Molecular phylogeny and character-mapping support the synonymy of Cordobia and Gallardoa in Mionandra (Malpighiaceae)

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Abstract

Background and aims – Cordobia, Gallardoa, Mionandra, and Peixotoa (Stigmaphylloid clade, Malpighiaceae) are four small, closely related genera comprising shrubs or lianas endemic to South American savannas, dry forests, and temperate steppes. Their generic limits have significantly changed in the last century, and past molecular phylogenetic studies of Malpighiaceae have not tested the morphological characters of this group to identify synapomorphies supporting these clades/genera.

Material and methods – We sampled the monospecific Cordobia and Gallardoa, one species of Mionandra (out of 2 spp.), nine species of Peixotoa (out of 29 spp.), and a single species of Camarea and Janusia as outgroups. Bayesian and Maximum Likelihood analyses were carried out for this clade based on five molecular markers (i.e. ETS, ITS, PHYC, matK, and ndhF). A set of 16 macromorphological characters was scored and coded for identifying synapomorphies under the Maximum Likelihood criteria.

Key results – Our molecular phylogeny recovered Peixotoa as monophyletic and sister to the clade comprising Cordobia + Gallardoa + Mionandra, strongly corroborating previous phylogenetic studies of Malpighiaceae. The character-mapping analyses recovered two synapomorphies supporting the Cordobia + Gallardoa + Mionandra + Peixotoa clade, six supporting Mionandra s.l. (i.e. Cordobia + Gallardoa + Mionandra), and five supporting Peixotoa. Cordobia and Gallardoa are proposed as synonyms of Mionandra, alongside the necessary combinations, typifications, and identification keys.

Conclusions – Morphological characters related to the degree of connation of the stipules, leaf indumentum type, petiole length, inflorescence architecture, number of flowers per inflorescence, presence of a peduncle in the 1-flowered cincinni, sepal connation, posture and texture, petal width and margin integrity, staminode presence, shape and size, and the shape of the apex of styles were key in circumscribing these lineages. Mionandra s.l. is proposed and characterised, including a new combination, an identification key to distinguish its species, a distribution map, and taxonomy notes.

Keywords

Cono Sur, Malpighiales, Peixotoa, taxonomy, Stigmaphylloid clade, systematics

INTRODUCTION

Malpighiaceae has undergone unparalleled changes in its traditional classification in the last two decades due to the publication of several molecular phylogenetic studies (Cameron et al. 2001; Davis et al. 2001; Davis and Anderson 2010). Several new lineages were resolved, bringing to light taxonomic problems regarding the monophyly of its subfamilies (e.g. Byrsonimoideae W.R.Anderson, Banisterioideae A.Juss., and Malpighioideae A.Juss.), tribes (e.g. only Gaudichaudieae Horan. was recovered as monophyletic), and genera (e.g. Banisteriopsis C.B.Rob.,...
In this study, we reconstructed a molecular phylogeny of the Peixotoid clade based on three nuclear (ETS, ITS, and PHYC) and two plastid (matK and ndhF) genes to answer the questions: 1. Are Cordobia, Gallardoa, and Mionandra supported by morphological synapomorphies? 2. If not, would Mionandra s.l. (including Cordobia and Gallardoa) be supported by any morphological synapomorphies?

MATERIAL AND METHODS

Molecular analyses

We sampled 14 species in this study representing 12 species from the Peixotoid clade (out of 31 spp.), including the type species of all four genera and a single species of Camarea and Janusia, respectively, as outgroups, representing tribe Gaudichaudiaceae as their sister group (Supplementary material 1). For DNA extraction, we used leaf fragments from herbarium specimens deposited at Universidade Estadual de Feira de Santana (HUEFS). Genomic DNA was extracted using the CTAB 2× protocol, modified from Doyle and Doyle (1987). Protocols to amplify and sequence the ETS and ITS regions followed Almeida et al. (2017). PCR products were purified using PEG 11% (polyethylene glycol) and were sequenced directly with the same primers used for the PCR amplification. Sequence electropherograms were produced in an automatic sequencer (ABI 3130XL Genetic Analyzer) using Big Dye Terminator 3.1 (Applied Biosystems). Additional sequences from a single nuclear (PHYC) and two plastid (matK and ndhF) regions were retrieved from GenBank (Supplementary material 1). Sequences were edited using Geneious v.4.8.4 (Kearse et al. 2012) and aligned using Muscle v.1.0 (Edgar 2004), with subsequent adjustments in the preliminary matrices made manually by eye. The complete data matrices are available on Figshare (https://doi.org/10.6084/m9.figshare.23823105).

