Lorenzi (2019) to classify functional traits when these characteristics were not reported in the Cerrado plant–pollinator interaction studies (Guimarães *et al*., in preparation).

For floral visitors, functional diversity was classified according to taxonomic groups (e.g., Nascimento *et al*., 2018; Guimarães *et al*., 2021). Accordingly, we categorized floral visitors into 15 functional groups. Bees (Apidae) were classified as oil-collecting bees – solitary bees from the tribes Centridini, Epicharitini, Tapinotaspidini, and Tetrapediini, which exhibit morphological adaptations for floral oil collection (Vogel, 1974; Guimarães *et al*., 2021); buzz-pollinating bees – bees of the genus *Melipona* (Meliponini), the tribes Augochlorini, Bombini, Euglossini, Exomalopsini, Oxaeini, and Xylocopini, as well as the subfamily Colletinae, which display the behavior of vibrating poricidal anthers to extract pollen (Nunes-Silva *et al*., 2010; Vallejo-Marín & Russell, 2023); fragrance-collecting bees – bees of the tribe Euglossini, which gather aromatic compounds from flowers using specialized structures on their hind legs (Nemésio, 2009); and generalist bees – encompassing other bees that collect pollen and nectar. Lepidopterans (Lepidoptera) were divided into butterflies and moths according to their diurnal and nocturnal behaviors, and sphingid moths (family Sphingidae) were considered separately due to their distinctive foraging behavior

(Oliveira *et al.*, 2004). Dipterans (Diptera) were divided into syrphid flies (Syrphidae) and other flies, as syrphids are specialized pollen feeders (Willmer, 2011). Birds (Aves) were divided into hummingbirds (Trochilidae) and other bird taxa due to the particular foraging behavior of hummingbirds (Rocca & Sazima, 2010). Additional groups included beetles (Coleoptera), ants and wasps (Apocrita, excluding bees), and bats (Chiroptera) (Koopman, 1981; Gottsberger & Silberbauer-Gottsberger, 2006; Datzmann *et al*., 2010; Clemente *et al*., 2012; Gottsberger, 2012; Das & Das, 2023).

Data analysis

To identify clusters of plant–floral visitor interactions in the Cerrado, we calculated network modularity using the Louvain algorithm implemented in the *igraph* package, which is widely used in large ecological networks due to its efficiency in maximizing modularity (Blondel *et al*., 2008; Carstensen *et al*., 2013). This method operates through the iterative reassignment of network nodes, seeking successive increases in modularity until reaching an optimal value (Blondel *et al*., 2008; Carstensen *et al*., 2013). Because structural properties of ecological networks may be influenced by species richness and sampling effort (Vázquez *et al*., 2005; Blüthgen *et al*., 2006; Fründ *et al*., 2016), we assessed the significance of the observed modularity value by comparing it with a null model of the *swap.web* type, which preserves both connectance and the marginal totals of the interaction matrix, as recommended by Vázquez *et al*. (2005, 2007). Significance was determined based on a 95% confidence interval computed from 1,000 simulated networks. The observed value was considered significant when it did not overlap with this interval.

To assess whether the composition of modules reflects functional patterns, we tested the association between the metanetwork modules and the functional traits of plants, as well as the functional groups of floral visitors, using the residuals from Pearson's chi-square test implemented in the *corrplot* package (Wei & Simko, 2024).

Moreover, modular structure allows the assessment of species roles, identifying their importance in connecting modules (c) and within-module connectivity (z) in the metanetwork (Olesen *et al*., 2007a; Dormann & Strauss, 2014). Accordingly, we calculated species roles and classified them as peripherals ($c < 0.62$ and $z < 2.5$), connectors ($c > 0.62$ and $z < 2.5$), module hubs ($c < 0.62$ and $z > 2.5$), and network hubs ($c > 0.62$ and $z > 2.5$) (Olesen *et al.,* 2007a).

All analyses were performed in the RStudio environment (R Development Core Team, 2025).

Results

When classifying plant floral traits, anthers with longitudinal dehiscence were the most frequent type (91.2%) compared to poricidal (8.6%) and transverse (0.2%) dehiscence (Figure 1a). Floral symmetry was predominantly actinomorphic (63.2%), followed by zygomorphic (32.7%) and asymmetric (4.1%) flowers (Figure 1b). Eight floral types were identified, with tube (38.3%), open-disk (30.7%), and bell-shaped (10.1%) being the most common among Cerrado plants, while the remaining types each accounted for less than 10% (Figure 1c). Regarding corolla color, white flowers represented the majority of species (38.3%), followed by yellow (22.2%), warm colors (19.1%), and cool colors (16.8%) (Figure 1d); additionally, 19 species (3.6%) exhibited more than one color classification. Finally, the most frequently reported floral resource available to pollinators was nectar (78.7%), followed by pollen (14.9%), oil (5.6%), and fragrance (0.2%), with 3.2% of records involving floral visitors feeding on floral tissues (Figure 1e).

Regarding the functional diversity of floral visitors, among the 15 functional groups, generalist bees were the most representative (17.7%), followed by vibrating bees (15.7%) and oil-collecting bees (11.9%), while each of the remaining groups accounted for less than 10% (Figure 1f).

Metanetwork structure

The metanetwork exhibited a significantly modular structure ($Q = 0.62$; $p < 0.0001$), comprising 42 interaction modules. Pearson's chi-square test indicated an association between the interaction groups (modules) and several floral traits, including anther dehiscence type, floral symmetry, floral type, predominant corolla color, and floral resource.

Anther dehiscence was significantly associated with the modular configuration ($\chi^2 = 606.34$; *d.f.* = 82; $p < 0.001$). Standardized residuals showed that poricidal anthers were positively related to several modules (13, 21, 24, 33, and 34), whereas transverse anthers were positively associated only with module 38 (Figure 2a).

Floral symmetry followed a similar pattern ($\chi^2 = 169.9$; *d.f.* = 82; $p < 0.001$), reflecting the functional identity of different modules: actinomorphic flowers predominated in modules 1 and 2, zygomorphic flowers in modules 5 and 8, and asymmetric flowers in module 32 (Figure 2b).

Floral type was one of the most determinant traits in the organization of the metanetwork ($\chi^2 = 722.33$; *d.f.* = 328; $p < 0.001$). Distinct modules concentrated flowers with specific morphologies. For instance, modules 27, 28, and 37 showed a strong association with bell-shaped flowers, whereas modules 8 and 11 were dominated by lantern and spherical flowers, respectively. Modules 5 and 26 were primarily composed of trumpet-shaped and tube flowers, while open-disk types exhibited a more diffuse distribution across modules (Figure 2c).

The predominant corolla color was also associated with the modular structure ($\chi^2 = 228.13$; *d.f.* = 123; $p < 0.001$). Cool-colored flowers occurred mainly in module 13, warm-colored flowers in modules 5 and 6, white flowers in module 15, and yellow flowers in modules 4 and 8 (Figure 2d).

Floral resources showed a strong influence on the organization of plant–floral visitor interactions ($\chi^2 = 493.24$; *d.f.* = 164; $p < 0.001$). Nectar-offering flowers were concentrated in modules 5 and 6, oil-offering flowers in module 8, while those offering floral tissues or pollen predominated in modules 11, 12, 32, and 33, respectively (Figure 2e).

A similar pattern was observed between the interaction groups of the metanetwork and the functional groups of floral visitors ($\chi^2 = 2024.4$; *d.f.* = 574; $p < 0.001$). The standardized residuals revealed well-defined associations between certain modules and visitor groups. Ants were strongly associated with module 7, beetles with modules 11 and 18, oil-collecting bees with module 8, moths with module 14, hummingbirds with modules 5 and 32, and sphingid moths with module 15 (Figure 2f).

Role of species in the metanetwork

According to the modular structure, most species were classified as *peripheral* (91.5%) ($c < 0.62$ and $z < 2.5$) in the plant–floral visitor metanetwork of the Cerrado (Figure 3). Among the remaining species, those with topological roles were mainly classified as connectors ($c > 0.62$ and $z < 2.5$), comprising 36 plant species that commonly exhibit longitudinal anthers (86.1%), actinomorphic flowers (55.6%) with open-disk (38.9%) or tube (33.3%) shapes, predominantly white (36.1%) and yellow (27.8%) corollas, and nectar as the main floral reward (80.6%) (Table S1). Among the 30 floral visitor species identified as connectors, all belonged to the family Apidae, and were classified as buzz-pollinating bees (Table S2).

Among the species classified as module hubs ($c < 0.62$ and $z > 2.5$) (1.9%), five were plant species and 13 were floral visitors (Figure 3). The plant species exclusively exhibited longitudinal anthers (100.0%), actinomorphic flowers (100.0%) with brush-shaped corollas (60.0%), white corollas (100.0%), and nectar as their primary floral reward (100.0%) (Table S1). In contrast, the main floral visitors were hummingbirds belonging to the family Trochilidae (53.8%) (Table S1).

Finally, only four species were classified as network hubs ($c > 0.62$ and $z > 2.5$) (0.5%), including two plant species and three floral visitors (Figure 3). The plant species were *Byrsonima intermedia* (Malpighiaceae) and *Curatella americana* (Dilleniaceae), both bearing longitudinal anthers and actinomorphic, open-disk flowers, although corolla color and floral rewards differed between them (Table S1). Regarding floral visitors, the three species belonged to the family Apidae, *Apis mellifera* and *Trigona spinipes* were classified as generalist bees, while *Bombus pauloensis* was classified as a buzz-pollinating bee (Table S2).

Discussion

Metanetwork structure

Our results are consistent with previous studies conducted both at the local scale (Souza *et al*., 2018) and across the entire biome (Aguiar *et al*., 2024), demonstrating that plant-floral visitor interactions in the Cerrado are organized in a modular structure, that is, groups of species interact more strongly within their own module than with species outside it (Olesen *et al*., 2007a). Here, we show how species' functional diversity shapes the modular conformation of Cerrado interactions (Figure 2), highlighting that traits intrinsically linked to pollination act as functional filters that reflect pollinator group specialization, thereby determining the topology of plant-floral visitor interactions (Vázquez *et al.*, 2005; 2007).

Both plant functional traits and the functional diversity of floral visitors showed a positive association with the modular structure of interactions in the Cerrado. The concentration of poricidal anthers, for example, suggests the formation of ecological groups sustained by specialized interactions mediated by bees capable of performing buzz pollination. In modules 13, 21, and 24, there was a predominance of bees from the genus *Melipona* (Meliponini) and the tribes Augochlorini, Bombini, Calliopsini, and Xylocopini. These pollinators vibrate their wing muscles and contract thoracic muscles against poricidal anthers, releasing pollen through internal resonance (Buchmann & Hurley, 1978; Nunes-Silva *et al.*, 2010; Vallejo-Marín & Russell, 2023). This functional aggregation reflects a consistent pattern in Cerrado communities, where species with poricidal anthers share specialized floral visitors due to morphological and behavioral constraints (e.g., Freitas & Sazima, 2006; Campos *et al.*, 2009).

Floral morphology was also a key factor shaping the modular structure of the metanetwork, as both floral symmetry and type are associated with morphological and behavioral differences among visitors (Olesen *et al*., 2007b). Zygomorphic flowers, for instance, tend to favor specific groups of pollinators, whereas actinomorphic flowers are more accessible and thus visited by a greater diversity of species (Lázaro & Totland, 2014; Yoder *et al*., 2020). Similarly, floral type may restrict or facilitate access to resources depending on the degree of floral openness (Olesen *et al.*, 2007b). Open-disk or bell-shaped flowers, for example, are more open and allow foraging by different groups, whereas tubular or throat-shaped flowers require specific morphological or behavioral adaptations from their visitors (Fenster *et al*., 2004; Olesen *et al*., 2007b). Therefore, variation in floral morphology contributes to the differentiation of interaction modules in the Cerrado.

The segregation of floral colors among the metanetwork modules suggests that coloration acts as a functional filter in structuring plant-floral visitor interactions. Modules dominated by flowers with cool coloration may reflect the preference of bees for wavelengths in the blue and ultraviolet ranges, which fall within their visual spectrum (Camargo *et al*., 2019). For example, module 13 showed a positive correlation with cool-colored flowers and a high diversity of bee species. In contrast, modules composed predominantly of warm-colored flowers, such as modules 5 and 6, tend to be associated with hummingbirds-pollinator groups frequently linked to reddish and orange hues (Camargo *et al.*, 2019).

A similar pattern was observed for floral resources, which, by requiring specialized behaviors and adaptations from pollinators (Fenster *et al*., 2004; Dellinger, 2020), acted as key determinants of modular structure. Oil-producing flowers, concentrated in module 8, exhibited a pattern of higher specialization, as expected given the specificity of this reward and the dependence on a few bee lineages capable of collecting floral oils (e.g., *Centris*, *Epicharis*, *Tetrapedia*) (Vogel, 1974; Carneiro & Machado, 2023). Nectar-offering flowers, predominant in modules 5 and 6, attracted a broad diversity of visitors, particularly generalist bees, butterflies, and hummingbirds, which rely on nectar as their main energetic resource (Fenster *et al*., 2004; Rosas-Guerrero *et al.*, 2014).

Even though generalist species may act as secondary pollination partners (Rosas-Guerrero *et al*., 2014), the pattern revealed by our results supports that functional filters of interacting species are key determinants of the compartmentalization of plant-floral visitor interactions in the Cerrado, thereby influencing the modular topology of the metanetwork.

Role of species in the metanetwork

Although most species played peripheral roles, that is, without contributing to the cohesion of interactions within the metanetwork (Olesen *et al.*, 2007a), our results revealed the existence of species that contribute to connecting plant–floral visitor interactions in the Cerrado, both among and within specific groups of interactions (Figure 3).

Most of the species central to the network topology were classified as connectors, playing a crucial role in maintaining connectivity between specialized and generalist modules (Olesen e*t al*., 2007a). Among the connector plant species, there was wide variation in floral type, symmetry, color, and resource, allowing interactions with a diverse array of visitors (Table S1). Connector floral visitors also exhibited high functional diversity (Table S2), including buzz-pollinating bees (*Bombus*, *Xylocopa*, *Melipona*, *Exomalopsis*) and oil-collecting bees (*Centris*, *Epicharis*), which, in addition to using nectar, are able to exploit specialized flowers such as *Melastomataceae* with poricidal anthers and *Malpighiaceae* offering floral oils, respectively (Vogel, 1974; Buchmann & Hurley, 1978; Buchmann, 1985; Guimarães *et al.*, 2021; Vallejo-Marín & Russell, 2023). In addition, generalist and small social bees also acted as connectors, promoting connectivity among modules composed of more accessible flowers (e.g., with less restrictive floral types and widely used floral resources). These results indicate that both specialists and generalists are essential for the modular structure and functional integration of the metanetwork. Connector species act as alternative routes between different interaction groups, contributing to the structure of the metanetwork and conferring resilience to the community in the face of species loss (Memmott *et al*., 2004; Vázquez *et al*., 2005; Olesen *et al*., 2007a; Rosas-Guerrero *et al*., 2014).

Most of the central species identified as module hubs act as structural cores within tightly cohesive groups of interactions, reinforcing the modular organization of the metanetwork, which contributes to community stability by containing the effects of perturbations within modules (Olesen *et al*., 2007a; Thébault & Fontaine, 2010). These modules exhibit high internal connectivity but limited functional redundancy, indicating that the loss of a hub could disproportionately compromise the integrity of plant-floral visitor interactions in the Cerrado (Memmott *et al*., 2004; Bascompte & Jordano, 2007). Thus, module hubs reflect complementary strategies of functional organization, ranging from highly specialized mutualisms to broadly accessible interactions, that confer structural stability and resilience to the Cerrado interaction network (Memmott *et al*., 2004; Thébault & Fontaine, 2010).

Among plant species, for instance, we highlight those with well-defined floral morphology and specific resources, such as *Byrsonima umbellata* and *Malpighia emarginata* (Malpighiaceae), which produce floral oils and are strongly associated with oil-collecting bees (e.g., *Centris*, *Epicharis*, *Paratetrapedia*, *Tetrapedia*) (Vogel, 1974; Guimarães *et al*., 2021; Carneiro & Machado, 2023). This relationship reinforces the role of hubs as centers of functional specialization, sustaining modules formed by narrow and highly specialized mutualisms. Conversely, species such as *Caryocar brasiliense* and *Inga vera* exhibit more accessible flowers (brush type) and abundant resources (nectar), forming more generalist modules composed of generalist and specialized bees, hummingbirds, lepidopterans, and bats (Table S2).

Only a small group of species was classified as network hubs, playing a central role in the global integration of the metanetwork. These hubs establish connections among multiple functional modules, ensuring structural cohesion and maintaining the flow of interactions between specialized groups (Olesen *et al*., 2007a; Thébault & Fontaine, 2010). Among plant species, *Byrsonima intermedia* and *Curatella americana* stood out as network hubs, exhibiting open floral morphologies and specific available resources in addition to pollen (oil and nectar, respectively). Both act as convergence points for visitors with different foraging modes, ranging from oil-collecting bees to social generalists, thereby sustaining connectivity between specialized and generalist modules (Table S1). Among floral visitors, *Apis mellifera*, *Bombus pauloensis*, and *Trigona spinipes* were identified as hub species, characterized by broad interaction breadth and high ecological tolerance. These bees combine high abundance, generalist behavior, and efficient foraging performance, which allows them to exploit a wide diversity of floral types and connect different functional compartments of the network (Aizen *et al.*, 2012; Emer *et al.*, 2016; Pires *et al.*, 2022). However, it is important to note that *Apis mellifera* is an exotic species widely distributed in the Cerrado, whose high dominance can alter the natural structure of interactions and reduce native pollinators' access to floral resources (Magrach *et al.*, 2017). Similarly, *Trigona spinipes*, although contributing to the structural connectivity of the network through its high visitation frequency and interaction breadth, often acts as a nectar robber, removing resources without performing pollination (Koschnitzke, 2011). Thus, the role of these species as hubs primarily reflects their structural position within the network rather than their pollination effectiveness (Magrach *et al.*, 2017; Pires *et al.*, 2022). Nevertheless, these hubs exert a strong influence on the organization and robustness of the metanetwork, promoting linkage among different interaction groups and conferring stability to the ecological structure of the Cerrado (Bascompte & Jordano, 2007; Thébault & Fontaine, 2010).

Thus, although further local-scale research is still needed to better understand the effect of functional diversity on the compartmentalization of interactions, our results reveal clear patterns indicating that species' functional diversity is a key determinant of the metanetwork's modular topology. Moreover, it highlights species that enhance the resilience and capacity to sustain both specialized and generalized interactions in the Cerrado.

Conclusion

In summary, our findings demonstrate that the modular structure of plant–floral visitor interactions in the Cerrado emerges from functional filters that shape the organization and connectivity of the metanetwork. Traits related to pollination ecology (e.g., floral morphology, color, and resource type) define the composition of interaction modules. Specialist species contribute primarily to the intra-module cohesion of interactions through more restricted and consistent interaction patterns, whereas generalist species act as connectors, linking different modules and promoting network integration. The identification of key connector and hub species underscores the importance of functional diversity for network robustness and resilience, particularly in a biome under increasing anthropogenic pressure. Understanding how functional traits mediate the assembly and integration of pollination networks provides a crucial framework for predicting how mutualistic interactions may respond to biodiversity loss and environmental change in the Cerrado.

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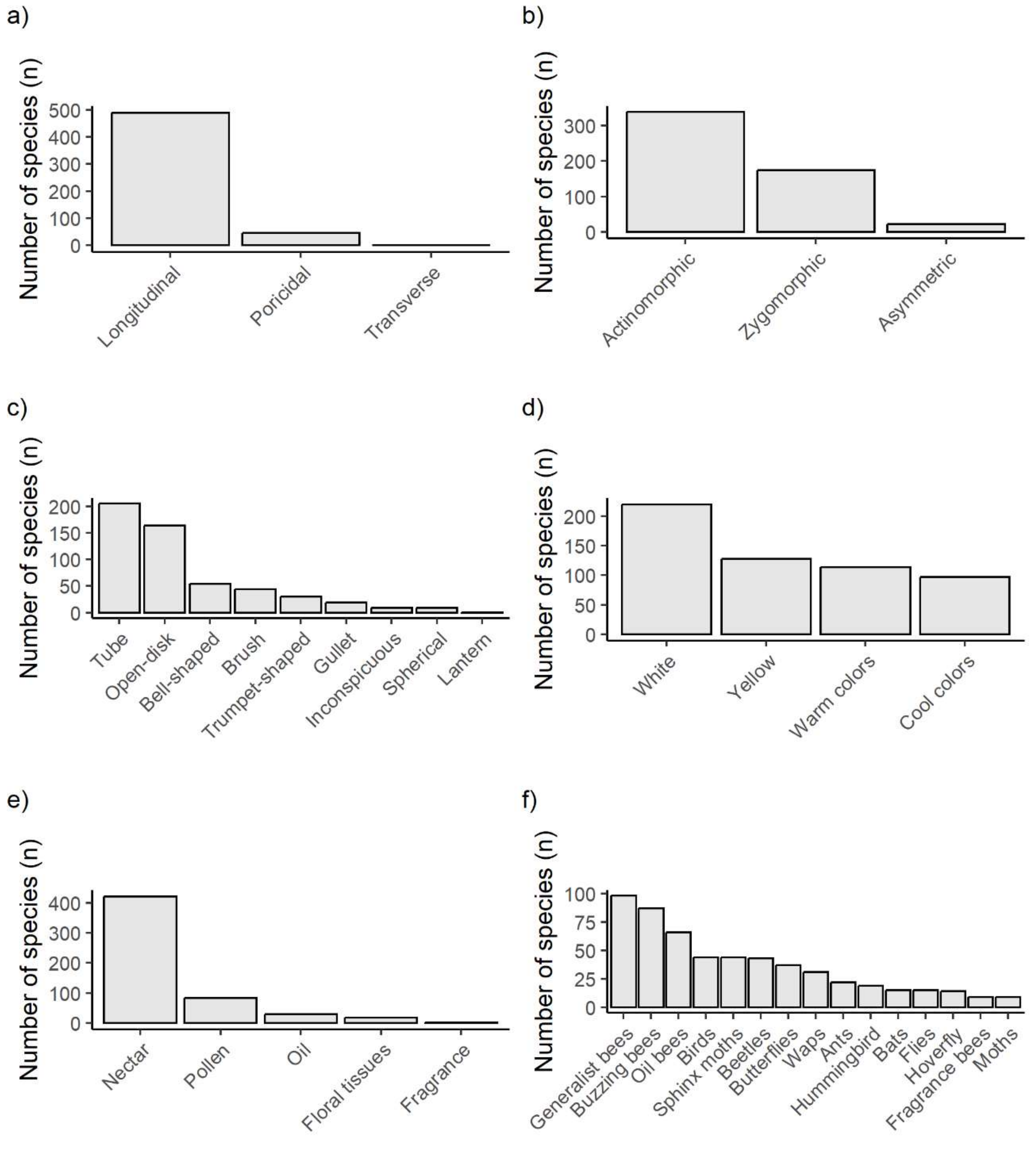
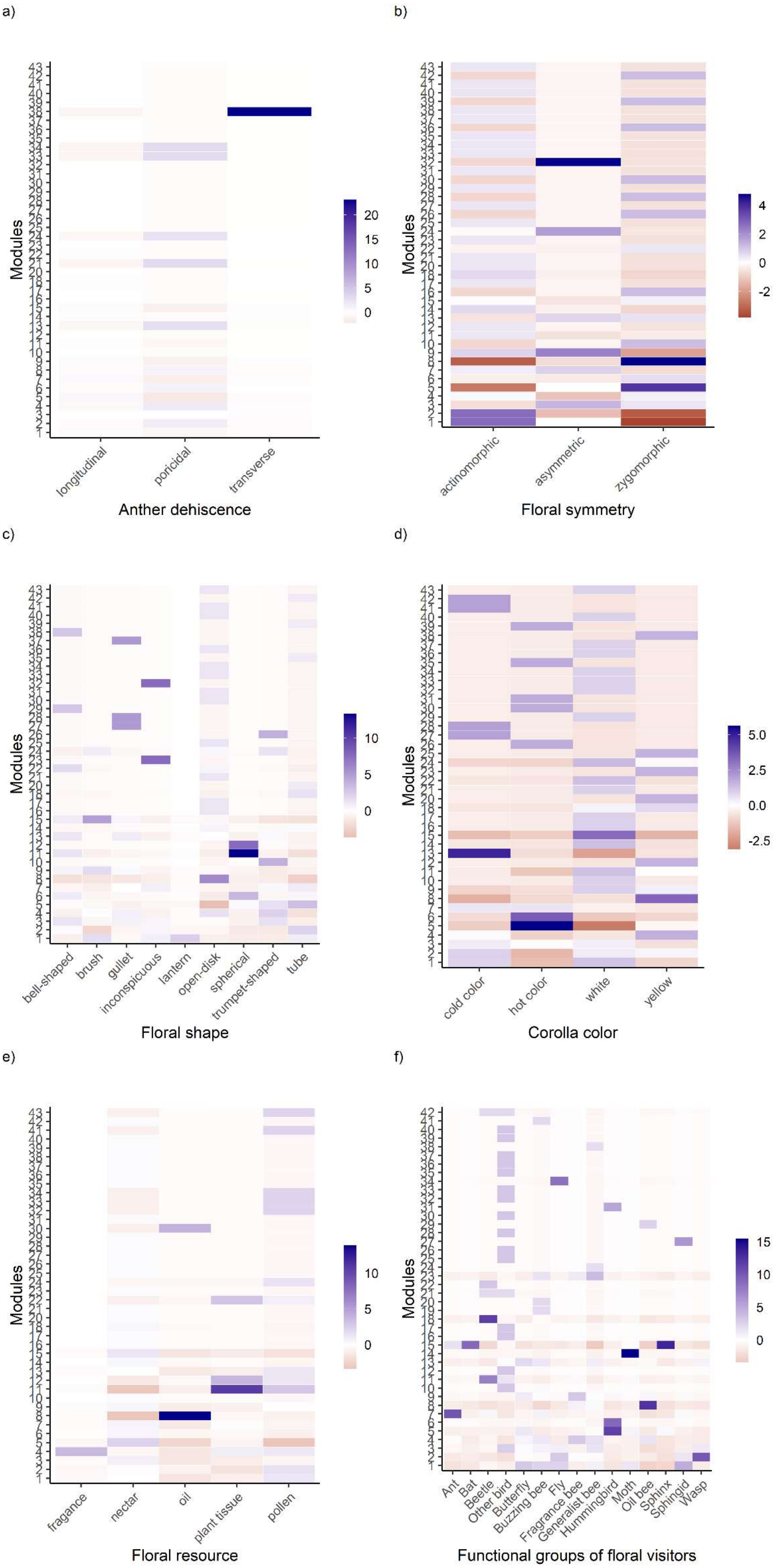


Figure 1. Functional diversity of plants and floral visitors in relation to: (a) types of anther dehiscence; (b) floral symmetry; (c) floral types; (d) predominant corolla color; (e) floral resources offered to visitors; and (f) functional groups of floral visitors.



a)
Modules
Anther dehiscence
longitudinal
poricidal
transverse
b)
Floral symmetry
actinomorphic
asymmetric
zygomorphic
c)
Floral shape
bell-shaped
brush
gullet
inconspicuous
lantern
open-disk
spherical
trumpet-shaped
tube
d)
Corolla color
cold color
hot color
white
yellow
e)
Floral resource
fragance
nectar
oil
plant tissue
pollen
f)
Functional groups of floral visitors
Ant
Bat
Beetle
Other bird
Butterfly
Buzzing bee
Fly
Fragrance bee
Generalist bee
Hummingbird
Moth
Oil bee
Sphinx
Sphingid
Wasp

Figure 2. Associations between metanetwork modules and functional diversity: (a) Anther dehiscence; (b) floral symmetry; (c) floral shape; (d) corolla color; (e) floral resources; (f) functional groups of floral visitors. Values correspond to standardized Pearson residuals, where positive values (blue) indicate categories overrepresented within modules and negative values (red) indicate underrepresented categories.

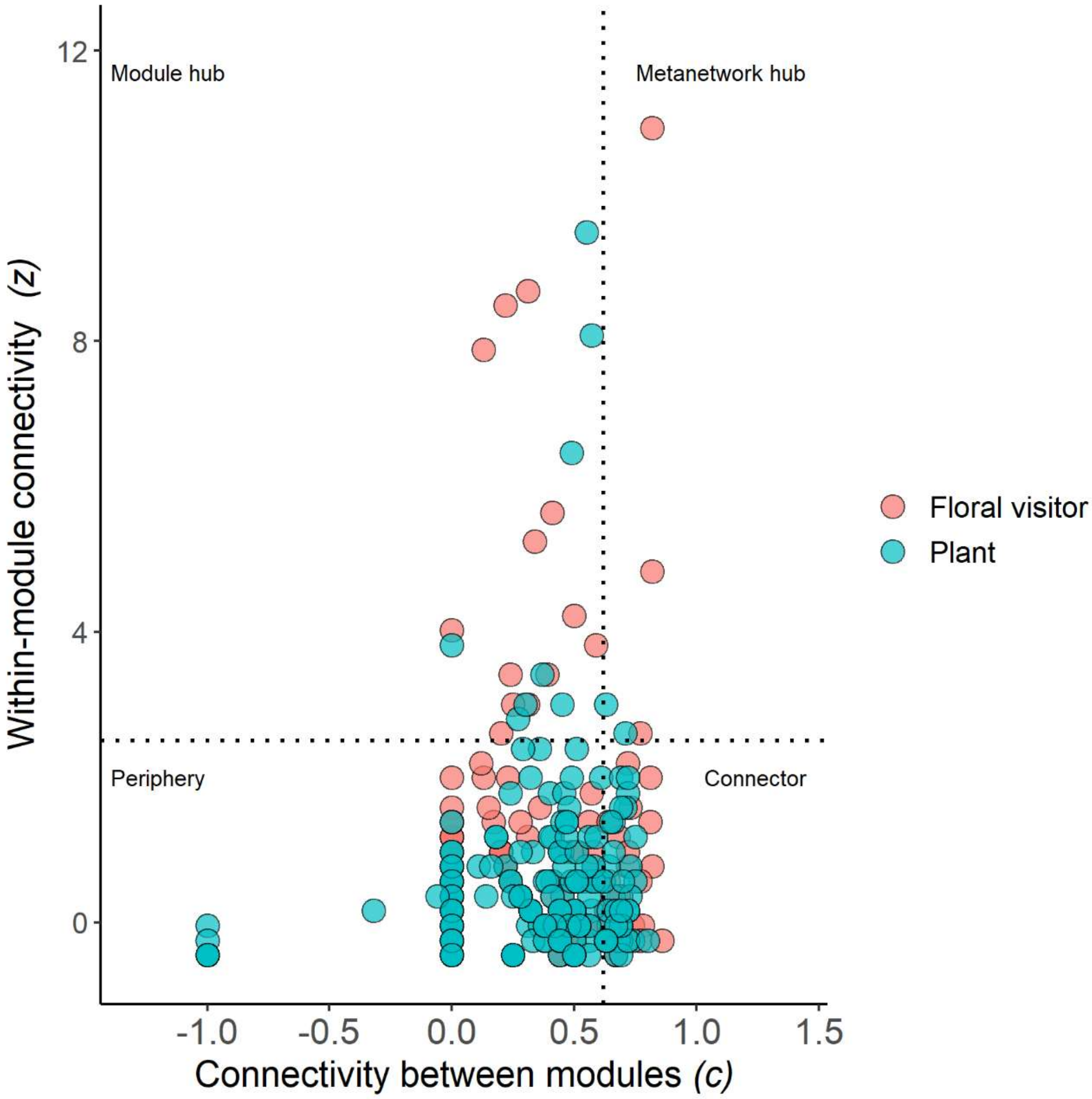


Figure 3. Distribution of species according to their within-module degree (z) and among-module connectivity (c), which define their topological roles in the plant–floral visitor metanetwork of the Cerrado. Role thresholds according to Olesen *et al*. (2007a).

Table S1. List of plant species included in the Cerrado plant–floral visitor metanetwork, with species roles (c and z values), floral traits (anther dehiscence type, floral symmetry, flower shape, colour, and floral resources), and module assignment.

Family	**Species**	***c***	***z***	**Role species**	**Anther Dehiscence Type**	**Floral simmetry**	**Flower shape**	**Colour**	**Floral resource**	**Module**
Acanthaceae	*Dicliptera squarrosa*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Acanthaceae	*Megaskepasma erythrochlamys*	0.00	-0.04	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Acanthaceae	*Ruellia brevifolia*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Acanthaceae	*Ruellia humilis*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	15
Acanthaceae	*Ruellia incomta*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	15
Acanthaceae	*Sanchezia oblonga*	0.00	0.16	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	5
Acanthaceae	*Thunbergia erecta*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	5
Acanthaceae	*Thunbergia mysorensis*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	5
Acanthaceae	*Aphelandra longiflora*	0.00	-0.04	peripheral	longitudinal	actinomorphic	spherical	white	plant tissue | pollen	5
Acanthaceae	*Eranthemum pulchellum*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	5
Acanthaceae	*Justicia brandegeeana*	0.00	0.16	peripheral	longitudinal	zygomorphic	tube	white	nectar	5
Acanthaceae	*Justicia monticola*	0.00	0.16	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Acanthaceae	*Lepidagathis floribunda*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Acanthaceae	*Pachystachys lutea*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	white	nectar	5
Alismataceae	*Sagittaria rhombifolia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	pollen	1
Amaranthaceae	*Alternanthera tenella*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	pollen	1
Amaranthaceae	*Gomphrena macrocephala*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	4
Amaryllidaceae	*Hippeastrum glaucescens*	0.50	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	hot color	nectar	6
Anacardiaceae	*Astronium urundeuva*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	cold color	nectar	4

Anacardiaceae	*Tapirira guianensis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	40
Anacardiaceae	*Anacardium occidentale*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	1
Annonaceae	*Annona coriacea*	0.00	0.77	peripheral	longitudinal	actinomorphic	spherical	white	plant tissue | pollen	11
Annonaceae	*Annona cornifolia*	0.00	-0.04	peripheral	longitudinal	actinomorphic	spherical	yellow	plant tissue | pollen	11
Annonaceae	*Annona crassiflora*	0.00	-0.25	peripheral	longitudinal	actinomorphic	spherical	white	plant tissue | pollen	11
Annonaceae	*Annona dioica*	0.00	-0.45	peripheral	longitudinal	actinomorphic	spherical	yellow	plant tissue | pollen	12
Annonaceae	*Annona montana*	0.00	-0.45	peripheral	longitudinal	actinomorphic	spherical	yellow	plant tissue | pollen	11
Annonaceae	*Cardiopetalum calophyllum*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	22
Annonaceae	*Duguetia furfuracea*	0.00	-0.25	peripheral	longitudinal	zygomorphic	bell-shaped	white	plant tissue | pollen	22
Annonaceae	*Duguetia riparia*	0.00	-0.45	peripheral	longitudinal	zygomorphic	bell-shaped	white	plant tissue | pollen	11
Annonaceae	*Duguetia ulei*	0.00	-0.45	peripheral	longitudinal	zygomorphic	bell-shaped	white	plant tissue | pollen	11
Annonaceae	*Xylopia aromatica*	0.00	-0.25	peripheral	longitudinal	actinomorphic	open-disk	white	pollen	43
Annonaceae	*Cymbopetalum euneurum*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	plant tissue | nectar	11
Annonaceae	*Malmea manausensis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	spherical	cold color | white	plant tissue | pollen	11
Apiaceae	*Eryngium horridum*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	white	pollen	2
Apocynaceae	*Aspidosperma*	0.00	0.16	peripheral	longitudinal	actinomorphic	tube	white	nectar	14

	macrocarpon									
Apocynaceae	*Hancornia speciosa*	0.00	0.16	peripheral	longitudinal	actinomorphic	tube	white	nectar	15
Apocynaceae	*Minaria acerosa*	0.00	-0.25	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	2
Apocynaceae	*Orthosia scoparia*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2
Apocynaceae	*Oxypetalum appendiculatum*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	cold color	nectar	3
Apocynaceae	*Oxypetalum sublanatum*	-1.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	13
Apocynaceae	*Prestonia coalita*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	5
Apocynaceae	*Rauvolfia weddelliana*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	1
Apocynaceae	*Schubertia grandiflora*	0.00	-0.25	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	15
Apocynaceae	*Mandevilla emarginata*	-1.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	yellow	nectar	13
Apocynaceae	*Mandevilla hirsuta*	0.00	-0.25	peripheral	longitudinal	actinomorphic	bell-shaped	yellow	nectar	5
Apocynaceae	*Mandevilla illustris*	0.00	-0.04	peripheral	longitudinal	actinomorphic	bell-shaped	hot color	nectar	15
Apocynaceae	*Mandevilla sellowii*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	hot color	nectar	2
Apocynaceae	*Peplonia organensis*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Aquifoliaceae	*Ilex affinis*	0.00	0.36	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	1
Aquifoliaceae	*Ilex dumosa*	0.32	0.16	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	2
Araliaceae	*Didymopanax vinosus*	0.50	0.16	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	1
Arecaceae	*Attalea phalerata*	0.00	0.36	peripheral	longitudinal	actinomorphic	tube	white	nectar	3
Arecaceae	*Butia paraguayensis*	0.46	1.78	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	18
Arecaceae	*Cocos nucifera*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	pollen	9
Arecaceae	*Syagrus petraea*	0.47	1.38	peripheral	longitudinal	actinomorphic	tube	white	nectar	18
Arecaceae	*Allagoptera campestris*	0.32	0.16	peripheral	longitudinal	actinomorphic	tube	white	nectar	7
Asparagaceae	*Cordyline fruticosa*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	hot color	nectar	5
Asteraceae	*Achyrocline satureioides*	0.52	0.57	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2

