

Danieli-Silva, A., de Souza, J. M. T., Donatti, A. J., Campos, R. P., Vicente-Silva, J., Freitas, L. and Varassin, I. G. 2012. Do pollination syndromes cause modularity and predict interactions in a pollination network in a tropical high-altitude grassland? – *Oikos* 121: 35–43.

Appendix A1

Floral diagnosis traits and pollination syndromes of high-altitude grassland species at Serra da Bocaina, southeastern Brazil, which were used in the analysis of network interactions. The allocation of the syndromes followed Faegri and van der Pijl (1979), Endress (1994) and Proctor et al. (1996) (references 1, 2 and 3, respectively).

Family/species	Pollination syndrome	Followed refer.	Decisive criteria
Amaryllidaceae			
<i>Hippeastrum glaucescens</i> Mart.	Ornithophily	1	scarlet colors; absence of odor; large distance nectar sexual organs
Apiaceae			
<i>Eryngium horridum</i> Malme	Myophily	1; 3	domed inflorescence with numerous small, dish-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar; easy access to the nectar
Apocynaceae			
<i>Gonioanthea hilariana</i> (E. Fourn.) Malme	Myophily	1	regular and small, dish-shaped blossom; light and dull color; odor imperceptible; little nectar
<i>Oxypetalum appendiculatum</i> Mart.	Myophily	1; 2	regular and small, dish-shaped blossom; light and dull color; odor imperceptible; little nectar; easy access to the nectar; tail-like perianth
<i>Oxypetalum sublanatum</i> Malme	Myophily	1; 2	regular and small, dish-shaped blossom; light and dull color; odor imperceptible; tail-like perianth
<i>Tassadia subulata</i> (Vell.) Fontella & E.A. Schwarz	Myophily	1	regular and small, dish-shaped blossom; dull color; odor imperceptible; little nectar
Aquifoliaceae			
<i>Ilex amara</i> (Vell.) Loes.	Melittophily	1	similar pattern to <i>Campanula</i> blossom (ref 1: p. 167); nectariferous bell-shaped blossom; bright color
Asteraceae			
<i>Achyrocline satureioides</i> (Lam.) DC.	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis aphylla</i> (Vell.) DC.	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis curitybensis</i> Heering & Dusen	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis dracunculifolia</i> DC.	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis intermixta</i> Gardner	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis leptoccephala</i> DC.	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis pentziiifolia</i> Sch. Bip. ex Baker	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar

<i>Baccharis platypoda</i> DC.	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis tarchonanthoides</i> Baker	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis</i> sp. indet. 1	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Baccharis</i> sp. indet. 2	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Barrosoa betoniciformis</i> (DC.) R.M. King & H. Rob.	Psychophily	3	same pattern as <i>Eupatorium cannabinum</i> blossom (ref 3: p. 182); brush-shaped blossom with flexible and curved style; long white style and reddish purple corolla contrast
<i>Campuloclinium megacephalum</i> (Mart. ex Baker) R.M. King & H. Rob.	Psychophily	3	same pattern as <i>Eupatorium cannabinum</i> blossom (ref 3: p. 182); brush-shaped blossom with flexible and curved style; long white style and reddish purple corolla contrast
<i>Chaptalia integerrima</i> (Vell.) Burkart	Melittophily	1; 3	head equivalent to a large dish-shaped flower; hidden nectar; erect and rigid style; fresh odor; bright white and yellow contrasting color, functioning as nectar guides
<i>Chaptalia runcinata</i> var. <i>graminifolia</i> (Dusen) Burkart	Melittophily	1; 3	head equivalent to a large dish-shaped flower; hidden nectar; erect and rigid style; fresh odor; bright white and yellow contrasting color, functioning as nectar guides
<i>Chromolaena</i> cf. <i>decumbens</i> Gardner	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
<i>Eremanthus erythropappus</i> (DC.) MacLeish	Psychophily	3	same pattern as <i>Eupatorium cannabinum</i> blossom (ref 3: p. 182); brush-shaped blossom with flexible and curved style; long white style and reddish purple corolla contrast
<i>Erigeron maximus</i> (D. Don) Otto ex DC.	Melittophily	1; 3	head equivalent to a large dish-shaped flower; hidden nectar; erect and rigid style; fresh odor; bright white and yellow contrasting color, functioning as nectar guides
<i>Eupatorium</i> sp. indet. 1	Psychophily	3	same pattern as <i>Eupatorium cannabinum</i> blossom (ref 3: p. 182); brush-shaped blossom with flexible and curved style; contrast among long white style and reddish purple sepal apex and corolla
<i>Eupatorium</i> sp. indet. 2	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
<i>Eupatorium</i> sp. indet. 3	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
<i>Eupatorium</i> sp. indet. 4	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style, vivid white color
<i>Gochmatia paniculata</i> (Less.) Cabrera	Myophily	1; 3	inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Grazielia gaudichaudeana</i> (DC.) R.M. King & H. Rob.	Psychophily	3	same pattern as <i>Eupatorium cannabinum</i> blossom (ref 3: p. 182); brush-shaped blossom with flexible and curved style; contrast between long white style and reddish purple sepal apex
<i>Hypochoeris gardneri</i> Baker	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid yellow color
<i>Lucilia lycopodioides</i> (Less.) S. E. Freire	Myophily	1; 3	flat inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar
<i>Mikania lundiana</i> DC.	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); marked honey-like odor; brush-shaped blossom with erect and rigid style; violet anthers contrasting with white corolla
<i>Mikania nummularia</i> DC.	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); marked honey-like odor; brush-shaped blossom with erect and rigid style; violet anthers contrasting with vivid white corolla
<i>Mikania sessilifolia</i> DC.	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); marked honey-like odor; brush-shaped blossom with erect and rigid style; violet anthers contrasting with white corolla
<i>Senecio oleosus</i> Vell.	Melittophily	1; 3	head equivalent to a large dish-shaped flower; hidden nectar; erect and rigid style; fresh odor; contrasting citrus and goldenrod-yellow colors, functioning as nectar guides

