INTRODUCTION

Urophylleae Bremek. ex Verdc. is a group in the coffee family (Rubiaceae) including about 200 species (Govaerts, 2006), which are usually woody and have indehiscent fruits with multi-volute locules. The name Urophylleae was first introduced by Bremekamp (1952) who suggested to include 22 genera (Table 1), characterized by exotestal cells with thick walls traversed by large numbers of narrow pit-canals. He refuted the usefulness of characters previously used to circumscribe tribes in Rubiaceae and suggested to segregate Urophylleae from Mussaendeae, where previous workers had placed these genera based on the number of ovules in each locule (Hooker, 1873; Schumann, 1891). Bremekamp (1952) could, however, not decide in what subfamily to place Urophylleae. For example, he did not consider the species in Urophylleae to have raphides and the group could therefore not be a part of Rubioideae. The name Urophylleae was not validly published until the treatment by Verdcourt (1958), who did not agree that they lack raphides and placed the group with other raphidiate taxa in Rubioideae. Verdcourt did not explicitly state what taxa he included in Urophylleae, but judging from the description and his expressed intention to validate taxon names of Bremekamp, he accepted Bremekamp’s (1952) circumscription. Bremekamp (1966) segregated Pauridiantheae from Urophylleae based on, among others, their usually bilocular instead of plurilocular ovaries, bisexual heterostylosous rather than dioecious flowers, and the shape and position of the placenta. These two groups were classified in a separate subfamily, Urophylloideae (Bremekamp, 1966). In addition, he also transferred Acranthera, originally included in Urophylleae (Bremekamp, 1952), to the monotypic tribe Acrantherae. The segregation of Pauridiantheae was accepted by Robbrecht (1988), who placed the two tribes in Cinchonoideae. Later studies (Bremer & Manen, 2000; Robbrecht & Manen, 2006) have returned to the original, wide circumscription of Urophylleae (Bremekamp, 1952; Verdcourt, 1958) and placed it in Rubioideae.

The first molecular phylogenetic study to indicate that Urophylleae belongs in Rubioideae (Bremer & Thulin, 1998) showed that Pauridiantha and Amphidasya are sister groups. In contrast to taxa traditionally placed in Urophylleae (Bremekamp, 1952), which all occur in the Old World, Amphidasya is restricted to central and southern tropical America. The latter genus had previously been classified in Isertiaeae (Kirkbride, 1979; Robbrecht, 1988) or Sabiceaeae (Andersson, 1996). Morphological characters supporting its position in Urophylleae are the presence of raphides, the absence of ornamentation on the inner surface of the exotesta, and the presence of fringed stipules.
The first molecular phylogenetic study to include a representative of Urophylleae (Bremer, 1996) showed that Pauridiantha belongs in Rubioideae. This genus was later shown to form a group with Urophyllum and Raritebe (Andersson & Rova, 1999), referred to as Urophylleae. Like Amphidasya, Raritebe is neotropical and has been classified in Isertieae (Kirkbride, 1979; Robbrecht, 1988). Together with Ophiorrhiza, Urophyllum was indicated to be the sister lineage of the rest of Rubioideae (Andersson & Rova, 1999). In addition to Pauridiantha and Urophyllum, Urophylleae was subsequently shown to include Maschalocorymbus, Commitheca, Pravinaria and Praravinia (Bremer & Manen, 2000). Piesschaert & al. (2000) confirmed that Amphidasya and Raritebe belong in Urophylleae and showed that these two genera are sisters. Based on a supertree analysis of the entire Rubiaceae (Robbrecht & Manen, 2006), Urophylleae comprises the genera Pauridiantha, Pravinaria, Praravinia, Urophyllum, Stelechantha Bremek., Maschalocorymbus, Commitheca Bremek., Amphidasya, and Raritebe. Khan & al. (2008) show that Pentaloncha and Temnopteryx, both included in the original circumscription of Urophylleae (Bremekamp, 1952), belong in Rubioideae but do not resolve their position within the group.