Asteraceae	*Baccharis aphylla*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Baccharis crispa*	0.00	0.57	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Baccharis curitybensis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Baccharis dracunculifolia*	0.32	0.16	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Baccharis intermixta*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Baccharis linearifolia*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2
Asteraceae	*Baccharis platypoda*	0.38	-0.04	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2
Asteraceae	*Baccharis rufidula*	0.00	0.36	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	2
Asteraceae	*Baccharis sessiliflora*	0.44	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Baccharis tarchonanthoides*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Barrosoa betoniciformis*	0.44	-0.25	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	2
Asteraceae	*Chaptalia integerrima*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Chaptalia piloselloides*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Chromolaena leucocephala*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	7
Asteraceae	*Chromolaena maximiliani*	0.31	-0.04	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Asteraceae	*Chromolaena squalida*	0.24	0.57	peripheral	longitudinal	actinomorphic	tube	hot color | white	nectar	1
Asteraceae	*Chrysolaena cognata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	1
Asteraceae	*Chrysolaena obovata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Asteraceae	*Conyza bonariensis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	7
Asteraceae	*Cosmos sulphureus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	3
Asteraceae	*Helianthus annuus*	0.61	1.99	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	4
Asteraceae	*Hololepis pedunculata*	0.00	0.16	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	5
Asteraceae	*Hypochaeris lutea*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2

Asteraceae	*Inulopsis scaposa*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2
Asteraceae	*Mikania acuminata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	2
Asteraceae	*Mikania cordifolia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Asteraceae	*Mikania hirsutissima*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Asteraceae	*Mikania lundiana*	0.28	0.36	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Mikania microdonta*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	2
Asteraceae	*Mikania sessilifolia*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Moquiniastrum paniculatum*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Piptocarpha rotundifolia*	0.33	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Asteraceae	*Praxelis decumbens*	0.25	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Asteraceae	*Praxelis kleinioides*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	35
Asteraceae	*Riencourtia oblongifolia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	7
Asteraceae	*Senecio brasiliensis*	0.00	0.16	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2
Asteraceae	*Senecio oleosus*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2
Asteraceae	*Sonchus oleraceus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	1
Asteraceae	*Stenocephalum megapotamicum*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Asteraceae	*Stenocephalum tragiifolium*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	39
Asteraceae	*Stevia myriadenia*	-0.32	0.16	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	13
Asteraceae	*Symphyopappus compressus*	-0.06	0.36	peripheral	longitudinal	actinomorphic	tube	white	nectar	13
Asteraceae	*Trichogonia attenuata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	pollen	1
Asteraceae	*Trixis antimenorrhoea*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	1
Asteraceae	*Vernonanthura polyanthes*	0.69	0.16	connector	longitudinal	actinomorphic	tube	cold color	nectar	1

Asteraceae	*Vernonanthura westiniana*	0.14	0.36	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	13
Asteraceae	*Wunderlichia mirabilis*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	5
Asteraceae	*Aldama grandiflora*	0.38	-0.04	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	7
Asteraceae	*Bidens gardneri*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	1
Asteraceae	*Bidens pilosa*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	1
Asteraceae	*Campuloclinium megacephalum*	0.39	0.57	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Asteraceae	*Elephantopus micropappus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	1
Asteraceae	*Erechtites hieracifolius*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	7
Asteraceae	*Eremanthus erythropappus*	0.32	0.16	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Asteraceae	*Eremanthus glomerulatus*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	2
Asteraceae	*Eremanthus mattogrossensis*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	1
Asteraceae	*Galinsoga parviflora*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	1
Asteraceae	*Grazielia dimorpholepis*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Asteraceae	*Grazielia gaudichaudeana*	0.32	0.16	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Asteraceae	*Lepidaploa salzmannii*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	1
Asteraceae	*Lessingianthus grandiflorus*	0.25	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	13
Asteraceae	*Lessingianthus linearifolius*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Asteraceae	*Lessingianthus roseus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Asteraceae	*Lessingianthus tomentellus*	0.28	0.97	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Asteraceae	*Lessingianthus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	1

	venosissimus									
Bignoniaceae	*Cuspidaria convoluta*	0.50	-0.45	peripheral	longitudinal	zygomorphic	bell-shaped	hot color	nectar	3
Bignoniaceae	*Handroanthus albus*	0.00	-0.25	peripheral	longitudinal	zygomorphic	bell-shaped	yellow	nectar	5
Bignoniaceae	*Handroanthus heptaphyllus*	0.00	-0.25	peripheral	longitudinal	zygomorphic	bell-shaped	hot color	nectar	5
Bignoniaceae	*Handroanthus impetiginosus*	0.00	0.16	peripheral	longitudinal	zygomorphic	bell-shaped	cold color	nectar	5
Bignoniaceae	*Handroanthus ochraceus*	0.44	0.97	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	4
Bignoniaceae	*Handroanthus serratifolius*	0.00	-0.25	peripheral	longitudinal	zygomorphic	bell-shaped	yellow	nectar	5
Bignoniaceae	*Jacaranda caroba*	0.69	-0.25	connector	longitudinal	zygomorphic	trumpet-shaped	cold color	nectar	5
Bignoniaceae	*Jacaranda oxyphylla*	0.64	0.16	connector	longitudinal	zygomorphic	trumpet-shaped	hot color	nectar	3
Bignoniaceae	*Jacaranda ulei*	0.62	0.57	peripheral	longitudinal	zygomorphic	trumpet-shaped	cold color	nectar	3
Bignoniaceae	*Pyrostegia venusta*	0.69	-0.04	connector	longitudinal	zygomorphic	tube	hot color	nectar	3
Bignoniaceae	*Spathodea campanulata*	0.00	-0.04	peripheral	longitudinal	zygomorphic	bell-shaped	hot color	nectar	5
Bignoniaceae	*Tabebuia aurea*	0.56	1.18	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	4
Bignoniaceae	*Tabebuia roseoalba*	0.48	-0.04	peripheral	longitudinal	zygomorphic	trumpet-shaped	white	nectar	5
Bignoniaceae	*Zeyheria montana*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	5
Bignoniaceae	*Adenocalymma bracteatum*	0.73	0.77	connector	longitudinal	zygomorphic	trumpet-shaped	yellow	nectar	3
Bignoniaceae	*Adenocalymma nodosum*	0.66	1.38	connector	longitudinal	zygomorphic	gullet	yellow	nectar	4
Bignoniaceae	*Adenocalymma peregrinum*	0.66	0.36	connector	longitudinal	zygomorphic	tube	yellow	nectar	4
Bignoniaceae	*Amphilophium elongatum*	0.00	0.16	peripheral	longitudinal	zygomorphic	bell-shaped	white	nectar	8
Bignoniaceae	*Anemopaegma*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	white	nectar	4

	acutifolium									
Bignoniaceae	*Fridericia chica*	0.58	0.77	peripheral	longitudinal	zygomorphic	bell-shaped	hot color	nectar	3
Bignoniaceae	*Fridericia florida*	0.45	0.97	peripheral	longitudinal	zygomorphic	bell-shaped	white	nectar	1
Bromeliaceae	*Vriesea friburgensis*	0.00	-0.04	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	5
Bromeliaceae	*Aechmea aquilega*	0.00	-0.45	peripheral	longitudinal	asymmetric	tube	yellow	nectar	5
Bromeliaceae	*Aechmea bromeliifolia*	0.00	0.16	peripheral	longitudinal	asymmetric	tube	yellow	nectar	5
Bromeliaceae	*Ananas ananassoides*	0.41	1.18	peripheral	longitudinal	actinomorphic	tube	hot color | white	nectar	5
Bromeliaceae	*Bromelia balansae*	0.28	0.36	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Bromeliaceae	*Bromelia karatas*	0.44	-0.25	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Bromeliaceae	*Dyckia leptostachya*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Bromeliaceae	*Dyckia minarum*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Bromeliaceae	*Dyckia tuberosa*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Burseraceae	*Protium ovatum*	0.48	-0.04	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	7
Cactaceae	*Cipocereus crassisepalus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	15
Calophyllaceae	*Calophyllum brasiliense*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	pollen	5
Calophyllaceae	*Kielmeyera abdita*	0.40	1.18	peripheral	longitudinal	actinomorphic	open-disk	hot color | white	pollen	4
Calophyllaceae	*Kielmeyera coriacea*	0.45	3.00	module hub	longitudinal	actinomorphic	open-disk	hot color | white	pollen	4
Calophyllaceae	*Kielmeyera speciosa*	0.36	2.39	peripheral	longitudinal	actinomorphic	open-disk	hot color | white	pollen	4
Calophyllaceae	*Kielmeyera variabilis*	0.45	1.38	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	4
Campanulaceae	*Wahlenbergia brasiliensis*	0.44	-0.25	peripheral	longitudinal	actinomorphic	bell-shaped	cold color | hot color	nectar	1
Campanulaceae	*Lobelia camporum*	0.00	-0.25	peripheral	longitudinal	zygomorphic	gullet	hot color	nectar	13
Cannabaceae	*Trema micranthum*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	cold color	pollen	41
Cannaceae	*Canna indica*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5

Capparaceae	*Cynophalla flexuosa*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	nectar	8
Caryocaraceae	*Caryocar brasiliense*	0.55	9.50	module hub	longitudinal	actinomorphic	brush	white | yellow	nectar	15
Celastraceae	*Plenckia populnea*	0.00	-0.25	peripheral	longitudinal	actinomorphic	bell-shaped	cold color	nectar	3
Celastraceae	*Salacia crassifolia*	0.00	-0.45	peripheral	transverse	actinomorphic	bell-shaped	yellow	nectar	38
Celastraceae	*Tontelea micrantha*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	7
Chloranthaceae	*Hedyosmum brasiliense*	0.00	-0.45	peripheral	longitudinal	asymmetric	inconspicuous	cold color	nectar	3
Chrysobalanaceae	*Hirtella gracilipes*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	hot color	nectar	31
Clethraceae	*Clethra scabra*	0.33	0.97	peripheral	poricidal	actinomorphic	bell-shaped	yellow	nectar	2
Combretaceae	*Combretum fruticosum*	0.00	0.16	peripheral	longitudinal	actinomorphic	brush	hot color	nectar	15
Combretaceae	*Combretum leprosum*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	9
Commelinaceae	*Commelina erecta*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	yellow	pollen	3
Connaraceae	*Connarus suberosus*	0.56	0.36	peripheral	longitudinal	actinomorphic	open-disk	cold color	nectar	4
Connaraceae	*Rourea induta*	0.44	0.97	peripheral	longitudinal	actinomorphic	open-disk	cold color | white	plant tissue | nectar	4
Convolvulaceae	*Convolvulus crenatifolius*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	hot color | white	nectar	1
Convolvulaceae	*Ipomoea hederifolia*	0.00	0.16	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Convolvulaceae	*Ipomoea procumbens*	0.00	-0.25	peripheral	longitudinal	actinomorphic	bell-shaped	hot color	nectar	13
Convolvulaceae	*Ipomoea purpurea*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	cold color | hot color | white	nectar	5
Convolvulaceae	*Ipomoea ramosissima*	0.00	-0.25	peripheral	longitudinal	actinomorphic	bell-shaped	hot color	nectar	15
Convolvulaceae	*Daustinia montana*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	9
Convolvulaceae	*Distimake macrocalyx*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	1
Convolvulaceae	*Distimake tomentosus*	0.00	-0.04	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	15

Convolvulaceae	*Jacquemontia ferruginea*	-1.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	cold color	nectar	13
Costaceae	*Costus spiralis*	0.00	-0.04	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Cunoniaceae	*Weinmannia organensis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	2
Cunoniaceae	*Weinmannia paulliniifolia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	2
Cunoniaceae	*Lamanonia ternata*	0.00	0.36	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	15
Cyperaceae	*Rhynchospora globosa*	0.00	-0.45	peripheral	longitudinal	actinomorphic	inconspicuous	hot color	pollen	2
Dilleniaceae	*Curatella americana*	0.71	2.60	network hub	longitudinal	actinomorphic	open-disk	white	nectar	24
Dilleniaceae	*Davilla elliptica*	0.50	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	pollen	7
Droseraceae	*Drosera montana*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	hot color	pollen	2
Ericaceae	*Agarista hispidula*	0.50	-0.45	peripheral	poricidal	actinomorphic	spherical	hot color	nectar	6
Ericaceae	*Gaylussacia brasiliensis*	0.00	-0.04	peripheral	poricidal	actinomorphic	spherical	hot color	nectar	5
Ericaceae	*Gaylussacia chamissonis*	0.50	-0.45	peripheral	poricidal	actinomorphic	bell-shaped	white	nectar	2
Ericaceae	*Gaylussacia jordanensis*	0.38	-0.04	peripheral	poricidal	actinomorphic	bell-shaped	white	nectar	2
Ericaceae	*Gaylussacia reticulata*	0.00	-0.04	peripheral	poricidal	actinomorphic	gullet	white	nectar	5
Eriocaulaceae	*Comanthera xeranthemoides*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	3
Eriocaulaceae	*Paepalanthus lundii*	0.32	0.16	peripheral	longitudinal	actinomorphic	tube	white	nectar	7
Eriocaulaceae	*Paepalanthus paulensis*	0.44	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Eriocaulaceae	*Actinocephalus polyanthus*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Eriocaulaceae	*Eriocaulon magnum*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Erythroxylaceae	*Erythroxylum amazonicum*	0.38	-0.04	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	7
Erythroxylaceae	*Erythroxylum campestre*	0.64	0.77	connector	longitudinal	actinomorphic	open-disk	white	nectar	3

Erythroxylaceae	*Erythroxylum cuneifolium*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	1
Erythroxylaceae	*Erythroxylum deciduum*	0.58	0.57	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	3
Erythroxylaceae	*Erythroxylum gonocladum*	0.18	1.18	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	2
Erythroxylaceae	*Erythroxylum microphyllum*	0.00	-0.25	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	2
Erythroxylaceae	*Erythroxylum suberosum*	0.75	0.57	connector	longitudinal	actinomorphic	open-disk	white	nectar	3
Erythroxylaceae	*Erythroxylum tortuosum*	0.64	-0.25	connector	longitudinal	actinomorphic	open-disk	white	nectar	3
Euphorbiaceae	*Croton abaitensis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	cold color	pollen	7
Euphorbiaceae	*Croton agoensis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	cold color	nectar	1
Euphorbiaceae	*Croton dichrous*	0.28	0.36	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	2
Euphorbiaceae	*Croton floribundus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	1
Euphorbiaceae	*Croton siderophyllus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	hot color	nectar	7
Euphorbiaceae	*Croton urucurana*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	1
Euphorbiaceae	*Euphorbia pulcherrima*	0.00	-0.25	peripheral	longitudinal	asymmetric	inconspicuous	hot color	nectar	5
Euphorbiaceae	*Microstachys serrulata*	0.00	-0.45	peripheral	longitudinal	asymmetric	inconspicuous	yellow	pollen	7
Euphorbiaceae	*Manihot oligantha*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	yellow	nectar	2
Euphorbiaceae	*Manihot tripartita*	0.48	-0.04	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	7
Euphorbiaceae	*Manihot violacea*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	cold color | yellow	nectar	4
Euphorbiaceae	*Maprounea guianensis*	0.00	-0.45	peripheral	longitudinal	asymmetric	inconspicuous	white	pollen	32
Fabaceae	*Acacia mangium*	0.41	0.57	peripheral	longitudinal	actinomorphic	brush	white	pollen	1
Fabaceae	*Andira cujabensis*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	white	nectar	10

Fabaceae	*Bionia coriacea*	0.00	0.57	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Fabaceae	*Bowdichia virgilioides*	0.00	-0.25	peripheral	longitudinal	zygomorphic	trumpet-shaped	hot color	nectar	5
Fabaceae	*Caesalpinia pulcherrima*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	hot color	nectar	5
Fabaceae	*Canavalia palmeri*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	cold color	nectar	5
Fabaceae	*Cenostigma nordestinum*	0.00	-0.25	peripheral	longitudinal	zygomorphic	open-disk	yellow	nectar	4
Fabaceae	*Cenostigma pluviosum*	0.00	0.16	peripheral	longitudinal	zygomorphic	open-disk	yellow	nectar	8
Fabaceae	*Centrosema brasilianum*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	hot color	nectar	4
Fabaceae	*Cerradicola elliptica*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	white	nectar	5
Fabaceae	*Chamaecrista debilis*	0.00	-0.45	peripheral	poricidal	asymmetric	open-disk	yellow	oil	8
Fabaceae	*Chamaecrista flexuosa*	0.00	-0.25	peripheral	poricidal	asymmetric	open-disk	yellow	nectar	3
Fabaceae	*Chamaecrista nictitans*	0.00	-0.45	peripheral	poricidal	zygomorphic	open-disk	yellow	pollen	3
Fabaceae	*Chamaecrista orbiculata*	0.00	-0.45	peripheral	poricidal	zygomorphic	trumpet-shaped	yellow	pollen	24
Fabaceae	*Chamaecrista punctulifera*	0.00	-0.45	peripheral	poricidal	zygomorphic	open-disk	yellow	pollen	8
Fabaceae	*Chamaecrista zygophylloides*	0.44	-0.25	peripheral	poricidal	zygomorphic	open-disk	yellow	pollen	8
Fabaceae	*Collaea cipoensis*	0.49	1.99	peripheral	longitudinal	zygomorphic	tube	hot color	plant tissue | nectar	7
Fabaceae	*Copaifera langsdorffii*	0.00	-0.25	peripheral	longitudinal	zygomorphic	open-disk	cold color	nectar	8
Fabaceae	*Copaifera luetzelburgii*	0.50	-0.45	peripheral	longitudinal	asymmetric	brush	white	nectar	24
Fabaceae	*Crotalaria breviflora*	-1.00	-0.04	peripheral	poricidal	zygomorphic	trumpet-shaped	yellow	nectar	13
Fabaceae	*Delonix regia*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	hot color | yellow	nectar	9

Fabaceae	*Desmodium barbatum*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	hot color	nectar	7
Fabaceae	*Dipteryx alata*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	hot color	nectar	26
Fabaceae	*Harpalyce brasiliana*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	hot color	nectar	3
Fabaceae	*Hymenaea courbaril*	0.00	-0.04	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	15
Fabaceae	*Hymenaea stigonocarpa*	0.00	0.97	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	15
Fabaceae	*Inga edulis*	0.00	-0.04	peripheral	longitudinal	actinomorphic	brush	white	pollen	15
Fabaceae	*Inga laurina*	0.00	-0.25	peripheral	longitudinal	actinomorphic	brush	white	nectar	15
Fabaceae	*Inga vera*	0.49	6.46	module hub	longitudinal	actinomorphic	brush	white	nectar	15
Fabaceae	*Libidibia ferrea*	0.00	-0.45	peripheral	longitudinal	zygomorphic	bell-shaped	yellow	nectar	5
Fabaceae	*Lupinus velutinus*	0.56	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	cold color	pollen	2
Fabaceae	*Machaerium opacum*	0.73	0.36	connector	poricidal	zygomorphic	tube	white	nectar	15
Fabaceae	*Parkia platycephala*	0.00	-0.45	peripheral	longitudinal	asymmetric	brush	hot color	nectar	1
Fabaceae	*Periandra mediterranea*	0.38	-0.04	peripheral	longitudinal	zygomorphic	trumpet-shaped	cold color	nectar	2
Fabaceae	*Phaseolus vulgaris*	0.51	2.39	peripheral	longitudinal	zygomorphic	trumpet-shaped	cold color | hot color | white | yellow	nectar	1
Fabaceae	*Pityrocarpa moniliformis*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	9
Fabaceae	*Plathymenia reticulata*	0.00	0.16	peripheral	longitudinal	actinomorphic	brush	white	nectar	1
Fabaceae	*Senegalia polyphylla*	0.44	0.16	peripheral	longitudinal	actinomorphic	brush	white	nectar	1
Fabaceae	*Senna cana*	0.50	-0.45	peripheral	poricidal	zygomorphic	open-disk	yellow	pollen	8
Fabaceae	*Senna obtusifolia*	0.38	-0.25	peripheral	poricidal	zygomorphic	open-disk	yellow	pollen	13
Fabaceae	*Senna rugosa*	0.00	-0.25	peripheral	poricidal	zygomorphic	open-disk	yellow	pollen	8

Fabaceae	*Senna silvestris*	0.44	-0.25	peripheral	poricidal	zygomorphic	open-disk	yellow	pollen	3
Fabaceae	*Stryphnodendron adstringens*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	4
Fabaceae	*Stryphnodendron rotundifolium*	0.44	-0.25	peripheral	longitudinal	actinomorphic	tube	white | yellow	nectar	1
Fabaceae	*Tachigali aurea*	0.00	-0.25	peripheral	longitudinal	actinomorphic	open-disk	yellow	pollen	1
Fabaceae	*Tachigali vulgaris*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	1
Fabaceae	*Anadenanthera colubrina*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	nectar	9
Fabaceae	*Bauhinia brevipes*	0.54	0.57	peripheral	longitudinal	zygomorphic	brush	white	nectar	15
Fabaceae	*Bauhinia curvula*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	15
Fabaceae	*Bauhinia dumosa*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	15
Fabaceae	*Bauhinia forficata*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	16
Fabaceae	*Bauhinia goyazensis*	0.00	-0.04	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	15
Fabaceae	*Bauhinia holophylla*	0.00	0.97	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	15
Fabaceae	*Bauhinia longifolia*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	15
Fabaceae	*Bauhinia pulchella*	0.44	-0.25	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	3
Fabaceae	*Bauhinia rufa*	0.38	0.57	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	15
Fabaceae	*Bauhinia ungulata*	0.22	0.77	peripheral	longitudinal	zygomorphic	brush	white	nectar	5
Fabaceae	*Bauhinia variegata*	0.00	-0.04	peripheral	longitudinal	zygomorphic	open-disk	hot color	nectar	5
Fabaceae	*Betencourtia martii*	0.00	0.16	peripheral	longitudinal	zygomorphic	trumpet-shaped	hot color	nectar	7
Fabaceae	*Calliandra dysantha*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	3
Fabaceae	*Dalbergia cuiabensis*	0.50	-0.25	peripheral	longitudinal	zygomorphic	trumpet-shaped	cold color	nectar	4
Fabaceae	*Dalbergia miscolobium*	0.38	-0.25	peripheral	longitudinal	zygomorphic	trumpet-shaped	cold color	nectar	13
Fabaceae	*Deguelia hatschbachii*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	hot color	nectar	5

Fabaceae	*Erythrina speciosa*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Fabaceae	*Leptolobium dasycarpum*	0.41	0.36	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	8
Fabaceae	*Leptolobium elegans*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	8
Fabaceae	*Leucaena leucocephala*	0.67	-0.45	connector	longitudinal	actinomorphic	brush	white	plant tissue | pollen	1
Fabaceae	*Mimosa caesalpiniifolia*	0.00	-0.45	peripheral	longitudinal	asymmetric	brush	white	nectar	9
Fabaceae	*Mimosa candollei*	0.00	-0.45	peripheral	longitudinal	asymmetric	brush	hot color	nectar	9
Fabaceae	*Mimosa claussenii*	0.00	-0.45	peripheral	longitudinal	asymmetric	brush	hot color	nectar	1
Fabaceae	*Mimosa debilis*	-1.00	-0.45	peripheral	longitudinal	asymmetric	brush	cold color	nectar	13
Fabaceae	*Mimosa dichroa*	0.50	-0.45	peripheral	longitudinal	asymmetric	brush	hot color	nectar	5
Fabaceae	*Mimosa dolens*	-1.00	-0.45	peripheral	longitudinal	asymmetric	brush	cold color	nectar	13
Fabaceae	*Mimosa gemmulata*	0.00	-0.45	peripheral	longitudinal	asymmetric	brush	cold color	nectar	7
Fabaceae	*Mimosa hebecarpa*	0.00	-0.25	peripheral	longitudinal	asymmetric	brush	hot color	nectar	1
Fabaceae	*Mimosa setosa*	0.00	-0.45	peripheral	longitudinal	asymmetric	brush	hot color	nectar	15
Fabaceae	*Mimosa tenuiflora*	0.00	-0.45	peripheral	longitudinal	asymmetric	brush	white	nectar	9
Fabaceae	*Strongylodon macrobotrys*	0.00	-0.04	peripheral	longitudinal	zygomorphic	open-disk	cold color	nectar	5
Gentianaceae	*Deianira pallescens*	0.50	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	pollen	3
Gentianaceae	*Zygostigma australe*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	cold color	pollen	1
Gesneriaceae	*Sinningia allagophylla*	0.38	-0.04	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	6
Gesneriaceae	*Sinningia elatior*	0.71	1.58	connector	longitudinal	zygomorphic	tube	hot color	plant tissue | nectar	5
Heliconiaceae	*Heliconia bihai*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	5
Heliconiaceae	*Heliconia collinsiana*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	5
Heliconiaceae	*Heliconia psittacorum*	0.00	0.36	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5

Heliconiaceae	*Heliconia rostrata*	0.00	-0.04	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	5
Hypericaceae	*Hypericum brasiliense*	0.00	-0.04	peripheral	longitudinal	actinomorphic	open-disk	yellow	pollen	2
Iridaceae	*Phalocallis geniculata*	0.25	0.36	peripheral	longitudinal	actinomorphic	bell-shaped	cold color	nectar	2
Iridaceae	*Sisyrinchium micranthum*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	oil	1
Iridaceae	*Sisyrinchium vaginatum*	0.50	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	oil	2
Iridaceae	*Calydorea campestris*	0.00	-0.25	peripheral	longitudinal	actinomorphic	open-disk	cold color	pollen	2
Lamiaceae	*Cantinoa plectranthoides*	0.25	-0.45	peripheral	longitudinal	zygomorphic	gullet	cold color	nectar	13
Lamiaceae	*Holmskioldia sanguinea*	0.00	0.16	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Lamiaceae	*Hypenia reticulata*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Lamiaceae	*Hyptis alutacea*	0.00	-0.45	peripheral	longitudinal	zygomorphic	gullet	cold color	nectar	3
Lamiaceae	*Hyptis crenata*	0.00	-0.25	peripheral	longitudinal	zygomorphic	gullet	cold color	nectar	4
Lamiaceae	*Hyptis radicans*	0.00	-0.45	peripheral	longitudinal	zygomorphic	gullet	cold color	nectar	1
Lamiaceae	*Hyptis villosa*	0.00	0.36	peripheral	longitudinal	zygomorphic	gullet	cold color	nectar	7
Lamiaceae	*Mesosphaerum suaveolens*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	cold color	pollen	9
Lamiaceae	*Rhabdocaulon stenodontum*	0.00	-0.04	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	7
Lamiaceae	*Salvia cerradicola*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	7
Lamiaceae	*Salvia scabrida*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Lamiaceae	*Aegiphila integrifolia*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	1
Lamiaceae	*Cyanocephalus caprariifolius*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	7
Lamiaceae	*Cyanocephalus lippioides*	0.64	-0.04	connector	longitudinal	zygomorphic	gullet	cold color	nectar	2
Lamiaceae	*Medusantha eriophylla*	0.00	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	white	nectar	1
Lecythidaceae	*Eschweilera nana*	0.48	1.58	peripheral	longitudinal	zygomorphic	open-disk	yellow	plant tissue | nectar	8
Lentibulariaceae	*Genlisea violacea*	0.00	-0.45	peripheral	longitudinal	zygomorphic	gullet	cold color	nectar	28

Loganiaceae	*Spigelia sellowiana*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	5
Loganiaceae	*Strychnos pseudoquina*	0.44	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	3
Loranthaceae	*Struthanthus polyanthus*	0.63	-0.25	connector	longitudinal	actinomorphic	tube	white	nectar	1
Loranthaceae	*Psittacanthus robustus*	0.47	1.38	peripheral	longitudinal	zygomorphic	tube	yellow	nectar	15
Lythraceae	*Cuphea carthagenensis*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	2
Lythraceae	*Cuphea glutinosa*	0.11	0.77	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	13
Lythraceae	*Cuphea melvilla*	0.00	0.36	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Lythraceae	*Lafoensia pacari*	0.27	2.80	module hub	longitudinal	actinomorphic	brush	white	nectar	15
Malpighiaceae	*Banisteriopsis adenopoda*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white | yellow	oil	8
Malpighiaceae	*Banisteriopsis argyrophylla*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white	oil	8
Malpighiaceae	*Banisteriopsis campestris*	0.40	1.78	peripheral	longitudinal	zygomorphic	open-disk	hot color	oil	8
Malpighiaceae	*Banisteriopsis laevifolia*	0.00	0.16	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Banisteriopsis malifolia*	0.32	1.99	peripheral	longitudinal	zygomorphic	open-disk	hot color	oil	8
Malpighiaceae	*Banisteriopsis oxyclada*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white	oil	8
Malpighiaceae	*Byrsonima basiloba*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Byrsonima brachybotrya*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white	oil	8
Malpighiaceae	*Byrsonima coccolobifolia*	0.45	0.36	peripheral	longitudinal	zygomorphic	open-disk	hot color	oil	8
Malpighiaceae	*Byrsonima crassifolia*	0.00	-0.04	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Byrsonima intermedia*	0.63	3.00	network hub	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Byrsonima pachyphylla*	0.60	0.57	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Byrsonima rotunda*	0.24	1.78	peripheral	longitudinal	zygomorphic	open-disk	white	oil	8
Malpighiaceae	*Byrsonima umbellata*	0.37	3.41	module hub	longitudinal	zygomorphic	open-disk	white	oil	8
Malpighiaceae	*Byrsonima variabilis*	0.50	0.16	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	2

Malpighiaceae	*Byrsonima verbascifolia*	0.50	-0.45	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	2
Malpighiaceae	*Heteropterys byrsonimifolia*	0.00	-0.25	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Heteropterys campestris*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	hot color	oil	30
Malpighiaceae	*Heteropterys pteropetala*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	hot color	oil	8
Malpighiaceae	*Heteropterys tomentosa*	0.00	-0.04	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Malpighia emarginata*	0.30	3.00	module hub	longitudinal	actinomorphic	open-disk	hot color	oil	8
Malpighiaceae	*Peixotoa goiana*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Peixotoa reticulata*	0.72	0.16	connector	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Peixotoa tomentosa*	0.46	0.77	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Pterandra pyroidea*	0.80	-0.25	connector	longitudinal	zygomorphic	open-disk	hot color	oil	8
Malpighiaceae	*Stigmaphyllon lalandianum*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malpighiaceae	*Diplopterys pubipetala*	0.28	0.36	peripheral	longitudinal	zygomorphic	open-disk	yellow	oil	8
Malvaceae	*Corchorus hirtus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	25
Malvaceae	*Pachira aquatica*	0.00	-0.25	peripheral	longitudinal	actinomorphic	brush	hot color	nectar	5
Malvaceae	*Pavonia kleinii*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	2
Malvaceae	*Pseudobombax grandiflorum*	0.00	-0.25	peripheral	longitudinal	actinomorphic	brush	white	nectar	4
Malvaceae	*Pseudobombax longiflorum*	0.55	0.77	peripheral	longitudinal	actinomorphic	brush	white	nectar	15
Malvaceae	*Pseudobombax tomentosum*	0.44	0.16	peripheral	longitudinal	actinomorphic	brush	white	nectar	15
Malvaceae	*Sida cordifolia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	9
Malvaceae	*Triumfetta bartramia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	9
Malvaceae	*Waltheria indica*	0.50	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	yellow	nectar	3
Malvaceae	*Wissadula hernandioides*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	1

Malvaceae	*Callianthe striata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	hot color	nectar	5
Malvaceae	*Ceiba pentandra*	0.00	-0.04	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	15
Malvaceae	*Ceiba speciosa*	0.00	-0.25	peripheral	longitudinal	actinomorphic	open-disk	hot color	nectar	5
Malvaceae	*Eriotheca gracilipes*	0.74	-0.25	connector	longitudinal	actinomorphic	open-disk	hot color	nectar	15
Malvaceae	*Eriotheca pubescens*	0.56	-0.04	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	4
Malvaceae	*Helicteres brevispira*	0.00	0.77	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	5
Malvaceae	*Helicteres sacarolha*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Malvaceae	*Luehea divaricata*	0.00	0.77	peripheral	longitudinal	actinomorphic	brush	cold color	nectar	15
Malvaceae	*Luehea grandiflora*	0.32	0.16	peripheral	longitudinal	actinomorphic	open-disk	cold color	nectar	5
Malvaceae	*Luehea paniculata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	5
Malvaceae	*Malvaviscus arboreus*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Marcgraviaceae	*Schwartzia adamantium*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	3
Melastomataceae	*Acisanthera quadrata*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	cold color	pollen	1
Melastomataceae	*Miconia albicans*	0.32	0.16	peripheral	poricidal	actinomorphic	open-disk	white	pollen	24
Melastomataceae	*Miconia burchellii*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	white	pollen	33
Melastomataceae	*Miconia chamissois*	0.67	0.16	connector	poricidal	actinomorphic	open-disk	white	pollen	1
Melastomataceae	*Microlicia laniflora*	0.51	0.57	peripheral	poricidal	actinomorphic	open-disk	white	plant tissue | pollen	4
Melastomataceae	*Mouriri elliptica*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	white	pollen	34
Melastomataceae	*Pleroma frigidulum*	0.00	-0.25	peripheral	poricidal	zygomorphic	open-disk	cold color	pollen	13
Melastomataceae	*Pleroma heteromallum*	-1.00	-0.45	peripheral	poricidal	zygomorphic	open-disk	cold color	pollen	13

Melastomataceae	*Pleroma martiale*	-1.00	-0.45	peripheral	poricidal	zygomorphic	open-disk	cold color	pollen	13
Melastomataceae	*Tococa guianensis*	0.42	-0.04	peripheral	poricidal	actinomorphic	open-disk	hot color	pollen	13
Melastomataceae	*Trembleya parviflora*	0.00	0.16	peripheral	poricidal	zygomorphic	open-disk	hot color	pollen	2
Melastomataceae	*Trembleya phlogiformis*	-1.00	-0.45	peripheral	poricidal	zygomorphic	open-disk	cold color	pollen	13
Melastomataceae	*Chaetogastra hieracioides*	0.00	-0.45	peripheral	poricidal	zygomorphic	open-disk	cold color	pollen	2
Melastomataceae	*Chaetogastra minor*	0.25	-0.45	peripheral	poricidal	zygomorphic	open-disk	cold color	pollen	2
Menispermaceae	*Cissampelos ovalifolia*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	7
Moraceae	*Brosimum gaudichaudii*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	17
Moraceae	*Ficus obtusifolia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	gullet	cold color	nectar	27
Myrtaceae	*Blepharocalyx salicifolius*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	nectar	1
Myrtaceae	*Myrcia bella*	0.68	-0.25	connector	longitudinal	asymmetric	brush	white	nectar	3
Myrtaceae	*Myrcia eriocalyx*	0.44	-0.25	peripheral	longitudinal	actinomorphic	brush	white	pollen	2
Myrtaceae	*Myrcia multiflora*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	pollen	15
Myrtaceae	*Myrcia splendens*	0.00	0.57	peripheral	longitudinal	actinomorphic	open-disk	white	pollen	1
Myrtaceae	*Myrcia tomentosa*	0.00	0.16	peripheral	longitudinal	actinomorphic	open-disk	white	pollen	1
Myrtaceae	*Syzygium jambos*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	nectar	5
Myrtaceae	*Callistemon linearis*	0.00	0.36	peripheral	longitudinal	actinomorphic	brush	hot color	nectar	5
Myrtaceae	*Campomanesia adamantium*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	21
Myrtaceae	*Campomanesia pubescens*	0.50	0.16	peripheral	poricidal	actinomorphic	brush	white	pollen	4
Myrtaceae	*Campomanesia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	7

	sessiliflora									
Myrtaceae	*Eucalyptus globulus*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	nectar	4
Myrtaceae	*Eugenia acutata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	nectar	3
Myrtaceae	*Eugenia aurata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	nectar	1
Myrtaceae	*Eugenia bimarginata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	brush	white	nectar	1
Nyctaginaceae	*Bougainvillea glabra*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	white	nectar	5
Nyctaginaceae	*Guapira noxia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	29
Ochnaceae	*Ouratea floribunda*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	yellow	pollen	4
Ochnaceae	*Ouratea hexasperma*	0.00	-0.25	peripheral	poricidal	actinomorphic	open-disk	yellow	pollen	4
Ochnaceae	*Ouratea semiserrata*	0.00	-0.25	peripheral	poricidal	actinomorphic	open-disk	yellow	pollen	2
Ochnaceae	*Ouratea spectabilis*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	yellow	pollen	1
Onagraceae	*Ludwigia nervosa*	0.52	-0.04	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	4
Onagraceae	*Ludwigia octovalvis*	0.25	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	13
Orchidaceae	*Campylocentrum micranthum*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	white	nectar	8
Orchidaceae	*Prosthechea pachysepala*	0.00	-0.45	peripheral	longitudinal	zygomorphic	gullet	white	nectar	2
Orobanchaceae	*Esterhazya macrodonta*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	6
Orobanchaceae	*Esterhazya splendida*	0.00	0.77	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Oxalidaceae	*Oxalis sellowii*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	nectar	7
Passifloraceae	*Passiflora cincinnata*	0.72	-0.25	connector	longitudinal	actinomorphic	open-disk	cold color	nectar	8
Passifloraceae	*Passiflora edulis*	0.75	1.18	connector	longitudinal	actinomorphic	open-disk	cold color	nectar	4
Passifloraceae	*Passiflora tenuifila*	0.50	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	2
Peraceae	*Pera glabrata*	0.44	0.16	peripheral	longitudinal	actinomorphic	lantern	cold color	nectar	1
Plantaginaceae	*Russelia equisetiformis*	0.00	0.36	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Poaceae	*Zea mays*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	hot color	pollen	1
Poaceae	*Loudetiopsis chrysothrix*	0.00	-0.45	peripheral	longitudinal	asymmetric	inconspicuous	hot color	pollen	2