All trees were rooted in tribe Gaudichaudiaceae (Camarea + Janusia), the sister group of the Peixotoid clade, according to Davis and Anderson (2010). A combined analysis of plastid + nuclear regions was carried out using Bayesian Inference and Maximum Likelihood. We selected the model using hierarchical likelihood ratio tests (HLRT) with jModelTest2 (Darriba et al. 2012). Both model-based methods were conducted with a mixed model (GTR+G+I) and unlinked parameters, using MrBayes v.3.1.2 (Ronquist and Huelsenbeck 2003) and RAxML v.8 (Stamatakis 2014) implemented in RAxMLGUI2 (Edler et al. 2021). For the Bayesian inference, the Markov Chain Monte Carlo (MCMC) was run using two simultaneous independent runs with four chains each (one cold and three heated), saving one tree every 1,000 generations for a total of ten million generations. We excluded 20% of retained trees as ‘burn in’, and checked for a stationary phase of Likelihood, checking for ESS values higher than 200 for all parameters with Tracer v.1.7 (Rambaut et al. 2018). The clades’ posterior probabilities (PP) were
RESULTS

Phylogenetic analyses

The nuclear dataset represented 2,366 characters of the dataset, the plastid dataset represented 1,729 characters, and the combined plastid + nuclear dataset included 4,095 analysed characters. Topologies produced by BI and ML analyses, based on the individual nuclear and plastid datasets, did not exhibit incongruences among the topologies produced, so we performed a combined analysis of plastid + nuclear datasets (Fig. 1). The BI and ML analyses recovered a partially resolved tree with seven well-supported clades (> PP 0.95 / BS 65) at generic levels and six poorly-supported clades (< PP 0.95 / BS 65) within Peixotoa (Fig. 1). The Peixotoid clade was recovered as monophyletic and highly supported by both BI and ML analyses (1/100) comprising two major clades: the first highly supported represented by the specimens of Cordobia + Gallardoa + Mionandra (PP 1.0 / BS 100) and a second clade represented by the highly supported Peixotoa (PP 1.0 / BS 100) (Fig. 1). Combined plastid + nuclear datasets provided higher support for more clades than the results based on single plastid or nuclear datasets (Fig. 1A).

Character mapping

We recovered three synapomorphies (stipules connate at the base or up to the middle, 1-flowered cincinni lacking peduncles [i.e. sessile], and sepals revolute at apex) for the Peixotoid clade alongside the outgroups representing tribe Gaudichaudieae (Fig. 1B). The three synapomorphies recovered by us for tribe Gaudichaudieae (thysri, cincinnus peduncle present, and petals widely elliptic) are interpreted as sampling artefacts caused by the limited outgroup sampling of our study. These characters most likely represent plesiomorphic states in the family, but a study focusing on Malpighiaceae as a whole is necessary to address this issue.

The first clade recovered within the Peixotoid clade included the genera Cordobia + Gallardoa + Mionandra supported by six synapomorphies (sepal free at base, chartaceous, and entirely revolute, antherodes filiform and minute, apex of styles truncate to expanded) and a single homoplasy (1-flowered cincinni) (Fig. 1B). The second clade recovered within the Peixotoid clade comprised only species of Peixotoa, being supported by five synapomorphies (stipules completely connate, secondary arrangement of inflorescences [i.e. synflorescences] of umbels arranged in thysri, petals orbicular, petal margins dentate, and filaments of staminodes as long as fertile stamens) and two homoplasies (long petioles and leaves glabrescent) (Fig. 1B).

DISCUSSION

The Peixotoid clade was recovered as highly supported (PP 1.0 / BS 100) in our tree (Fig. 1A), corroborating previous phylogenetic studies of Malpighiaceae (Davis and Anderson 2010; Davis et al. 2014; Willis et al. 2014; Cai et al. 2016). This clade was also recovered with three morphological synapomorphies: partially to completely conuate stipules, sessile 1-flowered cincinni, and sepals completely revolute. Partially conuate stipules are not exclusive to the Peixotoid clade, with several genera from the distantly related Byrsonimoid clade also showing this character (Anderson 1981). In contrast, sessile 1-flowered cincinni are quite rare in Malpighiaceae, additionally found only in Diplopterys and Coleostachys A.Juss. (Almeida et al. 2020). However, the flowers in Coleostachys are completely sessile, lacking both peduncle and pedicel (Almeida and Hall 2016). Finally, sepals revolute at the apex are very common in Malpighiaceae (Almeida et al.
2020), but sepals completely distally revolute or involute along margins are only found in *Mionandra* s.l. (pers. obs.).