The present study includes representatives of twelve genera that have been classified in Urophylleae at some point. Four of these, Temnopteryx, Pentaloncha, Pleiocarpidia, and Poecilocalyx, have never been shown by a phylogenetic study to belong to Urophylleae. The first two are small genera with petaloid sepals that both occur in western central tropical Africa. Temnopteryx is a shrub with relatively large flowers having purple sepals and a pink or red cylindrical corolla tube, while Pentaloncha is a trailing suffrutescent with anisophyllous leaves. Both of them were originally classified in Mussaendeae (Hooker, 1873; Schumann, 1891) and transferred to the new tribe Urophylleae by Bremekamp (1952). He expressed uncertainty, however, about their affinities and later included the two

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<td>Uro</td>
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<td>Uro</td>
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<td>?</td>
<td>Uro</td>
<td>Mus</td>
<td>Mus</td>
<td>Pau</td>
<td>Inc. sed.</td>
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<td>–</td>
<td>Mus</td>
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<td>Uro</td>
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<td>Raritebe Wernham</td>
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<td>Isé</td>
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<td>Uro</td>
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<td>Uro</td>
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<td>–</td>
<td>Mus</td>
<td>Pau</td>
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<td>?</td>
<td>Uro</td>
<td>Mus</td>
<td>Mus</td>
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<td>Isé</td>
<td>Sab</td>
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Note: Genus names in bold are represented in the present study.

Abbreviations: Acr, Acranthereae; Ise, Isertieae; Mus, Mussaendeae; Pau, Pauridiantheae; Sab, Sabiceae; Uro, Urophyllae; –: not included in the study; ?, no clear conclusion regarding relationships.
tentatively in the segregate Pauridiantheae (Bremekamp, 1966). No later workers have followed Bremekamp’s treatment of Pentaloncha and Temnopteryx. For example, Hallé (1961) considered Pentaloncha and Temnopteryx to be typical Mussaendeae because of their large, petaloid, often unequally sized calyx lobes, while Robbrecht (1988) placed Temnopteryx in Isertieae, but was unsure about the placement of Pentaloncha. Based on a morphological phylogenetic study, Andersson (1996) placed Pentaloncha and Temnopteryx in Sabiceae. Characters that supported this were the sparsely branched shrubby habit, large corollas, and the presence of a sterile process on the anther tip. Dessein & al. (2001) agreed that Pentaloncha seems to be closely related to Sabiceae based on morphological data.

Neither Pleiocarpidia nor Poecilocalyx have been included in a molecular phylogenetic study before. Pleiocarpidia is a monotypic genus occurring in western Malesia. It is a small tree with characteristic thick and disc-like stigmas. It was originally described as Aulacodiscus by Hooker (1873), a name which is invalid because it had already been used for a genus of diatoms, and was therefore renamed Pleiocarpidia (Schumann, 1891). Both Hooker (1873) and Schumann (1891) placed it in Mussaendeae. Bremekamp (1952) included Pleiocarpidia in Urophylleae, which has been followed in later treatments (Bremekamp, 1966; Robbrecht, 1988). The other genus, Poecilocalyx, includes four species that occur in western and central tropical Africa. They are shrubs with horizontal branches and have few flowered inflorescences subtended by involucral bracts. Like Pleiocarpidia, Poecilocalyx was also included in Urophylleae under the original circumscription (Bremekamp, 1952), but was later transferred to the segregate Pauridiantheae (Bremekamp, 1966; Robbrecht, 1988). Hallé (1966), on the other hand, placed it in Mussaendeae. None of these four genera were included in the most recent taxonomic treatments (e.g., Bremer & Manen, 2000; Robbrecht & Manen, 2006), since these were based on molecular phylogenetic data, which has not been available for these taxa until now.

The main aim of this study, therefore, is to determine the phylogenetic position of Pentaloncha, Temnopteryx, Pleiocarpidia, and Poecilocalyx. Do they belong in Urophylleae, or are their closest relatives to be found elsewhere in Rubioideae? To address this question we use DNA sequence data from the rps16 intron of the chloroplast for a taxon sample including representatives of all major lineages in Rubiaceae. In order to explore the effect of rooting and outgroup size on levels of support in Urophylleae, five additional datasets, where the more distantly related outgroup taxa had been removed, were also analyzed. We also want to get a first estimate of phylogenetic relationships within the group. Are, for example, the two large genera Urophyllum and Pauridiantha monophyletic, and does molecular data support clades corresponding to Urophyllum s.str. and Pauridiantheae (Bremekamp, 1966)?