Polygalaceae	*Asemeia violacea*	-1.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	cold color	nectar	13
Proteaceae	*Roupala montana*	0.00	0.16	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	14
Proteaceae	*Grevillea banksii*	0.00	-0.25	peripheral	longitudinal	zygomorphic	gullet	hot color	nectar	5
Rhamnaceae	*Rhamnidium elaeocarpum*	0.00	-0.45	peripheral	longitudinal	actinomorphic	gullet	white	nectar	37
Rhamnaceae	*Gouania latifolia*	0.00	0.36	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	1
Rosaceae	*Prunus myrtifolia*	0.00	-0.45	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	36
Rubiaceae	*Borreria capitata*	0.28	0.36	peripheral	longitudinal	actinomorphic	bell-shaped	white	pollen	2
Rubiaceae	*Borreria poaya*	0.25	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	cold color	nectar	13
Rubiaceae	*Borreria tenella*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	3
Rubiaceae	*Borreria verticillata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	9
Rubiaceae	*Cordiera humilis*	0.44	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	24
Rubiaceae	*Coussarea hydrangeifolia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	5
Rubiaceae	*Manettia cordifolia*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Rubiaceae	*Mussaenda alicia*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	5
Rubiaceae	*Mussaenda erythrophylla*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	5
Rubiaceae	*Palicourea coriacea*	0.69	-0.45	connector	longitudinal	actinomorphic	tube	white	nectar	3
Rubiaceae	*Palicourea crocea*	0.69	-0.04	connector	longitudinal	actinomorphic	tube	yellow	nectar	8
Rubiaceae	*Palicourea deflexa*	0.63	-0.25	connector	longitudinal	actinomorphic	tube	white	nectar	8
Rubiaceae	*Palicourea hoffmannseggiana*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	8
Rubiaceae	*Palicourea macrobotrys*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	5
Rubiaceae	*Palicourea marcgravii*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	5
Rubiaceae	*Palicourea officinalis*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	hot color	nectar	5
Rubiaceae	*Palicourea prunifolia*	0.67	0.16	connector	longitudinal	actinomorphic	tube	white	nectar	9

Rubiaceae	*Palicourea rigida*	0.69	1.99	connector	longitudinal	actinomorphic	tube	hot color | yellow	nectar	5
Rubiaceae	*Palicourea tenerior*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Rubiaceae	*Palicourea trichophora*	0.32	0.16	peripheral	longitudinal	actinomorphic	tube	white	nectar	8
Rubiaceae	*Palicourea violacea*	0.50	0.16	peripheral	longitudinal	actinomorphic	tube	white	nectar	8
Rubiaceae	*Posoqueria latifolia*	0.00	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Rubiaceae	*Richardia grandiflora*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	hot color	nectar	9
Rubiaceae	*Sipanea pratensis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Rubiaceae	*Tocoyena formosa*	0.00	1.38	peripheral	longitudinal	actinomorphic	tube	white	nectar	15
Rubiaceae	*Amaioua guianensis*	0.56	-0.25	peripheral	longitudinal	actinomorphic	tube	white	nectar	8
Rubiaceae	*Declieuxia cordigera*	-1.00	-0.25	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	13
Rubiaceae	*Declieuxia fruticosa*	0.49	0.57	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Rubiaceae	*Emmeorhiza umbellata*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	white	nectar	1
Rubiaceae	*Faramea hyacinthina*	0.36	-0.04	peripheral	longitudinal	actinomorphic	tube	white	nectar	13
Rubiaceae	*Galianthe angustifolia*	0.28	0.36	peripheral	longitudinal	actinomorphic	tube	white	nectar	13
Rubiaceae	*Galianthe brasiliensis*	0.24	0.57	peripheral	longitudinal	actinomorphic	tube	white	nectar	2
Rubiaceae	*Galianthe lanceifolia*	0.38	-0.04	peripheral	longitudinal	actinomorphic	tube	white	nectar	7
Rubiaceae	*Guettarda viburnoides*	0.00	3.82	module hub	longitudinal	actinomorphic	tube	white	nectar	15
Rubiaceae	*Psychotria nitidula*	0.72	0.16	connector	longitudinal	actinomorphic	tube	white	nectar	9
Rutaceae	*Citrus × limon*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	9
Rutaceae	*Hortia brasiliana*	0.18	1.18	peripheral	longitudinal	actinomorphic	bell-shaped	hot color	nectar	3
Sapindaceae	*Serjania caracasana*	0.67	-0.04	connector	longitudinal	actinomorphic	gullet	white	nectar	3
Sapindaceae	*Serjania erecta*	0.47	1.18	peripheral	longitudinal	actinomorphic	gullet	white	nectar	15
Sapindaceae	*Serjania laruotteana*	0.00	-0.25	peripheral	longitudinal	actinomorphic	gullet	white	nectar	1
Sapindaceae	*Serjania reticulata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	gullet	white	nectar	9

Sapindaceae	*Matayba guianensis*	0.57	8.08	module hub	longitudinal	actinomorphic	open-disk	white	nectar	1
Sapotaceae	*Chrysophyllum marginatum*	0.57	0.16	peripheral	longitudinal	actinomorphic	inconspicuous	white	nectar	1
Sapotaceae	*Pouteria ramiflora*	0.38	-0.04	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	2
Sapotaceae	*Pouteria torta*	0.50	-0.45	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	3
Simaroubaceae	*Simarouba versicolor*	0.50	-0.45	peripheral	longitudinal	actinomorphic	open-disk	cold color	nectar	9
Solanaceae	*Calibrachoa elegans*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	20
Solanaceae	*Cestrum schlechtendalii*	0.00	0.16	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	15
Solanaceae	*Solanum aculeatissimum*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	cold color	pollen	2
Solanaceae	*Solanum lycocarpum*	0.69	1.58	connector	poricidal	actinomorphic	open-disk	cold color	pollen	8
Solanaceae	*Solanum lycopersicum*	0.70	0.57	connector	poricidal	actinomorphic	open-disk	yellow	pollen	4
Solanaceae	*Solanum melissarum*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	white	fragance	4
Solanaceae	*Solanum paniculatum*	0.63	-0.25	connector	poricidal	actinomorphic	open-disk	cold color	pollen	1
Solanaceae	*Solanum pseudocapsicum*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	white	pollen	2
Solanaceae	*Solanum swartzianum*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	white	pollen	2
Solanaceae	*Solanum viarum*	0.00	-0.45	peripheral	poricidal	actinomorphic	open-disk	white	pollen	2
Strelitziaceae	*Strelitzia reginae*	0.00	-0.25	peripheral	longitudinal	zygomorphic	tube	hot color	nectar	5
Styracaceae	*Styrax camporum*	0.00	-0.45	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	9
Styracaceae	*Styrax ferrugineus*	0.51	0.57	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	5
Styracaceae	*Styrax pohlii*	0.00	-0.25	peripheral	longitudinal	actinomorphic	open-disk	white	nectar	5
Theaceae	*Laplacea fruticosa*	0.44	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	white	nectar	2
Turneraceae	*Turnera subulata*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	white | yellow	pollen	9
Urticaceae	*Cecropia pachystachya*	0.44	-0.25	peripheral	longitudinal	actinomorphic	inconspicuous	yellow	nectar	1
Urticaceae	*Cecropia saxatilis*	0.00	-0.45	peripheral	longitudinal	actinomorphic	inconspicuous	yellow	nectar	23

Velloziaceae	*Vellozia albiflora*	0.00	-0.45	peripheral	longitudinal	actinomorphic	bell-shaped	cold color	nectar	1
Velloziaceae	*Barbacenia flava*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	yellow	nectar	2
Velloziaceae	*Barbacenia lymansmithii*	0.00	-0.45	peripheral	longitudinal	actinomorphic	tube	white	nectar	5
Verbenaceae	*Stachytarpheta gesnerioides*	0.00	-0.04	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	5
Verbenaceae	*Lantana camara*	0.00	-0.04	peripheral	longitudinal	actinomorphic	tube	cold color | hot color | white | yellow	nectar	5
Verbenaceae	*Verbena hirta*	0.16	0.77	peripheral	longitudinal	actinomorphic	tube	cold color	nectar	13
Violaceae	*Viola cerasifolia*	0.00	-0.45	peripheral	longitudinal	zygomorphic	tube	cold color	nectar	42
Vitaceae	*Cissus erosa*	0.00	-0.25	peripheral	longitudinal	actinomorphic	open-disk	hot color	nectar	7
Vochysiaceae	*Qualea cordata*	0.00	0.16	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	5
Vochysiaceae	*Qualea grandiflora*	0.29	2.39	peripheral	longitudinal	zygomorphic	open-disk	yellow	nectar	15
Vochysiaceae	*Qualea multiflora*	0.72	1.78	connector	longitudinal	zygomorphic	open-disk	yellow	nectar	5
Vochysiaceae	*Qualea parviflora*	0.72	1.99	connector	longitudinal	zygomorphic	open-disk	hot color	nectar	8
Vochysiaceae	*Salvertia convallariodora*	0.51	0.97	peripheral	longitudinal	zygomorphic	open-disk	white	nectar	15
Vochysiaceae	*Vochysia cinnamomea*	0.59	1.18	peripheral	longitudinal	zygomorphic	trumpet-shaped	yellow	nectar	5
Vochysiaceae	*Vochysia elliptica*	0.38	-0.04	peripheral	longitudinal	zygomorphic	trumpet-shaped	yellow	nectar	4
Vochysiaceae	*Vochysia pumila*	0.00	-0.25	peripheral	longitudinal	zygomorphic	trumpet-shaped	yellow	nectar	4
Vochysiaceae	*Vochysia pyramidalis*	0.52	-0.04	peripheral	longitudinal	zygomorphic	trumpet-shaped	yellow	nectar	5
Vochysiaceae	*Vochysia rufa*	0.50	-0.45	peripheral	longitudinal	zygomorphic	trumpet-shaped	yellow	nectar	8
Vochysiaceae	*Vochysia thyrsoidea*	0.65	1.38	connector	longitudinal	zygomorphic	trumpet-shaped	yellow	nectar	4

Vochysiaceae	*Vochysia tucanorum*	0.66	0.97	connector	longitudinal	zygomorphic	trumpet-shaped	yellow	nectar	5
Xyridaceae	*Xyris asperula*	0.00	-0.25	peripheral	longitudinal	actinomorphic	open-disk	yellow	pollen	2
Xyridaceae	*Xyris jupicai*	0.28	0.36	peripheral	longitudinal	actinomorphic	open-disk	yellow	pollen	1
Xyridaceae	*Xyris tortula*	0.25	-0.45	peripheral	longitudinal	actinomorphic	open-disk	yellow	pollen	13
Zingiberaceae	*Hedychium coronarium*	0.00	-0.04	peripheral	longitudinal	zygomorphic	gullet	white	nectar	15

Table S2. List of floral visitor species included in the Cerrado plant–floral visitor metanetwork, with functional group and module assignment.

Family	Species	*c*	*z*	Role specie	Functional group	Module
Apidae	*Acamptopoeum prinii*	0.00	-0.45	peripheral	Generalist bee	4
Apidae	*Acanthopus excellens*	0.00	-0.45	peripheral	Generalist bee	4
Apidae	*Acanthopus superba*	0.00	-0.45	peripheral	Generalist bee	5
Apidae	*Alepidosceles imitatrix*	0.44	-0.25	peripheral	Generalist bee	4
Apidae	*Anthidium sertanicola*	0.00	-0.25	peripheral	Generalist bee	13
Apidae	*Anthodioctes megachiloides*	0.00	0.16	peripheral	Generalist bee	1
Apidae	*Apis mellifera*	0.82	10.93	network hub	Generalist bee	1
Apidae	*Augochlora caerulior*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Augochlora esox*	0.38	-0.04	peripheral	Buzz-pollinating bee	3
Apidae	*Augochlora michaelis*	0.00	-0.45	peripheral	Buzz-pollinating bee	18
Apidae	*Augochlora semiramis*	0.00	-0.25	peripheral	Buzz-pollinating bee	1
Apidae	*Augochlora thalia*	0.00	-0.25	peripheral	Buzz-pollinating bee	1
Apidae	*Augochlorella ephyra*	0.50	-0.45	peripheral	Buzz-pollinating bee	3
Apidae	*Augochlorodes turrifaciens*	0.00	-0.45	peripheral	Buzz-pollinating bee	42
Apidae	*Augochloropsis aphrodite*	0.00	0.16	peripheral	Buzz-pollinating bee	4
Apidae	*Augochloropsis aurifluens*	0.44	-0.25	peripheral	Buzz-pollinating bee	1
Apidae	*Augochloropsis brachycephala*	0.50	-0.45	peripheral	Buzz-pollinating bee	13
Apidae	*Augochloropsis callichroa*	0.50	-0.25	peripheral	Buzz-pollinating bee	1
Apidae	*Augochloropsis cleopatra*	0.00	-0.45	peripheral	Buzz-pollinating bee	18
Apidae	*Augochloropsis cognata*	0.36	1.58	peripheral	Buzz-pollinating bee	2
Apidae	*Augochloropsis cupreola*	0.24	0.57	peripheral	Buzz-pollinating bee	4
Apidae	*Augochloropsis cyanea*	0.23	1.99	peripheral	Buzz-pollinating bee	2
Apidae	*Augochloropsis euphrosyne*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Augochloropsis heterochroa*	0.00	0.16	peripheral	Buzz-pollinating bee	7

Apidae	*Augochloropsis iris*	0.00	-0.25	peripheral	Buzz-pollinating bee	2
Apidae	*Augochloropsis patens*	0.45	0.36	peripheral	Buzz-pollinating bee	1
Apidae	*Augochloropsis semele*	0.17	1.38	peripheral	Buzz-pollinating bee	7
Apidae	*Augochloropsis smithiana*	0.58	0.77	peripheral	Buzz-pollinating bee	3
Apidae	*Augochloropsis wallacei*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Austrostelis silveirai*	0.00	-0.45	peripheral	Generalist bee	3
Apidae	*Bombus brasiliensis*	0.00	0.57	peripheral	Buzz-pollinating bee	13
Apidae	*Bombus brevivillus*	0.67	-0.04	connector	Buzz-pollinating bee	8
Apidae	*Bombus morio*	0.81	1.99	connector	Buzz-pollinating bee	13
Apidae	*Bombus pauloensis*	0.77	2.60	network hub	Buzz-pollinating bee	13
Apidae	*Centris aenea*	0.57	1.78	peripheral	Oil-collecting bee	8
Apidae	*Centris albopilosa*	0.00	-0.25	peripheral	Oil-collecting bee	4
Apidae	*Centris analis*	0.51	0.97	peripheral	Oil-collecting bee	8
Apidae	*Centris bicolor*	0.24	0.57	peripheral	Oil-collecting bee	8
Apidae	*Centris burgdorfi*	0.00	-0.25	peripheral	Oil-collecting bee	13
Apidae	*Centris collaris*	0.00	0.16	peripheral	Oil-collecting bee	8
Apidae	*Centris decolorata*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Centris dentata*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Centris denudans*	0.38	-0.04	peripheral	Oil-collecting bee	8
Apidae	*Centris discolor*	0.63	-0.25	connector	Oil-collecting bee	4
Apidae	*Centris dorsata*	0.00	-0.04	peripheral	Oil-collecting bee	8
Apidae	*Centris flavifrons*	0.58	0.97	peripheral	Oil-collecting bee	8
Apidae	*Centris fuscata*	0.69	0.36	connector	Oil-collecting bee	4
Apidae	*Centris insularis*	0.00	-0.45	peripheral	Oil-collecting bee	2
Apidae	*Centris klugii*	0.28	0.36	peripheral	Oil-collecting bee	2
Apidae	*Centris longimana*	0.24	0.57	peripheral	Oil-collecting bee	8
Apidae	*Centris lutea*	0.00	-0.25	peripheral	Oil-collecting bee	4

Apidae	*Centris machadoi*	0.50	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Centris maranhensis*	0.00	-0.25	peripheral	Oil-collecting bee	8
Apidae	*Centris mocsaryi*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Centris nitens*	0.44	0.16	peripheral	Oil-collecting bee	4
Apidae	*Centris obsoleta*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Centris poecila*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Centris scopipes*	0.31	3.00	module hub	Oil-collecting bee	8
Apidae	*Centris similis*	0.50	-0.45	peripheral	Oil-collecting bee	4
Apidae	*Centris spilopoda*	0.20	0.97	peripheral	Oil-collecting bee	8
Apidae	*Centris sponsa*	0.32	0.16	peripheral	Oil-collecting bee	8
Apidae	*Centris tarsata*	0.68	1.18	connector	Oil-collecting bee	8
Apidae	*Centris trigonoides*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Centris varia*	0.31	1.18	peripheral	Oil-collecting bee	8
Apidae	*Centris violacea*	0.00	-0.04	peripheral	Oil-collecting bee	4
Apidae	*Centris vittata*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Centris xanthomelaena*	0.00	-0.45	peripheral	Oil-collecting bee	2
Apidae	*Cephalotrigona capitata*	0.50	-0.45	peripheral	Generalist bee	3
Apidae	*Ceratalictus clonius*	0.20	2.60	module hub	Buzz-pollinating bee	7
Apidae	*Ceratalictus theius*	0.00	-0.45	peripheral	Buzz-pollinating bee	18
Apidae	*Ceratina asuncionis*	0.69	-0.04	connector	Buzz-pollinating bee	2
Apidae	*Ceratina gossypii*	0.00	-0.45	peripheral	Buzz-pollinating bee	3
Apidae	*Ceratina maculifrons*	0.00	-0.45	peripheral	Buzz-pollinating bee	3
Apidae	*Ceratina morrensis*	0.00	-0.45	peripheral	Buzz-pollinating bee	24
Apidae	*Coelioxys simillimus*	0.00	-0.45	peripheral	Generalist bee	1
Apidae	*Colletes meridionalis*	0.50	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Colletes petropolitanus*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Ctenioschelus goryi*	0.00	-0.45	peripheral	Generalist bee	5

Apidae	*Dialictus opacus*	0.00	-0.45	peripheral	Generalist bee	3
Apidae	*Epanthidium anisitsi*	0.00	-0.45	peripheral	Generalist bee	3
Apidae	*Epanthidium aureocinctum*	0.00	-0.45	peripheral	Generalist bee	8
Apidae	*Epanthidium autumnale*	0.00	-0.45	peripheral	Generalist bee	13
Apidae	*Epicharis affinis*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Epicharis albofasciata*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Epicharis analis*	0.69	0.36	connector	Oil-collecting bee	4
Apidae	*Epicharis bicolor*	0.57	0.57	peripheral	Oil-collecting bee	4
Apidae	*Epicharis cockerelli*	0.63	0.16	connector	Oil-collecting bee	8
Apidae	*Epicharis dejeanii*	0.44	-0.25	peripheral	Oil-collecting bee	5
Apidae	*Epicharis flava*	0.59	3.82	module hub	Oil-collecting bee	8
Apidae	*Epicharis iheringi*	0.44	-0.25	peripheral	Oil-collecting bee	8
Apidae	*Epicharis maculata*	0.44	-0.25	peripheral	Oil-collecting bee	8
Apidae	*Epicharis nigrita*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Epicharis xanthogastra*	0.00	-0.25	peripheral	Oil-collecting bee	8
Apidae	*Eufriesea auriceps*	0.50	-0.45	peripheral	Fragrance-collecting bee	8
Apidae	*Eufriesea nordestina*	0.00	-0.45	peripheral	Fragrance-collecting bee	2
Apidae	*Eufriesea violascens*	0.00	0.36	peripheral	Fragrance-collecting bee	4
Apidae	*Euglossa cordata*	0.38	-0.04	peripheral	Fragrance-collecting bee	4
Apidae	*Euglossa imperialis*	0.00	-0.45	peripheral	Fragrance-collecting bee	9
Apidae	*Euglossa melanotricha*	0.41	0.57	peripheral	Fragrance-collecting bee	4
Apidae	*Euglossa townsendi*	0.44	-0.25	peripheral	Fragrance-collecting	24

					bee	
Apidae	*Eulaema cingulata*	0.50	-0.45	peripheral	Fragrance-collecting bee	8
Apidae	*Eulaema nigrita*	0.72	2.19	connector	Fragrance-collecting bee	4
Apidae	*Exomalopsis analis*	0.64	0.57	connector	Buzz-pollinating bee	1
Apidae	*Exomalopsis auropilosa*	0.56	-0.04	peripheral	Buzz-pollinating bee	1
Apidae	*Exomalopsis campestris*	0.32	0.16	peripheral	Buzz-pollinating bee	7
Apidae	*Exomalopsis collaris*	0.00	-0.45	peripheral	Buzz-pollinating bee	8
Apidae	*Exomalopsis fulvofasciata*	0.73	1.58	connector	Buzz-pollinating bee	4
Apidae	*Exomalopsis minor*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Exomalopsis tomentosa*	0.00	-0.25	peripheral	Buzz-pollinating bee	1
Apidae	*Exomalopsis ypirangensis*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Frieseomelitta doederleini*	0.44	-0.25	peripheral	Generalist bee	1
Apidae	*Frieseomelitta flavicornis*	0.44	-0.45	peripheral	Generalist bee	4
Apidae	*Frieseomelitta portoi*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Frieseomelitta silvestrii*	0.00	-0.45	peripheral	Generalist bee	8
Apidae	*Frieseomelitta varia*	0.67	-0.04	connector	Generalist bee	4
Apidae	*Gaesischia nigra*	0.00	-0.45	peripheral	Generalist bee	39
Apidae	*Geotrigona mombuca*	0.74	-0.04	connector	Generalist bee	7
Apidae	*Geotrigona subterranea*	0.00	-0.45	peripheral	Generalist bee	3
Apidae	*Hexantheda missionica*	0.00	-0.45	peripheral	Buzz-pollinating bee	20
Apidae	*Hopliophora superba*	0.00	-0.25	peripheral	Generalist bee	4
Apidae	*Larocanthidium fasciatum*	0.00	-0.45	peripheral	Generalist bee	7
Apidae	*Leurotrigona muelleri*	0.44	-0.25	peripheral	Generalist bee	1
Apidae	*Lophopedia nigrispinis*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Lophopedia pygmaea*	0.24	0.57	peripheral	Oil-collecting bee	8

Apidae	*Lophopedia savanicola*	0.00	-0.25	peripheral	Oil-collecting bee	9
Apidae	*Lophornis magnificus*	0.00	0.16	peripheral	Generalist bee	5
Apidae	*Megachile brethesi*	0.00	-0.45	peripheral	Generalist bee	7
Apidae	*Megachile curvipes*	0.00	-0.45	peripheral	Generalist bee	1
Apidae	*Megachile diasi*	0.00	-0.25	peripheral	Generalist bee	7
Apidae	*Megachile frankieana*	0.44	-0.25	peripheral	Generalist bee	3
Apidae	*Megachile gracilis*	0.00	-0.45	peripheral	Generalist bee	1
Apidae	*Megachile iheringi*	0.00	0.16	peripheral	Generalist bee	2
Apidae	*Megachile laeta*	0.50	0.16	peripheral	Generalist bee	3
Apidae	*Megachile maculata*	0.00	-0.25	peripheral	Generalist bee	13
Apidae	*Megachile paulistana*	0.00	-0.45	peripheral	Generalist bee	1
Apidae	*Megachile rubricata*	0.50	-0.45	peripheral	Generalist bee	5
Apidae	*Megachile terrestris*	0.50	-0.45	peripheral	Generalist bee	2
Apidae	*Megachile verrucosa*	0.00	-0.45	peripheral	Generalist bee	25
Apidae	*Megalopta aegis*	0.00	-0.25	peripheral	Buzz-pollinating bee	15
Apidae	*Megalopta amoena*	0.00	-0.25	peripheral	Buzz-pollinating bee	15
Apidae	*Melipona bicolor*	0.15	1.58	peripheral	Buzz-pollinating bee	2
Apidae	*Melipona fasciculata*	0.00	-0.45	peripheral	Buzz-pollinating bee	4
Apidae	*Melipona fuliginosa*	0.00	-0.45	peripheral	Buzz-pollinating bee	24
Apidae	*Melipona marginata*	0.00	-0.45	peripheral	Buzz-pollinating bee	7
Apidae	*Melipona melanoventer*	0.00	-0.45	peripheral	Buzz-pollinating bee	24
Apidae	*Melipona quadrifasciata*	0.66	0.16	connector	Buzz-pollinating bee	2
Apidae	*Melipona quinquefasciata*	0.78	-0.04	connector	Buzz-pollinating bee	4
Apidae	*Melipona rufiventris*	0.44	-0.25	peripheral	Buzz-pollinating bee	1
Apidae	*Melipona seminigra*	0.00	-0.45	peripheral	Buzz-pollinating bee	24
Apidae	*Melipona trinofaciata*	0.00	-0.45	peripheral	Buzz-pollinating bee	4
Apidae	*Melissodes nigroaenea*	0.00	-0.45	peripheral	Generalist bee	4

Apidae	*Melissoptila aureocincta*	0.00	-0.45	peripheral	Generalist bee	13
Apidae	*Melissoptila minarum*	0.00	-0.25	peripheral	Generalist bee	1
Apidae	*Mesonychium coerulescens*	0.38	-0.04	peripheral	Generalist bee	13
Apidae	*Mesoplia friesei*	0.00	-0.25	peripheral	Generalist bee	4
Apidae	*Mesoplia rufipes*	0.00	-0.45	peripheral	Generalist bee	4
Apidae	*Monoeca brasiliensis*	0.00	-0.25	peripheral	Oil-collecting bee	8
Apidae	*Nannotrigona melanocera*	0.00	-0.45	peripheral	Generalist bee	4
Apidae	*Nannotrigona testaceicornis*	0.00	-0.25	peripheral	Generalist bee	1
Apidae	*Oxaea austera*	0.00	-0.45	peripheral	Buzz-pollinating bee	4
Apidae	*Oxaea flavescens*	0.82	0.77	connector	Buzz-pollinating bee	3
Apidae	*Oxaea mourei*	0.00	-0.45	peripheral	Buzz-pollinating bee	21
Apidae	*Oxytrigona flaveola*	0.00	-0.45	peripheral	Generalist bee	4
Apidae	*Paratetrapedia connexa*	0.00	-0.45	peripheral	Oil-collecting bee	1
Apidae	*Paratetrapedia flaveola*	0.00	-0.25	peripheral	Oil-collecting bee	8
Apidae	*Paratetrapedia iheringii*	0.67	-0.45	connector	Oil-collecting bee	24
Apidae	*Paratetrapedia larocai*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Paratetrapedia leucostoma*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Paratetrapedia lugubris*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Paratetrapedia punctata*	0.00	-0.45	peripheral	Oil-collecting bee	30
Apidae	*Paratetrapedia pygmaea*	0.00	-0.25	peripheral	Oil-collecting bee	13
Apidae	*Paratetrapedia testacea*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Paratetrapedia xanthopoda*	0.00	0.16	peripheral	Oil-collecting bee	4
Apidae	*Paratrigona lineata*	0.81	1.38	connector	Generalist bee	4
Apidae	*Paratrigona subnuda*	0.00	-0.04	peripheral	Generalist bee	2
Apidae	*Paroxystoglossa jocasta*	0.00	-0.45	peripheral	Buzz-pollinating bee	2
Apidae	*Paroxystoglossa mimetica*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Partamona ailyae*	0.00	-0.45	peripheral	Generalist bee	24

Apidae	*Partamona auripenis*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Partamona combinata*	0.00	-0.45	peripheral	Generalist bee	1
Apidae	*Partamona cupira*	0.00	-0.04	peripheral	Generalist bee	4
Apidae	*Partamona helleri*	0.00	-0.45	peripheral	Generalist bee	1
Apidae	*Partamona rustica*	0.24	3.41	module hub	Generalist bee	9
Apidae	*Partamona vicina*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Plebeia droryana*	0.67	-0.45	connector	Generalist bee	2
Apidae	*Plebeia remota*	0.00	-0.45	peripheral	Generalist bee	1
Apidae	*Plebeia saiqui*	0.22	0.77	peripheral	Generalist bee	2
Apidae	*Pseudagapostemon cyaneus*	0.00	-0.25	peripheral	Generalist bee	2
Apidae	*Pseudaugochlora flammula*	0.00	-0.45	peripheral	Buzz-pollinating bee	4
Apidae	*Pseudaugochlora graminea*	0.44	-0.25	peripheral	Buzz-pollinating bee	13
Apidae	*Pseudaugochlora pandora*	0.00	-0.25	peripheral	Buzz-pollinating bee	1
Apidae	*Pseudaugochloropsis graminea*	0.32	0.16	peripheral	Buzz-pollinating bee	4
Apidae	*Ptiloglossa latecalcarata*	0.00	-0.45	peripheral	Buzz-pollinating bee	15
Apidae	*Ptiloglossa matutina*	0.00	-0.45	peripheral	Buzz-pollinating bee	15
Apidae	*Ptiloglossa pretiosa*	0.00	-0.45	peripheral	Buzz-pollinating bee	15
Apidae	*Ptiloglossa stafuzzai*	0.00	-0.45	peripheral	Buzz-pollinating bee	15
Apidae	*Ptiloglossa xanthotricha*	0.00	-0.45	peripheral	Buzz-pollinating bee	15
Apidae	*Rhathymus bicolor*	0.00	-0.45	peripheral	Generalist bee	8
Apidae	*Rhinocorynura crotonis*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Rhinocorynura vernoniae*	0.00	-0.45	peripheral	Buzz-pollinating bee	7
Apidae	*Scaptotrigona bipunctata*	0.50	-0.45	peripheral	Generalist bee	2
Apidae	*Scaptotrigona depilis*	0.00	0.16	peripheral	Generalist bee	1
Apidae	*Scaptotrigona polysticta*	0.44	-0.25	peripheral	Generalist bee	1
Apidae	*Scaptotrigona postica*	0.64	-0.25	connector	Generalist bee	4
Apidae	*Schwarziana mourei*	0.00	-0.45	peripheral	Generalist bee	1

Apidae	*Schwarziana quadripunctata*	0.00	0.36	peripheral	Generalist bee	2
Apidae	*Schwarzula timida*	0.00	-0.04	peripheral	Generalist bee	1
Apidae	*Temnosoma metallicum*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Tetragona clavipes*	0.68	0.36	connector	Generalist bee	4
Apidae	*Tetragona quadrangula*	0.00	-0.25	peripheral	Generalist bee	8
Apidae	*Tetragonisca angustula*	0.77	-0.25	connector	Generalist bee	15
Apidae	*Tetragonisca fiebrigi*	0.00	-0.25	peripheral	Generalist bee	3
Apidae	*Tetrapedia angustula*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Tetrapedia curvitarsis*	0.00	0.16	peripheral	Oil-collecting bee	8
Apidae	*Tetrapedia diversipes*	0.24	0.57	peripheral	Oil-collecting bee	8
Apidae	*Tetrapedia imitatrix*	0.38	-0.04	peripheral	Oil-collecting bee	8
Apidae	*Tetrapedia peckoltii*	0.00	0.36	peripheral	Oil-collecting bee	8
Apidae	*Tetrapedia rugulosa*	0.00	0.57	peripheral	Oil-collecting bee	4
Apidae	*Thalestria spinosa*	0.44	-0.25	peripheral	Generalist bee	3
Apidae	*Thectochlora alaris*	0.56	-0.04	peripheral	Buzz-pollinating bee	1
Apidae	*Thectochlora brachycera*	0.00	-0.45	peripheral	Buzz-pollinating bee	1
Apidae	*Thygater analis*	0.00	-0.25	peripheral	Generalist bee	5
Apidae	*Thygater palliventris*	0.00	-0.45	peripheral	Generalist bee	13
Apidae	*Trigona amalthea*	0.50	-0.45	peripheral	Generalist bee	3
Apidae	*Trigona amazonensis*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Trigona branneri*	0.50	-0.45	peripheral	Generalist bee	8
Apidae	*Trigona braueri*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Trigona chanchamayoensis*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Trigona dallatorreana*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Trigona fulviventris*	0.00	-0.25	peripheral	Generalist bee	8
Apidae	*Trigona fuscipennis*	0.00	-0.25	peripheral	Generalist bee	8
Apidae	*Trigona guianae*	0.00	-0.45	peripheral	Generalist bee	4

Apidae	*Trigona hyalinata*	0.86	-0.25	connector	Generalist bee	1
Apidae	*Trigona meridionalis*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Trigona pallens*	0.44	-0.25	peripheral	Generalist bee	8
Apidae	*Trigona recursa*	0.50	0.16	peripheral	Generalist bee	24
Apidae	*Trigona spinipes*	0.82	4.83	network hub	Generalist bee	3
Apidae	*Trigonisca intermedia*	0.00	-0.25	peripheral	Generalist bee	8
Apidae	*Trigonisca pediculana*	0.00	-0.45	peripheral	Generalist bee	8
Apidae	*Trigonisca pseudogreaffii*	0.00	-0.45	peripheral	Generalist bee	18
Apidae	*Trigonisca vitrifrons*	0.00	-0.45	peripheral	Generalist bee	24
Apidae	*Tropidopedia carinata*	0.00	-0.45	peripheral	Generalist bee	8
Apidae	*Tropidopedia flavolineata*	0.00	-0.04	peripheral	Generalist bee	8
Apidae	*Tropidopedia nigrocarinata*	0.00	-0.45	peripheral	Generalist bee	8
Apidae	*Tropidopedia punctifrons*	0.00	-0.45	peripheral	Generalist bee	8
Apidae	*Xanthopedia globulosa*	0.00	-0.45	peripheral	Oil-collecting bee	8
Apidae	*Xanthopedia larocai*	0.00	-0.25	peripheral	Oil-collecting bee	8
Apidae	*Xylocopa bimaculata*	0.00	-0.45	peripheral	Buzz-pollinating bee	4
Apidae	*Xylocopa bruesi*	0.72	0.77	connector	Buzz-pollinating bee	13
Apidae	*Xylocopa cearensis*	0.00	-0.45	peripheral	Buzz-pollinating bee	24
Apidae	*Xylocopa fimbriata*	0.00	-0.45	peripheral	Buzz-pollinating bee	3
Apidae	*Xylocopa frontalis*	0.64	1.38	connector	Buzz-pollinating bee	4
Apidae	*Xylocopa grisescens*	0.72	0.97	connector	Buzz-pollinating bee	4
Apidae	*Xylocopa hirsutissima*	0.77	0.57	connector	Buzz-pollinating bee	3
Apidae	*Xylocopa muscaria*	0.00	-0.45	peripheral	Buzz-pollinating bee	24
Apidae	*Xylocopa nogueirai*	0.00	-0.45	peripheral	Buzz-pollinating bee	5
Apidae	*Xylocopa ordinaria*	0.00	-0.25	peripheral	Buzz-pollinating bee	8
Apidae	*Xylocopa subcyanea*	0.61	-0.04	peripheral	Buzz-pollinating bee	5
Apidae	*Xylocopa suspecta*	0.72	-0.25	connector	Buzz-pollinating bee	9

Apidae	*Xylocopa truxali*	0.00	-0.45	peripheral	Buzz-pollinating bee	4
Calliphoridae	*Chloroprocta idioidea*	0.00	-0.45	peripheral	Fly	1
Calliphoridae	*Chrysomya albiceps*	0.00	-0.25	peripheral	Fly	1
Calliphoridae	*Chrysomya megacephala*	0.38	-0.04	peripheral	Fly	1
Calliphoridae	*Chrysomya putoria*	0.00	-0.45	peripheral	Fly	3
Calliphoridae	*Lucilia eximia*	0.00	-0.04	peripheral	Fly	1
Calliphoridae	*Phaenicia eximia*	0.00	-0.45	peripheral	Fly	2
Cantharidae	*Discodon tucumanum*	0.00	-0.45	peripheral	Beetle	2
Cerambycidae	*Paratenthras martinsi*	0.00	-0.45	peripheral	Beetle	3
Chrysomelidae	*Diabrotica speciosa*	0.00	-0.25	peripheral	Beetle	1
Chrysomelidae	*Megalostomis gigas*	0.00	-0.45	peripheral	Beetle	4
Chrysomelidae	*Megalostomis glossa*	0.00	-0.45	peripheral	Beetle	4
Chrysopidae	*Chrysoperla externa*	0.00	-0.45	peripheral	Beetle	1
Coccinellidae	*Cycloneda sanguinea*	0.00	-0.45	peripheral	Beetle	1
Columbidae	*Leptotila verreauxi*	0.00	-0.45	peripheral	Other bird	11
Columbidae	*Patagioenas picazuro*	0.00	-0.45	peripheral	Other bird	40
Crabronidae	*Bicyrtes paranae*	0.00	-0.45	peripheral	Wasp	13
Crabronidae	*Pryonyx thomaz*	0.00	-0.45	peripheral	Wasp	2
Crambidae	*Sameodes phyllisalis*	0.00	-0.25	peripheral	Moth	14
Crambidae	*Syngamia florella*	0.00	-0.45	peripheral	Moth	1
Curculionidae	*Anchylorhynchus bicolor*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Anchylorhynchus campestris*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Anchylorhynchus camposi*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Angelocentris schubarti*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Cryptobaris sulcata*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Groatus roticollis*	0.00	-0.45	peripheral	Beetle	7
Curculionidae	*Groatus rufipennis*	0.00	-0.45	peripheral	Beetle	7

Curculionidae	*Hustachea campestris*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Ladustes speciosus*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Microstrates cocoscampestris*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Microstrates rufus*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Palmocentrinus lucidulus*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Parapantomorus flexuosus*	0.00	-0.45	peripheral	Beetle	7
Curculionidae	*Parisoschoenus plagiatus*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Petalochilus lineolatus*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Revena rubiginosa*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Rhinochenus brevicollis*	0.00	-0.45	peripheral	Beetle	43
Curculionidae	*Tripusus leiospathae*	0.00	-0.45	peripheral	Beetle	18
Curculionidae	*Udeus cerradensis*	0.00	-0.45	peripheral	Beetle	23
Drosophilidae	*Drosophila melanogaster*	0.00	-0.45	peripheral	Fly	3
Emberizidae	*Volatinia jacarina*	0.00	-0.45	peripheral	Other bird	3
Erebidae	*Cyclopis caecutiens*	0.00	-0.45	peripheral	Moth	15
Erebidae	*Epidromia zetophora*	0.00	-0.25	peripheral	Moth	14
Erebidae	*Melipotis fasciolaris*	0.00	-0.25	peripheral	Moth	14
Formicidae	*Brachymyrmex cordemoyi*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Camponotus crassus*	0.24	0.57	peripheral	Ant	7
Formicidae	*Camponotus melanoticus*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Camponotus novogranadensis*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Camponotus rufipes*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Cephalotes angustus*	0.00	-0.45	peripheral	Ant	15
Formicidae	*Cephalotes atratus*	0.00	-0.45	peripheral	Ant	15
Formicidae	*Cephalotes pusillus*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Crematogaster curvispinosa*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Crematogaster erecta*	0.00	-0.45	peripheral	Ant	7