<i>Stevia myriadenia</i> Sch. Bip. ex Baker	Melittophily	3	similar to <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; nectar guides; fresh odor
<i>Symphiopappus compressus</i> (Gardner) B.L. Rob.	Psychophily	3	same pattern as <i>Eupatorium cannabinum</i> blossom (ref 3: p. 182); brush-shaped blossom with flexible and curved style; contrast among long white style, reddish-purple sepal apex and violet anthers
<i>Vernonia herbacea</i> (Vell.) Rusby	Melittophily	3	same pattern as <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
<i>Vernonia megapotamica</i> Spreng.	Melittophily	3	same pattern as <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
<i>Vernonia</i> cf. <i>rosea</i> Mart. ex DC.	Melittophily	3	same pattern as <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
<i>Vernonia tomentella</i> Mart. ex DC.	Melittophily	3	same pattern as <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
<i>Vernonia tragiaefolia</i> DC.	Melittophily	3	same pattern as <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
<i>Vernonia westiniana</i> Less.	Melittophily	3	same pattern as <i>Centaurea nigra</i> blossom (ref 3: p. 178); brush-shaped blossom with erect and rigid style; vivid violet color
Bromeliaceae			
<i>Dyckia tuberosa</i> (Vell.) Beer	Ornithophily	1	scarlet colors; absence of odor; large distance nectar-sexual organs, tubular blossom
Campanulaceae			
<i>Lobelia camporum</i> Pohl	Melittophily	1; 3	zygomorphic blossom with great depth effect; strong mechanical barrier to nectar access; nectar guides
<i>Wahlenbergia brasiliensis</i> Cham.	Melittophily	1	typical melittophilous <i>Campanula</i> blossom (ref 1: p. 167); fresh odor and lilac color
Clethraceae			
<i>Clethra scabra</i> Pers. var. <i>scabra</i>	Myophily	1	small, bowl-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar; easy access to the nectar
Convolvulaceae			
<i>Convolvulus crenatifolius</i> Ruiz & Pav.	Melittophily	1; 3	trumpet-shaped blossom with great depth effect; bright-colored, with nectar guides; nectar chamber at the corolla base
<i>Ipomoea procumbens</i> Mart.	Melittophily	1; 3	large trumpet-shaped blossom with great depth effect; bright-colored, with nectar guides; nectar chamber at the corolla base; high nectar production; fresh odor
<i>Jacquemontia grandiflora</i> Meisn.	Melittophily	1; 3	trumpet-shaped blossom with great depth effect; bright-colored, with nectar guides; nectar chamber at the corolla base; fresh odor
Cunoniaceae			
<i>Weinmannia organensis</i> Gardner	Myophily	1	inflorescence with numerous small, dish-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; very little nectar; easy access to the nectar
Droseraceae			
<i>Drosera montana</i> A.St.-Hil.	Melittophily	2	dish-shaped and nectarless blossom; many stamens (<i>Papaver</i> pollen-flower type, ref 2: p. 148); vivid pink color
Ericaceae			
<i>Agarista hispidula</i> (DC.) Hook. f. ex Nied.	Ornithophily	1	scarlet colors; absence of odor; large distance nectar-sexual organs, tubular blossom
<i>Gaylussacia chamissonis</i> Meisn.	Melittophily	1	similar pattern to <i>Campanula</i> blossom (ref 1: p. 167); nectariferous bell-shaped blossom; fresh odor; bright color; poricidal anthers
<i>Gaylussacia jordanensis</i> Sleumer	Melittophily	1	similar pattern to <i>Campanula</i> blossom (ref 1: p. 167); nectariferous bell-shaped blossom; fresh odor; bright color; poricidal anthers
Eriocaulaceae			
<i>Paepalanthus paulensis</i> Ruhland	Myophily	1; 3	domed inflorescence with numerous diminutive, bowl-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; very little nectar; easy access to the nectar
<i>Paepalanthus polyanthus</i> (Bong.) Kuntz	Myophily	1; 3	domed inflorescence with numerous diminutive, bowl-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; very little nectar; easy access to the nectar

Erythroxylaceae

Erythroxylum microphyllum A. St.-Hil. Myophily 1; 3 small, dish-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar; easy access to the nectar

Escalloniaceae

Escallonia farinacea A. St.-Hil. Melittophily 1 similar pattern to *Campanula* blossom (ref 1: p. 167); nectariferous bell-shaped blossom; fresh odor; bright color; poricide anthers

Euphorbiaceae

Croton dichrous Müll. Arg. Myophily 1; 3 small, dish-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar; easy access to the nectar

Gentianaceae

Deianira nervosa Cham. & Schtdl. Melittophily 2 dish-shaped and nectarless blossom; optically attractive anthers; pink color

Zygotigma australe (Cham. & Schtdl.) Griseb. Melittophily 2 Dish-shaped and nectarless blossom; bright violet color

Gesneriaceae

Sinningia allagophylla (Mart.) Wiehler Ornithophily 1 scarlet colors; absence of odor; large distance nectar-sexual organs, tubular blossom

Hypericaceae

Hypericum brasiliense A. St.-Hil. Melittophily 2 dish-shaped and nectarless blossom; many stamens (*Papaver* pollen-flower type, ref 2: p. 148); vivid yellow color

Iridaceae

Alophia geniculata Klatt Melittophily 1; 3 similar pattern to gentians' bumblebee blossoms (ref 3: p. 150); trumpet-shaped blossom with great depth effect; bright violet color; nectar guides (but nectarless)

Alophia sp. indet. 1 Melittophily 1; 3 similar pattern to gentians' bumblebee blossoms (ref 3: p. 150); trumpet-shaped blossom with great depth effect; bright color; nectar guides (but nectarless)