Previous phylogenetic studies (Bremer, 1996; Andersson & Rova, 1999; Bremer & Manen, 2000; Piesschaert & al., 2000; Robbrecht & Manen, 2006) have all relied exclusively on parsimony analyses. In some cases when evolutionary rates are not uniform parsimony analyses have been shown to fail in finding the correct topology (Felsenstein, 1985). In this study, we use model based Bayesian inference, in addition to parsimony, in order to evaluate whether the result is influenced by the method of analysis.

MATERIALS AND METHODS

Plant material and selection of taxa. — Species were selected to represent as many as possible of the genera included in Urophylleae; type species were included when available. The sample was limited by access to herbarium specimens and our success in amplifying rps16. A total of 53 terminals, representing 50 putatively different species, were included in the study. Of these, 36 are classified in genera that have been shown in previous phylogenetic studies to belong to Urophylleae (Andersson & Rova, 1999; Bremer & Manen, 2000; Piesschaert & al., 2000), and 4 in genera that have been associated with this group but not based on phylogeny. Since Luculia has been indicated to belong to the sister lineage of all other Rubiaceae (Bremer, 1996), a species from this genus was used to root the tree (dataset a). Ten other species in genera outside Urophylleae were also included in these analyses, two from each of the other three basal Rubioideae tribes (Bremer & Manen, 2000) Coussareaeae, Ophiorrhizaeae, and Lasiantheae, one from each of the Psychotria and Spermacocea alliances (Bremer & Manen, 2000), as well as one from each of Cinchonoeoidea and Ixoroidea (Bremer & al., 1995). This sample of outgroups was based on a phylogenetic analysis of 260 rps16 sequences, mainly from Rubioideae (not shown).

Five smaller datasets were also constructed. In one of these matrices (b), Luculia, Mussaenda, Spermacoeae, and Psychotria had been removed, and Cinchona was used to root the resulting trees. Placing the root inside Rubioideae and still keeping a good sample of outgroup species is not possible based on our current knowledge of phylogenetic relationships within the group, unless the tree is rooted using a taxon that is in a more derived position than Urophylleae. Ophiorrhizaeae and Urophylleae have been shown to have been the first lineages to diverge within Rubioideae, although their exact interrelationships have not yet been clarified. They have either been found to be sister groups with moderate support (Andersson & Rova, 1999) or unresolved (Bremer & Manen, 2000; Piesschaert & al., 2000) in phylogenetic analyses. There-
fore, there is no known lineage within Rubioideae that is basal to Urophylleae that can be used for rooting. In order to evaluate whether other branches within Rubioideae affect the support for relationships within Urophylleae, a dataset including only the Rubioideae taxa in the original dataset was analyzed, placing the root on the branch to the derived Spermacoce (dataset c). The other three matrices included only two outgroup species representing one of the other basal lineages in Rubioideae; Coussareaeae (d), Ophiorrhizaeae (e), and Lasiantheae (f), respectively. Leaf material was sampled from herbarium specimens in most cases, but for a few species silica gel dried material was used. Voucher specimens are listed in the Appendix.

**Molecular methods and dataset construction.** — DNA extractions were carried out using a slightly modified version of the CTAB extraction method (Doyle & Doyle, 1990). The rps16 intron was amplified using the rpsF and rpsR2 primers (Oxelman & al., 1997), following standard PCR procedures, and sequenced using the same two primers. Sequences were assembled and edited using the phred (Green & Ewing, 2002) and phrap (Green, 1999) modules in Pregap4 and Gap4 (Staden & al., 1998). All new sequences have been submitted to EMBL. Accession numbers are presented in the Appendix. Sequence alignment was performed by eye, in the sequence alignment editor Se-Al (Rambaut, 1996).