Formicidae	*Dorymyrmex goetschi*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Ectatomma planidens*	0.00	-0.45	peripheral	Ant	3
Formicidae	*Ectatomma tuberculatum*	0.38	-0.04	peripheral	Ant	8
Formicidae	*Linepithema anathema*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Linepithema fuscum*	0.00	-0.45	peripheral	Ant	15
Formicidae	*Myrmelachista rudolphi*	0.00	-0.45	peripheral	Ant	15
Formicidae	*Pheidole megacephala*	0.00	-0.45	peripheral	Ant	15
Formicidae	*Pseudomyrmex acanthobius*	0.00	-0.45	peripheral	Ant	15
Formicidae	*Pseudomyrmex flavidulus*	0.00	-0.45	peripheral	Ant	7
Formicidae	*Pseudomyrmex gracilis*	0.64	-0.25	connector	Ant	4
Formicidae	*Pseudomyrmex pallidus*	0.00	-0.25	peripheral	Ant	7
Formicidae	*Pseudomyrmex unicolor*	0.00	-0.25	peripheral	Ant	4
Fringillidae	*Euphonia chlorotica*	0.00	-0.45	peripheral	Other bird	10
Geometridae	*Hymenomina cogigaria*	0.00	-0.25	peripheral	Moth	14
Hesperiidae	*Aguna albistria*	0.50	-0.45	peripheral	Butterfly	3
Hesperiidae	*Aguna asander*	0.00	-0.45	peripheral	Butterfly	1
Hesperiidae	*Aides epitus*	0.00	-0.45	peripheral	Butterfly	5
Hesperiidae	*Chioides catillus*	0.00	-0.45	peripheral	Butterfly	1
Hesperiidae	*Cymaenes gisca*	0.00	-0.45	peripheral	Butterfly	4
Hesperiidae	*Drephalys oriander*	0.00	-0.45	peripheral	Butterfly	8
Hesperiidae	*Heliopetes omrina*	0.00	-0.45	peripheral	Butterfly	1
Hesperiidae	*Hylephila phyleus*	0.00	-0.45	peripheral	Butterfly	1
Hesperiidae	*Nyctelius nyctelius*	0.00	-0.45	peripheral	Butterfly	3
Hesperiidae	*Panoquina lucas*	0.00	-0.45	peripheral	Butterfly	1
Hesperiidae	*Polites vibex*	0.00	-0.45	peripheral	Butterfly	4
Hesperiidae	*Pyrrhopyge charybdes*	0.00	-0.45	peripheral	Butterfly	4
Hesperiidae	*Sarbia damippe*	0.00	-0.25	peripheral	Butterfly	2

Hesperiidae	*Sarbia xanthippe*	0.00	-0.45	peripheral	Butterfly	13
Hesperiidae	*Urbanus dorantes*	0.00	-0.25	peripheral	Butterfly	1
Hesperiidae	*Urbanus proteus*	0.50	-0.25	peripheral	Butterfly	9
Icteridae	*Molothrus bonariensis*	0.00	-0.45	peripheral	Other bird	15
Lycaenidae	*Chlorostrymon simaethis*	0.00	-0.45	peripheral	Butterfly	1
Lycaenidae	*Electrostrymon endymion*	0.00	-0.45	peripheral	Butterfly	1
Lycaenidae	*Leptotes cassius*	0.63	-0.25	connector	Butterfly	4
Lycaenidae	*Michaelus thordesa*	0.00	-0.45	peripheral	Butterfly	3
Melolonthidae	*Arriguttia brevissima*	0.00	-0.45	peripheral	Beetle	11
Melyridae	*Astylus variegatus*	0.00	-0.45	peripheral	Beetle	1
Mimidae	*Mimus saturninus*	0.00	-0.45	peripheral	Other bird	3
Molossidae	*Mollosops temminckii*	0.00	-0.45	peripheral	Bat	15
Momotidae	*Momotus momota*	0.00	-0.45	peripheral	Other bird	16
Muscidae	*Musca domestica*	0.00	-0.45	peripheral	Fly	1
Nitidulidae	*Colopterus niger*	0.00	-0.45	peripheral	Beetle	3
Nitidulidae	*Lobiopa insularis*	0.50	-0.25	peripheral	Beetle	22
Nitidulidae	*Mystrops palmarum*	0.00	-0.45	peripheral	Beetle	18
Noctuidae	*Helicoverpa zea*	0.00	-0.45	peripheral	Moth	1
Noctuidae	*Heliothis virescens*	0.00	-0.45	peripheral	Moth	1
Nymphalidae	*Agraulis vanillae*	0.00	-0.25	peripheral	Butterfly	2
Nymphalidae	*Dryas iulia*	0.00	-0.25	peripheral	Butterfly	1
Nymphalidae	*Euptoieta hegesia*	0.00	-0.04	peripheral	Butterfly	1
Nymphalidae	*Hamadryas februa*	0.00	-0.45	peripheral	Butterfly	5
Nymphalidae	*Heliconius erato*	0.44	-0.25	peripheral	Butterfly	8
Nymphalidae	*Junonia evarete*	0.00	-0.45	peripheral	Butterfly	4
Nymphalidae	*Paryphthimoides phronius*	0.00	-0.45	peripheral	Butterfly	1
Nymphalidae	*Vanessa myrinna*	0.00	-0.25	peripheral	Butterfly	2

Nymphalidae	*Yphthimoides ochracea*	0.50	-0.45	peripheral	Butterfly	13
Parulidae	*Myiothlypis flaveola*	0.00	-0.45	peripheral	Other bird	1
Passerellidae	*Zonotrichia capensis*	0.00	-0.45	peripheral	Other bird	3
Phyllostomidae	*Anoura caudifer*	0.13	1.99	peripheral	Bat	15
Phyllostomidae	*Anoura geoffroyi*	0.22	0.77	peripheral	Bat	15
Phyllostomidae	*Artibeus anderseni*	0.00	-0.45	peripheral	Bat	15
Phyllostomidae	*Artibeus cinereus*	0.00	0.16	peripheral	Bat	15
Phyllostomidae	*Artibeus lituratus*	0.00	0.77	peripheral	Bat	15
Phyllostomidae	*Artibeus planirostris*	0.00	0.16	peripheral	Bat	15
Phyllostomidae	*Carollia perspicillata*	0.20	0.97	peripheral	Bat	15
Phyllostomidae	*Glossophaga soricina*	0.00	1.99	peripheral	Bat	15
Phyllostomidae	*Lonchophylla dekeyseri*	0.00	1.58	peripheral	Bat	15
Phyllostomidae	*Micronycteris schmidtorum*	0.00	-0.45	peripheral	Bat	15
Phyllostomidae	*Phyllostomus discolor*	0.00	-0.04	peripheral	Bat	15
Phyllostomidae	*Platyrrhinus lineatus*	0.00	1.38	peripheral	Bat	15
Phyllostomidae	*Sturnira lilium*	0.00	-0.04	peripheral	Bat	15
Phyllostomidae	*Vampyrops lineatus*	0.00	-0.45	peripheral	Bat	15
Pieridae	*Ascia monuste*	0.00	-0.45	peripheral	Butterfly	15
Pieridae	*Eurema elathea*	0.00	-0.45	peripheral	Butterfly	1
Pieridae	*Eurema nise*	0.00	-0.25	peripheral	Butterfly	13
Pieridae	*Hesperocharis erota*	0.00	-0.45	peripheral	Butterfly	13
Pieridae	*Phoebis sennae*	0.44	-0.25	peripheral	Butterfly	5
Pieridae	*Pyrisitia leuce*	0.00	-0.45	peripheral	Butterfly	7
Pipridae	*Antilophia galeata*	0.00	-0.45	peripheral	Other bird	26
Psittacidae	*Alipiopsitta xanthops*	0.00	-0.45	peripheral	Other bird	38
Psittacidae	*Amazona aestiva*	0.00	-0.45	peripheral	Other bird	31
Psittacidae	*Amazona amazonica*	0.00	-0.45	peripheral	Other bird	3

Psittacidae	*Ara ararauna*	0.00	-0.45	peripheral	Other bird	11
Psittacidae	*Ara chloropterus*	0.00	-0.45	peripheral	Other bird	12
Psittacidae	*Brotogeris chiriri*	0.00	-0.45	peripheral	Other bird	15
Psittacidae	*Diopsittaca nobilis*	0.00	-0.45	peripheral	Other bird	22
Psittacidae	*Eupsittula aurea*	0.00	-0.45	peripheral	Other bird	41
Psittacidae	*Psittacara leucophthalmus*	0.00	-0.45	peripheral	Other bird	43
Ramphastidae	*Pteroglossus castanotis*	0.00	-0.45	peripheral	Other bird	13
Ramphastidae	*Ramphastos toco*	0.00	-0.45	peripheral	Other bird	8
Riodinidae	*Eurytis funereus*	0.00	-0.45	peripheral	Butterfly	5
Riodinidae	*Stalachtis phlegia*	0.00	-0.45	peripheral	Butterfly	1
Sarcophagidae	*Blaesoxipha hunteri*	0.00	-0.45	peripheral	Fly	35
Sarcophagidae	*Dexosarcophaga transita*	0.56	-0.04	peripheral	Fly	1
Sarcophagidae	*Helicobia alvarengai*	0.00	-0.45	peripheral	Fly	35
Sarcophagidae	*Helicobia borgmeieri*	0.00	-0.45	peripheral	Fly	2
Scarabaeidae	*Cyclocephala atricapilla*	0.00	-0.25	peripheral	Beetle	11
Scarabaeidae	*Cyclocephala bicolor*	0.00	-0.45	peripheral	Beetle	8
Scarabaeidae	*Cyclocephala celata*	0.00	-0.45	peripheral	Beetle	11
Scarabaeidae	*Cyclocephala octopunctata*	0.00	-0.25	peripheral	Beetle	11
Scarabaeidae	*Cyclocephala ohausiana*	0.00	-0.45	peripheral	Beetle	11
Scarabaeidae	*Cyclocephala quatuordecimpunctata*	0.00	-0.25	peripheral	Beetle	11
Scarabaeidae	*Cyclocephala undata*	0.00	0.57	peripheral	Beetle	11
Scarabaeidae	*Macraspis morio*	0.44	-0.25	peripheral	Beetle	1
Scarabaeidae	*Pelidnota sumptuosa*	0.00	-0.45	peripheral	Beetle	4
Sphecidae	*Sphex dorsalis*	0.00	-0.45	peripheral	Wasp	13
Sphingidae	*Aellopos fadus*	0.50	0.16	peripheral	Sphingid	5
Sphingidae	*Aellopos titan*	0.56	-0.04	peripheral	Sphingid	8

Sphingidae	*Aellopos ulan*	0.00	-0.45	peripheral	Sphingid	4
Sphingidae	*Agrius cingulata*	0.00	0.97	peripheral	Sphingid	15
Sphingidae	*Aleuron chloroptera*	0.00	-0.45	peripheral	Sphingid	5
Sphingidae	*Callionima parce*	0.00	0.57	peripheral	Sphingid	15
Sphingidae	*Cocytius antaeus*	0.00	0.57	peripheral	Sphingid	15
Sphingidae	*Cocytius lucifer*	0.00	1.18	peripheral	Sphingid	15
Sphingidae	*Enyo ocypete*	0.00	0.77	peripheral	Sphingid	15
Sphingidae	*Erinnyis alope*	0.00	0.36	peripheral	Sphingid	15
Sphingidae	*Erinnyis ello*	0.00	1.18	peripheral	Sphingid	15
Sphingidae	*Erinnyis obscura*	0.00	0.36	peripheral	Sphingid	15
Sphingidae	*Erinnyis oenotrus*	0.00	0.16	peripheral	Sphingid	15
Sphingidae	*Eumorpha adamsi*	0.00	0.16	peripheral	Sphingid	15
Sphingidae	*Eumorpha anchemolus*	0.00	0.57	peripheral	Sphingid	15
Sphingidae	*Eumorpha labruscae*	0.00	-0.25	peripheral	Sphingid	15
Sphingidae	*Eumorpha vitis*	0.00	-0.04	peripheral	Sphingid	15
Sphingidae	*Eupyrrhoglossum sagra*	0.00	-0.45	peripheral	Sphingid	5
Sphingidae	*Isognathus allamandae*	0.00	-0.45	peripheral	Sphingid	15
Sphingidae	*Isognathus caricae*	0.00	0.97	peripheral	Sphingid	15
Sphingidae	*Isognathus menechus*	0.00	-0.04	peripheral	Sphingid	15
Sphingidae	*Madoryx plutonius*	0.00	-0.45	peripheral	Sphingid	15
Sphingidae	*Manduca albiplaga*	0.00	-0.04	peripheral	Sphingid	15
Sphingidae	*Manduca contracta*	0.00	-0.25	peripheral	Sphingid	15
Sphingidae	*Manduca diffissa*	0.00	0.57	peripheral	Sphingid	15
Sphingidae	*Manduca florestan*	0.00	0.36	peripheral	Sphingid	15
Sphingidae	*Manduca hannibal*	0.00	-0.45	peripheral	Sphingid	15
Sphingidae	*Manduca lefeburii*	0.00	-0.04	peripheral	Sphingid	15
Sphingidae	*Manduca manducoides*	0.00	-0.25	peripheral	Sphingid	15

Sphingidae	*Manduca plutonius*	0.00	-0.45	peripheral	Sphingid	15
Sphingidae	*Manduca rustica*	0.00	-0.25	peripheral	Sphingid	15
Sphingidae	*Manduca sexta*	0.00	1.18	peripheral	Sphingid	15
Sphingidae	*Neogene dynaeus*	0.00	-0.25	peripheral	Sphingid	15
Sphingidae	*Pachylia ficus*	0.00	0.16	peripheral	Sphingid	15
Sphingidae	*Perigonia pallida*	0.00	-0.45	peripheral	Sphingid	15
Sphingidae	*Protambulyx astygonus*	0.00	-0.25	peripheral	Sphingid	15
Sphingidae	*Protambulyx strigilis*	0.12	2.19	peripheral	Sphingid	15
Sphingidae	*Pseudosphinx tetrio*	0.00	-0.04	peripheral	Sphingid	15
Sphingidae	*Thysania zenobia*	0.00	-0.45	peripheral	Sphingid	15
Sphingidae	*Xylophanes anubus*	0.00	-0.45	peripheral	Sphingid	15
Sphingidae	*Xylophanes chiron*	0.00	-0.04	peripheral	Sphingid	15
Sphingidae	*Xylophanes pistacina*	0.00	-0.04	peripheral	Sphingid	15
Sphingidae	*Xylophanes tersa*	0.00	1.38	peripheral	Sphingid	15
Sphingidae	*Xylophanes tyndarus*	0.00	0.16	peripheral	Sphingid	15
Syrphidae	*Allograpta exotica*	0.24	0.57	peripheral	Syrphid	1
Syrphidae	*Episyrphus balteatus*	0.00	-0.25	peripheral	Syrphid	1
Syrphidae	*Eristalinus aeneus*	0.00	-0.04	peripheral	Syrphid	1
Syrphidae	*Eristalinus taeniops*	0.00	-0.45	peripheral	Syrphid	1
Syrphidae	*Ornidia obesa*	0.24	0.57	peripheral	Syrphid	1
Syrphidae	*Palpada pusio*	0.00	-0.45	peripheral	Syrphid	1
Syrphidae	*Palpada rufipedes*	0.00	-0.25	peripheral	Syrphid	2
Syrphidae	*Palpada vinetorum*	0.00	-0.04	peripheral	Syrphid	1
Syrphidae	*Pseudodoros clavatus*	0.00	-0.04	peripheral	Fly	2
Syrphidae	*Syrphus phaeostigma*	0.00	-0.45	peripheral	Syrphid	2
Syrphidae	*Toxomerus lacrymosus*	0.00	-0.45	peripheral	Syrphid	1
Syrphidae	*Toxomerus musicus*	0.00	-0.45	peripheral	Syrphid	7

Syrphidae	*Toxomerus politus*	0.00	-0.25	peripheral	Syrphid	1
Syrphidae	*Toxomerus virgulatus*	0.00	-0.45	peripheral	Syrphid	28
Syrphidae	*Toxomerus watsoni*	0.25	3.00	module hub	Syrphid	2
Tachinidae	*Cylindromyia dorsalis*	0.00	-0.25	peripheral	Fly	2
Tachinidae	*Jurinella corpulenta*	0.00	0.16	peripheral	Fly	2
Tenebrionidae	*Lagria villosa*	0.00	-0.45	peripheral	Beetle	5
Tenebrionidae	*Prostenus cyaneus*	0.00	-0.45	peripheral	Beetle	18
Thraupidae	*Coereba flaveola*	0.44	-0.25	peripheral	Other bird	1
Thraupidae	*Coryphospingus cucullatus*	0.00	-0.45	peripheral	Other bird	3
Thraupidae	*Cyanerpes cyaneus*	0.00	-0.45	peripheral	Other bird	36
Thraupidae	*Dacnis cayana*	0.00	-0.45	peripheral	Other bird	37
Thraupidae	*Lanio cucullatus*	0.00	-0.45	peripheral	Other bird	1
Thraupidae	*Ramphocelus carbo*	0.00	-0.45	peripheral	Other bird	15
Thraupidae	*Saltatricula atricollis*	0.00	-0.45	peripheral	Other bird	3
Thraupidae	*Schistochlamys ruficapillus*	0.00	-0.45	peripheral	Other bird	3
Thraupidae	*Stilpnia cayana*	0.00	-0.45	peripheral	Other bird	5
Thraupidae	*Tersida viridis*	0.00	-0.45	peripheral	Other bird	15
Thraupidae	*Thraupis palmarum*	0.50	-0.45	peripheral	Other bird	1
Thraupidae	*Thraupis sayaca*	0.50	-0.45	peripheral	Other bird	4
Trochilidae	*Anthracothorax nigricollis*	0.32	0.16	peripheral	Hummingbird	5
Trochilidae	*Calliphlox amethystina*	0.50	-0.25	peripheral	Hummingbird	15
Trochilidae	*Chionomesa fimbriata*	0.39	3.41	module hub	Hummingbird	5
Trochilidae	*Chionomesa lactea*	0.13	7.88	module hub	Hummingbird	5
Trochilidae	*Chlorostilbon lucidus*	0.41	5.64	module hub	Hummingbird	5
Trochilidae	*Chrysolampis mosquitus*	0.50	-0.45	peripheral	Hummingbird	4
Trochilidae	*Clytolaema rubricauda*	0.00	-0.45	peripheral	Hummingbird	6
Trochilidae	*Colibri serrirostris*	0.50	4.22	module hub	Hummingbird	5

Trochilidae	*Eupetomena macroura*	0.31	8.69	module hub	Hummingbird	5
Trochilidae	*Florisuga fusca*	0.44	-0.25	peripheral	Hummingbird	5
Trochilidae	*Heliactin bilophus*	0.00	-0.45	peripheral	Hummingbird	5
Trochilidae	*Heliomaster furcifer*	0.00	-0.45	peripheral	Hummingbird	32
Trochilidae	*Heliomaster squamosus*	0.49	0.97	peripheral	Hummingbird	5
Trochilidae	*Hylocharis chrysura*	0.56	1.38	peripheral	Moth	5
Trochilidae	*Leucochloris albicollis*	0.32	0.16	peripheral	Hummingbird	6
Trochilidae	*Phaethornis pretrei*	0.34	5.24	module hub	Hummingbird	5
Trochilidae	*Polytmus guainumbi*	0.44	-0.45	peripheral	Hummingbird	5
Trochilidae	*Stephanoxis lalandi*	0.00	-0.45	peripheral	Hummingbird	6
Trochilidae	*Thalurania furcata*	0.22	8.49	module hub	Hummingbird	5
Trochilidae	*Thalurania glaucopis*	0.44	-0.45	peripheral	Hummingbird	5
Turdidae	*Turdus amaurochalinus*	0.00	-0.45	peripheral	Other bird	27
Turdidae	*Turdus leucomelas*	0.00	-0.45	peripheral	Other bird	17
Turdidae	*Turdus rufiventris*	0.00	-0.45	peripheral	Other bird	34
Tyrannidae	*Empidonomus varius*	0.00	-0.45	peripheral	Other bird	29
Tyrannidae	*Griseotyrannus aurantioatrocristatus*	0.00	-0.45	peripheral	Other bird	8
Tyrannidae	*Myiarchus ferox*	0.00	-0.45	peripheral	Other bird	15
Tyrannidae	*Myiarchus swainsoni*	0.00	-0.45	peripheral	Other bird	3
Tyrannidae	*Tyrannus melancholicus*	0.00	-0.45	peripheral	Other bird	24
Tyrannidae	*Tyrannus savana*	0.00	-0.45	peripheral	Other bird	18
Tyrannidae	*Xolmis velatus*	0.00	-0.45	peripheral	Other bird	33
Vespidae	*Agelaia multipica*	0.00	-0.45	peripheral	Wasp	2
Vespidae	*Agelaia pallipes*	0.00	-0.45	peripheral	Wasp	8
Vespidae	*Agelaia vicina*	0.00	-0.25	peripheral	Wasp	2
Vespidae	*Apoica pallens*	0.00	-0.25	peripheral	Wasp	2

Vespidae	*Brachygastra lecheguana*	0.00	0.77	peripheral	Wasp	1
Vespidae	*Mischocyttarus cerberus*	0.00	-0.45	peripheral	Wasp	2
Vespidae	*Mischocyttarus confusos*	0.00	0.97	peripheral	Wasp	2
Vespidae	*Mischocyttarus drewseni*	0.00	4.02	module hub	Wasp	2
Vespidae	*Polistes actaeon*	0.00	-0.25	peripheral	Wasp	2
Vespidae	*Polistes billardieri*	0.28	1.38	peripheral	Wasp	2
Vespidae	*Polistes cinerascens*	0.00	0.16	peripheral	Wasp	2
Vespidae	*Polistes ferreri*	0.00	-0.25	peripheral	Wasp	2
Vespidae	*Polistes lanio*	0.00	-0.45	peripheral	Wasp	3
Vespidae	*Polistes subsericeus*	0.00	-0.45	peripheral	Wasp	3
Vespidae	*Polistes versicolor*	0.00	-0.45	peripheral	Wasp	3
Vespidae	*Polybia chrysothorax*	0.00	-0.45	peripheral	Wasp	2
Vespidae	*Polybia dimidiata*	0.00	-0.45	peripheral	Wasp	1
Vespidae	*Polybia fastidiosuscula*	0.38	-0.04	peripheral	Wasp	2
Vespidae	*Polybia ignobilis*	0.61	-0.04	peripheral	Wasp	2
Vespidae	*Polybia minarum*	0.00	-0.25	peripheral	Wasp	2
Vespidae	*Polybia occidentalis*	0.20	0.97	peripheral	Wasp	2
Vespidae	*Polybia paulista*	0.20	0.97	peripheral	Wasp	2
Vespidae	*Polybia scutellaris*	0.00	-0.25	peripheral	Wasp	2
Vespidae	*Polybia sericea*	0.41	0.36	peripheral	Wasp	3
Vespidae	*Protonectarina sylveirae*	0.00	0.36	peripheral	Wasp	2
Vespidae	*Synoeca cyanea*	0.00	-0.45	peripheral	Wasp	2
Vespidae	*Synoeca surinama*	0.44	-0.25	peripheral	Wasp	4
Vespidae	*Zeta argillaceum*	0.00	-0.45	peripheral	Wasp	7
Vireonidae	*Cyclarhis gujanensis*	0.00	-0.45	peripheral	Other bird	13
Zopheridae	*Bitoma palmarum*	0.00	-0.25	peripheral	Beetle	18

CAPÍTULO 3 – HUMAN INFLUENCE INCREASES BETA DIVERSITY IN PLANT-POLLINATOR INTERACTIONS IN A CERRADO MOSAIC LANDSCAPE

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Abstract

Anthropogenic pressures are increasingly reshaping natural landscapes, threatening the persistence of species and disrupting key ecological processes. In the Brazilian Cerrado, a biodiversity hotspot undergoing extensive habitat modification, understanding how environmental heterogeneity and human influence affect plant-pollinator systems is essential for conservation. Here, we investigated how human presence shapes plant-pollinator interaction networks. We assessed interaction networks in six sites representing Campo sujo and Campo Rupestre physiognomies in a vegetation cover gradient of the Cerrado within the Serra da Boa Esperança State Park, and quantified anthropogenic pressure using the Human Presence Index (HPI) to assess its effects on beta diversity in these networks. We recorded 1,235 interactions involving 88 plant species and 159 pollinator species. Networks exhibited consistently low nestedness but high specialization and modularity, indicating compartmentalized interaction structures. Beta diversity analyses revealed high dissimilarity among networks, primarily driven by species turnover rather than interaction rewiring, with only a few interactions shared among sites. Also, our results show that differences in human presence in each site increased structural dissimilarity, species turnover, and total network dissimilarity, although rewiring remained unaffected. Species roles were predominantly peripheral, with few connectors or module hubs, suggesting limited structural redundancy within networks. Overall, our results demonstrate that even within a protected Cerrado area, human disturbance contributes to marked spatial variation in species composition and interaction structure. The dominance of turnover-driven dissimilarity and strong modularity suggests that plant-pollinator communities in these heterogeneous landscapes are both specialized and sensitive to environmental change. These findings highlight the importance of preserving habitat heterogeneity and minimizing anthropogenic impacts to maintain interaction diversity and ecological functioning in the Cerrado.

Key-words: Brazilian savanna; floral visitors; habitat heterogeneity; interaction networks; species turnover.

Introduction

Biodiversity faces increasing threats from alterations to natural landscapes (Marcantonio *et al.*, 2023), influencing multiple factors that allow or prevent species from persisting in modified habitats (Laurance *et al.*, 2002; Fahrig, 2003). Accordingly, biomes whose natural areas are increasingly transformed by human activities, such as the Cerrado, have become critical priorities for conservation (Myers *et al*., 2000; Françoso *et al.*, 2020; Hardouin & Hargreaves, 2023). Indeed, the Cerrado harbors exceptionally high species richness and endemism (Myers *et al*., 2000; Klink & Machado, 2005; Strassburg *et al*., 2017). The primary drivers of biodiversity loss in the Cerrado are large-scale land-use changes associated with the expansion of agriculture and pasture, which have led to extensive conversion and fragmentation of native vegetation over recent decades, profoundly altering species composition, abundance, and ecological processes (Myers *et al*., 2000; Klink & Machado, 2005; Strassburg *et al*., 2017; Sano *et al.*, 2019).

These pressures affect not only the occurrence and abundance of species, but also reduce the availability and quality of habitats, compromising essential ecological processes such as pollination, which depends on interactions between plants and pollinators (Astegiano *et al*., 2015). This occurs because reductions in native vegetation can have serious consequences for pollination, as changes in the abundance of available floral resources tend to decrease the abundance and diversity of pollinators, also impacting plant reproductive success (Kearns *et al*., 1998; Ollerton *et al*., 2011; Astegiano *et al*., 2015; Brudvig *et al*., 2015; Alroy, 2018). This decline in interacting species directly affects the dynamics of these interactions, increasing the risks of local extinction and the loss of associated ecosystem services (Kearns *et al*., 1998; Ollerton *et al*., 2011; Astegiano *et al*., 2015).

The analysis of ecological interactions through quantitative networks has proven to be a powerful tool for understanding how species are connected and how these connections respond to environmental changes (Bascompte & Jordano, 2007; Ings *et al*., 2009; Landi *et al*., 2018). This is because by considering the network formed by species interactions, it becomes possible to evaluate its stability through its topology, including emergent community-level structures (e.g. nestedness, modularity, and overall specialization), as well as the roles that species play in its structure (Jordano *et* *al*., 2003; Bascompte & Jordano, 2007; Olesen *et al*., 2007; Bascompte, 2010; Thébault & Fontaine, 2010). For example, it is possible to assess the extent to which less abundant interactions are subsets of more abundant interactions (nestedness) (Bascompte *et al*., 2003), or the extent to which species that interact more strongly with specific partners form groups of interactions within the community (modularity) (Olesen *et al*., 2007**).** In addition to these network-level properties, quantitative networks also allow the assessment of species-level metrics, such as the importance of the species that make up these communities (Bascompte *et al*., 2006; Blüthgen *et al*., 2006; Olesen *et al*., 2007; Landi *et al*., 2018).

Furthermore, we must consider the influence that landscape heterogeneity has on the diversity of species and interactions (Klein *et al*., 2007; Brudvig *et al*., 2015; Mitchell *et al*., 2015). This is because the intrinsic characteristics of these landscapes can allow, prevent, or favor the persistence of species within communities, leading to interaction rearrangement (rewiring) as species are replaced (turnover) (Carstensen *et al*., 2014; Trøjelsgaard & Olesen, 2016; Trøjelsgaard *et al.*, 2015). Thus, the interaction network approach provides valuable insights into how communities and interactions change across space (Poisot *et al*., 2012; Souza *et al*., 2021). Assessing beta diversity in interaction networks is particularly relevant in ecosystems under strong anthropogenic pressure, such as the Cerrado, as it allows identifying whether species loss is accompanied by the loss or replacement of interactions, which may indicate changes in ecological functioning (Tylianakis & Morris, 2017).

Thus, the main objective of this study was to evaluate plant-pollinator interaction networks along a gradient of vegetation cover in the Cerrado to assess how species are replaced and interactions are rearranged in these networks. Specifically, we aimed to: (1) analyze the structure of interaction networks along a vegetation gradient; (2) estimate the beta diversity of species and interactions across vegetation gradient; (3) assess the effect of the degree of anthropogenic disturbance on network dissimilarity; and (4) identify the role of species in the network topology. We hypothesized that plant-pollinator networks exhibit a nested structure, reflecting low specialization and modularity. In addition, we expected that the areas would show low dissimilarity in species and interactions, and that this dissimilarity would be influenced by human presence, such that landscapes under higher anthropogenic impact exhibit lower dissimilarity (greater homogenization), whereas less disturbed landscapes display greater differentiation among their interaction networks. Finally, we expected to identify species with a central role in network topology, and that this role would vary among the different areas evaluated.

Methodology

Study area

This study was conducted in the Serra da Boa Esperança State Park (PESBE), a protected area located in the municipality of Boa Esperança, southern Minas Gerais, Brazil (20°05'38"S, 45°34'29"W). The PESBE is situated within a transitional zone between the Cerrado and the Atlantic Forest biomes, comprising a mosaic of vegetation types that include Semideciduous Seasonal Forest, Campo Sujo, Cerrado, and Campos Rupestres at higher elevations, according to MapBiomas land cover data (https://brasil.mapbiomas.org/) and previous studies (Neto *et al.*, 2021; Alves *et al.*, 2022). The PESBE's topography is diverse, ranging from flat plateaus at approximately 900 m above sea level to mountain ridges and escarpments reaching about 1,400 m (Alves *et al.*, 2022). The region has a tropical highland climate (Cwa), characterized by warm, wet summers and cool, dry winters, with mean annual temperatures ranging from 21°C to 23°C and mean annual precipitation between 1,200 and 1,600 mm (Reboita *et al.*, 2015).

Despite being a protected area, the PESBE is subject to anthropogenic pressures in its surroundings, primarily from monocultures (mainly coffee plantations) as well as grazing and other low-intensity human activities (Morais *et al.*, 2021; Alves *et al.*, 2022). These pressures, combined with the natural heterogeneity of the vegetation mosaic, make the area an ideal setting to assess how disturbances and variations in vegetation cover influence plant-pollinator interactions.

Data Collection

Data collection was conducted quarterly throughout 2023, in January, April, July, and October. To assess the gradient of vegetation cover, observations of plant-pollinator interactions were carried out at six sampling sites representing Cerrado phytophysiognomies, three located in *Campo Sujo* areas and three in *Campo Rupestre* areas, ranging from 1,050 to 1,400 m in elevation (Figure 1). At each site, 50 m² plots were established, with a minimum distance of 500 m between sampling points. Observations were conducted between 09:00 and 14:00 h, totaling 20 observation hours per site and 120 hours overall. Interactions were recorded by three observers using random walk surveys within each plot, focusing on flowering individuals. Each plant species in the study areas was monitored equally, with individual plants observed during five-minute sessions in which all floral visitor interactions were recorded visually. During observations, the frequency of pollinator moving among different flowers of the same plant individual was recorded. We only included legitimate interactions in the analysis (i.e., when the floral visitor contacted the reproductive structures of the flowers). From this point forward, these legitimate visitors are referred to as "pollinators". We collected vouchers for all plant species that were identified, and we lodged them in the Herbarium of the Federal University of Alfenas. The family names followed the Angiosperm Phylogeny Group (APG IV, 2016), and species names were confirmed in the Plant List database (http://www.theplantlist.org/) and updated/corrected whenever necessary. After a visit was recorded, we captured the insect visitors and placed them in separate clean kill vials for posterior identification in the laboratory.

To estimate the intensity of anthropogenic disturbance in each sampled plot, we defined an index based on the frequency of visual evidence of human activities. Each plot was subdivided into 16 quadrants of 12.5 m². During each sampling campaign, we recorded the presence or absence, in each quadrant, of the following indicators: (1) direct evidence of human presence (e.g., general litter such as beverage cans, packaging, among others), and (2) evidence of livestock animals (e.g., feces, footprints). Based on these observations, we calculated a Human Presence Index (HPI), defined as the number of quadrants with evidence of human or domestic animal presence divided by the total number of quadrants. The resulting index ranged from 0 (no indicators of human presence) to 1 (all quadrants containing some type of evidence), allowing direct comparisons among plots regarding the degree of anthropogenic impact.

Plant-pollinator interaction networks

For each sampling point (six points), we constructed quantitative matrices using the frequency of visits between each pair of interacting species. We then calculated different network metrics (nestedness, specialization, and modularity) using the bipartite package in the R program, which describe structural properties of the community (Dormann *et al.*, 2008; 2009). All analyses were based on quantitative indices, which are less sensitive to sampling effort (Fründ *et al.*, 2016).

For each matrix, we calculated network nestedness, specialization, and modularity. Nestedness quantifies the extent to which the interactions of less abundant species are subsets of those of more abundant species in the network, using the wNODF index (Almeida-Neto & Ulrich, 2011). Network-level specialization was estimated using the H2 index, which describes whether species restrict their interactions beyond what would be expected by chance based on partner availability (Blüthgen *et al.*, 2006). Finally, modularity quantifies the prevalence of interactions within subsets of species in the community (Olesen *et al.*, 2007) and was estimated using the LPAb+ algorithm (Beckett, 2016).

Network metrics can be influenced by intrinsic characteristics such as the number of interacting species and sampling effort (Blüthgen *et al.*, 2006; Fründ *et al.*, 2016). Therefore, the significance of each metric was assessed by comparison with null distributions. For each observed network, we generated 1,000 randomized networks using the *vaznull* null model, which is more conservative for quantitative networks (Vázquez *et al.*, 2007).

Beta diversity of species and interactions

The dissimilarity among plant-pollinator interaction networks was quantified through interaction beta diversity using the Jaccard index (Poisot *et al.*, 2012). This approach allows estimating: (i) structural dissimilarity between networks (global topology), independent of species composition ($\beta WN = \beta ST + \beta OS$); (ii) dissimilarity caused by differences in species composition, i.e., species turnover (βST); (iii) dissimilarity due to rewiring among shared species, i.e., changes in the interactions of species common to both networks (*βOS*); and (iv) total dissimilarity between networks considering all species and interactions (*βS*) (Canard *et al*., 2011; Poisot *et al*., 2012). Beta diversity analyses of interaction networks were performed using the *betalink_multi* function implemented in the *bipartite* package (Dormann *et al*., 2009), which decomposes the total dissimilarity among multiple interaction networks by considering both species and interaction turnover among areas, as well as differences related to richness. This metric ranges from 0, when interaction composition is identical, to 1, when networks share no common species or interactions. We also constructed an illustrative network to visualize patterns of pairwise interactions across sites. To do so, we combined all plant-pollinator interactions recorded in the six sampled areas and identified which interactions were unique to each site or shared among multiple sites. The network was assembled from the pooled interaction matrix and visualized in Cytoscape (Shanon *et al*., 2003), allowing us to highlight exclusive and shared links among areas.

To assess the influence of human presence on community dissimilarity, we fitted Generalized Linear Models (GLMs), using as response variables the different components of beta diversity among interaction networks: structural dissimilarity between sites (*βWN*), species turnover dissimilarity (*βST*), rewiring dissimilarity (*βOS*), and total dissimilarity (*βS*). As a predictor variable, we used the absolute difference in the Human Presence Index (HPI) between each pair of sampled sites, calculated as the difference in HPI values between networks *i* and *j*. This approach allowed us to test whether greater contrasts in human presence between sites were associated with higher dissimilarity in network structure and composition. The models were primarily fitted using a quasi-Poisson distribution to account for overdispersion detected in the data (Zuur *et al*., 2009). For each model, statistical significance was assessed through ANOVA using the *car* package (Fox & Weisberg, 2011).

Species Roles

To assess the role of species across the evaluated areas, we calculated indices that capture distinct topological properties of each species. Based on the modular structure, we computed the role of each species in terms of connectivity among (*c*) and within modules (*z*) (Olesen *et al*., 2007; Dormann & Strauss, 2014). According to these values, species were classified as peripheral (low *c* and *z* values), module hubs (high *z* and low *c*), connectors (low *z* and high *c*), and network hubs (high *c* and *z*) (Olesen *et al*., 2007).