Morphologically, *Mionandra* s.l. (including *Cordobia* and *Gallardoa*) is well-circumscribed with six synapomorphies and a single homoplasy (Fig. 1B), being easily differentiated from *Peixotoa* by the sepals free at base, chartaceous and entirely revolute, antherodes filiform and minute, and apex of styles truncate to expanded. Since several morphological synapomorphies supporting *Mionandra* s.l. were recovered in our analysis, we have chosen to follow Grisebach’s (1874) broader concept of *Mionandra* (including *Cordobia*) but also synonymising *Gallardoa* under it (see taxonomic treatment). For more information, see the identification key in the taxonomy

![Figure 1](image-url)
section, differentiating the genera of the Peixotoid clade accepted in this study.

Even though Anderson (1982) did not accept any infrageneric ranks in her monograph of *Peixotoida*, Niedenzu (1928) accepted two sections for this genus in his taxonomic revision for Malpighiaceae: *P. sect. Balantiopsis* Nied. and *P. sect. Perinopsis* Nied. The first was characterised by its leaves and stems pubescent and anthers with connectives 1-lobed (Niedenzu 1928). In contrast, the latter was characterised by glabrous leaves and stems, and anthers with connectives 2-lobed (Niedenzu 1928). Our analysis evidenced that the sections of *Peixotoida* proposed by Niedenzu (1928) are not monophyletic (Fig. 1B, *P. glabra*, *P. hatschbachii*, and *P. hispidula* in red represent *P. sect. Perinopsis*, while the remaining species in black represent *P. sect. Balantiopsis*) and further morphological studies must be carried out within this genus to shed light on any infrageneric classification to be proposed.

**Table 1. Diagnostic morphological characters differentiating both genera of the Peixotoid clade.**

<table>
<thead>
<tr>
<th>Character</th>
<th><em>Mionandra</em></th>
<th><em>Peixotoida</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Habit</td>
<td>Erect or scandent to prostrate subshrubs</td>
<td>Erect to scandent shrubs or lianas</td>
</tr>
<tr>
<td>Stipules</td>
<td>Connate at base or up to the middle (i.e. bifid)</td>
<td>Completely connate (i.e. entire)</td>
</tr>
<tr>
<td>Leaves</td>
<td>Never reduced in the inflorescences</td>
<td>Reduced in the inflorescences</td>
</tr>
<tr>
<td>Petiole</td>
<td>Short</td>
<td>Long</td>
</tr>
<tr>
<td>Leaf blades</td>
<td>Hirsute-sericeous</td>
<td>Various but never hirsute-sericeous</td>
</tr>
<tr>
<td>Inflorescences</td>
<td>Solitary umbels</td>
<td>Umbels arranged in dichasia or thyrsi</td>
</tr>
<tr>
<td>Umbels</td>
<td>Sessile, 1-flowered</td>
<td>Pedunculate, 4-flowered</td>
</tr>
<tr>
<td>Bracts</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Bracteoles</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Sepals</td>
<td>Free, chartaceous, completely revolute or involute along margins</td>
<td>Connate at base, coriaceous, revolute only at apex</td>
</tr>
<tr>
<td>Petal limb</td>
<td>Narrowly elliptic to oblanceolate or obovate to widely obovate</td>
<td>Orbicular</td>
</tr>
<tr>
<td>Stamina</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Staminaodes</td>
<td>3–5</td>
<td>5</td>
</tr>
<tr>
<td>Antherodes</td>
<td>Filiform, minute</td>
<td>Globose, conspicuous</td>
</tr>
<tr>
<td>Style</td>
<td>Truncate to slightly expanded</td>
<td>Capitate</td>
</tr>
<tr>
<td>Fruits</td>
<td>Wings reduced, rarely dorsal wing well-developed, lateral wings free or fused at base</td>
<td>Wings well-developed, dorsal wing dominant, lateral and dorsal wings fused at base forming a basal crest</td>
</tr>
</tbody>
</table>

**TAXONOMIC TREATMENT**

**Peixotoid clade**

**Diagnosis.** Distinguished from the remaining genera of the Stigmaphylloid clade by its stipules connate, cincinni sessile and 1-flowered, and sepals completely distally revolute or involute along margins.