**Model selection and phylogenetic analysis.** — An evolutionary model was selected based on the Akaike information criterion (AIC; Akaike, 1973) and the Bayesian information criterion (BIC; Schwartz, 1978), which were calculated with MrAIC (ver. 1.4; Nylander, 2004). Both criteria favoured the General time reversible (GTR; Tavaré, 1986) substitution model with gamma distributed rate variation among sites (+Γ) for all datasets. In MrBayes (ver. 3.1.1; Huelsenbeck & Ronquist, 2001; Ronquist & Huelsenbeck, 2003), the Markov chain was run for 3 million generations, sampling phylogenetic hypotheses every 1,000 generations. Because mixing among heated chains was poor, the temperature was decreased to 0.12 (0.15 for the pruned datasets) and the number of chains in each analysis increased to eight. Convergence of the Markov chain was assumed to be reached when plots of the overall likelihood, as well as individual parameters of the model, were fluctuating around stable values. At this point the average standard deviation of split frequencies for two analyses run in parallel was less than 0.01 and the potential scale reduction factor was 1.00 for all parameters. The first 1,000,000 generations were discarded as “burn-in” and the last 2,000 trees from both of the parallel analyses were used to construct a majority rule consensus tree and calculate posterior probabilities of clades (PPs). To make sure that the Markov chain really had been sampling from the posterior distribution, three independent analyses, each starting from a random tree, were performed. Since the topologies of the resulting majority rule consensus trees contained the same nodes with posterior probabilities above 0.95 and were free from supported incongruence, this was considered to be the case.

A bootstrap analysis (Felsenstein, 1985) with 10,000 pseudoreplicates was performed with PAUP* (ver. 4.0b10, Swofford, 2002). Each pseudoreplicate was analyzed with heuristic search, creating ten start trees by random addition and improving these by TBR branch swapping. One tree was saved each time and used to construct a majority rule consensus tree and calculate bootstrap proportions (BPs). The analysis was repeated three times to make sure that very similar BPs were obtained in independent runs.

### RESULTS

**Data.** — Forty-four new rps16 sequences were produced in this study (Appendix). Sequences ranged in length from 704 to 972 basespans. EMDB accession numbers are shown in the Appendix. The large matrix (a) consisted of 53 terminals and 1,412 aligned DNA characters and included 1.5% missing data. Of the 358 variable characters, 174 were parsimony informative. The one reduced dataset from which the resulting tree is presented, that with only Ophiorrhizeae as outgroup (e), consisted of 44 terminals and 969 aligned DNA characters and included 2.1% missing data. Of the 177 variable characters, 91 were parsimony informative.