In addition, we calculated the species strength of each species, defined as the sum of the proportions of interactions performed by a given species relative to all its interaction partners (Bascompte *et al*., 2006). Higher values indicate that more plant species depend on particular floral visitor species, and vice versa (Bascompte *et al*., 2006).

We also calculated the species-level specialization index (*d'*), which quantifies how the interaction frequencies of a given species deviate from the availability of potential partners in the network, with higher values indicating greater specialization (Blüthgen *et al.*, 2006).

All analyses were performed in the software R using the bipartite package (Dormann *et al*., 2008; 2009).

Results

A total of 1,235 interactions were recorded between 88 plant species (or morphospecies) and 159 floral visitor species (or morphospecies) during the observation period. Among plants, species were distributed across 29 families, with Asteraceae (33.0%), Rubiaceae (9.1%), Melastomataceae (8.0%), Malpighiaceae (8.0%), and Fabaceae (5.7%) being the most representative in terms of species richness, while other families accounted for less than 5% of the sampled species (Table S1). Nearly half of the plant species (43.2%) occurred in more than one sampled area (Figure 2a). Regarding floral visitors, species were distributed among 16 families and seven orders, with Apidae (64.2%) and Vespidae (10.1%) being the most represented, while all other families comprised less than 5% of the sampled species (Table S2). Approximately one-third (33.3%) of these species were recorded in more than one sampled area (Figure 2b).

In addition, visual evidence of human presence (HPI) was detected across all areas, although the intensity varied (Table 1). The lowest value was recorded at Site D

(HPI = 0.02), while the highest was observed at Site B (HPI = 0.21). However, no clear trend was associated with the vegetation types evaluated, as both *Campo Rupestre* (HPI = 0.04–0.21) and *Campo sujo* (HPI = 0.02–0.19) showed comparable variation (Table 1).

Plant-pollinator interaction networks

The six sampled sites exhibited variation in both species richness and the number of recorded interactions (Table 1). Site B showed the network with the highest number of interactions between specific species pairs, whereas Site F displayed the lowest. Nestedness (*wNODF*) was below 4.00 across all sites, with the highest value observed at Site A (*wNODF* = 3.95) and the lowest at Site E (*wNODF* = 2.16). Community-level specialization (*H2*) was higher than 0.60 in all networks, reaching its maximum at Site E (*H2* = 0.81) and minimum at Site F (*H2* = 0.60). Modularity (*Q*) ranged from 0.56 (Site A) to 0.75 (Site E). Only the specialization and modularity indices showed statistically significant values ($p \leq 0.05$) in most of the sampled sites (Table 1).

Regarding the vegetation types, the network indices between *Campo Rupestre* and *Campo Sujo* revealed subtle variations in the structure of plant-pollinator interactions (Table 1). Nestedness (*wNODF*) was, on average, higher in *Campo Rupestre* (3.52 ± 0.65) than in *Campo Sujo* (3.19 ± 0.85). Community-level specialization (*H2*) showed higher values in *Campo Sujo* (0.73 ± 0.11) compared to *Campo Rupestre* (0.68 ± 0.03), suggesting slightly more specialized networks in this vegetation type, although one *Campo Sujo* site exhibited a lower *H2* value. Modularity (*Q*) presented slightly higher mean values in *Campo Sujo* (0.72 ± 0.03) than in *Campo Rupestre* (0.62 ± 0.06), with no marked differences between vegetation types.

Beta diversity of species and interactions

The comparison among networks revealed high variation in the beta diversity of interactions. Structural dissimilarity (*βWN*), representing the overall variation in the composition of interactions between network pairs, ranged widely from 0.03 to 0.99, indicating networks that were highly similar, such as those from Sites D and F (*βWN* = 0.03), to networks that were almost completely distinct in terms of plant-pollinator interactions (*βWN* > 0.95) (Figure 3a). Total network dissimilarity was mainly driven by interaction turnover (*βWN.repl* = 0.89 ± 0.06), whereas differences in interaction richness contributed to a lesser extent (*βWN.rich* = 0.08 ± 0.05).

The main contribution to this dissimilarity was species turnover (*βST*), with only 27 interactions between specific partners occurring in more than one landscape, the most consistent being between *Eremanthus erythropappus* (Asteraceae) and *Apis mellifera* (Apidae) (Figure 4). The lowest value was observed between Sites D and F (*βST* = 0.03), while other comparisons showed high values (*βST* > 0.83) (Figure 3b). Turnover of plants (*βST.l*) and floral visitors (*βST.h*) contributed similarly to dissimilarity (*βST.l* = 0.26 ± 0.03; *βST.h* = 0.20 ± 0.06). The fraction associated with simultaneous turnover of both groups (*βST.lh*) was relatively high (0.40 ± 0.10).

The dissimilarity in interactions among shared species (*βOS*) was relatively low, ranging from 0.00 to 0.17 (Figure 3c). In contrast, total dissimilarity between networks considering all species and interactions (*βS*) was relatively high for most pairwise comparisons of interaction networks (*βS* > 0.76), except for the networks from Sites D and F (*βS* = 0.02) (Figure 3d).

Anthropogenic disturbance (HPI) explained structural dissimilarity (*βWN*) (df = 1, χ^2 = 3.87, p = 0.05), species turnover dissimilarity (*βST*) (df = 1, χ^2 = 4.46, p = 0.03), and total dissimilarity (*βS*) (df = 1, χ^2 = 4.16, p = 0.04) (Figure 5). However, this pattern was not observed for rewiring dissimilarity (*βOS*) (df = 1, χ^2 = 0.08, p = 0.78) (Figure 5).

Role of species

Based on the modular structure, the topological roles of species were mostly classified as peripheral in the plant-pollinator interaction networks, with only one species acting as a connector (*Vernonanthura mucronulata* in Site B) and a single species as a module hub (*Paratrigona lineata* in Site E) (Figure 6).

Regarding species strength (*ss*), the index ranged from 0.01 (*Chromolaena squalida* and *Diplusodon villosissimus*) to 7.32 (*Byrsonima gardneriana*) across species, considering all six networks, with a mean of 1.00 ± 1.23 (Table S3). Species-level specialization (*d′*) ranged from 0 (3 plant species and 4 pollinator species) to 1 (39 plant species and 37 pollinator species) across the six interaction networks, with a mean of 0.63 ± 0.29 (Table S3). Additionally, species occurring in more than one area showed variation in both interaction strength (*ss*) and species-level specialization (*d′*) (Figure 7).

Discussion

Plant-pollinator interaction networks

Our study revealed that plant-pollinator interaction networks across a vegetation gradient in the Cerrado exhibit high variability in both species composition and interaction structure among different physiognomies. Overall, our results showed low nestedness and high levels of community-level specialization and modularity.

Although the literature has demonstrated a tendency for plant-pollinator interaction networks to exhibit nested structure (Bascompte *et al*., 2003), our results showed that the networks evaluated along the vegetation cover gradient have a structural topology in which interactions are less consistently subsets of others, indicating that the observed nestedness does not differ significantly from random networks. Although this result is unexpected not only for the mutualistic system studied, given that previous studies have reported nestedness in pollination networks of local Cerrado communities (e.g., Souza *et al*., 2018; Maianne *et al*., 2022), the metanetwork of known interactions for the Cerrado supports a modular structure (Aguiar *et al*., 2024), as the biome harbors a wide diversity of pollination systems that may explain the tendency toward the formation of interaction modules in these networks (Cardoso *et al*., 2025).

Indeed, although not opposing nestedness, community-level specialization and modularity indicated that species tend to form specific pairs of interactions. Community-level specialization exhibited high values across the networks, suggesting that species interact preferentially with specific partners within the interaction networks, forming a small subset of interactions (Blüthgen *et al.*, 2006). Similarly, the observed modularity values indicate that species are organized into relatively well-defined groups of interactions, with species interacting more frequently within each group than between distinct groups (Olesen *et al.*, 2007). The combination of high specialization and modularity suggests that the network structure is characterized by strong compartmentalization, which may reduce the propagation of disturbances within the network and increase local stability (Thébault & Fontaine, 2010). However, this same pattern may also indicate greater vulnerability to the loss of key species within each module, as interaction replacement tends to be more limited when partners are highly specific.

Analysis of species composition within network modules revealed two recurrent interaction groups across all areas (Table S3). The first included Asteraceae, with *Calea cuneifolia* as the most consistent species, and Apidae, including *Bombus morio* and representatives of the Eucerini and Halictini tribes. The second consisted of Rubiaceae species (mainly *Borreria* spp.) interacting with social bees such as *Apis mellifera*, *Geotrigona subterranea*, and *Trigona spinipes*. These modules were consistently observed across networks, indicating that despite environmental and floristic heterogeneity, certain species groupings form stable cores of Cerrado pollination networks. Some interactions, for example, *B. morio*–*Baccharis* spp. and *A. mellifera*–*Borreria* spp., were identical across sites, highlighting the predictability of these associations. Overall, modular composition appears non-random, likely shaped by floral traits and dominant species, which may enhance network resilience to local environmental variation (Olesen *et al*., 2007).

Although the effects of environmental heterogeneity at local scales remain poorly explored in ecological network studies, our results highlight growing concerns regarding local environmental alterations in the Cerrado, particularly those associated with the intensity of local human impact. While the limited sample size precludes robust statistical evaluation of the relationships between variables (Zuur *et al*., 2010; Bujang, 2024), network structural indices (nestedness, community-level specialization, and modularity) suggested trends associated with local environmental conditions and the intensity of human presence (HPI). For instance, more modular or specialized networks tended to occur in areas with lower HPI (Table 1). Although based on a limited number of networks, these patterns indicate that local anthropogenic disturbance may influence how species interact, emphasizing that even subtle human pressures within the sampled sites should be considered in the maintenance of pollination interactions in the Cerrado (Emer *et al*., 2016; Carstensen *et al*., 2012).

Thus, the observed network structures have direct implications for the conservation and persistence of species. The low degree of nestedness observed suggests a less predictable organization that may be more vulnerable to local environmental fluctuations or ecological disturbances (Burkle & Alarcón, 2011). In more nested networks, species maintain multiple interaction partners, reducing isolation and creating alternative pathways under impact scenarios, thereby promoting greater cohesion and functional robustness (Bascompte *et al*., 2003; Memmott *et al.*, 2004; Thébault & Fontaine, 2010). On the other hand, modularity can contribute to local resilience by containing disturbances within specific modules (Olesen *et al*., 2007; Thébault & Fontaine, 2010). However, when such modularity combines with low interaction overlap and high specialization, the risk of partial collapse increases, as the loss of key species may trigger secondary extinctions (Thébault & Fontaine, 2010; Stouffer & Bascompte, 2011).

Furthermore, four out of the six networks showed significantly higher values than expected for community-level specialization and modularity, indicating that these structures are more likely to reflect ecological filters such as trait complementarity among species, morphological constraints, and phenology (Blüthgen *et al*., 2006; Vázquez *et al*., 2007). The absence of significant nestedness, combined with the presence of specialization and modularity in part of the networks, reinforces the conclusion that interactions are organized into specific subsets rather than forming a highly connected and predictable network (Olesen *et al*., 2007; Dalsgaard *et al*., 2013).

Beta diversity of species and interactions

The high variation in beta diversity among the evaluated areas, with total dissimilarity values close to 1 in several comparisons, indicates that plant and floral visitor communities exhibit a highly differentiated interaction structure (Figure 3). This differentiation was mainly explained by species turnover, suggesting that taxonomic changes are the primary driver of variation among networks (Poisot *et al*., 2012;

Trøjelsgaard *et al*., 2015). The sampled region comprises a mosaic of vegetation types and land uses, including Cerrado, Atlantic Forest fragments, coffee plantations, eucalyptus stands, and pastures (Morais *et al*., 2021; Alves *et al*., 2022), whose environmental heterogeneity may promote spatial filters that constrain species distributions and interactions (Arroyo-Rodríguez *et al*., 2013). In this context, it is plausible that the high dissimilarity in interactions among communities is linked to the environmental heterogeneity of the Cerrado, historically shaped by both natural (e.g., fire) and anthropogenic disturbances (Myers *et al*., 2000; Strassburg *et al*., 2017; Hardouin & Hargreaves, 2023), which favor species turnover across the areas (Carstensen *et al*., 2014; Trøjelsgaard *et al*., 2015).

On the other hand, the low dissimilarity in interactions among shared species suggests that when a species occurs in more than one network, it tends to maintain a stable interaction pattern. This pattern, high species turnover coupled with low rewiring, has been reported in other regions (e.g., Trøjelsgaard *et al.,* 2015; MacLeod *et al*., 2016), but has been little documented across spatial scales in the Cerrado. Although not directly tested here, such fidelity may reflect functional coherence among recurrent species, even within taxonomically distinct communities. This pattern has already been observed in tropical savannas and in the Cerrado, where the persistence of interactions contributes to ecosystem maintenance even in the face of species turnover (Del-Claro & Torezan-Silingardi, 2019). Thus, our findings reinforce the importance of conserving multiple habitat types in the Cerrado, aiming to protect not only species diversity but also the functional integrity of ecological networks.

Our results indicated that human presence affected total dissimilarity (*βS*), structural dissimilarity (*βWN*), and species turnover dissimilarity (*βST*) (Figure 5). Increases in human presence (HPI) were associated with reductions in both total dissimilarity and species turnover, suggesting a homogenization of species composition. Consistently, lower structural dissimilarity in impacted areas reflects a topological simplification of the networks. In contrast, interaction rewiring dissimilarity (*βOS*) was not influenced by HPI, indicating that the reorganization of interactions among shared species remained stable even in more disturbed sites. These results suggest that although human presence may homogenize species and simplify network structure, flexibility in interactions among common species may help maintain a certain degree of functional resilience within communities.

Role of species

The modular configuration of plant-pollinator interaction networks revealed that most species play peripheral roles, indicating that a large portion of the system's actors are involved in specific interactions within the modules to which they belong (Olesen *et al*., 2007). Although these species mainly influence localized interactions within their respective modules, their limited external connections make them more susceptible to the loss of interaction partners, which may compromise their persistence within the local community (Guimarães *et al*., 2011). Moreover, the fact that only two species (*Paratrigona lineata* and *Vernonanthura mucronulata*) occupied central roles in the evaluated networks (Figure 6) highlights their importance for maintaining the structural cohesion of the communities and raises a conservation concern, given the scarcity of species with central functions across the studied areas (Olesen *et al*., 2007; Guimarães *et al*., 2011).

Among the species with central roles in the modular configuration, *Paratrigona lineata* (Apidae) stands out as a native, generalist social bee previously reported as a key species in Cerrado plant-pollinator networks (Aguiar *et al*., 2024). Although identified as a module hub only in Site E, *P. lineata* occurred in all networks and exhibited high within-module connectivity in most of the evaluated areas (Table S3). *Vernonanthura mucronulata* (Asteraceae), in turn, was recorded in only one area but functioned as a connector among modules, playing a crucial role in maintaining the overall network cohesion by promoting pollinator flow and community stability in the face of local disturbances (Olesen *et al*., 2007; Guimarães *et al*., 2011). Species such as *Bombus morio* and *Trigona spinipes*, although not formally reaching the connector threshold defined by Olesen *et al.* (2007), exhibited connectivity values close to the critical limit, reflecting their generalist nature and ability to interact across multiple modules. This pattern suggests that these species may act as potential connectors, with small structural changes in the network possibly shifting their role toward a more central position within the community. The same applies to *Apis mellifera*, another generalist bee that reached the within-module connectivity threshold across different networks, although it was not classified as a module hub in any of them (Table S3).

Species strength indicates the degree of importance of a species to its partners, either as a source of essential resources or as an agent of pollen transfer (Bascompte *et* *al*., 2006; Landi *et al*., 2018). Our results revealed substantial variation in this index among species, with values far from the mean, highlighting that only a few species exert a strong influence on the plant-pollinator interaction networks evaluated. Among the flower visitors, bees such as *Apis mellifera*, *Paratrigona lineata*, and *Trigona spinipes* showed high interaction strength, reflecting their importance for multiple plant species (Bascompte *et al*., 2006). For plants, *Calea cuneifolia* and other Asteraceae spp. stood out as a central resource, providing nectar and pollen to a wide range of flower visitors, confirming the role of this family as a hub of interactions in the Cerrado. Conversely, peripheral species, although exhibiting low interaction strength, may play critical roles for more specialized visitors, functioning as key resources within specific network modules (Blüthgen *et al*., 2006; Schleuning *et al*., 2014). This inequality in the distribution of interaction strength, typical of mutualistic networks, reinforces the idea that the loss of a few highly influential species can cause disproportionate effects on community stability and functioning (Memmott *et al.*, 2004; Bascompte & Jordano, 2007).

Species-level specialization also varied widely, ranging from generalist species, which interact with multiple partners, to specialists, which maintain more restricted interactions. Our results indicate that only a minority of the species assessed contribute to greater redundancy and stability within the networks by establishing multiple interactions. This reveals that the majority of species across the six plant-pollinator interaction networks exhibit high specialization, which may render them more vulnerable to disturbances, even though they play important roles in specific interactions (Blüthgen *et al*., 2006; Guimarães *et al*., 2011).

Among flower visitors, species such as *B. morio* and *A. mellifera* exemplify a generalist profile, interacting with plants from different families and modules and exhibiting low species-level specialization (*d'*). In contrast, representatives of Vespidae and some Halictinae showed higher values, reflecting interactions restricted to a few partners and indicating a more specialized behavior within the assessed networks. Regarding plants, *C. cuneifolia* (Asteraceae), recurrent across different modules and areas, established multiple interactions, reinforcing its role as a generalist resource. Conversely, species such as *V. mucronulata* (Asteraceae), although acting as connectors among modules, interacted with a more limited number of visitors, showing a higher degree of specialization. This pattern highlights that species with greater dependence on specific partners, i.e., those with higher species-level specialization and classified as peripheral within the modular structure (Table S3), tend to be more vulnerable to the loss of interaction partners (Memmott *et al*., 2004; Bascompte & Jordano, 2007; Guimarães *et al*., 2011). Nevertheless, even under these conditions, such species can play important roles by maintaining specific and unique interactions within the network (Blüthgen *et al*., 2006).

Finally, the variation in species-level indices across the different evaluated areas (Figure 6; Figure 7) suggests functional plasticity and adaptability, indicating that the ecological role of a species may depend on the environmental context and the composition of the local community. For instance, *Paratrigona lineata* played a central role in maintaining community cohesion, even though it was present in all six communities. Among flower visitors, *Apis mellifera*, *Bombus morio*, and *P. lineata* were present in all communities, yet their interaction strength and specialization varied markedly (Figure 7). This spatial variation has important conservation implications, as it highlights the need for strategies that consider environmental heterogeneity and the dynamics of ecological interactions across the landscape (Tylianakis *et al*., 2007).

Conclusion

Our results revealed a structural topology of plant-pollinator interaction networks that differs from what has been previously reported in the literature. The patterns observed here indicate that ecological interactions are not distributed uniformly, but rather are organized in a compartmentalized manner, with specific groups of species interacting in distinct environmental contexts. The predominance of peripheral species and the occurrence of few hubs and connectors suggest that network stability may rely on a small number of key species. The high dissimilarity among areas was mainly explained by species and interaction turnover, with few recurrent connections between sites, indicating that local composition plays a central role in maintaining the networks. Furthermore, the association between the Human Presence Index and structural variation in interactions highlights the sensitivity of these communities to anthropogenic pressure, even at small spatial scales.

These findings indicate that the loss of species or habitats can directly compromise the functional integrity of communities. Therefore, conservation strategies in the Cerrado should go beyond the protection of individual species and also consider interaction patterns and habitat complementarity. The high beta diversity observed underscores the importance of preserving multiple environments with distinct ecological contexts to maintain the resilience of local communities. Promoting the conservation of environmental heterogeneity is thus essential to ensure the persistence of ecological interactions in the Cerrado in the face of increasing anthropogenic pressures and climate change.

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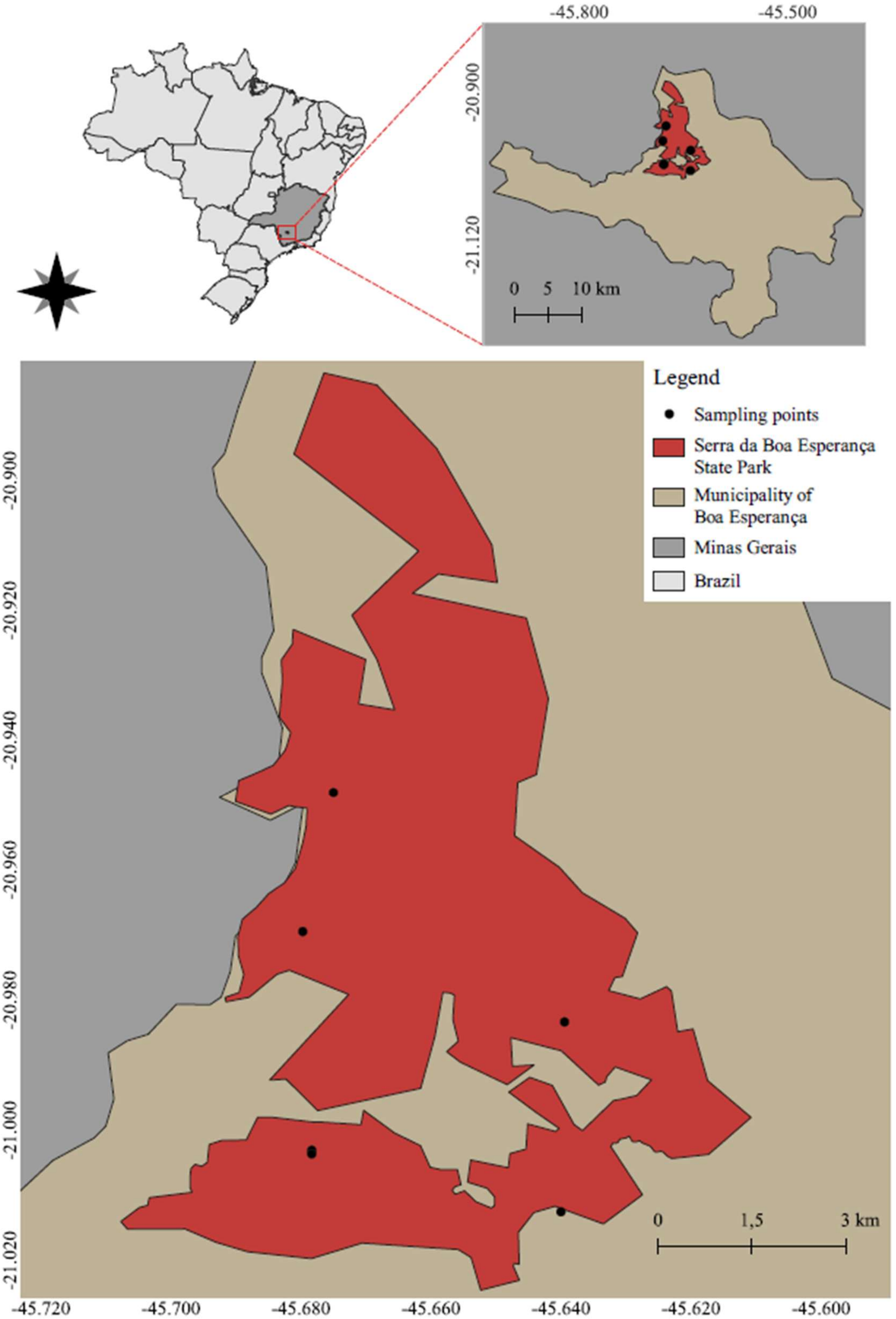

Figure 1. Location of the Serra da Boa Esperança State Park with the sampled areas across a vegetation cover gradient in the municipality of Boa Esperança, southern Minas Gerais, Brazil.

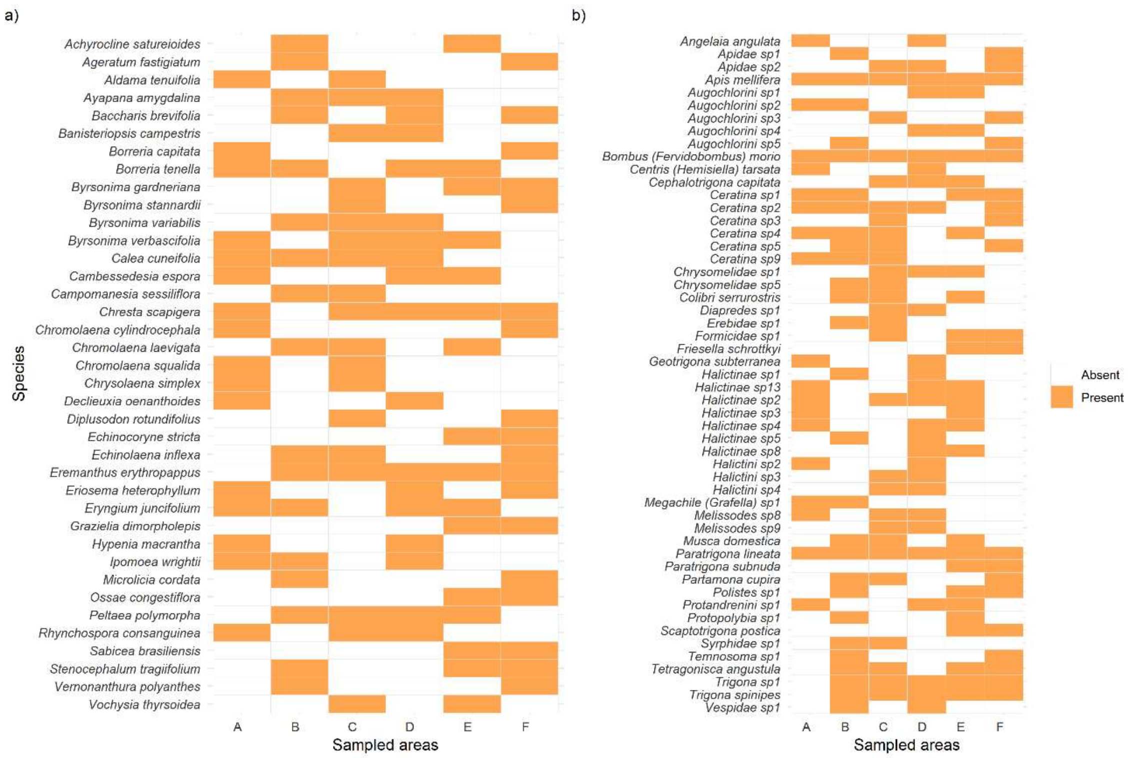

Figure 2. Plant species (a) and floral visitors (b) that occurred in more than one sampled area in the Serra de Boa Esperança State Park, southern Minas Gerais, Brazil.

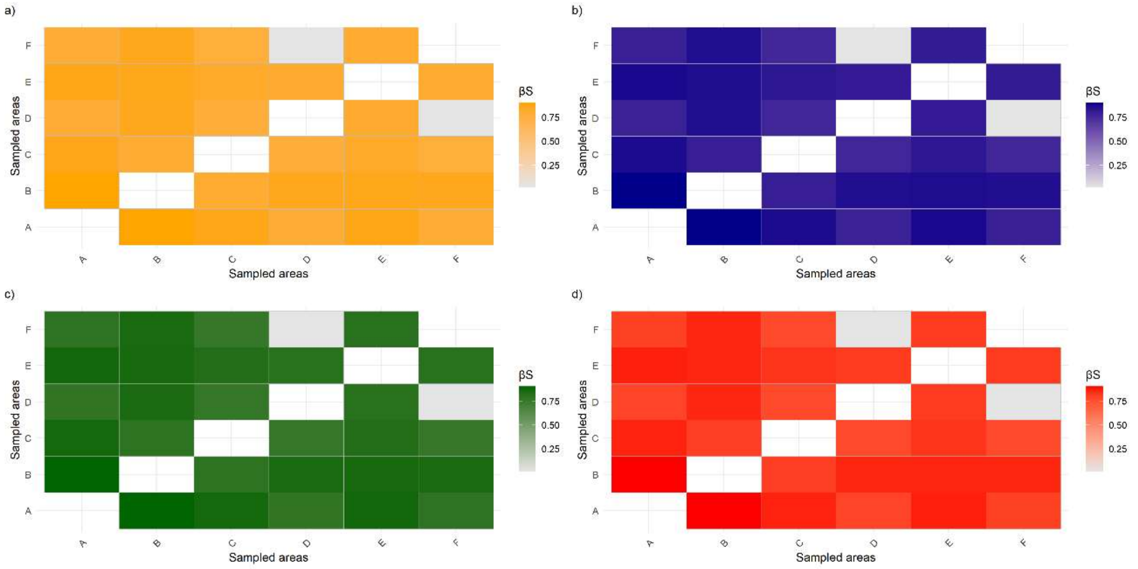

Figure 3. Dissimilarity among plant-pollinator interaction networks across six Cerrado sampled areas in the Serra de Boa Esperança State Park, southern Minas Gerais, Brazil, with respect to: (a) structural dissimilarity (*βWN*) among networks; (b) species composition dissimilarity (*βST*) among networks; (c) interaction dissimilarity (*βOS*) among networks; and (d) total dissimilarity (*βS*) among interaction networks.

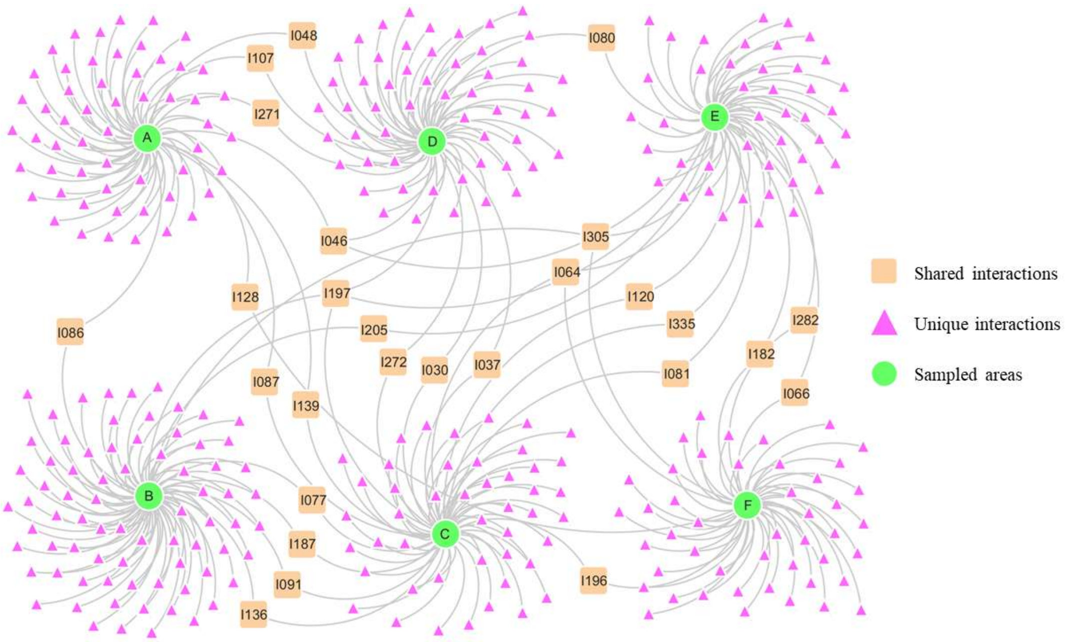

Figure 4. Interactions between specific species pairs across the sampled areas along the vegetation cover gradient in the Serra de Boa Esperança State Park, southern Minas Gerais, Brazil, with: triangles representing interactions that occurred in only one area; squares representing interactions shared across more than one area; and circles representing the sampled areas (see Table S4 for details).

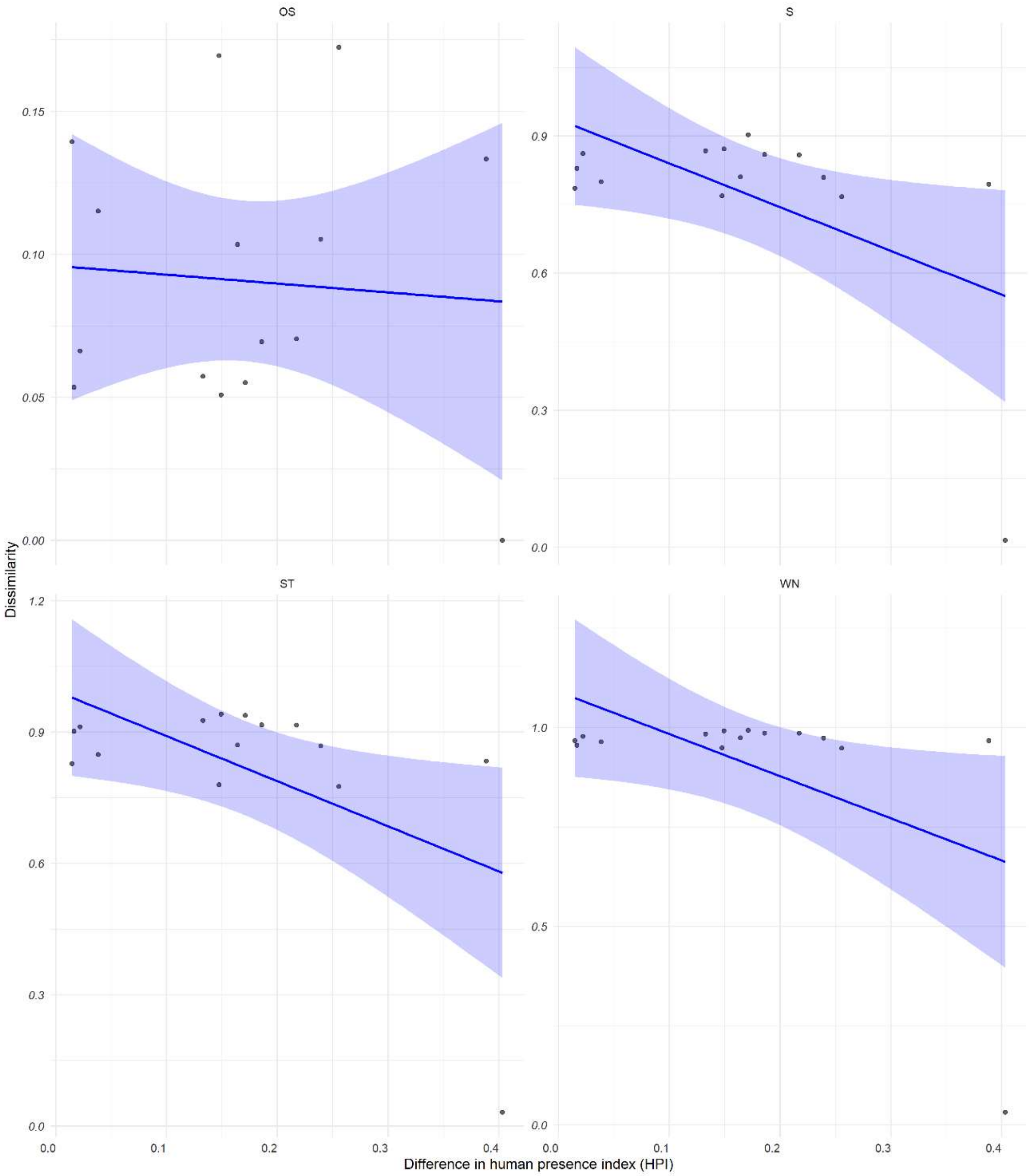

Figure 5. Relationship between the difference in the Human Presence Index (HPI) and the components of dissimilarity in plant-pollinator networks: structural (*βWN*), species turnover (*βST*), interaction rewiring (*βOS*), and total dissimilarity (*βS*).

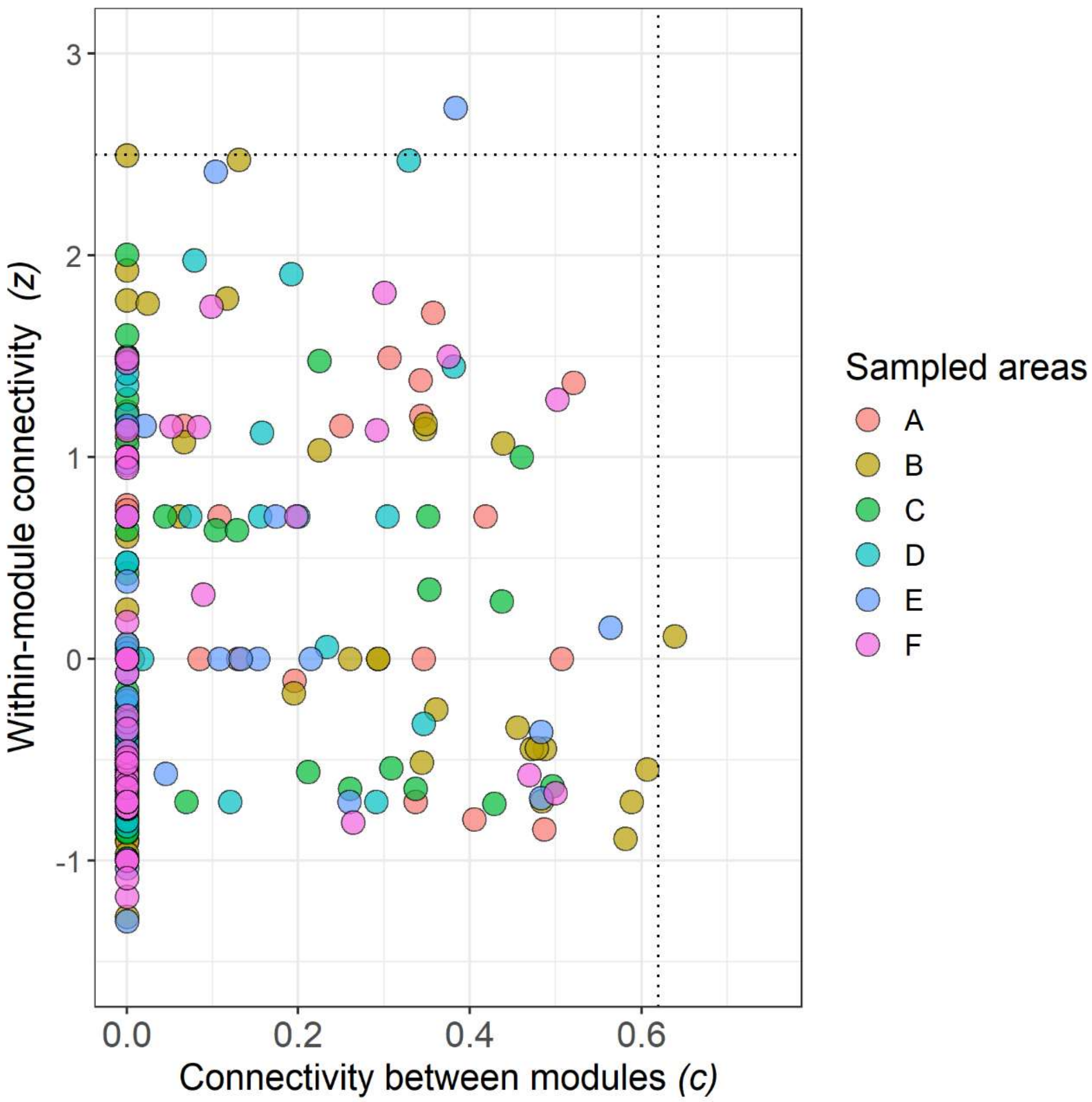

Figure 6. Role of species in the modular structure of the six plant-pollinator interaction networks at Serra de Boa Esperança State Park, southern Minas Gerais, Brazil, based on *c* and *z* values proposed by Olesen *et al.* (2007).