**Notes.** The Peixotoid clade currently comprises two monophyletic and morphologically well-circumscribed genera divided into a total of 32 species. *Peixotoida* is the largest genus of the two, currently with 29 species (Anderson 1982, 2001), with *Mionandra* comprising only four species (this study). As aforementioned, both genera share some peculiar morphological characters but can be easily differentiated based on both vegetative and reproductive characters (see Table 1 and the key).

**Key to the genera of the Peixotoid clade**

1. Stipules connate at base up to middle (i.e. bifid); umbels 1-flowered, bract and bracteoles absent; sepals free, completely revolute or involute along margins; antherodes filiform, minute; styles apex truncate to slightly expanded................. *Mionandra*
   = Stipules connate (i.e. entire); umbels 4-flowered, bract and bracteoles present; sepals connate at base, revolute only at apex; antherodes globose, conspicuous; styles apex capitata................................................................................................................................. *Peixotoida*

**Mionandra** Griseb. (Grisebach 1874: 101)

Figs 2–5

**Brittonella** Rusby (Rusby 1893: 429) – Type species: *Brittonella pilosa* Rusby [= *M. camareoides* Griseb.]

**Cordobia** Nied. (Niedenzu 1912: 41), syn. nov. – Type species: *Cordobia argentea* (Griseb.) Nied. [= *M. argentea* Griseb.]

**Gallardoa** Hicken (Hicken 1916: 102), syn. nov. – Type species: *Gallardoa fischeri* Hicken [= *M. fischeri* (Hicken) R.F. Almeida]
Figure 2. Distribution map of *Mionandra* (grey circles) and *Peixotoa* (white circles) in South America. Dark green: rainforests; Light green: dry forests; Orange: savannas; Lilac: Tundra/Puna; Yellow: temperate steppes; Light red: temperate forests.
Type species. Mionandra camareoides Griseb.

Diagnosis. Distinguished from Peixotoa by its stipules connate at the base or up to the middle (i.e. bifid), leaves short-petiolate, hirsute-sericous; umbels 1-flowered, peduncles absent; sepals free, chartaceous, completely revolute or involute along margins; petals narrowly elliptic, margin glandular-fimbriate; fertile stamens 5, staminodes 3–5, antherodes filiform, minute; style apex truncate to slightly expanded; mericarps with wings reduced, rarely dorsal wing well-developed (Table 1).

Description. Erect or scandent to prostrate subshrubs; xylopodium present; indumentum throughout the plant ranging from sericeous to glabrescent; stipules expanded, connate at base or up to the middle (i.e. bifid), triangular, interpetiolar, persistent or deciduous. Leaves opposite, never reduced in the inflorescences; petioles cylindric, short-petiolate (up to 2 mm long), eglandular; blade narrowly elliptic, elliptic, lanceolate to ovate, base cuneate to obtuse, margin entire, apex acute to acuminate, abaxially 0–2-glandular near the base. Umbels solitary, terminal; cincinni 1-flowered; bracts ovate, to acuminate, abaxially 0–2-glandular near the base. Petals clawed, yellow, sometimes anthesis, lateral sepals abaxially 2-glandular, the anterior of bud, completely revolute or involute along margins at anthesis, lateral sepals abaxially 2-glandular, the anterior usually eglandular; petals clawed, yellow, sometimes turning orange at age, both sides glabrous, limb narrowly elliptic to ob lanceolate or obovate to widely obovate, base cuneate, margin glandular-fimbriate, apex round, claw plane, posterior petal erect, glandular along margins, lateral petals patent to erect. Androc eium 8–10, fertile stamens 5, staminodes 3–5; filaments connate at base, straight, rarely curved, stamen filaments longer than stam inode filaments, glabrous or pubescent; connective minute, inconspicuous; fertile anthers monomorphic or dimorphic, erect at apex, glabrous; antherodes absent to present, filiform, reduced to a glandular tissue, glabrous. Gynoe cium with carpels connate their whole length in flower, separating during fruit development, styles thick, cylindric, erect, equal, divergent, apex of styles truncate to slightly expanded, stigma terminal to lateral, crateriform or discoid. Schizocarp breaking apart into 3 winged mericarps, separating from a short torus; mericarps with dorsal wing reduced, sometimes well-developed; lateral wings always reduced, free or fused; wings coriaceous, margin sinuate; nut ridged near areole; areole ovate to elliptic. Seeds smooth or rugose; embryos ovoid, cotyledons bent, equal or unequal.