Calydorea campestris (Klatt) Baker Melittophily 2 dish-shaped and nectarless blossom; optically attractive anthers (vivid yellow); violet corolla

Sisyrinchium micranthum Cav. Melittophily 2 typical Iridaceae oil-flower (ref 2: p. 163); bell-shaped blossom with trichome on the floral base; yellow-violet contrasting colors

Sisyrinchium vaginatum Spreng. Melittophily 2 dish-shaped and nectarless blossom; optically attractive anthers; vivid yellow color

Lamiaceae

Hyptis lippoides Pohl ex Benth. Melittophily 1 zygomorphic blossom with great depth effect; strong mechanical barrier to nectar access; nectar guides; perfume; typical gullet-shaped blossom of melittophilous Labiatae (ref 1: pg 188 on)

Hyptis plectranthoides Benth. Melittophily 1 zygomorphic blossom with great depth effect; strong mechanical barrier to nectar access; nectar guides; perfume; typical gullet-shaped blossom of melittophilous Labiatae (ref 1: pg 188 on)

Hyptis umbrosa Salzm. ex Benth. Melittophily 1 zygomorphic blossom with great depth effect; strong mechanical barrier to nectar access; nectar guides; perfume; typical gullet-shaped blossom of melittophilous Labiatae (ref 1: pg 188 on)

Peltodon radicans Pohl Melittophily 1 zygomorphic blossom with great depth effect; strong mechanical barrier to nectar access; nectar guides; perfume; typical gullet-shaped blossom of melittophilous Labiatae (ref 1: pg 188 on)

Leguminosae

Chamaecrista sp. indet. 1 Melittophily 3 dish-shaped and nectarless blossom; powdery pollen in poricidal anthers; heteranthery (Melastomataceae pollen-flower type, ref 3: p. 294)

Crotalaria breviflora DC. Melittophily 1 typical nectariferous flag blossom; same pattern as *Astragalus depressus* (ref 1: p. 180); vivid yellow color

Lupinus velutinus Benth. Melittophily 1 typical polleniferous flag blossom; same pattern as *Coronilla emerus* (ref 1: p. 181); violet color

Lythraceae

Cuphea glutinosa Cham. & Schtdl. Melittophily 1; 3 zygomorphic blossom with great depth effect; strong mechanical barrier to nectar access; nectar guides

Malpighiaceae

Byrsonima variabilis A. Juss. Melittophily 2 same pattern as *Malpighia glabra* oil-flower (ref 2: p. 164); dish-shaped blossom with elaiophores on the sepals; bright contrasting colors

Malvaceae

Pavonia kleinii Krapov. & Cristóbal Melittophily 1; 3 bell-shaped blossom with great depth effect; bright color; nectar chamber at the corolla base

Sida sp. indet. 1 Melittophily 1; 3 large bell-shaped blossom with great depth effect; bright-colored, with nectar guides; nectar chamber at the corolla base

Melastomataceae

Tibouchina frigidula (DC.) Cogn. Melittophily 3 dish-shaped and nectarless blossom; powdery pollen in poricidal anthers; heteranthery; contrasting colors (Melastomataceae pollen-flower type, ref 3: p. 294)

Tibouchina martialis Cogn. Melittophily 3 dish-shaped and nectarless blossom; powdery pollen in poricidal anthers; heteranthery; contrasting colors (Melastomataceae pollen-flower type, ref 3: p. 294)

Tibouchina minor Cogn. Melittophily 3 dish-shaped and nectarless blossom; powdery pollen in poricidal anthers; heteranthery; contrasting colors (Melastomataceae pollen-flower type, ref 3: p. 294)

Trembleya parviflora (D. Don) Cogn. Melittophily 3 dish-shaped and nectarless blossom; powdery pollen in poricidal anthers; heteranthery; contrasting colors (Melastomataceae pollen-flower type, ref 3: p. 294)