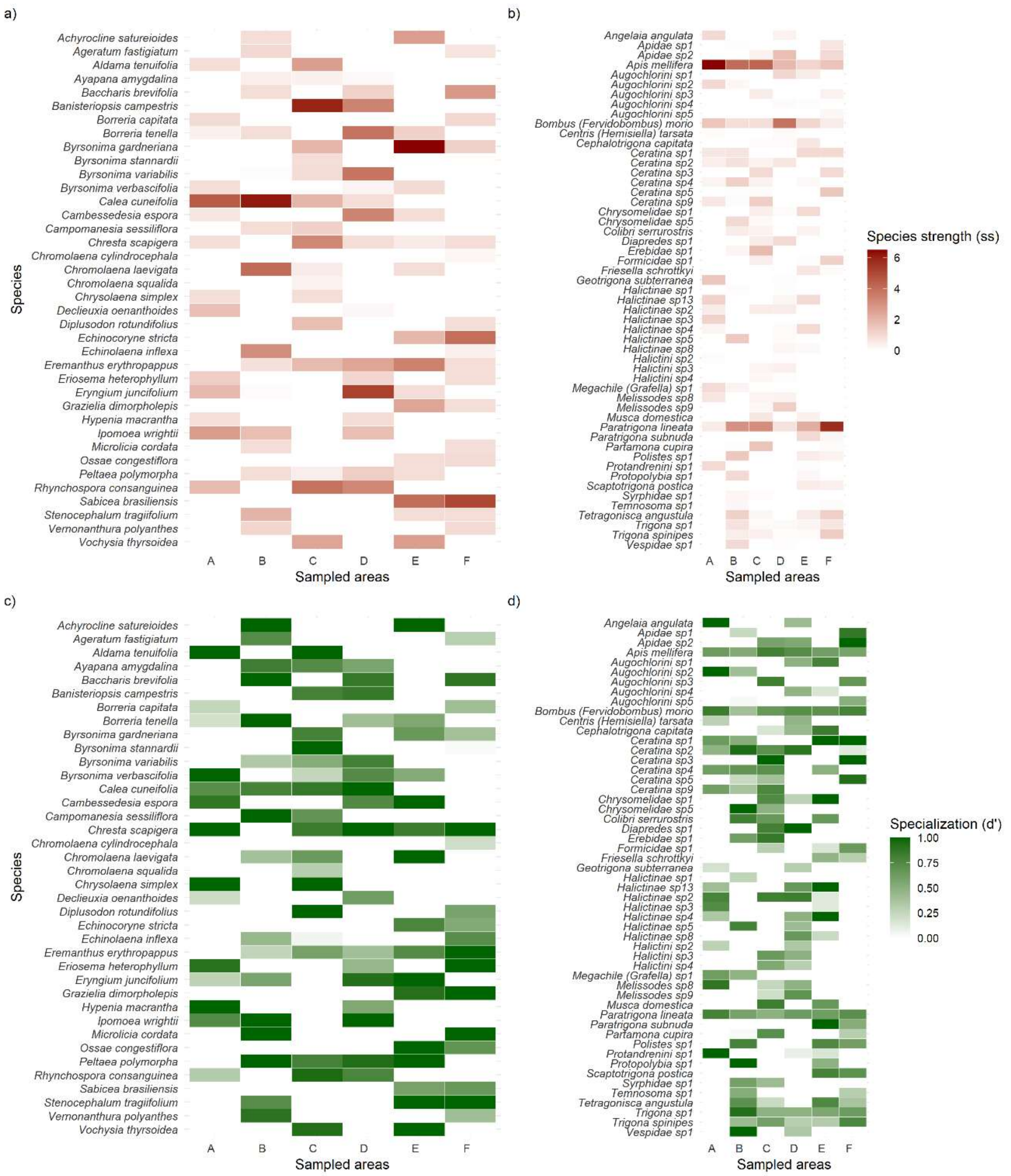

Figure 7. Variation in the indices of (a) species strength (*ss*) and (b) specialization (*d'*) for species occurring in more than one sampled area along the Cerrado vegetation cover gradient in the Serra de Boa Esperança State Park, southern Minas Gerais region, Brazil.

Table 1. Network structures of plant-pollinator interactions for each sampled area along the vegetation cover gradient in the Serra de Boa Esperança State Park, southern Minas Gerais, Brazil. * Indicates significant structures according to the null model vaznull ($p \leq 0.05$).

Sampled area	**Plant (n)**	**Floral visitor (n)**	**Phytophysiognomy**	**HPI**	**Nestedness (wNODF)**	**Specialization (H2)**	**Modularity (Q)**
A	28	37	Campo rupestre	0.04	3.95	0.69*	0.56*
B	30	51	Campo rupestre	0.21	3.91	0.64*	0.60*
C	24	39	Campo rupestre	0.17	2.92	0.70*	0.71*
D	21	44	Campo sujo	0.02	3.71	0.77*	0.71*
E	23	45	Campo sujo	0.19	2.16	0.81	0.75
F	27	39	Campo sujo	0.14	3.71	0.60	0.70

Table S1. List of plant species occurring in the Serra de Boa Esperança State Park, southern Minas Gerais, Brazil.

Plants	Sampled areas (n)	Interaction partners (n)
Apiaceae		
Eryngium juncifolium (Urb.) Mathias & Constance	4	13
Apocynaceae		
Mandevilla illustris (Vell.) Woodson	1	1
Araliaceae		
Didymopanax macrocarpus (Cham. & Schltdl.) Seem.	1	3
Asteraceae		
Achyrocline satureioides (Lam.) DC.	2	4
Ageratum fastigiatum (Gardner) R.M.King & H.Rob.	2	5
Aldama tenuifolia (Gardner) E.E.Schill. & Panero	2	4
Ayapana amygdalina (Lam.) R.M.King & H.Rob.	3	3
Baccharis brevifolia DC.	3	3
Baccharis dracunculifolia DC.	1	1
Baccharis pingraea DC.	1	1
Calea cuneifolia DC.	4	19
Chresta scapigera (Less.) Gardner	5	8
Chromolaena chaseae (B.L.Rob.) R.M.King & H.Robinson	1	1
Chromolaena cylindrocephala (Sch.Bip. ex Baker) R.M.King & H.Rob.	2	2
Chromolaena laevigata (Lam.) R.M.King & H.Rob.	3	9
Chromolaena squalida (DC.) R.M.King & H.Rob.	2	2

Chrysolaena obovata (Less.) Dematt.	1	2
Chrysolaena simplex (Less.) Dematt.	2	2
Cyanthillium cinereum (L.) H.Rob.	1	1
Echinocoryne schwenkiifolia (Mart. ex DC.) H.Rob.	1	2
Echinocoryne stricta (Gardner) H.Rob.	2	8
Eremanthus elaeagnus (Mart. ex DC.) Sch.Bip.	1	1
Eremanthus erythropappus (DC.) MacLeish	5	12
Grazielia dimorpholepis (Baker) R.M.King & H.Rob.	2	5
Lepidaploa sororia (DC.) H.Rob.	1	2
Lessingianthus linearifolius (Less.) H.Rob.	1	3
Moquiniastrum densicephalum (Cabrera) G. Sancho	1	1
Stenocephalum tragiifolium (DC.) Sch.Bip.	3	5
Stevia heptachaeta DC.	1	1
Verbesina sordescens DC.	1	7
Vernonanthura mucronulata (Less.) H.Rob.	1	6
Vernonanthura polyanthes (Sprengel) Vega & Dematteis	2	4
Campanulaceae		
Wahlenbergia brasiliensis Cham.	1	4
Convolvulaceae		
Ipomoea wrightii A.Gray	3	8
Cyperaceae		
Rhynchospora consanguinea (Kunth) Boeckeler	3	10
Euphorbiaceae		
Croton antisyphiliticus Mart.	1	1
Croton glandulosus L.	1	1
Croton sp.2	1	1
Fabaceae		
Chamaecrista cathartica (Mart.) H.S.Irwin & Barneby	1	4

Chamaecrista linearifolia (G.Don) H.S.Irwin & Barneby	1	1
Eriosema heterophyllum Benth.	3	6
Mimosa calocephala Mart.	1	1
Mimosa pigra L.	1	3
Gentianaceae		
Calolisianthus speciosus (Cham. & Schltdl.) Gilg	1	1
Iridaceae		
Sisyrinchium vaginatum Spreng.	1	3
Lamiaceae		
Cyanocephalus rugosus (Benth.) Harley & J.F.B.Pastore	1	6
Hypenia macrantha (A.St.-Hil. ex Benth.) Harley	2	3
Lauraceae		
Ocotea pulchella (Nees & Mart.) Mez	1	1
Lythraceae		
Cuphea ericoides Cham. & Schltdl.	1	2
Diplusodon rotundifolius DC.	2	4
Diplusodon villosissimus Pohl	1	1
Malpighiaceae		
Banisteriopsis campestris (A.Juss.) Little	2	13
Byrsonima gardneriana A.Juss.	3	12
Byrsonima guilleminiana A.Juss.	1	2
Byrsonima stannardii W.R.Anderson	2	2
Byrsonima variabilis A.Juss.	3	9
Byrsonima verbascifolia (L.) DC.	4	3
Peixotoa tomentosa A.Juss.	1	1
Malvaceae		
Peltaea polymorpha (A.St.-Hil.) Krapov. & Cristóbal	4	5
Melastomataceae		

Cambessedesia espora (A.St.-Hil. ex Bonpl.) DC.	3	7
Marcetia taxifolia (A.St.-Hil.) DC.	1	3
Microlicia cordata (Spreng.) Cham.	2	2
Ossaea congestiflora (Naudin) Cogn.	2	3
Pleroma frigidulum (Schrank et Mart. ex DC.) Triana	1	1
Pleroma sp.1	1	1
Pleroma stenocarpum (Schrank et Mart. ex DC.) Triana	1	1
Myrtaceae		
Campomanesia sessiliflora (O.Berg) Mattos	2	4
Ochnaceae		
Luxemburgia octandra A.St.-Hil.	1	1
Poaceae		
Echinolaena inflexa (Poir.) Chase	3	6
Polygalaceae		
Senega longicaulis (Kunth) J.F.B.Pastore	1	1
Senega paniculata (L.) J.F.B.Pastore & J.R.Abbott	1	1
Rubiaceae		
Borreria capitata (Ruiz & Pav.) DC.	2	5
Borreria latifolia (Aubl.) K.Schum.	1	1
Borreria tenella (Kunth) Cham. & Schltdl.	4	9
Cordiera rigida (K.Schum.) Kuntze	1	3
Declieuxia cordigera var. *cordigera* Mart. & Zucc. ex Schult. & Schult.f.	1	3
Declieuxia oenanthoides Mart. & Zucc. ex Schult. & Schult.f.	2	6
Sabicea brasiliensis Wernham	2	13
Tocoyena formosa (Cham. & Schltdl.) K.Schum.	1	1
Rutaceae		

Zanthoxylum rigidum Humb. & Bonpl. ex Willd.	1	2
Sapindaceae		
Serjania sp.1	1	1
Solanaceae		
Solanum lycocarpum A.St.-Hil.	1	3
Solanum paniculatum L.	1	1
Symplocaceae		
Symplocos oblongifolia Casar.	1	1
Velloziaceae		
Vellozia nivea L.B.Sm. & Ayensu	1	4
Vochysiaceae		
Vochysia thyrsoidea Pohl	2	5
Vochysia tucanorum Mart.	1	2
Xyridaceae		
Xyris asperula Mart.	1	2

Table S2. List of floral visitor species occurring in the Serra de Boa Esperança State Park, southern Minas Gerais, Brazil.

Floral visitor	Sampled areas (n)	Interaction partners (n)
APODIFORMES		
Trochilidae		
Colibri serrirostris (Vieillot, 1816)	1	2
Eupetomena macroura (Gmelin, 1788)	1	1
Phaethornis pretrei (Lesson & Delattre, 1839)	1	1
COLEOPTERA		
Coleoptera sp.1	1	1
Coleoptera sp.2	1	1
Coleoptera sp.3	1	1
Coleoptera sp.4	1	1
Coleoptera sp.5	1	1
Carabidae		
Callidum sp.2	1	1
Callidum sp.3	1	2
Chrysomelidae		
Chrysomelidae sp.1	3	2
Chrysomelidae sp.2	1	1
Chrysomelidae sp.3	1	1
Chrysomelidae sp.4	1	1
Chrysomelidae sp.5	2	2
Cucurlionidae		
Diapredes sp.1	2	2
DERMAPTERA		
Forficulidae		
Doru taeniatum (Dohrn, 1862)	1	1
DIPTERA		
Diptera sp.1	1	1
Diptera sp.3	1	1

Diptera sp.4	1	1
Diptera sp.6	1	1
Diptera sp.8	1	1
Calliphoridae		
Calliphora (Calliphora) vicina Robineau-Desvoidy, 1830	1	1
Muscidae		
Musca domestica Linnaeus, 1758	3	2
Syrphidae		
Baccha sp.1	1	1
Palpada sp.1	1	2
Palpada sp.2	1	1
Palpada sp.3	1	1
Syrphidae sp.1	2	2
Syrphidae sp.2	1	1
Syrphidae sp.3	1	2
HYMENOPTERA		
Apidae		
Anthidiini sp.1	1	1
Anthrenoides sp.1	1	1
Apis mellifera Linnaeus, 1758	6	19
Apidae sp.1	2	2
Apidae sp.2	3	5
Apidae sp.3	1	1
Apidae sp.4	1	1
Apidae sp.5	1	1
Apidae sp.6	1	1
Apidae sp.7	1	1
Apidae sp.9	1	1
Apidae sp.11	1	1
Apidae sp.12	1	1
Apidae sp.14	1	1
Augochlorini sp.1	2	2

Augochlorini sp.2	2	3
Augochlorini sp.3	2	2
Augochlorini sp.4	2	2
Augochlorini sp.5	2	1
Augochlorini sp.6	1	1
Augochlorini sp.7	1	1
Augochlorini sp.8	1	1
Augochloropsis sp.1	1	1
Bombus (Fervidobombus) morio (Swederus, 1787)	6	8
Brachynomada sp.1	1	2
Centris (*Centris*) sp.1	1	1
Centris (*Hemisiella*) *tarsata* Smith, 1874	2	2
Centris (*Melacentris*) sp.1	1	1
Centris (*Trachina*) sp.1	1	1
Centris sp.1	1	1
Centris sp.2	1	1
Cephalotrigona capitata (Smith, 1854)	3	3
Ceratina sp.1	4	4
Ceratina sp.2	5	5
Ceratina sp.3	2	2
Ceratina sp.4	4	6
Ceratina sp.5	3	4
Ceratina sp.6	1	1
Ceratina sp.7	1	2
Ceratina sp.9	3	5
Ceratina sp.11	1	1
Ceratina sp.12	1	1
Ceratina sp.13	1	1
Emphorini sp.1	1	1
Emphorini sp.2	1	1
Epicharis (Epicharis) flava Friese, 1900	1	1
Eucerini sp.1	1	1

Eucerini sp.2	1	1
Eucerini sp.3	1	1
Eucerini sp.4	1	1
Eufriesa sp.1	1	1
Exomalopsis sp.1	1	1
Exomalopsis sp.8	1	1
Friesella schrottkyi (Friese, 1900)	2	4
Geotrigona subterranea (Friese, 1901)	2	6
Halictinae sp.1	2	2
Halictinae sp.2	4	4
Halictinae sp.3	2	3
Halictinae sp.4	3	4
Halictinae sp.5	2	3
Halictinae sp.6	1	1
Halictinae sp.7	1	1
Halictinae sp.8	2	3
Halictinae sp.10	1	2
Halictinae sp.12	1	2
Halictinae sp.13	3	5
Halictini sp.1	1	1
Halictini sp.2	2	2
Halictini sp.3	2	3
Halictini sp.4	2	2
Halictini sp.5	1	1
Megachile (*Austromegachile*) sp.1	1	1
Megachile (*Grafella*) sp.1	2	5
Megachile (*Moureapis*) sp.1	1	1
Megachile (*Zonomegachile*) sp.1	1	1
Megachile sp.1	1	1
Melipona (*Melikerria*) *quinquefasciata* Lepeletier, 1836	1	2
Melipona (*Melipona*) *quadrifasciata* Lepeletier, 1836	1	1

Melipona sp.1	1	1
Melissodes sp.1	1	1
Melissodes sp.3	1	1
Melissodes sp.4	1	1
Melissodes sp.6	1	1
Melissodes sp.7	1	3
Melissodes sp.8	3	5
Melissodes sp.9	2	3
Nannotrigona sp.1	1	1
Oxytrigona sp.2	1	1
Paratrigona lineata (Lepeletier, 1836)	6	23
Paratrigona subnuda Moure, 1947	2	2
Paroxystoglossa sp.1	1	1
Partamona cupira (Smith, 1863)	3	5
Plebeia sp.1	1	1
Protandrenini sp.1	3	3
Rhathymus sp.1	1	1
Scaptotrigona postica (Latreille, 1807)	2	2
Temnosoma sp.1	2	2
Tetragona clavipes (Fabricius, 1804)	1	1
Tetragonisca angustula (Latreille, 1811)	4	10
Trigona sp.1	5	5
Trigona spinipes (Fabricius, 1793)	5	7
Xylocopa (*Schonnherria*) sp.1	1	1
Formicidae		
Formicidae sp.1	3	5
Formicidae sp.2	1	1
Scoliidae		
Campsomeris sp.1	1	1
Vespidae		
Agelaia angulata (Fabricius, 1804)	2	3
Brachygastra lecheguana (Latreille, 1824)	1	1
Parachartergus pseudapicalis Willink,	1	1

1959		
Polistes billardieri Fabricius, 1804	1	1
Polistes sp.1	2	3
Polistes sp.2	1	1
Polistes sp.3	1	1
Polistes sp.4	1	1
Protopolybia sp.1	2	2
Vespidae sp.1	2	2
Vespidae sp.4	1	1
Vespidae sp.7	1	1
Vespidae sp.8	1	1
Vespidae sp.10	1	1
Vespidae sp.11	1	1
Vespidae sp.13	1	1
LEPIDOPTERA		
Eribidae		
Erebidae sp.1	2	3
Hesperiidae		
Hesperiidae sp.1	1	1
Nymphalidae		
Nymphalidae sp.1	1	1
Nymphalidae sp.2	1	1
ORTHOPTERA		
Acrididae		
Acredidae sp.1	1	1
Acredidae sp.2	1	1
Acredidae sp.3	1	1

Table S3. Species-level indices of plant-floral visitor interaction networks across the sampled areas along the vegetation cover gradient in Serra de Boa Esperança State Park, southern Minas Gerais, Brazil.

Level	**Family**	**Species**	**Sites**	**Between-module connectivity (*c*)**	**Within-module connectivity (*z*)**	**Interaction degree**	**Species strength (*ss*)**	**Specialization (*d’*)**	**Module**
Animal	Acrididae	Acrididae sp.1	A	0.00	1.20	1	1.00	1.00	2
Animal	Acrididae	Acrididae sp.2	F	0.00	1.00	1	1.00	1.00	3
Animal	Acrididae	Acrididae sp.3	E	0.00	0.00	1	1.00	1.00	1
Animal	Apidae	*Agelaia angulata*	D	0.00	1.36	2	0.31	0.43	1
Animal	Apidae	*Agelaia angulata*	A	0.00	0.00	1	1.00	1.00	8
Animal	Apidae	Anthidiini sp.1	F	0.00	-0.69	1	0.04	0.00	10
Animal	Apidae	*Anthrenoides* sp.1	D	0.00	0.48	1	0.17	0.48	1
Animal	Apidae	Apidae sp.1	B	0.00	-0.73	1	0.05	0.23	2
Animal	Apidae	Apidae sp.1	F	0.00	0.00	1	0.67	0.87	3
Animal	Apidae	Apidae sp.11	C	0.00	-0.16	1	0.18	0.40	2
Animal	Apidae	Apidae sp.12	F	0.00	1.47	1	1.00	1.00	5
Animal	Apidae	Apidae sp.14	B	0.00	0.00	1	1.00	1.00	9
Animal	Apidae	Apidae sp.2	F	0.00	1.00	1	1.00	1.00	1

Animal	Apidae	Apidae sp.2	D	0.30	0.71	4	1.72	0.55	3
Animal	Apidae	Apidae sp.2	C	0.00	-0.43	1	0.32	0.58	9
Animal	Apidae	Apidae sp.3	E	0.00	-0.48	1	0.05	0.16	11
Animal	Apidae	Apidae sp.4	B	0.00	-0.47	1	0.08	0.33	4
Animal	Apidae	Apidae sp.5	F	0.00	-0.73	1	0.10	0.31	5
Animal	Apidae	Apidae sp.6	E	0.00	0.00	1	1.00	1.00	15
Animal	Apidae	Apidae sp.7	F	0.00	-0.52	1	0.33	0.67	6
Animal	Apidae	Apidae sp.9	B	0.00	-0.71	1	0.03	0.09	10
Animal	Apidae	*Apis mellifera*	B	0.13	2.47	7	4.04	0.54	1
Animal	Apidae	*Apis mellifera*	D	0.33	2.47	3	1.88	0.74	6
Animal	Apidae	*Apis mellifera*	C	0.00	1.50	5	4.20	0.81	9
Animal	Apidae	*Apis mellifera*	F	0.30	1.82	4	1.59	0.58	10
Animal	Apidae	*Apis mellifera*	E	0.10	2.41	3	1.14	0.61	12
Animal	Apidae	*Apis mellifera*	A	0.36	1.72	9	6.49	0.63	15
Animal	Apidae	Augochlorini sp.1	E	0.00	0.00	1	0.50	0.79	8
Animal	Apidae	Augochlorini sp.1	D	0.00	0.05	2	1.07	0.49	9
Animal	Apidae	Augochlorini sp.2	B	0.49	-0.45	2	0.22	0.41	2
Animal	Apidae	Augochlorini sp.2	A	0.00	1.31	1	1.00	1.00	12
Animal	Apidae	Augochlorini sp.3	F	0.00	-1.00	1	0.33	0.67	3
Animal	Apidae	Augochlorini sp.3	C	0.00	-0.58	1	0.50	0.82	6

Animal	Apidae	Augochlorini sp.4	D	0.00	-0.55	1	0.14	0.47	1
Animal	Apidae	Augochlorini sp.4	E	0.00	-0.48	1	0.05	0.16	11
Animal	Apidae	Augochlorini sp.5	B	0.00	-0.39	1	0.02	0.03	1
Animal	Apidae	Augochlorini sp.5	F	0.00	-0.57	1	0.22	0.50	2
Animal	Apidae	Augochlorini sp.6	A	0.00	-0.58	1	0.33	0.67	11
Animal	Apidae	Augochlorini sp.7	B	0.00	-0.47	1	0.09	0.37	4
Animal	Apidae	Augochlorini sp.8	B	0.00	-0.53	1	0.11	0.40	2
Animal	Apidae	*Augochloropsis* sp.1	D	0.00	-0.63	1	0.04	0.18	9
Animal	Syrphidae	*Baccha* sp.1	B	0.00	-0.51	1	0.08	0.33	3
Animal	Apidae	*Bombus (Fervidobombus) morio*	E	0.15	0.00	2	1.09	0.70	2
Animal	Apidae	*Bombus (Fervidobombus) morio*	A	0.50	0.00	3	1.52	0.83	3
Animal	Apidae	*Bombus (Fervidobombus) morio*	C	0.46	1.00	3	0.85	0.66	3
Animal	Apidae	*Bombus*	F	0.00	0.18	1	0.50	0.79	5

		(Fervidobombus) morio							
Animal	Apidae	*Bombus (Fervidobombus) morio*	D	0.08	1.98	7	3.91	0.72	9
Animal	Apidae	*Bombus (Fervidobombus) morio*	B	0.61	-0.55	4	0.87	0.39	10
Animal	Vespidae	*Brachygastra lecheguana*	E	0.00	-1.03	1	0.13	0.38	9
Animal	Vespidae	*Brachynomada* sp.1	D	0.16	1.12	2	0.68	0.72	2
Animal	Simuliidae	*Callidum* sp.2	A	0.00	-0.58	1	0.17	0.46	14
Animal	Simuliidae	*Callidum* sp.3	E	0.48	-0.69	2	0.21	0.27	14
Animal	Calliphoridae	*Calliphora (Calliphora) vicina*	D	0.00	-0.71	1	0.60	0.85	3
Animal	Scoliidae	*Campsomeris* sp.1	F	0.00	-0.50	1	0.17	0.46	8
Animal	Apidae	*Centris (Centris)* sp.1	A	0.00	1.10	1	0.56	0.76	10
Animal	Apidae	*Centris (Hemisiella) tarsata*	A	0.00	0.00	1	0.07	0.28	3

Animal	Apidae	*Centris (Hemisiella) tarsata*	D	0.00	-0.54	1	0.14	0.47	7
Animal	Apidae	*Centris (Melacentris)* sp.1	C	0.00	0.00	1	1.00	1.00	8
Animal	Apidae	*Centris (Trachina)* sp.1	D	0.00	-0.36	1	0.29	0.67	4
Animal	Apidae	*Centris* sp.1	E	0.00	-0.58	1	0.17	0.46	14
Animal	Apidae	*Centris* sp.2	B	0.00	-0.83	1	0.05	0.25	10
Animal	Apidae	*Cephalotrigona capitata*	C	0.31	-0.54	2	0.12	0.16	9
Animal	Apidae	*Cephalotrigona capitata*	D	0.00	-0.41	1	0.14	0.44	10
Animal	Apidae	*Cephalotrigona capitata*	E	0.00	1.15	1	0.63	0.83	14
Animal	Apidae	*Ceratina* sp.1	B	0.35	1.14	3	0.69	0.51	2
Animal	Apidae	*Ceratina* sp.1	E	0.00	0.00	1	1.00	1.00	6
Animal	Apidae	*Ceratina* sp.1	A	0.42	-0.60	2	0.61	0.63	6
Animal	Apidae	*Ceratina* sp.1	F	0.00	0.00	1	1.00	1.00	9
Animal	Apidae	*Ceratina* sp.11	B	0.00	-0.71	1	0.20	0.58	5
Animal	Apidae	*Ceratina* sp.12	D	0.00	-0.71	1	0.33	0.73	4

Animal	Apidae	*Ceratina* sp.13	E	0.00	0.71	1	0.50	0.79	5
Animal	Apidae	*Ceratina* sp.2	A	0.34	-0.41	2	0.42	0.48	1
Animal	Apidae	*Ceratina* sp.2	C	0.00	-0.85	1	0.33	0.71	1
Animal	Apidae	*Ceratina* sp.2	B	0.00	0.71	1	0.80	0.94	5
Animal	Apidae	*Ceratina* sp.2	D	0.00	0.71	1	0.67	0.89	5
Animal	Apidae	*Ceratina* sp.2	F	0.00	-0.62	1	0.07	0.13	10
Animal	Apidae	*Ceratina* sp.3	C	0.00	1.15	1	1.00	1.00	6
Animal	Apidae	*Ceratina* sp.3	F	0.00	0.00	1	1.00	1.00	7
Animal	Apidae	*Ceratina* sp.4	C	0.00	-0.85	1	0.33	0.71	1
Animal	Apidae	*Ceratina* sp.4	E	0.00	-0.71	1	0.17	0.50	5
Animal	Apidae	*Ceratina* sp.4	A	0.00	-1.20	1	0.29	0.62	6
Animal	Apidae	*Ceratina* sp.4	B	0.29	0.00	3	1.20	0.67	9
Animal	Apidae	*Ceratina* sp.5	B	0.00	-0.73	1	0.05	0.23	2
Animal	Apidae	*Ceratina* sp.5	F	0.00	1.00	2	1.50	0.92	4
Animal	Apidae	*Ceratina* sp.5	C	0.00	-0.69	1	0.10	0.39	8
Animal	Apidae	*Ceratina* sp.6	F	0.00	-0.62	1	0.07	0.13	10
Animal	Apidae	*Ceratina* sp.7	B	0.47	-0.45	2	0.20	0.38	2
Animal	Apidae	*Ceratina* sp.9	B	0.00	-0.47	1	0.09	0.37	4
Animal	Apidae	*Ceratina* sp.9	A	0.00	0.00	2	0.64	0.60	7
Animal	Apidae	*Ceratina* sp.9	C	0.00	1.48	2	1.30	0.77	8

Animal	Chrysomelidae	Chrysomelidae sp.1	C	0.00	0.43	1	0.43	0.75	4
Animal	Chrysomelidae	Chrysomelidae sp.1	D	0.00	-0.28	1	0.11	0.28	6
Animal	Chrysomelidae	Chrysomelidae sp.1	E	0.00	0.97	1	1.00	1.00	7
Animal	Chrysomelidae	Chrysomelidae sp.2	F	0.00	-0.50	1	0.17	0.46	8
Animal	Chrysomelidae	Chrysomelidae sp.3	A	0.00	0.71	1	0.23	0.56	4
Animal	Chrysomelidae	Chrysomelidae sp.4	D	0.00	0.71	1	0.67	0.89	4
Animal	Chrysomelidae	Chrysomelidae sp.5	C	0.00	-0.85	1	0.14	0.49	4
Animal	Chrysomelidae	Chrysomelidae sp.5	B	0.00	0.00	1	1.00	1.00	8
Animal		Coleoptera sp.1	F	0.00	1.00	1	1.00	1.00	10
Animal		Coleoptera sp.2	F	0.00	-0.50	1	0.17	0.46	8
Animal		Coleoptera sp.3	A	0.00	0.00	1	1.00	1.00	9
Animal		Coleoptera sp.4	F	0.00	0.00	1	1.00	1.00	4
Animal		Coleoptera sp.5	C	0.00	-0.50	1	0.33	0.71	5
Animal	Trochilidae	*Colibri serrurostris*	C	0.00	0.00	1	0.33	0.65	3
Animal	Trochilidae	*Colibri serrurostris*	E	0.00	-0.65	1	0.33	0.65	7
Animal	Trochilidae	*Colibri serrurostris*	B	0.00	0.00	1	0.50	0.82	11
Animal	Curculionidae	*Diapredes* sp.1	C	0.00	1.49	1	0.50	0.81	4
Animal	Curculionidae	*Diapredes* sp.1	D	0.00	0.00	1	1.00	1.00	11
Animal		Diptera sp.1	C	0.00	-0.50	1	0.33	0.71	5
Animal		Diptera sp.3	E	0.00	0.00	1	1.00	1.00	2

Animal		Diptera sp.4	C	0.00	-0.66	1	0.06	0.27	7
Animal		Diptera sp.6	D	0.00	1.21	1	0.43	0.73	1
Animal		Diptera sp.8	C	0.00	-0.85	1	0.14	0.49	4
Animal	Forficulidae	*Doru taeniatum*	A	0.00	-0.78	1	0.17	0.46	5
Animal	Apidae	Emphorini sp.1	C	0.00	1.50	1	1.00	1.00	5
Animal	Apidae	Emphorini sp.2	C	0.00	2.00	1	1.00	1.00	2
Animal	Apidae	*Epicharis (Epicharis) flava*	C	0.00	-0.56	1	0.07	0.20	2
Animal	Erebidae	Erebidae sp.1	C	0.00	1.07	3	1.83	0.86	1
Animal	Erebidae	Erebidae sp.1	B	0.00	0.07	1	0.26	0.61	2
Animal	Apidae	Eucerini sp.1	F	0.00	0.00	1	1.00	1.00	7
Animal	Apidae	Eucerini sp.2	B	0.00	-0.73	1	0.05	0.23	2
Animal	Apidae	Eucerini sp.3	B	0.00	0.00	1	1.00	1.00	6
Animal	Apidae	Eucerini sp.4	C	0.00	-0.64	1	0.05	0.14	2
Animal	Apidae	*Eufriesa* sp.1	A	0.00	-0.78	1	0.17	0.46	5
Animal	Apidae	*Eupetomena macroura*	E	0.00	0.00	1	0.60	0.82	7
Animal	Apidae	*Exomalopsis* sp.1	A	0.00	-0.71	1	0.08	0.23	4
Animal	Apidae	*Exomalopsis* sp.8	D	0.00	-0.23	1	0.29	0.62	7
Animal	Formicidae	Formicidae sp.1	F	0.00	1.49	2	1.22	0.64	2

Animal	Formicidae	Formicidae sp.1	C	0.10	0.64	3	0.42	0.29	4
Animal	Formicidae	Formicidae sp.1	E	0.00	-0.48	1	0.05	0.16	11
Animal	Formicidae	Formicidae sp.2	B	0.00	-0.71	1	0.03	0.09	10
Animal	Apidae	*Friesella schrottkyi*	F	0.00	-0.73	1	0.10	0.31	5
Animal	Apidae	*Friesella schrottkyi*	E	0.56	0.16	3	0.67	0.47	12
Animal	Apidae	*Geotrigona subterranea*	D	0.00	-0.36	1	0.06	0.30	6
Animal	Apidae	*Geotrigona subterranea*	A	0.20	-0.11	6	1.52	0.18	15
Animal	Apidae	Halictinae sp.1	D	0.00	-0.45	1	0.02	0.00	6
Animal	Apidae	Halictinae sp.1	B	0.00	-0.65	1	0.06	0.26	10
Animal	Apidae	Halictinae sp.10	A	0.07	0.00	2	1.04	0.66	14
Animal	Apidae	Halictinae sp.12	A	0.40	-0.41	2	0.13	0.14	3
Animal	Apidae	Halictinae sp.13	E	0.00	0.00	1	1.00	1.00	4
Animal	Apidae	Halictinae sp.13	D	0.00	-0.71	1	0.25	0.66	8
Animal	Apidae	Halictinae sp.13	A	0.00	-0.19	3	1.18	0.41	15
Animal	Apidae	Halictinae sp.2	A	0.00	0.26	1	0.50	0.79	5
Animal	Apidae	Halictinae sp.2	C	0.00	-0.58	1	0.50	0.82	6
Animal	Apidae	Halictinae sp.2	D	0.00	-0.33	1	0.50	0.83	9
Animal	Apidae	Halictinae sp.2	E	0.00	-0.49	1	0.05	0.13	12

Animal	Apidae	Halictinae sp.3	A	0.00	2.04	2	1.18	0.74	3
Animal	Apidae	Halictinae sp.3	E	0.00	-0.49	1	0.05	0.13	12
Animal	Apidae	Halictinae sp.4	D	0.00	-0.80	1	0.13	0.49	2
Animal	Apidae	Halictinae sp.4	A	0.49	-0.84	2	0.28	0.35	10
Animal	Apidae	Halictinae sp.4	E	0.00	0.00	1	1.00	1.00	13
Animal	Apidae	Halictinae sp.5	D	0.00	-0.24	1	0.12	0.42	6
Animal	Apidae	Halictinae sp.5	B	0.00	1.23	2	1.45	0.80	10
Animal	Apidae	Halictinae sp.6	A	0.00	-0.69	1	0.12	0.35	15
Animal	Apidae	Halictinae sp.7	E	0.00	-0.36	1	0.09	0.28	12
Animal	Apidae	Halictinae sp.8	D	0.00	-0.71	1	0.25	0.66	8
Animal	Apidae	Halictinae sp.8	E	0.48	-0.36	2	0.15	0.23	12
Animal	Apidae	Halictini sp.1	C	0.00	-0.50	1	0.33	0.71	5
Animal	Apidae	Halictini sp.2	D	0.00	-0.99	1	0.07	0.35	1
Animal	Apidae	Halictini sp.2	A	0.00	-0.41	1	0.09	0.28	3
Animal	Apidae	Halictini sp.3	D	0.29	-0.71	2	0.40	0.49	5
Animal	Apidae	Halictini sp.3	C	0.00	-0.30	1	0.30	0.64	8
Animal	Apidae	Halictini sp.4	D	0.00	-0.36	1	0.06	0.30	6
Animal	Apidae	Halictini sp.4	C	0.00	-0.49	1	0.20	0.55	8
Animal	Apidae	Halictini sp.5	A	0.00	0.00	1	1.00	1.00	3
Animal	Hesperiidae	Hesperiidae sp.1	A	0.00	-0.58	1	0.50	0.79	11