Distribution, habitat, and ecology. Mionandra s.l. comprises four species confined to dry forests (Chaco), savannas, and temperate steppes (Patagonian steppes) from Argentina, southern Bolivia, and western Paraguay in South America (Fig. 2).

Notes. A comprehensive treatment for the genera comprising Mionandra s.l. (including Cordobia and Gallardoa) and three of their four species are presented by Aliscioni and Torretta (2017) within the Flora of Argentina project, with M. paraguariensis (which does not occur in Argentina) not included in the treatment. Thus, we provide an updated key to all species of Mionandra s.l., plus comments on the recognition of M. paraguariensis.

Key to the species of Mionandra

1. Leaves 2-glandular near base; sepals involute along margins; stamens dimorphic (the latero-posterior ones with shorter, stout and curved filaments, the posterior ones and the anterior filaments thin and straight but the anterior shorter in length); mericarps rugose, dorsal wing well-developed ................................................................. M. argentea
   - Leaves eglandular; sepals revolute at apex; stamen monomorphic; mericarps smooth, dorsal wing reduced to a crest ................. 2
2. Erect subshrubs; leaves adpressed-sericous, margin revolute; petals turning orange at age; style apex slightly expanded; mericarps with lateral wings fused in an orbicular structure; cotyledons equal ......................................................................................................................... M. fischeri
   - Scandent to prostrate subshrubs; leaves hirsute-sericous at least abaxially, margin plane; petals remaining yellow at age; apex truncate; mericarps with lateral wings free; cotyledons unequal ..................................................................................................................... M. camareoides
3. Leaves adaxially hirsute-sericous at maturity; flowers 1–1.2 cm diam.; petals narrowly elliptic to ob lanceolate, apex obtuse; stamens filaments pubescent; staminodes 3, ½ the length of the stamens filaments ............................................................................................................................... M. camareoides
   - Leaves adaxially glabrous at maturity; flowers 2.5–3 cm diam.; petals obovate to widely obovate, apex truncate to emarginate; stamens filaments glabrous; staminodes 5, the same length as the stamens filaments ................................................................................. M. paraguariensis

Mionandra argentea Griseb. (Grisebach 1874: 101)

Cryptolappa argentea (Griseb.) Kuntze (Kuntze 1898: 27)
   – Type: same as for Mionandra argentea.

Aspicarpa argentea (Griseb.) Nied. (Niedenzu 1912: 58), nom. illeg. – Type: same as for Mionandra argentea.

Cordobia argentea (Griseb.) Nied. (Niedenzu 1913: 41) – Type: same as for Mionandra argentea.

Gaudichaudia argentea (Griseb.) Chodat (Chodat and Vischer 1917: 204) – Type: same as for Mionandra argentea.

Janusia argentea Griseb., nom. not validly publ.

Peixot ota cordobensis Kuntze (Kuntze 1898: 28) – Type: ARGENTINA – Córdoba • 1891; fl., fr.; Kuntze s.n.; holotype: NY; isotypes: F, NY.

Type. ARGENTINA – Córdoba • in fruticetis Sierra de Córdoba, prope La Higuera; 1872; fl., Lorentz s.n.; holotype: GOET; isotypes: CORD [CORD00005912], K [K000427020].
Mionandra camareoides Griseb. (Grisebach 1874: 102)

*var. camareoides* – Type: same as for *Mionandra camareoides*.


*Mionandra prostrata* Stuck. ex Nied. (Niedenzu 1928: 232), pro. syn. – Type: same as for *Mionandra camareoides* f. prostrata.

**Type.** ARGENTINA – Córdoba • en el campo acerca de Córdoba; Dec. 1870; fl.; Lorentz 407b; lectotype (designated here): GOET [GOET007649]; isolectotype: CORD [CORD00005913].

*Mionandra paraguariensis* Chodat (Chodat and Vischer 1917: 165)

*Mionandra camareoides* var. paraguariensis (Chodat) Nied. (Niedenzu 1928: 232)

Type. PARAGUAY – Cordillera • between the municipalities of Caacupé and Tobati; s.d.; Chodat & Vischer 238; holotype: G [G 208718].