**Phylogenetic relationships.** — The majority rule consensus tree from the Bayesian phylogenetic analysis of the dataset with a larger sample of outgroup taxa (a) is shown in Fig. 1. In this tree, there is low support (Fig. 1, clade M, PP = 0.78, BP < 50) for Urophylleae including Temnopteryx. The support for this node is likewise low when Luculia, Mussaenda, Spermacoce, and Psychotria are removed from the analysis, and the tree rooted using Cinchona (dataset b: PP = 0.69, BP < 50, not shown), as well as when all non-Rubioideae taxa are left out and the tree rooted using Spermacoce (c: PP = 0.71, BP < 50, not shown). This relationship is, however, strongly supported in all three analyses with an outgroup restricted to a single other lineage within Rubioideae. When the tree is rooted on Neurocalyx in Ophiorrhizeae (dataset e: Fig. 2) instead of the more distantly related Luculia (a: Fig. 1), the Bayesian PP increases from 0.78 to 0.99. Placing the root in Lasiantheae (dataset f) or Coussareaeae (d) also yielded high support for Temnopteryx being the sister of the remainder of Urophylleae, with BPs of 1.00 in both cases (not shown). We choose to present the tree rooted on Ophiorrhizeae (dataset e), rather than those rooted on Coussareaeae (d) or Lasiantheae (f) because several analyses have indicated that Ophiorrhizeae is most closely...
related to Urophylleae (Andersson & Rova, 1999; Bremer & Manen, 2000; Piesschaert & al., 2000). In both trees (Figs. 1–2), Urophylleae includes two strongly supported clades; one consisting entirely of Old World taxa, all of which were originally placed in Urophylleae (Bremekamp, 1952; Figs. 1–2, clade F), and the other of the Neotropical Amphidasya and Raritebe (Figs. 1–2, clade N). These two lineages form a clade with strong support (Figs. 1–2, clade J). The other three genera, besides Temnopteryx, whose phylogenetic affinities were to be examined in this study, Pentaloncha, Poecilocalyx, and Pleiocarpidia, all belong in clade F (Figs. 1–2). Poecilocalyx is strongly supported to be the sister of Stelechantha (Figs. 1–2, clade C), the position of Pentaloncha is unresolved, and Pleio-
carpidia is strongly supported to be the sister of *Urophyllum leucophleum* (Figs. 1–2, clade D). *Urophyllum* species are found in three unresolved lineages (Figs. 1–2, clades D, H, and L) and the genus is paraphyletic, since *Maschalocorymbus*, *Pravinaria*, *Praravinia*, and maybe also *Pleiocarpidia*, are all nested inside it. The analysis does not answer the question of whether *Pauridiantha* is monophyletic. Species in this genus belong to two lineages whose relationships are not resolved (Figs. 1–2, clades A and B). *Pauridiantheae* (fide Bremekamp, 1966), here represented by *Pauridiantha*, *Poecilocalyx*, *Stelechantha*, *Pentaloncha*, and *Temnopteryx*, is shown not to be monophyletic, since *Temnopteryx* (Figs. 1–2, node O) belongs to a separate lineage that is indicated to be the sister of the rest of *Urophylleae* (Fig. 2, node M). It is not possible to conclude from the present analysis whether *Urophylleae*

Fig. 2. Phylogram from Bayesian analysis under the GTR+Γ model of a dataset with a reduced number of outgroups. Posterior probabilities of clades are given above branches and parsimony bootstrap proportions below. Clades mentioned in the text are labeled with capital letters.
s.str. (fide Bremekamp, 1966), represented by Urophyllum, Pleiocarpidia, Maschalocorymbus, Praravinia, and Pravinaria, is monophyletic or not, since the three lineages where these genera are found (Figs. 1–2, clades D, H, and L) are unresolved.

**Discussion**

**Phylogenetic relationships.** — There are no contradictions between clades supported by Bayesian phylogenetic inference and parsimony bootstrapping (Figs. 1–2). Both types of analyses support the same topology, despite the fact that a couple of branches are distinctly longer than the rest (Fig. 2, Urophyllum glaucescens and Temnopteryx). This agreement makes it less likely that there are errors in the phylogenetic reconstruction and increases the confidence in the topologies presented.