Animal	Apidae	*Megachile (Austromegachile)* sp.1	D	0.00	-0.44	1	0.25	0.66	9
Animal	Apidae	*Megachile (Grafella)* sp.1	B	0.00	0.25	2	0.30	0.48	2
Animal	Apidae	*Megachile (Grafella)* sp.1	A	0.25	1.15	3	0.98	0.62	11
Animal	Apidae	*Megachile (Moureapis)* sp.1	D	0.00	1.41	1	1.00	1.00	8
Animal	Apidae	*Megachile (Zonomegachile)* sp.1	B	0.00	0.00	1	1.00	1.00	8
Animal	Apidae	*Megachile* sp.1	A	0.00	-0.41	1	0.09	0.28	3
Animal	Apidae	*Melipona (Melikerria) quinquefasciata*	D	0.48	-0.44	2	0.31	0.36	10
Animal	Apidae	*Melipona (Melipona) quadrifasciata*	B	0.00	-0.63	1	0.04	0.18	9
Animal	Apidae	*Melipona* sp.1	A	0.00	-0.26	1	0.28	0.58	10

Animal	Apidae	*Melissodes* sp.1	D	0.00	-0.21	1	0.19	0.50	10
Animal	Apidae	*Melissodes* sp.3	E	0.00	-0.48	1	0.05	0.16	11
Animal	Apidae	*Melissodes* sp.4	D	0.00	-0.70	1	0.07	0.35	7
Animal	Apidae	*Melissodes* sp.6	A	0.00	-0.41	1	0.09	0.28	3
Animal	Apidae	*Melissodes* sp.7	B	0.00	1.93	3	1.89	0.68	10
Animal	Apidae	*Melissodes* sp.8	A	0.00	1.20	1	0.67	0.88	1
Animal	Apidae	*Melissodes* sp.8	C	0.26	-0.64	2	0.30	0.25	2
Animal	Apidae	*Melissodes* sp.8	D	0.35	-0.32	2	0.32	0.48	2
Animal	Apidae	*Melissodes* sp.9	C	0.34	-0.64	2	0.21	0.21	2
Animal	Apidae	*Melissodes* sp.9	D	0.00	1.47	2	1.29	0.69	7
Animal	Muscidae	*Musca domestica*	B	0.00	-0.40	1	0.02	0.00	1
Animal	Muscidae	*Musca domestica*	C	0.00	-0.26	1	0.63	0.83	7
Animal	Muscidae	*Musca domestica*	E	0.00	0.07	1	0.35	0.65	9
Animal	Apidae	*Nannotrigona* sp.1	F	0.00	-0.58	1	0.20	0.52	6
Animal	Nymphalidae	Nymphalidae sp.1	F	0.00	-0.28	1	0.25	0.41	10
Animal	Nymphalidae	Nymphalidae sp.2	B	0.00	-0.33	1	0.16	0.50	2
Animal	Apidae	*Oxytrigona* sp.2	F	0.00	-0.58	1	0.17	0.46	6
Animal	Syrphidae	*Palpada* sp.1	B	0.46	-0.34	2	0.15	0.29	1
Animal	Syrphidae	*Palpada* sp.2	B	0.00	-0.36	1	0.07	0.26	1
Animal	Syrphidae	*Palpada* sp.3	B	0.00	-0.34	1	0.10	0.35	1

Animal	Vespidae	*Parachartergus pseudapicalis*	E	0.00	-0.48	1	0.05	0.16	11
Animal	Apidae	*Paratrigona lineata*	B	0.12	1.79	6	2.98	0.58	4
Animal	Apidae	*Paratrigona lineata*	F	0.10	1.75	8	5.77	0.71	6
Animal	Apidae	*Paratrigona lineata*	A	0.00	-0.60	1	0.50	0.79	7
Animal	Apidae	*Paratrigona lineata*	C	0.22	1.48	6	3.12	0.49	7
Animal	Apidae	*Paratrigona lineata*	D	0.38	1.45	3	0.75	0.63	10
Animal	Apidae	*Paratrigona lineata*	E	0.38	2.73	5	2.20	0.61	11
Animal	Apidae	*Paratrigona subnuda*	F	0.00	-1.00	1	0.20	0.52	1
Animal	Apidae	*Paratrigona subnuda*	E	0.00	0.00	1	1.00	1.00	10
Animal	Apidae	*Paroxystoglossa* sp.1	F	0.00	-0.62	1	0.07	0.13	10
Animal	Apidae	*Partamona cupira*	C	0.13	0.64	3	1.61	0.71	1
Animal	Apidae	*Partamona cupira*	F	0.00	-0.73	1	0.10	0.31	5
Animal	Apidae	*Partamona cupira*	B	0.48	-0.71	2	0.05	0.03	10
Animal	Trochilidae	*Phaethornis pretrei*	E	0.00	-1.30	1	0.07	0.24	7
Animal	Apidae	*Plebeia* sp.1	E	0.00	0.00	1	0.33	0.67	3
Animal	Vespidae	*Polistes billardieri*	E	0.00	-1.00	1	0.17	0.50	3

Animal	Vespidae	*Polistes* sp.1	F	0.00	-0.34	1	0.33	0.60	2
Animal	Vespidae	*Polistes* sp.1	B	0.00	1.78	2	1.46	0.79	3
Animal	Vespidae	*Polistes* sp.1	E	0.00	0.38	1	0.50	0.75	11
Animal	Vespidae	*Polistes* sp.2	F	0.47	-0.57	2	0.36	0.33	2
Animal	Vespidae	*Polistes* sp.3	E	0.00	-0.55	1	0.03	0.00	12
Animal	Vespidae	*Polistes* sp.4	E	0.00	0.00	1	1.00	1.00	6
Animal	Apidae	Protandrenini sp.1	D	0.00	-0.41	1	0.04	0.09	6
Animal	Apidae	Protandrenini sp.1	E	0.00	-0.48	1	0.05	0.16	11
Animal	Apidae	Protandrenini sp.1	A	0.00	0.00	1	1.00	1.00	13
Animal	Apidae	*Protopolybia* sp.1	B	0.00	0.61	1	1.00	1.00	10
Animal	Apidae	*Protopolybia* sp.1	E	0.00	-0.19	1	0.19	0.49	11
Animal	Apidae	*Rhathymus* sp.1	B	0.00	-0.38	1	0.04	0.17	1
Animal	Apidae	*Scaptotrigona postica*	F	0.00	0.00	1	0.40	0.70	1
Animal	Apidae	*Scaptotrigona postica*	E	0.00	1.00	1	0.50	0.79	3
Animal	Syrphidae	Syrphidae sp.1	B	0.00	-0.24	1	0.23	0.60	3
Animal	Syrphidae	Syrphidae sp.1	C	0.00	-0.53	1	0.11	0.42	9
Animal	Syrphidae	Syrphidae sp.2	B	0.00	-0.51	1	0.08	0.33	3
Animal	Syrphidae	Syrphidae sp.3	B	0.34	-0.51	2	0.10	0.15	3

Animal	Apidae	*Temnosoma* sp.1	B	0.00	-0.26	1	0.19	0.52	1
Animal	Apidae	*Temnosoma* sp.1	F	0.00	-0.73	1	0.10	0.31	5
Animal	Apidae	*Tetragona clavipes*	E	0.00	-0.46	1	0.19	0.49	14
Animal	Apidae	*Tetragonisca angustula*	F	0.50	1.29	4	1.27	0.37	5
Animal	Apidae	*Tetragonisca angustula*	B	0.29	0.00	3	1.20	0.70	7
Animal	Apidae	*Tetragonisca angustula*	C	0.21	-0.56	2	0.19	0.23	7
Animal	Apidae	*Tetragonisca angustula*	E	0.00	0.96	1	0.52	0.75	9
Animal	Apidae	*Trigona* sp.1	D	0.00	0.48	1	0.17	0.48	1
Animal	Apidae	*Trigona* sp.1	C	0.00	-0.85	1	0.14	0.49	4
Animal	Apidae	*Trigona* sp.1	F	0.38	1.50	2	0.67	0.63	8
Animal	Apidae	*Trigona* sp.1	E	0.00	-0.07	1	0.25	0.56	11
Animal	Apidae	*Trigona* sp.1	B	0.00	0.71	1	0.75	0.92	12
Animal	Apidae	*Trigona spinipes*	C	0.00	0.64	1	0.41	0.60	2
Animal	Apidae	*Trigona spinipes*	D	0.00	-0.36	1	0.06	0.30	6
Animal	Apidae	*Trigona spinipes*	F	0.00	-0.07	2	1.38	0.77	6
Animal	Apidae	*Trigona spinipes*	B	0.59	-0.71	3	0.45	0.43	12

Animal	Apidae	*Trigona spinipes*	E	0.00	-0.31	1	0.11	0.32	12
Animal	Vespidae	Vespidae sp.1	D	0.00	-0.99	1	0.07	0.35	1
Animal	Vespidae	Vespidae sp.1	B	0.00	0.00	1	1.00	1.00	6
Animal	Vespidae	Vespidae sp.10	D	0.00	0.00	1	0.50	0.81	8
Animal	Vespidae	Vespidae sp.11	F	0.00	-1.00	1	0.50	0.79	4
Animal	Vespidae	Vespidae sp.13	E	0.00	0.97	1	1.00	1.00	7
Animal	Vespidae	Vespidae sp.4	D	0.00	-0.99	1	0.07	0.35	1
Animal	Vespidae	Vespidae sp.7	B	0.00	0.00	1	1.00	1.00	2
Animal	Vespidae	Vespidae sp.8	B	0.00	0.00	1	1.00	1.00	11
Animal	Apidae	*Xylocopa (Schonnherria)* sp.1	A	0.00	0.00	1	1.00	1.00	13
Plant	Asteraceae	*Achyrocline satureioides*	E	0.00	0.00	3	3.00	1.00	9
Plant	Asteraceae	*Achyrocline satureioides*	B	0.00	0.00	1	1.00	1.00	11
Plant	Asteraceae	*Ageratum fastigiatum*	F	0.09	0.32	3	0.80	0.30	6
Plant	Asteraceae	*Ageratum fastigiatum*	B	0.00	-0.24	2	1.15	0.74	10
Plant	Asteraceae	*Aldama tenuifolia*	C	0.00	0.71	3	3.00	1.00	5

Plant	Asteraceae	*Aldama tenuifolia*	A	0.00	0.00	1	1.00	1.00	9
Plant	Asteraceae	*Ayapana amygdalina*	D	0.00	-0.71	1	0.17	0.57	3
Plant	Asteraceae	*Ayapana amygdalina*	C	0.00	-0.71	1	0.40	0.74	8
Plant	Asteraceae	*Ayapana amygdalina*	B	0.00	0.00	1	0.50	0.82	9
Plant	Asteraceae	*Baccharis brevifolia*	F	0.00	0.71	4	3.17	0.88	2
Plant	Asteraceae	*Baccharis brevifolia*	D	0.00	0.71	2	1.33	0.86	3
Plant	Asteraceae	*Baccharis brevifolia*	B	0.00	0.00	1	1.00	1.00	9
Plant	Asteraceae	*Baccharis dracunculifolia*	B	0.00	-0.29	1	1.00	1.00	10
Plant	Asteraceae	*Baccharis pingreae*	B	0.06	0.71	6	4.50	0.89	3
Plant	Malpighiaceae	*Banisteriopsis campestris*	C	0.35	0.71	10	6.72	0.80	2
Plant	Malpighiaceae	*Banisteriopsis campestris*	D	0.02	0.00	5	3.83	0.85	10

Plant	Rubiaceae	*Borreria capitata*	F	0.00	1.13	2	1.16	0.41	6
Plant	Rubiaceae	*Borreria capitata*	A	0.00	0.74	3	1.08	0.25	15
Plant	Rubiaceae	*Borreria latifolia*	A	0.00	0.00	1	1.00	1.00	8
Plant	Rubiaceae	*Borreria tenella*	B	0.00	-0.90	1	1.00	1.00	2
Plant	Rubiaceae	*Borreria tenella*	D	0.07	0.71	6	4.33	0.41	6
Plant	Rubiaceae	*Borreria tenella*	E	0.05	-0.57	3	1.40	0.55	11
Plant	Rubiaceae	*Borreria tenella*	A	0.00	-0.29	2	0.38	0.19	15
Plant	Malpighiaceae	*Byrsonima gardneriana*	F	0.29	1.13	3	1.41	0.39	6
Plant	Malpighiaceae	*Byrsonima gardneriana*	C	0.00	1.29	3	2.25	0.80	7
Plant	Malpighiaceae	*Byrsonima gardneriana*	E	0.02	1.15	9	7.32	0.65	11
Plant	Malpighiaceae	*Byrsonima guillermiana*	C	0.43	-0.72	2	0.48	0.46	7
Plant	Malpighiaceae	*Byrsonima stannardii*	C	0.00	-0.71	1	1.00	1.00	5
Plant	Malpighiaceae	*Byrsonima stannardii*	F	0.00	-1.18	1	0.04	0.02	6
Plant	Malpighiaceae	*Byrsonima*	B	0.00	-1.28	1	0.07	0.34	4

		variabilis							
Plant	Malpighiaceae	*Byrsonima variabilis*	C	0.44	0.29	3	1.03	0.52	7
Plant	Malpighiaceae	*Byrsonima variabilis*	D	0.20	0.71	6	4.27	0.81	7
Plant	Malpighiaceae	*Byrsonima verbascifolia*	C	0.00	-0.86	1	0.05	0.25	7
Plant	Malpighiaceae	*Byrsonima verbascifolia*	E	0.11	0.00	2	1.06	0.53	8
Plant	Malpighiaceae	*Byrsonima verbascifolia*	D	0.00	-0.51	1	0.33	0.74	9
Plant	Malpighiaceae	*Byrsonima verbascifolia*	A	0.00	0.00	1	1.00	1.00	13
Plant	Asteraceae	*Calea cuneifolia*	C	0.00	1.49	3	2.25	0.86	1
Plant	Asteraceae	*Calea cuneifolia*	B	0.07	1.07	10	6.95	0.80	2
Plant	Asteraceae	*Calea cuneifolia*	A	0.21	0.71	8	5.10	0.72	3
Plant	Asteraceae	*Calea cuneifolia*	D	0.00	0.00	1	1.00	1.00	11
Plant	Gentianaceae	*Calolisianthus speciosus*	C	0.00	-0.71	1	1.00	1.00	2
Plant	Melastomataceae	*Cambessedesia*	E	0.00	0.00	1	1.00	1.00	1

		espora							
Plant	Melastomataceae	*Cambessedesia espora*	A	0.00	0.00	1	0.70	0.88	3
Plant	Melastomataceae	*Cambessedesia espora*	D	0.19	1.91	6	3.79	0.75	9
Plant	Myrtaceae	*Campomanesia sessiliflora*	C	0.07	-0.71	3	1.38	0.67	4
Plant	Myrtaceae	*Campomanesia sessiliflora*	B	0.00	0.00	1	1.00	1.00	8
Plant	Fabaceae	*Chamaecrista cathartica*	F	0.00	0.00	4	3.75	0.94	8
Plant	Fabaceae	*Chamaecrista linearifolia*	D	0.00	-0.74	1	0.03	0.20	9
Plant	Asteraceae	*Chresta scapigera*	A	0.00	-0.71	1	1.00	1.00	2
Plant	Asteraceae	*Chresta scapigera*	E	0.00	0.00	1	0.60	0.84	2
Plant	Asteraceae	*Chresta scapigera*	F	0.00	0.00	1	1.00	1.00	7
Plant	Asteraceae	*Chresta scapigera*	C	0.04	0.71	5	3.68	0.84	8
Plant	Asteraceae	*Chresta scapigera*	D	0.00	-0.71	1	1.00	1.00	8
Plant	Asteraceae	*Chromolaena chaseae*	B	0.00	-0.60	1	0.17	0.61	10

Plant	Asteraceae	*Chromolaena cylindrocephala*	F	0.26	-0.81	2	0.24	0.21	6
Plant	Asteraceae	*Chromolaena cylindrocephala*	A	0.00	-0.86	1	0.03	0.00	15
Plant	Asteraceae	*Chromolaena laevigata*	B	0.44	1.07	7	4.56	0.39	1
Plant	Asteraceae	*Chromolaena laevigata*	C	0.00	-0.30	2	0.58	0.65	1
Plant	Asteraceae	*Chromolaena laevigata*	E	0.00	0.00	1	1.00	1.00	8
Plant	Asteraceae	*Chromolaena squalida*	C	0.50	-0.63	2	0.37	0.30	9
Plant	Asteraceae	*Chromolaena squalida*	A	0.00	-0.90	1	0.01	0.00	15
Plant	Asteraceae	*Chrysolaena obovata*	F	0.00	1.00	2	1.33	0.83	4
Plant	Asteraceae	*Chrysolaena simplex*	A	0.00	0.00	1	1.00	1.00	3
Plant	Asteraceae	*Chrysolaena simplex*	C	0.00	-0.71	1	1.00	1.00	6

Plant	Rubiaceae	*Cordiera rigida*	B	0.36	-0.25	3	1.54	0.38	1
Plant	Euphorbiaceae	*Croton antisyphiliticus*	F	0.00	-1.00	1	0.67	0.88	4
Plant	Euphorbiaceae	*Croton glandulosus*	B	0.00	-0.62	1	0.11	0.43	10
Plant	Euphorbiaceae	*Croton* sp.2	F	0.00	0.00	1	1.00	1.00	7
Plant	Lythraceae	*Cuphea ericoides*	A	0.44	-0.71	2	1.50	0.93	1
Plant	Lamiaceae	*Cyanocephalus rugosus*	B	0.35	1.17	6	2.82	0.44	4
Plant	Asteraceae	*Cyanthillium cinereum*	A	0.00	-0.71	1	0.50	0.82	3
Plant	Rubiaceae	*Declieuxia cordigera* var. *cordigera*	D	0.00	0.00	3	2.50	0.92	2
Plant	Rubiaceae	*Declieuxia oenanthoides*	D	0.00	-0.71	1	0.20	0.62	7
Plant	Rubiaceae	*Declieuxia oenanthoides*	A	0.34	1.38	5	1.95	0.22	15
Plant	Araliaceae	*Didymopanax macrocarpus*	F	0.20	0.71	3	2.25	0.78	1
Plant	Lythraceae	*Diplusodon*	C	0.00	0.71	2	2.00	1.00	6

		rotundifolius							
Plant	Lythraceae	*Diplusodon rotundifolius*	F	0.50	-0.66	2	0.98	0.58	10
Plant	Lythraceae	*Diplusodon villosissimus*	B	0.00	-0.97	1	0.01	0.00	1
Plant	Asteraceae	*Echinocoryne schwenkiifolia*	A	0.00	0.00	2	1.33	0.86	11
Plant	Asteraceae	*Echinocoryne stricta*	E	0.13	0.00	3	2.15	0.77	5
Plant	Asteraceae	*Echinocoryne stricta*	F	0.05	1.15	6	4.50	0.54	5
Plant	Poaceae	*Echinolaena inflexa*	B	0.22	1.03	5	3.54	0.45	1
Plant	Poaceae	*Echinolaena inflexa*	F	0.00	-0.46	1	0.40	0.72	6
Plant	Poaceae	*Echinolaena inflexa*	C	0.00	-0.80	1	0.04	0.05	9
Plant	Asteraceae	*Eremanthus elaeagnus*	E	0.00	0.00	1	1.00	1.00	15
Plant	Asteraceae	*Eremanthus erythropappus*	B	0.58	-0.89	3	0.91	0.26	1
Plant	Asteraceae	*Eremanthus erythropappus*	D	0.12	-0.71	5	2.78	0.40	1

Plant	Asteraceae	*Eremanthus erythropappus*	F	0.00	-0.71	1	1.00	1.00	1
Plant	Asteraceae	*Eremanthus erythropappus*	C	0.00	1.60	3	2.08	0.59	9
Plant	Asteraceae	*Eremanthus erythropappus*	E	0.26	-0.71	5	3.92	0.74	12
Plant	Fabaceae	*Eriosema heterophyllum*	F	0.00	-0.64	1	1.00	1.00	5
Plant	Fabaceae	*Eriosema heterophyllum*	A	0.00	0.00	2	1.50	0.91	7
Plant	Fabaceae	*Eriosema heterophyllum*	D	0.23	0.06	3	1.24	0.45	9
Plant	Apiaceae	*Eryngium juncifolium*	D	0.16	0.71	7	5.90	0.92	1
Plant	Apiaceae	*Eryngium juncifolium*	E	0.00	0.00	1	1.00	1.00	2
Plant	Apiaceae	*Eryngium juncifolium*	B	0.00	-0.71	1	0.14	0.57	3
Plant	Apiaceae	*Eryngium juncifolium*	A	0.11	0.00	4	2.12	0.28	14

Plant	Asteraceae	*Grazielia dimorpholepis*	F	0.00	0.00	1	1.00	1.00	4
Plant	Asteraceae	*Grazielia dimorpholepis*	E	0.21	0.00	4	2.73	0.92	14
Plant	Lamiaceae	*Hypenia macrantha*	D	0.00	0.03	2	1.03	0.55	9
Plant	Lamiaceae	*Hypenia macrantha*	A	0.00	0.00	1	1.00	1.00	13
Plant	Convolvulaceae	*Ipomoea wrightii*	D	0.00	0.00	2	2.00	1.00	4
Plant	Convolvulaceae	*Ipomoea wrightii*	A	0.01	0.71	4	3.01	0.74	5
Plant	Convolvulaceae	*Ipomoea wrightii*	B	0.00	0.00	2	2.00	1.00	5
Plant	Asteraceae	*Lepidaploa sororia*	B	0.00	0.00	2	1.19	0.61	4
Plant	Asteraceae	*Lessingianthus linearifolius*	A	0.00	0.00	3	2.57	0.95	10
Plant	Ochnaceae	*Luxemburgia octandra*	D	0.00	-0.74	1	0.03	0.20	9
Plant	Apocynaceae	*Mandevilla illustris*	F	0.00	-0.71	1	1.00	1.00	3
Plant	Melastomataceae	*Marcetia taxifolia*	A	0.13	0.00	3	1.43	0.67	11
Plant	Melastomataceae	*Microlicia cordata*	B	0.00	0.00	1	1.00	1.00	6
Plant	Melastomataceae	*Microlicia cordata*	F	0.00	-0.49	1	1.00	1.00	10
Plant	Fabaceae	*Mimosa calocephala*	C	0.00	-0.59	1	0.33	0.73	1

Plant	Fabaceae	*Mimosa pigra*	C	0.35	0.34	3	1.46	0.35	9
Plant	Asteraceae	*Moquiniastrum densicephalum*	B	0.00	0.00	1	0.57	0.84	7
Plant	Lauraceae	*Ocotea pulchella*	F	0.00	-0.71	1	0.33	0.67	2
Plant	Melastomataceae	*Ossae congestiflora*	F	0.00	-0.52	2	1.13	0.68	5
Plant	Melastomataceae	*Ossae congestiflora*	E	0.00	-0.58	1	1.00	1.00	7
Plant	Malpighiaceae	*Peixotoa tomentosa*	A	0.00	-0.71	1	1.00	1.00	12
Plant	Malvaceae	*Peltaea polymorpha*	C	0.00	-0.59	1	0.50	0.80	1
Plant	Malvaceae	*Peltaea polymorpha*	D	0.00	0.00	2	1.50	0.93	5
Plant	Malvaceae	*Peltaea polymorpha*	E	0.00	-0.58	1	1.00	1.00	7
Plant	Malvaceae	*Peltaea polymorpha*	B	0.00	0.00	1	1.00	1.00	8
Plant	Melastomataceae	*Pleroma frigidulum*	A	0.00	0.00	1	0.67	0.90	14
Plant	Melastomataceae	*Pleroma* sp.1	A	0.00	-0.67	1	0.17	0.61	15
Plant	Melastomataceae	*Pleroma stenocarpum*	E	0.00	0.00	1	1.00	1.00	10
Plant	Cyperaceae	*Rhynchospora consanguinea*	A	0.08	0.00	3	2.09	0.32	4
Plant	Cyperaceae	*Rhynchospora consanguinea*	C	0.00	0.71	5	4.33	0.94	4
Plant	Cyperaceae	*Rhynchospora*	D	0.00	-0.71	4	3.73	0.78	6

		consanguinea							
Plant	Rubiaceae	*Sabicea brasiliensis*	F	0.08	1.15	7	5.69	0.65	10
Plant	Rubiaceae	*Sabicea brasiliensis*	E	0.17	0.71	7	4.52	0.59	12
Plant	Polygalaceae	*Senega ongicaulis*	E	0.00	0.00	1	1.00	1.00	13
Plant	Polygalaceae	*Senega paniculata*	A	0.00	-0.77	1	0.09	0.48	15
Plant	Sapindaceae	*Serjania* sp.1	F	0.00	-1.09	1	0.08	0.22	6
Plant	Iridaceae	*Sisyrinchium vaginatum*	D	0.00	0.71	3	3.00	1.00	8
Plant	Solanaceae	*Solanum lycocarpum*	E	0.00	0.00	3	3.00	1.00	3
Plant	Solanaceae	*Solanum paniculatum*	B	0.00	0.00	1	1.00	1.00	6
Plant	Asteraceae	*Stenocephalum tragiifolium*	B	0.19	-0.17	5	2.29	0.73	2
Plant	Asteraceae	*Stenocephalum tragiifolium*	E	0.00	0.00	1	1.00	1.00	6
Plant	Asteraceae	*Stenocephalum tragiifolium*	F	0.00	0.00	1	1.00	1.00	9
Plant	Asteraceae	*Stevia heptachaeta*	E	0.00	0.00	1	1.00	1.00	4
Plant	Symplocaceae	*Symplocos*	C	0.00	-0.52	1	0.31	0.45	9

		oblongifolia							
Plant	Rubiaceae	*Tocoyena formosa*	E	0.00	0.00	1	1.00	1.00	6
Plant	Velloziaceae	*Vellozia nivea*	A	0.52	1.37	5	2.33	0.24	15
Plant	Asteraceae	*Verbesina sordescens*	B	0.02	1.76	8	5.05	0.49	10
Plant	Asteraceae	*Vernonanthura mucronulata*	B	0.64	0.11	6	2.51	0.53	4
Plant	Asteraceae	*Vernonanthura polyanthes*	F	0.00	0.95	2	1.08	0.41	6
Plant	Asteraceae	*Vernonanthura polyanthes*	B	0.00	0.00	2	1.25	0.90	12
Plant	Vochysiaceae	*Vochysia thyrsoidea*	C	0.00	0.00	3	2.75	0.92	3
Plant	Vochysiaceae	*Vochysia thyrsoidea*	E	0.00	1.15	3	3.00	1.00	7
Plant	Vochysiaceae	*Vochysia tucanorum*	B	0.26	0.00	2	1.18	0.76	11
Plant	Campanulaceae	*Wahlenbergia brasiliensis*	A	0.24	1.41	4	2.43	0.83	6
Plant	Xyridaceae	*Xyris asperula*	F	0.00	0.71	2	2.00	1.00	3
Plant	Rutaceae	*Zanthoxylum rigidum*	E	0.00	-0.59	2	1.30	0.70	11

Table S4. List of plant-floral visitor interactions among the sampled areas along the vegetation cover gradient in Serra de Boa Esperança State Park, southern Minas Gerais, Brazil.

Code	**Site**	**Family**	**Plant**	**Family**	**Floral visitor**	**Frequency**	**Interaction occurrence**
I001	E	Asteraceae	*Achyrocline satureioides*	Vespidae	*Brachygastra lecheguana*	3	Unique
I002	E	Asteraceae	*Achyrocline satureioides*	Apidae	*Melissodes* sp3	8	Unique
I003	E	Asteraceae	*Achyrocline satureioides*	Apidae	*Tetragonisca angustula*	12	Unique
I004	B	Asteraceae	*Achyrocline satureioides*	Vespidae	Vespidae sp8	1	Unique
I005	F	Asteraceae	*Ageratum fastigiatum*	Apidae	*Apis mellifera*	1	Unique
I006	B	Asteraceae	*Ageratum fastigiatum*	Apidae	Halictinae sp5	5	Unique
I007	B	Asteraceae	*Ageratum fastigiatum*	Apidae	*Melissodes* sp7	6	Unique
I008	F	Asteraceae	*Ageratum fastigiatum*	Apidae	*Paratrigona lineata*	4	Unique
I009	F	Asteraceae	*Ageratum fastigiatum*	Apidae	*Trigona spinipes*	3	Unique
I010	A	Asteraceae	*Aldama tenuifolia*		Coleoptera sp3	1	Unique
I011	C	Asteraceae	*Aldama tenuifolia*		Coleoptera sp5	1	Unique
I012	C	Asteraceae	*Aldama tenuifolia*		Diptera sp1	1	Unique
I013	C	Asteraceae	*Aldama tenuifolia*	Apidae	Halictini sp1	1	Unique
I014	D	Asteraceae	*Ayapana amygdalina*	Apidae	Apidae sp2	1	Unique
I015	B	Asteraceae	*Ayapana amygdalina*	Apidae	*Ceratina* sp4	2	Unique

I016	C	Asteraceae	*Ayapana amygdalina*	Apidae	*Ceratina* sp9	2	Unique
I017	B	Asteraceae	*Baccharis brevifolia*	Apidae	Apidae sp14	1	Unique
I018	D	Asteraceae	*Baccharis brevifolia*	Apidae	Apidae sp2	2	Unique
I019	D	Asteraceae	*Baccharis brevifolia*	Calliphoridae	*Calliphora vicina*	3	Unique
I020	B	Asteraceae	*Baccharis dracunculifolia*	Vespidae	*Protopolybia* sp1	1	Unique
I021	B	Asteraceae	*Baccharis pingreae*	Syrphidae	*Baccha* sp1	1	Unique
I022	B	Asteraceae	*Baccharis pingreae*	Vespidae	*Polistes* sp1	6	Unique
I023	B	Asteraceae	*Baccharis pingreae*	Syrphidae	Syrphidae sp1	3	Unique
I024	B	Asteraceae	*Baccharis pingreae*	Syrphidae	Syrphidae sp2	1	Unique
I025	B	Asteraceae	*Baccharis pingreae*	Syrphidae	Syrphidae sp3	1	Unique
I026	B	Asteraceae	*Baccharis pingreae*	Apidae	*Tetragonisca angustula*	1	Unique
I027	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Apidae* sp11	8	Unique
I028	D	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Bombus morio*	1	Unique
I029	D	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Centris tarsata*	1	Unique
I030	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Cephalotrigona capitata*	1	Shared
I030	D	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Cephalotrigona capitata*	3	Shared
I031	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Epicharis flava*	3	Unique
I032	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	Eucerini sp4	2	Unique
I033	C	Malpighiaceae	*Banisteriopsis campestris*	Formicidae	Formicidae sp1	1	Unique
I034	D	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Melissodes* sp1	4	Unique

I035	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Melissodes* sp8	2	Unique
I036	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Melissodes* sp9	2	Unique
I037	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Paratrigona lineata*	6	Shared
I037	D	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Paratrigona lineata*	12	Shared
I038	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Tetragonisca angustula*	1	Unique
I039	C	Malpighiaceae	*Banisteriopsis campestris*	Apidae	*Trigona spinipes*	18	Unique
I040	A	Rubiaceae	*Borreria capitata*	Apidae	*Apis mellifera*	22	Unique
I041	A	Rubiaceae	*Borreria capitata*	Apidae	*Geotrigona subterranea*	2	Unique
I042	A	Rubiaceae	*Borreria capitata*	Apidae	Halictinae sp13	4	Unique
I043	F	Rubiaceae	*Borreria capitata*	Apidae	*Nannotrigona* sp1	1	Unique
I044	F	Rubiaceae	*Borreria capitata*	Apidae	*Paratrigona lineata*	4	Unique
I045	A	Rubiaceae	*Borreria latifolia*	Vespidae	*Agelaia angulata*	4	Unique
I046	A	Rubiaceae	*Borreria tenella*	Apidae	*Apis mellifera*	19	Shared
I046	D	Rubiaceae	*Borreria tenella*	Apidae	*Apis mellifera*	11	Shared
I046	E	Rubiaceae	*Borreria tenella*	Apidae	*Apis mellifera*	1	Shared
I047	D	Rubiaceae	*Borreria tenella*	Apidae	*Brachynomada* sp1	1	Unique
I048	A	Rubiaceae	*Borreria tenella*	Apidae	*Geotrigona subterranea*	2	Shared
I048	D	Rubiaceae	*Borreria tenella*	Apidae	*Geotrigona subterranea*	1	Shared
I049	D	Rubiaceae	*Borreria tenella*	Apidae	Halictinae sp5	2	Unique
I050	D	Rubiaceae	*Borreria tenella*	Apidae	Halictini sp4	1	Unique

I051	E	Rubiaceae	*Borreria tenella*	Apidae	*Paratrigona lineata*	12	Unique
I052	E	Rubiaceae	*Borreria tenella*	Vespidae	*Protopolybia* sp1	3	Unique
I053	D	Rubiaceae	*Borreria tenella*	Apidae	*Trigona spinipes*	1	Unique
I054	B	Rubiaceae	*Borreria tenella*	Vespidae	Vespidae sp7	2	Unique
I055	E	Malpighiaceae	*Byrsonima gardneriana*	Apidae	Apidae sp3	1	Unique
I056	E	Malpighiaceae	*Byrsonima gardneriana*	Apidae	Augochlorini sp4	1	Unique
I057	C	Malpighiaceae	*Byrsonima gardneriana*		Diptera sp4	1	Unique
I058	E	Malpighiaceae	*Byrsonima gardneriana*	Formicidae	Formicidae sp1	1	Unique
I059	E	Malpighiaceae	*Byrsonima gardneriana*	Apidae	*Friesella schrottkyi*	1	Unique
I060	E	Malpighiaceae	*Byrsonima gardneriana*	Apidae	*Melissodes* sp3	1	Unique
I061	C	Malpighiaceae	*Byrsonima gardneriana*	Muscidae	*Musca domestica*	10	Unique
I062	F	Malpighiaceae	*Byrsonima gardneriana*	Apidae	*Oxytrigona* sp2	1	Unique
I063	E	Malpighiaceae	*Byrsonima gardneriana*	Vespidae	*Parachartergus pseudapicalis*	1	Unique
I064	C	Malpighiaceae	*Byrsonima gardneriana*	Apidae	*Paratrigona lineata*	6	Shared
I064	E	Malpighiaceae	*Byrsonima gardneriana*	Apidae	*Paratrigona lineata*	8	Shared
I064	F	Malpighiaceae	*Byrsonima gardneriana*	Apidae	*Paratrigona lineata*	4	Shared
I065	E	Malpighiaceae	*Byrsonima gardneriana*	Apidae	Protandrenini sp1	1	Unique
I066	E	Malpighiaceae	*Byrsonima gardneriana*	Apidae	*Trigona* sp1	5	Shared
I066	F	Malpighiaceae	*Byrsonima gardneriana*	Apidae	*Trigona* sp1	1	Shared

I067	C	Malpighiaceae	*Byrsonima guillermiana*	Apidae	*Melissodes* sp8	1	Unique
I068	C	Malpighiaceae	*Byrsonima guillermiana*	Apidae	*Paratrigona lineata*	3	Unique
I069	C	Malpighiaceae	*Byrsonima stannardii*	Apidae	Emphorini sp1	3	Unique
I070	F	Malpighiaceae	*Byrsonima stannardii*	Apidae	*Paratrigona lineata*	1	Unique
I071	D	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Centris* (*Trachina*) sp1	2	Unique
I072	D	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Exomalopsis* sp8	4	Unique
I073	D	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Melissodes* sp4	1	Unique
I074	D	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Melissodes* sp8	1	Unique
I075	C	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Melissodes* sp9	1	Unique
I076	D	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Melissodes* sp9	4	Unique
I077	B	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Paratrigona lineata*	2	Shared
I077	C	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Paratrigona lineata*	4	Shared
I078	D	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Paratrigona lineata*	2	Unique
I079	C	Malpighiaceae	*Byrsonima variabilis*	Apidae	*Tetragonisca angustula*	1	Unique
I080	D	Malpighiaceae	*Byrsonima verbascifolia*	Apidae	Augochlorini sp1	1	Shared
I080	E	Malpighiaceae	*Byrsonima verbascifolia*	Apidae	Augochlorini sp1	2	Shared
I081	C	Malpighiaceae	*Byrsonima verbascifolia*	Apidae	*Paratrigona lineata*	1	Shared
I081	E	Malpighiaceae	*Byrsonima verbascifolia*	Apidae	*Paratrigona lineata*	2	Shared
I082	A	Malpighiaceae	*Byrsonima verbascifolia*	Apidae	Protandrenini sp1	1	Unique
I083	B	Asteraceae	*Calea cuneifolia*	Apidae	Apidae sp1	1	Unique

I084	B	Asteraceae	*Calea cuneifolia*	Apidae	Augochlorini sp8	2	Unique
I085	A	Asteraceae	*Calea cuneifolia*	Apidae	*Bombus morio*	2	Unique
I086	A	Asteraceae	*Calea cuneifolia*	Apidae	*Ceratina* sp1	2	Shared
I086	B	Asteraceae	*Calea cuneifolia*	Apidae	*Ceratina* sp1	3	Shared
I087	A	Asteraceae	*Calea cuneifolia*	Apidae	*Ceratina* sp2	1	Shared
I087	C	Asteraceae	*Calea cuneifolia*	Apidae	*Ceratina* sp2	1	Shared
I088	C	Asteraceae	*Calea cuneifolia*	Apidae	*Ceratina* sp4	1	Unique
I089	B	Asteraceae	*Calea cuneifolia*	Apidae	*Ceratina* sp5	1	Unique
I090	D	Asteraceae	*Calea cuneifolia*	Curculionidae	*Diapredes* sp1	1	Unique
I091	B	Asteraceae	*Calea cuneifolia*	Erebidae	Erebidae sp1	5	Shared
I091	C	Asteraceae	*Calea cuneifolia*	Erebidae	Erebidae sp1	1	Shared
I092	B	Asteraceae	*Calea cuneifolia*	Apidae	Eucerini sp2	1	Unique
I093	A	Asteraceae	*Calea cuneifolia*	Apidae	Halictinae sp12	1	Unique
I094	A	Asteraceae	*Calea cuneifolia*	Apidae	Halictinae sp3	2	Unique
I095	A	Asteraceae	*Calea cuneifolia*	Apidae	Halictini sp2	1	Unique
I096	B	Asteraceae	*Calea cuneifolia*	Apidae	*Megachile* (*Grafella*) sp1	1	Unique
I097	A	Asteraceae	*Calea cuneifolia*	Apidae	*Megachile* sp1	1	Unique
I098	A	Asteraceae	*Calea cuneifolia*	Apidae	*Melissodes* sp6	1	Unique
I099	B	Asteraceae	*Calea cuneifolia*	Nymphalidae	Nymphalidae sp2	3	Unique
I100	B	Asteraceae	*Calea cuneifolia*	Syrphidae	*Palpada* sp1	1	Unique