Trembleya phlogiformis DC. Melittophily 3 dish-shaped and nectarless blossom; powdery pollen in poricidal anthers; heteranthery; contrasting colors (Melastomataceae pollen-flower type, ref 3: p. 294)

Ochnaceae

Ouratea semiserrata (Mart. & Nees) Engl. Melittophily 2 dish-shaped and nectarless blossom; powdery pollen in poricidal, large anthers (*Solanum* pollen-flower type, ref 2: p. 149)

Orobanchaceae

Esterhazyia macrodonta Cham. & Schtdl. Ornithophily 1 scarlet colors; absence of odor; large distance nectar-sexual organs, tubular blossom

Polygalaceae

Polygala brasiliensis L. Melittophily 1 same pattern as *Polygala chamaebuxus* (ref 1: p. 165); flag blossom that hides the nectar; violet color

Polygala cneorum A. St.-Hil. & Moq. Melittophily 1 same pattern as *Polygala chamaebuxus* (ref 1: p. 165); flag blossom that hides the nectar; violet color

Rubiaceae

Borreria capitata (Ruiz & Pav.) DC. Myophily 1; 3 domed inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar; easy access to the nectar

Borreria tenella Cham. & Schtdl. Melittophily 1 similar pattern to *Campanula* blossom (ref 1: p. 167); nectariferous bell-shaped blossom; fresh odor; bright white color with contrasting violet anthers

Declieuxia cordigera var. *angustifolia* Müll. Arg. Melittophily 1; 3 trumpet-shaped blossom with great depth effect; bright violet color; nectar hidden (hairy inner corolla)

Galianthe angustifolia (Cham. & Schtdl.) E.L. Cabral Myophily 1; 3 domed inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar; easy access to the nectar

Galianthe brasiliensis Spreng. Myophily 1; 3 domed inflorescence with numerous short, tubular-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar; easy access to the nectar

Galium hypocarpium (L.) Endl. ex Griseb. Myophily 1 small, dish-shaped flowers; light and dull color; odor imperceptible; sexual organs well exposed; little nectar; easy access to the nectar

Solanaceae

Solanum aculeatissimum Jacq. Melittophily 2 dish-shaped and nectarless blossom; powdery pollen in poricidal, large anthers (*Solanum* pollen-flower type, ref 2: p. 149)

Solanum americanum Mill. Melittophily 2 dish-shaped and nectarless blossom; powdery pollen in poricidal, large anthers (*Solanum* pollen-flower type, ref 2: p. 149)

Solanum pseudocapsicum L. Melittophily 2 dish-shaped and nectarless blossom; powdery pollen in poricidal, large anthers (*Solanum* pollen-flower type, ref 2: p. 149)

<i>Solanum swartzianum</i> Roem. & Schult.	Melittophily	2	dish-shaped and nectarless blossom; powdery pollen in poricidal, large anthers (<i>Solanum</i> pollen-flower type, ref 2: p. 149)
<i>Solanum viarum</i> Dunal	Melittophily	2	dish-shaped and nectarless blossom; powdery pollen in poricidal, large anthers (<i>Solanum</i> pollen-flower type, ref 2: p. 149)
Verbenaceae			
<i>Verbena hirta</i> Spreng.	Melittophily	1; 3	zygomorphic blossom with great depth effect; strong mechanical barrier to nectar access; nectar guides
Violaceae			
<i>Viola cerasifolia</i> A. St.-Hil.	Melittophily	1; 3	zygomorphic blossom with great depth effect; strong mechanical barrier to nectar access; nectar guides and spur
Xyridaceae			
<i>Xyris asperula</i> Mart.	Melittophily	2	dish-shaped and nectarless blossom; many stamens- staminoids (<i>Papaver</i> pollen-flower type, ref 2: p. 148); vivid yellow color
<i>Xyris tortulla</i> Mart.	Melittophily	2	dish-shaped and nectarless blossom; many stamens-staminoids (<i>Papaver</i> pollen-flower type, ref 2: p. 148); vivid yellow color