This study corroborates Verdcourt’s opinion that Pentaloncha, Temnopteryx, Pleiocarpidia, and Poecilocalyx belong in Rubioideae (1958). All other workers have placed them in either Cinchonoideae (Hooker, 1873; Schumann, 1891; Hallé, 1961; Hallé 1966; Robbrecht, 1988) or in a separate subfamily, Urophylloideae (Bremekamp, 1966). The analysis of the large rps16 dataset (a), including representatives of all major lineages in Rubiaceae (Fig. 1), showed that Temnopteryx belongs in Rubioideae, but did not provide convincing support for its position within this group. Both analyses rooted on a taxon outside Rubioideae (datasets a and b), as well as that including multiple outgroup taxa from within Rubioideae (c), gave weak support for Temnopteryx being the sister of the remainder of Urophylleae (e.g., Fig. 1). It is possible that this modest support is caused by conflict regarding the resolution among lineages within Rubioideae rather than conflict regarding the actual placement of Temnopteryx. To test this, we performed analyses where all outgroup taxa except representatives of a single other lineage within Rubioideae had been removed. The fact that rooting on Ophiorrhizeae (dataset e; Fig. 2), Coussareae or Lasianthaea (d and f, not shown) gave high support (PPs of 0.99 or 1.00) for Temnopteryx being the sister of the remainder of Urophylleae indicates that conflicting signals regarding the relationships among the four major lineages in Rubioideae (Fig. 1, clades M, P–R) affect the support for the position of Temnopteryx. The branch leading to Temnopteryx is quite long (Fig. 2), which could contribute to the low support, given that there is conflict among the other branches, in the same way that homoplasy can contribute to long branch attraction (Felsenstein, 1978). We conclude from these results that Temnopteryx does indeed belong in Urophylleae. The other three genera, Pentaloncha, Poecilocalyx, and Pleiocarpidia, were found to be nested within a strongly supported group (Figs. 1–2, clade F) that only comprises taxa included in the original circumscription of Urophylleae (Bremekamp, 1952, see Table 1). Bremekamp (1952, 1966) characterized this group by an exotesta with large, thick-walled cells and an inner surface covered with minute pits. Amphidaisa and Raritebe, that make up the sister group of clade F (Figs. 1–2), also have this type of exotesta while that of Temnopteryx has a different structure (Andersson, 1996). This combination of testal characters could therefore be a synapomorphy for clade J. These characters do, however, need to be studied more closely in order to evaluate whether they have any diagnostic value. The basic chromosome number of Pauridiantha and Urophyllum is \( x = 9 \) (Kiehn, 1995), which differs from those of other groups in Rubioideae (Coussareae \( x = 10 \) or 11, Lasianthaea \( x = 11 \), and Ophiorrhizeae \( x = 11 \) or 12, Psychotria alliance \( x = 10 \) or 11, Spermacoce alliance \( x = 8, 10, 11, 14, 15 \) or 17). They also have a heteromorphic karyotype with both long and short chromosomes, a feature that is unique in Rubiaceae (Kiehn, 1995). These two karyological characteristics are probably synapomorphies for clade F, or perhaps for Urophyllum as a whole (Figs. 1–2, clade M), although the chromosomes of Amphidaisa, Raritebe, and Temnopteryx have not yet been studied. Poecilocalyx is found to be the sister of Stelichantha (Figs. 1–2, clade C), which like Poecilocalyx is a small genus occurring in western tropical Africa. Both genera lack domatia, a character that is common in closely related taxa but otherwise differ considerably morphologically. They do, however, share several characters that are also found in for example Pauridiantha, for example heterostylos flowers, upright stigmas, ovaries with a false septum dividing the upper part of each locule, and obcordate placentas that are attached to the middle of the septum. Pleiocarpidia, which is distributed in western Malesia, is found to be the sister of Urophyllum leucophleum (Figs. 1–2, clade D) from peninsular Malaysia. Morphological characters supporting the affinity of Pleiocarpidia to Urophyllum are the dioecious flowers, flattened hairs in the corolla tube, paired axile placentas, and spreading stigmas. Urophyllum species are also found in two other unresolved clades H, and L (Figs. 1–2). Since the type species of Urophyllum, U. villosum, was not included in the analysis, it is not possible to determine whether Pleiocarpidia, Pravinaria, Praravinia, and Maschalocorymbus, which are all nested inside Urophyllum, should be included in this genus or whether Urophyllum should perhaps be divided into smaller genera. The other large genus in Urophylleae, Pauridiantha, is not supported to be monophyletic either and the type species, P. canthiflora, is found in clade B. Like in the case of Urophyllum, the clades of Pauridiantha species are unresolved (Figs. 1–2, clades A and B) but there is no indication that either of these two genera are polyphyletic. Future research in our laboratory will
strive to add additional molecular markers and widen the taxon sample in order to produce a more robust phylogeny that may resolve these issues. Such a study will hopefully also answer the question whether Pauridiantheae (excluding Temnopteryx) and Urophylleae s.str. (Bremerkamp, 1966) constitute evolutionary groups within clade F. Biogeographical and morphological evidence (Bremerkamp, 1966; Robbrecht, 1988; Ntore & al. 2003) suggests that at least one of them may be monophyletic, but neither one is supported in the present analyses.

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LITERATURE CITED


Appendix. Material used in the study.

Species; origin; collector, collection number and herbarium; EMBL accession.