I101	B	Asteraceae	*Calea cuneifolia*	Apidae	*Paratrigona lineata*	1	Unique
I102	C	Gentianaceae	*Calolisianthus speciosus*	Apidae	Emphorini sp2	2	Unique
I103	E	Melastomataceae	*Cambessedesia espora*	Acrididae	Acrididae sp3	1	Unique
I104	D	Melastomataceae	*Cambessedesia espora*	Apidae	Apidae sp2	2	Unique
I105	D	Melastomataceae	*Cambessedesia espora*	Apidae	Augochlorini sp1	2	Unique
I106	D	Melastomataceae	*Cambessedesia espora*	Apidae	*Augochloropsis* sp1	1	Unique
I107	A	Melastomataceae	*Cambessedesia espora*	Apidae	*Bombus morio*	7	Shared
I107	D	Melastomataceae	*Cambessedesia espora*	Apidae	*Bombus morio*	21	Shared
I108	D	Melastomataceae	*Cambessedesia espora*	Apidae	*Melipona quinquefasciata*	1	Unique
I109	D	Melastomataceae	*Cambessedesia espora*	Apidae	*Paratrigona lineata*	1	Unique
I110	B	Myrtaceae	*Campomanesia sessiliflora*	Chrysomelidae	Chrysomelidae sp5	1	Unique
I111	C	Myrtaceae	*Campomanesia sessiliflora*	Curculionidae	*Diapredes* sp1	2	Unique
I112	C	Myrtaceae	*Campomanesia sessiliflora*	Formicidae	Formicidae sp1	1	Unique
I113	C	Myrtaceae	*Campomanesia sessiliflora*	Apidae	*Paratrigona lineata*	1	Unique
I114	F	Fabaceae	*Chamaecrista cathartica*	Chrysomelidae	Chrysomelidae sp2	1	Unique
I115	F	Fabaceae	*Chamaecrista cathartica*		Coleoptera sp2	1	Unique
I116	F	Fabaceae	*Chamaecrista cathartica*	Scoliidae	*Megascolia maculata*	1	Unique
I117	F	Fabaceae	*Chamaecrista cathartica*	Apidae	*Trigona* sp1	3	Unique
I118	D	Fabaceae	*Chamaecrista linearifolia*	Apidae	*Bombus morio*	1	Unique
I119	A	Asteraceae	*Chresta scapigera*	Acrididae	Acrididae sp1	1	Unique

I120	C	Asteraceae	*Chresta scapigera*	Apidae	*Bombus morio*	1	Shared
I120	E	Asteraceae	*Chresta scapigera*	Apidae	*Bombus morio*	3	Shared
I121	F	Asteraceae	*Chresta scapigera*	Apidae	*Ceratina* sp3	2	Unique
I122	C	Asteraceae	*Chresta scapigera*	Apidae	*Ceratina* sp5	1	Unique
I123	C	Asteraceae	*Chresta scapigera*	Apidae	*Ceratina* sp9	3	Unique
I124	C	Asteraceae	*Chresta scapigera*	Apidae	Halictini sp3	3	Unique
I125	C	Asteraceae	*Chresta scapigera*	Apidae	Halictini sp4	2	Unique
I126	D	Asteraceae	*Chresta scapigera*	Apidae	*Megachile* (*Moureapis*) sp1	7	Unique
I127	B	Asteraceae	*Chromolaena chaseae*	Apidae	Halictinae sp5	1	Unique
I128	A	Asteraceae	*Chromolaena cylindrocephala*	Apidae	*Apis mellifera*	3	Shared
I128	F	Asteraceae	*Chromolaena cylindrocephala*	Apidae	*Apis mellifera*	1	Shared
I129	F	Asteraceae	*Chromolaena cylindrocephala*	Apidae	*Paratrigona lineata*	5	Unique
I130	B	Asteraceae	*Chromolaena laevigata*	Apidae	*Apis mellifera*	32	Unique
I131	E	Asteraceae	*Chromolaena laevigata*	Apidae	*Centris* sp1	5	Unique
I132	C	Asteraceae	*Chromolaena laevigata*	Erebidae	Erebidae sp1	1	Unique
I133	B	Asteraceae	*Chromolaena laevigata*	Muscidae	*Musca domestica*	1	Unique
I134	B	Asteraceae	*Chromolaena laevigata*	Syrphidae	*Palpada* sp2	3	Unique

I135	B	Asteraceae	*Chromolaena laevigata*	Apidae	*Paratrigona lineata*	6	Unique
I136	B	Asteraceae	*Chromolaena laevigata*	Apidae	*Partamona cupira*	1	Shared
I136	C	Asteraceae	*Chromolaena laevigata*	Apidae	*Partamona cupira*	1	Shared
I137	B	Asteraceae	*Chromolaena laevigata*	Apidae	*Rhathymus* sp1	2	Unique
I138	B	Asteraceae	*Chromolaena laevigata*	Syrphidae	Syrphidae sp3	1	Unique
I139	A	Asteraceae	*Chromolaena squalida*	Apidae	*Apis mellifera*	1	Shared
I139	C	Asteraceae	*Chromolaena squalida*	Apidae	*Apis mellifera*	11	Shared
I140	C	Asteraceae	*Chromolaena squalida*	Apidae	*Bombus morio*	2	Unique
I141	F	Asteraceae	*Chrysolaena obovata*	Apidae	*Ceratina* sp5	1	Unique
I142	F	Asteraceae	*Chrysolaena obovata*	Vespidae	Vespidae sp11	1	Unique
I143	C	Asteraceae	*Chrysolaena simplex*	Apidae	*Ceratina* sp3	1	Unique
I144	A	Asteraceae	*Chrysolaena simplex*	Apidae	Halictini sp5	1	Unique
I145	B	Rubiaceae	*Cordiera rigida*	Apidae	*Apis mellifera*	17	Unique
I146	B	Rubiaceae	*Cordiera rigida*	Apidae	*Bombus morio*	4	Unique
I147	B	Rubiaceae	*Cordiera rigida*	Apidae	*Temnosoma* sp1	5	Unique
I148	F	Euphorbiaceae	*Croton antisyphiliticus*	Apidae	*Ceratina* sp5	2	Unique
I149	B	Euphorbiaceae	*Croton glandulosus*	Apidae	*Melissodes* sp7	2	Unique
I150	F	Euphorbiaceae	*Croton* sp.2	Apidae	Eucerini sp1	2	Unique
I151	A	Lythraceae	*Cuphea ericoides*	Apidae	*Ceratina* sp2	1	Unique
I152	A	Lythraceae	*Cuphea ericoides*	Apidae	*Melissodes* sp8	2	Unique

I153	B	Lamiaceae	*Cyanocephalus rugosus*	Apidae	*Apis mellifera*	1	Unique
I154	B	Lamiaceae	*Cyanocephalus rugosus*	Apidae	Augochlorini sp2	1	Unique
I155	B	Lamiaceae	*Cyanocephalus rugosus*	Apidae	Augochlorini sp7	1	Unique
I156	B	Lamiaceae	*Cyanocephalus rugosus*	Apidae	*Bombus morio*	1	Unique
I157	B	Lamiaceae	*Cyanocephalus rugosus*	Apidae	*Ceratina* sp9	1	Unique
I158	B	Lamiaceae	*Cyanocephalus rugosus*	Apidae	*Paratrigona lineata*	6	Unique
I159	A	Asteraceae	*Cyanthilium cinereum*	Apidae	Halictinae sp3	2	Unique
I160	D	Rubiaceae	*Declieuxia cordigera var cordigera*	Apidae	*Brachynomada* sp1	5	Unique
I161	D	Rubiaceae	*Declieuxia cordigera var cordigera*	Apidae	Halictinae sp4	1	Unique
I162	D	Rubiaceae	*Declieuxia cordigera var cordigera*	Apidae	*Melissodes* sp8	2	Unique
I163	A	Rubiaceae	*Declieuxia oenanthoides*	Apidae	*Apis mellifera*	17	Unique
I164	A	Rubiaceae	*Declieuxia oenanthoides*	Apidae	*Geotrigona subterranea*	2	Unique
I165	A	Rubiaceae	*Declieuxia oenanthoides*	Apidae	Halictinae sp13	1	Unique
I166	A	Rubiaceae	*Declieuxia oenanthoides*	Apidae	Halictinae sp4	3	Unique
I167	A	Rubiaceae	*Declieuxia oenanthoides*	Apidae	Halictinae sp6	3	Unique
I168	D	Rubiaceae	*Declieuxia oenanthoides*	Apidae	*Melissodes* sp9	1	Unique
I169	F	Araliaceae	*Didymopanax macrocarpus*	Apidae	*Paratrigona subnuda*	1	Unique

I170	F	Araliaceae	*Didymopanax macrocarpus*	Apidae	*Scaptotrigona postica*	2	Unique
I171	F	Araliaceae	*Didymopanax macrocarpus*	Apidae	*Tetragonisca angustula*	2	Unique
I172	F	Lythraceae	*Diplusodon rotundifolius*		*Apis mellifera*	13	Unique
I173	C	Lythraceae	*Diplusodon rotundifolius*	Apidae	Augochlorini sp3	1	Unique
I174	C	Lythraceae	*Diplusodon rotundifolius*	Apidae	Halictinae sp2	1	Unique
I175	F	Lythraceae	*Diplusodon rotundifolius*	Vespidae	*Polistes* sp2	2	Unique
I176	B	Lythraceae	*Diplusodon villosissimus*	Apidae	*Apis mellifera*	1	Unique
I177	A	Asteraceae	*Echinocoryne schwenkiifolia*	Hesperiidae	Hesperiidae sp1	1	Unique
I178	A	Asteraceae	*Echinocoryne schwenkiifolia*	Apidae	*Megachile* (*Grafella*) sp1	1	Unique
I179	F	Asteraceae	*Echinocoryne stricta*	Apidae	Apidae sp5	1	Unique
I180	E	Asteraceae	*Echinocoryne stricta*	Apidae	*Ceratina* sp13	3	Unique
I181	E	Asteraceae	*Echinocoryne stricta*	Apidae	*Ceratina* sp4	1	Unique
I182	E	Asteraceae	*Echinocoryne stricta*	Apidae	*Friesella schrottkyi*	2	Shared
I182	F	Asteraceae	*Echinocoryne stricta*	Apidae	*Friesella schrottkyi*	1	Shared
I183	F	Asteraceae	*Echinocoryne stricta*	Apidae	*Paratrigona lineata*	3	Unique
I184	F	Asteraceae	*Echinocoryne stricta*	Apidae	*Partamona cupira*	1	Unique
I185	F	Asteraceae	*Echinocoryne stricta*	Apidae	*Temnosoma* sp1	1	Unique
I186	F	Asteraceae	*Echinocoryne stricta*	Apidae	*Tetragonisca angustula*	3	Unique

I187	B	Poaceae	*Echinolaena inflexa*	Apidae	*Apis mellifera*	27	Shared
I187	C	Poaceae	*Echinolaena inflexa*	Apidae	*Apis mellifera*	2	Shared
I188	B	Poaceae	*Echinolaena inflexa*	Apidae	Augochlorini sp5	1	Unique
I189	B	Poaceae	*Echinolaena inflexa*	Apidae	*Melipona quadrifasciata*	5	Unique
I190	B	Poaceae	*Echinolaena inflexa*	Syrphidae	*Palpada* sp1	4	Unique
I191	B	Poaceae	*Echinolaena inflexa*	Syrphidae	*Palpada* sp3	4	Unique
I192	F	Poaceae	*Echinolaena inflexa*	Apidae	*Trigona spinipes*	2	Unique
I193	E	Asteraceae	*Eremanthus elaeagnus*	Apidae	Apidae sp6	2	Unique
I194	D	Asteraceae	*Eremanthus erythropappus*	Vespidae	*Agelaia angulata*	3	Unique
I195	D	Asteraceae	*Eremanthus erythropappus*	Apidae	*Anthrenoides* sp1	3	Unique
I196	C	Asteraceae	*Eremanthus erythropappus*	Apidae	Apidae sp2	10	Shared
I196	F	Asteraceae	*Eremanthus erythropappus*	Apidae	Apidae sp2	1	Shared
I197	B	Asteraceae	*Eremanthus erythropappus*	Apidae	*Apis mellifera*	12	Shared
I197	C	Asteraceae	*Eremanthus erythropappus*	Apidae	*Apis mellifera*	18	Shared
I197	D	Asteraceae	*Eremanthus erythropappus*	Apidae	*Apis mellifera*	7	Shared
I197	E	Asteraceae	*Eremanthus erythropappus*	Apidae	*Apis mellifera*	17	Shared
I198	D	Asteraceae	*Eremanthus erythropappus*	Apidae	*Bombus morio*	2	Unique
I199	E	Asteraceae	*Eremanthus erythropappus*		*Callidum* sp3	3	Unique
I200	C	Asteraceae	*Eremanthus erythropappus*	Apidae	*Cephalotrigona capitata*	2	Unique
I201	E	Asteraceae	*Eremanthus erythropappus*	Apidae	*Friesella schrottkyi*	10	Unique

I202	E	Asteraceae	*Eremanthus erythropappus*	Vespidae	*Polistes* sp3	1	Unique
I203	B	Asteraceae	*Eremanthus erythropappus*	Apidae	*Tetragonisca angustula*	2	Unique
I204	D	Asteraceae	*Eremanthus erythropappus*	Apidae	*Trigona* sp1	3	Unique
I205	B	Asteraceae	*Eremanthus erythropappus*	Apidae	*Trigona spinipes*	2	Shared
I205	E	Asteraceae	*Eremanthus erythropappus*	Apidae	*Trigona spinipes*	4	Shared
I206	F	Fabaceae	*Eriosema heterophyllum*	Apidae	Apidae sp12	2	Unique
I207	D	Fabaceae	*Eriosema heterophyllum*	Apidae	Apidae sp2	1	Unique
I208	D	Fabaceae	*Eriosema heterophyllum*	Apidae	*Bombus morio*	2	Unique
I209	A	Fabaceae	*Eriosema heterophyllum*	Apidae	*Ceratina* sp9	1	Unique
I210	D	Fabaceae	*Eriosema heterophyllum*	Apidae	*Megachile* (*Austromegachile*) sp.1	1	Unique
I211	A	Fabaceae	*Eriosema heterophyllum*	Apidae	*Paratrigona lineata*	1	Unique
I212	D	Apiaceae	*Eryngium juncifolium*	Vespidae	*Agelaia angulata*	2	Unique
I213	A	Apiaceae	*Eryngium juncifolium*	Apidae	*Apis mellifera*	3	Unique
I214	D	Apiaceae	*Eryngium juncifolium*	Apidae	Augochlorini sp4	2	Unique
I215	A	Apiaceae	*Eryngium juncifolium*	Cerambycidae	*Callidum* sp2	1	Unique
I216	A	Apiaceae	*Eryngium juncifolium*	Apidae	*Centris tarsata*	1	Unique
I217	E	Apiaceae	*Eryngium juncifolium*		Diptera sp3	1	Unique
I218	D	Apiaceae	*Eryngium juncifolium*		Diptera sp6	6	Unique
I219	A	Apiaceae	*Eryngium juncifolium*	Apidae	*Geotrigona subterranea*	1	Unique

I220	D	Apiaceae	*Eryngium juncifolium*	Apidae	Halictini sp2	1	Unique
I221	D	Apiaceae	*Eryngium juncifolium*	Apidae	Halictini sp3	1	Unique
I222	B	Apiaceae	*Eryngium juncifolium*	Vespidae	*Polistes* sp1	1	Unique
I223	D	Apiaceae	*Eryngium juncifolium*	Vespidae	Vespidae sp1	1	Unique
I224	D	Apiaceae	*Eryngium juncifolium*	Vespidae	Vespidae sp4	1	Unique
I225	E	Asteraceae	*Grazielia dimorpholepis*		*Callidum* sp3	3	Unique
I226	E	Asteraceae	*Grazielia dimorpholepis*	Apidae	*Cephalotrigona capitata*	10	Unique
I227	F	Asteraceae	*Grazielia dimorpholepis*		Coleoptera sp4	1	Unique
I228	E	Asteraceae	*Grazielia dimorpholepis*	Apidae	Halictinae sp8	1	Unique
I229	E	Asteraceae	*Grazielia dimorpholepis*	Apidae	*Tetragona clavipes*	3	Unique
I230	D	Lamiaceae	*Hypenia macrantha*	Apidae	*Bombus morio*	1	Unique
I231	D	Lamiaceae	*Hypenia macrantha*	Apidae	Halictinae sp2	1	Unique
I232	A	Lamiaceae	*Hypenia macrantha*	Apidae	*Xylocopa* (*Schonnherria*) sp1	3	Unique
I233	A	Convolvulaceae	*Ipomoea wrightii*	Apidae	*Apis mellifera*	1	Unique
I234	B	Convolvulaceae	*Ipomoea wrightii*	Apidae	*Ceratina* sp11	1	Unique
I235	D	Convolvulaceae	*Ipomoea wrightii*	Apidae	*Ceratina* sp12	1	Unique
I236	B	Convolvulaceae	*Ipomoea wrightii*	Apidae	*Ceratina* sp2	4	Unique
I237	D	Convolvulaceae	*Ipomoea wrightii*	Chrysomelidae	Chrysomelidae sp4	2	Unique
I238	A	Convolvulaceae	*Ipomoea wrightii*	Forficulidae	*Doru taeniatum*	1	Unique

I239	A	Convolvulaceae	*Ipomoea wrightii*	Apidae	*Eufriesa* sp1	1	Unique
I240	A	Convolvulaceae	*Ipomoea wrightii*	Apidae	Halictinae sp2	3	Unique
I241	B	Asteraceae	*Lepidaploa sororia*	Apidae	*Centris* sp2	2	Unique
I242	B	Asteraceae	*Lepidaploa sororia*	Apidae	*Paratrigona lineata*	5	Unique
I243	A	Asteraceae	*Lessingianthus linearifolius*	Apidae	*Centris* (*Centris*) sp1	14	Unique
I244	A	Asteraceae	*Lessingianthus linearifolius*	Apidae	Halictinae sp4	4	Unique
I245	A	Asteraceae	*Lessingianthus linearifolius*	Apidae	*Melipona* sp1	7	Unique
I246	D	Ochnaceae	*Luxemburgia octandra*	Apidae	*Bombus morio*	1	Unique
I247	F	Apocynaceae	*Mandevilla illustrais*	Acrididae	Acrididae sp2	1	Unique
I248	A	Melastomataceae	*Marcetia taxifolia*	Apidae	Augochlorini sp6	1	Unique
I249	A	Melastomataceae	*Marcetia taxifolia*	Apidae	*Bombus morio*	1	Unique
I250	A	Melastomataceae	*Marcetia taxifolia*	Apidae	*Megachile* (*Grafella*) sp1	1	Unique
I251	F	Melastomataceae	*Microlicia cordata*		Coleoptera sp1	1	Unique
I252	B	Melastomataceae	*Microlicia cordata*	Apidae	Eucerini sp3	2	Unique
I253	C	Fabaceae	*Mimosa calocephala*	Apidae	*Partamona cupira*	1	Unique
I254	C	Fabaceae	*Mimosa pigra*	Apidae	*Apis mellifera*	7	Unique
I255	C	Fabaceae	*Mimosa pigra*	Apidae	*Partamona cupira*	1	Unique
I256	C	Fabaceae	*Mimosa pigra*	Syrphidae	Syrphidae sp1	1	Unique
I257	B	Asteraceae	*Moquiniastrum densicephalum*	Apidae	*Tetragonisca angustula*	4	Unique

I258	F	Lauraceae	*Ocotea pulchella*	Formicidae	Formicidae sp1	1	Unique
I259	F	Melastomataceae	*Ossae congestiflora*	Apidae	*Bombus morio*	1	Unique
I260	F	Melastomataceae	*Ossae congestiflora*	Apidae	*Tetragonisca angustula*	1	Unique
I261	E	Melastomataceae	*Ossae congestiflora*	Vespidae	Vespidae sp13	1	Unique
I262	A	Malpighiaceae	*Peixotoa tomentosa*	Apidae	Augochlorini sp2	2	Unique
I263	D	Malvaceae	*Peltaea polymorpha*	Apidae	*Ceratina* sp2	2	Unique
I264	E	Malvaceae	*Peltaea polymorpha*	Chrysomelidae	Chrysomelidae sp1	2	Unique
I265	C	Malvaceae	*Peltaea polymorpha*	Erebidae	Erebidae sp1	2	Unique
I266	D	Malvaceae	*Peltaea polymorpha*	Apidae	Halictini sp3	1	Unique
I267	B	Malvaceae	*Peltaea polymorpha*	Apidae	*Megachile* (*Zonomegachile*) sp1	1	Unique
I268	A	Melastomataceae	*Pleroma frigidulum*	Apidae	Halictinae sp10	2	Unique
I269	A	Melastomataceae	*Pleroma* sp.1	Apidae	Halictinae sp13	1	Unique
I270	E	Melastomataceae	*Pleroma stenocarpum*	Apidae	*Paratrigona subnuda*	1	Unique
I271	A	Cyperaceae	*Rhynchospora consanguinea*	Apidae	*Apis mellifera*	9	Shared
I271	D	Cyperaceae	*Rhynchospora consanguinea*	Apidae	*Apis mellifera*	48	Shared
I272	C	Cyperaceae	*Rhynchospora consanguinea*	Chrysomelidae	Chrysomelidae sp1	3	Shared

I272	D	Cyperaceae	*Rhynchospora consanguinea*	Chrysomelidae	Chrysomelidae sp1	6	Shared
I273	A	Cyperaceae	*Rhynchospora consanguinea*	Chrysomelidae	Chrysomelidae sp3	3	Unique
I274	C	Cyperaceae	*Rhynchospora consanguinea*	Chrysomelidae	Chrysomelidae sp5	1	Unique
I275	C	Cyperaceae	*Rhynchospora consanguinea*		Diptera sp8	1	Unique
I276	A	Cyperaceae	*Rhynchospora consanguinea*	Apidae	*Exomalopsis* sp1	1	Unique
I277	C	Cyperaceae	*Rhynchospora consanguinea*	Formicidae	Formicidae sp1	1	Unique
I278	D	Cyperaceae	*Rhynchospora consanguinea*	Apidae	Halictinae sp1	1	Unique
I279	D	Cyperaceae	*Rhynchospora consanguinea*	Apidae	Protandrenini sp1	2	Unique
I280	C	Cyperaceae	*Rhynchospora consanguinea*	Apidae	*Trigona* sp1	1	Unique
I281	F	Rubiaceae	*Sabicea brasiliensis*	Apidae	Anthidiini sp1	1	Unique
I282	E	Rubiaceae	*Sabicea brasiliensis*	Apidae	*Apis mellifera*	13	Shared

I282	F	Rubiaceae	*Sabicea brasiliensis*	Apidae	*Apis mellifera*	12	Shared
I283	E	Rubiaceae	*Sabicea brasiliensis*	Apidae	*Bombus morio*	2	Unique
I284	F	Rubiaceae	*Sabicea brasiliensis*	Apidae	*Ceratina* sp2	2	Unique
I285	F	Rubiaceae	*Sabicea brasiliensis*	Apidae	*Ceratina* sp6	2	Unique
I286	E	Rubiaceae	*Sabicea brasiliensis*	Apidae	Halictinae sp2	1	Unique
I287	E	Rubiaceae	*Sabicea brasiliensis*	Apidae	Halictinae sp3	1	Unique
I288	E	Rubiaceae	*Sabicea brasiliensis*	Apidae	Halictinae sp7	2	Unique
I289	E	Rubiaceae	*Sabicea brasiliensis*	Apidae	Halictinae sp8	2	Unique
I290	F	Rubiaceae	*Sabicea brasiliensis*	Nymphalidae	Nymphalidae sp1	7	Unique
I291	E	Rubiaceae	*Sabicea brasiliensis*	Apidae	*Paratrigona lineata*	1	Unique
I292	F	Rubiaceae	*Sabicea brasiliensis*	Apidae	*Paroxystoglossa* sp1	2	Unique
I293	F	Rubiaceae	*Sabicea brasiliensis*	Apidae	*Tetragonisca angustula*	2	Unique
I294	E	Polygalaceae	*Senega longicaulis*	Apidae	Halictinae sp4	1	Unique
I295	A	Polygalaceae	*Senega paniculata*	Apidae	*Geotrigona subterranea*	1	Unique
I296	F	Sapindaceae	*Serjania* sp.1	Apidae	*Paratrigona lineata*	2	Unique
I297	D	Iridaceae	*Sisyrinchium vaginatum*	Apidae	Halictinae sp13	1	Unique
I298	D	Iridaceae	*Sisyrinchium vaginatum*	Apidae	Halictinae sp8	1	Unique
I299	D	Iridaceae	*Sisyrinchium vaginatum*	Vespidae	Vespidae sp10	2	Unique
I300	E	Solanaceae	*Solanum lycocarpum*	Apidae	*Plebeia* sp1	2	Unique
I301	E	Solanaceae	*Solanum lycocarpum*	Vespidae	*Polistes billardieri*	1	Unique

I302	E	Solanaceae	*Solanum lycocarpum*	Apidae	*Scaptotrigona postica*	3	Unique
I303	B	Solanaceae	*Solanum paniculatum*	Vespidae	Vespidae sp1	2	Unique
I304	B	Asteraceae	*Stenocephalum tragiifolium*	Apidae	Augochlorini sp2	1	Unique
I305	B	Asteraceae	*Stenocephalum tragiifolium*	Apidae	*Ceratina* sp1	3	Shared
I305	E	Asteraceae	*Stenocephalum tragiifolium*	Apidae	*Ceratina* sp1	1	Shared
I305	F	Asteraceae	*Stenocephalum tragiifolium*	Apidae	*Ceratina* sp1	3	Shared
I306	B	Asteraceae	*Stenocephalum tragiifolium*	Apidae	*Ceratina* sp4	1	Unique
I307	B	Asteraceae	*Stenocephalum tragiifolium*	Apidae	*Ceratina* sp7	1	Unique
I308	B	Asteraceae	*Stenocephalum tragiifolium*	Apidae	*Megachile* (*Grafella*) sp1	2	Unique
I309	E	Asteraceae	*Stevia heptachaeta*	Apidae	Halictinae sp13	2	Unique
I310	C	Symplocaceae	*Symplocos oblongifolia*	Apidae	*Apis mellifera*	17	Unique
I311	E	Rubiaceae	*Tocoyema formosa*	Vespidae	*Polistes* sp4	1	Unique
I312	A	Velloziaceae	*Vellozia nivea*	Apidae	*Apis mellifera*	22	Unique
I313	A	Velloziaceae	*Vellozia nivea*	Apidae	*Geotrigona subterranea*	3	Unique
I314	A	Velloziaceae	*Vellozia nivea*	Apidae	Halictinae sp10	1	Unique
I315	A	Velloziaceae	*Vellozia nivea*	Apidae	Halictinae sp12	1	Unique
I316	B	Asteraceae	*Verbesina sordescens*	Apidae	Apidae sp9	1	Unique
I317	B	Asteraceae	*Verbesina sordescens*	Apidae	*Bombus morio*	4	Unique
I318	B	Asteraceae	*Verbesina sordescens*	Formicidae	Formicidae sp2	1	Unique
I319	B	Asteraceae	*Verbesina sordescens*	Apidae	Halictinae sp1	2	Unique

I320	B	Asteraceae	*Verbesina sordescens*	Apidae	*Melipona quadrifasciata*	6	Unique
I321	B	Asteraceae	*Verbesina sordescens*	Apidae	*Melissodes* sp7	11	Unique
I322	B	Asteraceae	*Verbesina sordescens*	Apidae	*Partamona cupira*	1	Unique
I323	B	Asteraceae	*Vernonanthura mucronulata*	Apidae	Apidae sp4	1	Unique
I324	B	Asteraceae	*Vernonanthura mucronulata*	Apidae	*Ceratina* sp1	2	Unique
I325	B	Asteraceae	*Vernonanthura mucronulata*	Apidae	*Ceratina* sp4	1	Unique
I326	B	Asteraceae	*Vernonanthura mucronulata*	Apidae	*Ceratina* sp7	1	Unique
I327	B	Asteraceae	*Vernonanthura mucronulata*	Apidae	*Paratrigona lineata*	7	Unique
I328	B	Asteraceae	*Vernonanthura mucronulata*	Apidae	*Trigona spinipes*	1	Unique
I329	F	Asteraceae	*Vernonanthura polyanthes*	Apidae	Apidae sp7	1	Unique
I330	F	Asteraceae	*Vernonanthura polyanthes*	Apidae	*Paratrigona lineata*	2	Unique
I331	B	Asteraceae	*Vernonanthura polyanthes*	Apidae	*Trigona* sp1	3	Unique
I332	B	Asteraceae	*Vernonanthura polyanthes*	Apidae	*Trigona spinipes*	1	Unique
I333	C	Vochysiaceae	*Vochysia thyrsoidea*	Apidae	*Bombus morio*	9	Unique

I334	C	Vochysiaceae	*Vochysia thyrsoidea*	Apidae	*Centris* (*Melacentris*) sp1	1	Unique
I335	C	Vochysiaceae	*Vochysia thyrsoidea*	Trochilidae	*Colibri serrurostris*	5	Shared
I335	E	Vochysiaceae	*Vochysia thyrsoidea*	Trochilidae	*Colibri serrurostris*	5	Shared
I336	E	Vochysiaceae	*Vochysia thyrsoidea*	Trochilidae	*Eupetomena macroura*	9	Unique
I337	E	Vochysiaceae	*Vochysia thyrsoidea*	Trochilidae	*Phaethornis pretrei*	1	Unique
I338	B	Vochysiaceae	*Vochysia tucanorum*	Apidae	*Bombus morio*	2	Unique
I339	B	Vochysiaceae	*Vochysia tucanorum*	Trochilidae	*Colibri serrurostris*	2	Unique
I340	A	Campanulaceae	*Wahlenbergia brasiliensis*	Apidae	*Ceratina* sp1	3	Unique
I341	A	Campanulaceae	*Wahlenbergia brasiliensis*	Apidae	*Ceratina* sp4	2	Unique
I342	A	Campanulaceae	*Wahlenbergia brasiliensis*	Apidae	*Ceratina* sp9	1	Unique
I343	A	Campanulaceae	*Wahlenbergia brasiliensis*	Apidae	*Megachile* (*Grafella*) sp1	1	Unique
I344	F	Xyridaceae	*Xyris asperula*	Apidae	Apidae sp1	2	Unique
I345	F	Xyridaceae	*Xyris asperula*	Apidae	Augochlorini sp3	1	Unique
I346	E	Rutaceae	*Zanthoxylum rigidum*	Apidae	*Paratrigona lineata*	10	Unique
I347	E	Rutaceae	*Zanthoxylum rigidum*	Vespidae	*Polistes* sp1	10	Unique

CONSIDERAÇÕES FINAIS

A presente tese colabora significativamente para o entendimento sobre as interações planta-polinizador no Cerrado ao integrar três níveis de abordagem complementares: (1) a síntese do conhecimento disponível sobre polinização no bioma, padronizando vocabulário utilizado nesses estudos afim de facilitar o compartilhamento das informações disponíveis na literatura especifica, além de mapear lacunas de conhecimento; (2) a avaliação de atributos funcionais das espécies como moduladora de interações do Bioma, além de evidenciar espécies com papeis centrais para a topologia dessas interações; e (3) a avaliação da beta diversidade de interações planta-polinizador em um mosaico de cobertura de vegetação, além de evidenciar o efeito da presença humana na homogeização das redes e catalisador da substituição de espécies e rearranjo de interações. Em conjunto, esses capítulos fornecem um panorama abrangente sobre o estado atual do conhecimento, os mecanismos ecológicos que moldam as interações e as implicações para a conservação desses sistemas mutualísticos em um dos *hotspots* mais ameaçados do planeta.

O primeiro capítulo revelou que, apesar do aumento substancial de estudos sobre polinização nas últimas décadas, o conhecimento disponível ainda é marcado por fortes lacunas. Essa constatação confirma a existência de múltiplos *shortfalls* clássicos da ecologia da biodiversidade (Wallacean*,* Hutchinsonian *e* Eltonian *shortfalls*) ressaltando que nossa compreensão das interações ainda é fragmentada e insuficiente para representar a complexidade do Cerrado. Ao construir o maior conjunto de dados padronizados sobre interações planta-polinizador do bioma até o momento, este trabalho contribui diretamente para reduzir parte dessas lacunas e fornece uma base metodológica e operacional para estudos futuros em síntese ecológica, modelagem e conservação.

No segundo capítulo, a análise de atributos funcionais dentro de uma metarrede sintetizada a partir da revisão sistemática demonstrou que diferenças na morfologia floral e nas características funcionais de visitantes e plantas moldam de maneira consistente os padrões de modularidade das interações, isto é, na caracterização das espécies que formam grupos de espécies que interagem mais fortemente entre si do que com outros parceiros de interações conhecidos no Cerrado. Ao revelar que módulos funcionais são estruturados por combinações específicas de traços, o estudo avança na compreensão dos mecanismos que governam a organização das interações planta-polinizador, contribuindo para a teoria das redes ecológicas ao integrar explicitamente atributos funcionais às estruturas detectadas. Esses achados dialogam diretamente com pressupostos centrais da ecologia funcional e da teoria de redes mutualísticas ao evidenciar que a organização das interações planta–polinizador no Cerrado é mediada por traços funcionais e pelos papéis desempenhados pelas espécies na rede. A estrutura modular observada, associada à variação funcional entre plantas e visitantes florais, indica que preferências, compatibilidades e restrições ecológicas não são aleatórias, mas refletem filtros funcionais que limitam quais espécies interagem entre si. Nesse sentido, a heterogeneidade nos papéis de espécies e a elevada dissimilaridade entre redes reforçam que mudanças na composição funcional – seja por variação espacial, distúrbios ou histórico de uso da paisagem – têm consequências diretas sobre a arquitetura das interações, com implicações para a persistência e a conservação dos sistemas de polinização no bioma.

No terceiro capitulo, os resultados revelaram como a heterogeneidade em um gradiente de cobertura de vegetação e o histórico de presença humana influenciam a beta diversidade de interações. A substituição de espécies e o rearranjo das interações observados, aliados à homogeneização impulsionada pela presença humana, reforçam que mudanças na paisagem natural do Cerrado, alteram profundamente a organização das redes de interações planta-polinizador. Esses resultados ampliam discussões recentes sobre vulnerabilidade funcional e mostram que processos ecológicos locais têm papel determinante na estruturação das interações.

Os resultados desta tese abrem importantes perspectivas para o avanço do conhecimento sobre interações planta-polinizador no Cerrado. Ao evidenciar padrões consistentes de organização de redes, dissimilaridade estrutural e papéis funcionais das espécies, o estudo aponta direções promissoras para pesquisas futuras capazes de aprofundar os mecanismos que estruturam essas interações. A ampliação espacial e temporal do monitoramento em regiões ainda pouco amostradas, aliada à coleta padronizada de traços morfológicos, reprodutivos e comportamentais, permitirá testar de forma mais robusta como filtros funcionais, distúrbios e contexto ambiental moldam a arquitetura das redes ecológicas. Além disso, a integração entre abordagens quantitativas, funcionais e filogenéticas, bem como o desenvolvimento de redes que incorporem recursos florais, fenologia e distúrbios ambientais, representa um caminho natural para expandir as inferências aqui apresentadas. Por fim, modelos preditivos que explorem cenários de perda de espécies, mudanças climáticas e fragmentação poderão se beneficiar diretamente da base conceitual e empírica construída nesta tese, contribuindo para estratégias mais eficazes de conservação e restauração ecológica no Cerrado. Nesse sentido, este trabalho demonstra que compreender a biodiversidade do Cerrado exige uma visão integrada, capaz de conectar padrões de interação observados a processos funcionais subjacentes e às transformações em curso no bioma.

Em conjunto, os três capítulos desta tese convergem para uma mensagem central: a biodiversidade do Cerrado não pode ser compreendida nem conservada apenas a partir da riqueza de espécies, mas exige a consideração explícita da organização funcional e estrutural das interações planta-polinizador. As lacunas de conhecimento identificadas na literatura, a organização modular mediada por traços funcionais e a homogeneização das redes sob maior presença humana indicam que a perda de heterogeneidade ambiental compromete não apenas quais espécies persistem, mas também como elas interagem. Nesse contexto, estratégias de conservação e manejo devem ir além da proteção de áreas ou espécies isoladas, incorporando a manutenção da diversidade funcional, da conectividade entre módulos de interação e do papel de espécies-chave que sustentam a arquitetura das redes. A restauração ecológica no Cerrado, portanto, deve priorizar a recomposição de conjuntos funcionais e de contextos ambientais que favoreçam múltiplos sistemas de polinização, assegurando a resiliência dos processos ecológicos frente às transformações em curso no bioma. À luz dos resultados obtidos em cada capítulo, este trabalho contribui de forma robusta para a ecologia de interações e fornece subsídios concretos para políticas públicas, manejo da biodiversidade e ações de conservação em um bioma crucial e ameaçado.