Figure 5. *Mionandra fischeri*. A. Shrubby habit. B. Detail of a flower in frontal view. C. Detail of a flower in lateral view. D. Detail of floral branches. Photographs A–B by Anival Prina; C by Michelle Delaloye; D by Ivan Federico Ebrecht.
Figure 6. *Peixotoa catarinensis*. A. Detail of a sterile branch showing the connate stipules. B. Detail of the base of a leaf in abaxial view. C. Detail of a flowering branch. D. Floral bud in lateral view. E. Flower in frontal view. F. Winged mericarps in lateral view. Photographs by Marco Pellegrini.
Notes. After revisiting the original description of Chodat and Vischer (1917) and analysing the type specimen, we disagree with Niedenzu’s (1928) treatment of *M. paraguariensis* as a variety of *M. camareoides*. Aside from the difference in leaf indumentum, *M. paraguariensis* differs from *M. camareoides* due to its larger flowers, differently shaped petals, stamens with pubescent filaments, and 5 staminodes the same length as the filaments. Thus, we unambiguously recognise it as a distinct species.

*Mionandra fischeri* (Hicken) R.F.Almeida, **comb. nov.**

Fig. 5


*Cordobia fischeri* (Hicken) Nied. (Niedenzu 1928: 532)


**Peixotoa** A.Juss. (Jussieu 1833: 59)

Figs 2, 6

**Type species.** *Peixotoa glabra* A.Juss.

**Diagnosis.** Distinguished from *Mionandra* s.l. by its stipules completely connate, leaves long-petiolate, never hirsute-sericeous; umbels 4-flowered; sepals connate at base, coriaceous, revolute only at apex; petals orbicular, margin dentate; fertile stamens 5, staminodes 5, antherodes globose, conspicuous; style apex capitate; mericarps with wings well-developed, dorsal wing dominant.

**Distribution, habitat, and ecology.** *Peixotoa* comprises 29 species occurring in dry forests, rainforests, and savannas in Brazil, eastern Bolivia, and eastern Paraguay in South America (Fig. 2).

**Notes.** *Peixotoa* has a contemporary taxonomic revision available for 28 of its species (Anderson 2001). Nonetheless, less well-developed, dorsal wing dominant.

**Distribution, habitat, and ecology.** *Peixotoa* comprises 29 species occurring in dry forests, rainforests, and savannas in Brazil, eastern Bolivia, and eastern Paraguay in South America (Fig. 2).

**Notes.** *Peixotoa* has a contemporary taxonomic revision available for 28 of its species (Anderson 2001). Nonetheless, misguided morphological interpretations drawn by this author from the inflorescence architecture have made the identification keys provided in these studies challenging to use by the general public and even for Malpighiaceae specialists (pers. obs.). Since C. Anderson published more than two-thirds of the species diversity of *Peixotoa*, only species with conspicuous morphological traits (e.g. glabrous leaves – *Peixotoa glabra* A.Juss.) or specific geographical distributions (e.g. *Peixotoa catarinensis* C.E.Anderson and *P. hispida* A.Juss.) are correctly identified in Brazilian herbaria (pers. obs.). For a preliminary revisionary study of *Peixotoa* in Brazil, see Almeida et al. (2020). A revised monograph for this genus is urgently needed to enable the correct application of names in *Peixotoa* (pers. obs.).

**CONCLUSIONS**

Studies mapping the evolution of macro-morphological characters in molecular phylogenies are the steppingstone to challenge traditional classifications and propose new predictive systems in Malpighiaceae, reflecting the evolutionary history of their taxa (Almeida and van den Berg 2021). As a continuation of the studies of Cameron et al. (2001), Davis et al. (2001), and Almeida and van den Berg (2021), we revised the circumscription within the genera of the Peixotoid clade based on molecular and morphological data to finally ensure the taxonomic stability of generic circumscriptions within this clade. *Cordobia* and *Gallardoa* were synonymised under *Mionandra*, and the necessary combination was made alongside typifications and identification keys.

**ACKNOWLEDGEMENTS**

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**REFERENCES**


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SUPPLEMENTARY MATERIALS

**Supplementary material 1**
GenBank accession numbers for all markers and species sampled in this study.
https://doi.org/10.5091/plecevo.101657.suppl1

**Supplementary material 2**
Morphological matrix with all 16 characters scored and coded for all species sampled.
https://doi.org/10.5091/plecevo.101657.suppl2

**Supplementary material 3**
Character descriptions for all 16 characters scored in the morphological matrix.
https://doi.org/10.5091/plecevo.101657.suppl3