- **Amphidasya ambigua** (Stend.) Stand.; Ecuador; Stähl & al. 3542 (GB); AM129721
- **Amphidasya colombiana** (Standl.) Steyer.; Ecuador; Stähl & al. 3542 (GB); AF242906
- **Amphidasya longicalycina** (Dwyer) C.M. Taylor; Costa Rica; Huber 2963 (CR); AM900637
- **Annona** sp.; Peru; Morawetz & Wallnöfer 114-11888 (GB); AM900636
- **Cinchona pubescens** Vahl; Cult. Göteborg Botanical Garden; Andersson 2214 (GB); AF400435
- **Coussetia iheoica** Müll.Agr.; Brazil; De Carvalho & al. 4081 (K); AM900597
- **Paramea triervina** K. Schum. & Dunm.Sm.; Costa Rica; Gomez-Lauro 8374 (CR); AM900598
- **Lasianthus chevalieri** Pit.; Vietnam; Averyanov & al. VH2673 (AAU); AM900596
- **Luculia grandifolia** Ghose; Cult. Stockholm Univ.; Bremer 2713 (S); AM900593
- **Maschalocorymbus corymbosus** (Blume) Bremek.; Sri Lanka; B. & K. Bremer 937 (S); AM900594
- **Ophiorrhiza mungos** L.; Cult. Uppsala University; Bremer 3301 (UPS); AF400406
- **Pauridiantha canthiflora** Hook.; Gabon; Breteler 6746 (AAU); AM900604
- **Pauridiantha dewevrei** (De Wild. & T. Durand) Bremer.; Congo; Champluvier 5083 (K); AM900603
- **Pauridiantha mayumbensis** (R.D. Good) Bremer.; Gabon; Diabata 1158 (UPS); AM900601
- **Pauridiantha paucinervis** (Hiern) Bremek.; Tanzania; Bremer 3090 (UPS); AM900600
- **Pauridiantha pyramidata** (K. Krause) Bremer.; Central African Republic; Harris & Fay 644 (K); AM900607
- **Pauridiantha schnelli** N. Hallé; Liberia; Adanes 829 (UPS); AM900606
- **Pauridiantha sp.** (K. Krause) Bremer.; Gabon; Devred 2297 (UPS); AM900605
- **Pauridiantha sylvicola** (Hutch. & Dalziel) Bremek.; Cameroon; Leeuwenberg 9711 (UPS); AM900602
- **Pauridiantha symplacoides** (S. Moore) Bremer.; Malawi; Lantz 123 (UPS); AM900599
- **Pentaloncha humiditii** Hook. f.; Gabon; Breteler & al. 10985 (WAG); AM900632
- **Pleonocardia kinabaluensis** Bremek.; Borneo; Beaman 8841 (S); AM900610
- **Poeilocalyx stipulosa** (Hutch. & Dalziel) N. Hallé; Ivory coast; Wilde & Leeuwenberg 3515 (UPS); AM900608
- **Praravinia verruculosa** Bremek.; Borneo; Beaman 9670 (S); AM900612
- **Pravinaria cf. endertii** Bremer.; Brunei; Sands 5262 (K); AM900614
- **Pravinaria leucocarpa** Bremek.; Borneo; Beaman 7930 (S); AM900613
- **Psychotria micralabastra** (Lauterb. & K. Schum.) Valleton; New Guinea; Dropzd & Molem 11523 Nov. 1998; AJ320084
- **Raritebe palicouraeoides** Wernham subsp. palicouraeoides; Ecuador; Jaramillo & Rivea 195 (NY); AF400475
- **Raritebe palicouraeoides** subsp. dreyeramii J.H. Kirkbr.; Panama; Antonio 1697 (AAU); AM900635
- **Spermacoce confusa** Rendle ex Gilliss; Colombia; Andersson & al. 2136 (GB); AF400361
- **Stelechanta zianaeana** (Jacq.-Fél.) N. Hallé; Liberia; Adam 20999 (UPS); AM900609
- **Temnotropex sericea** 1 Hook. f.; Gabon; Tabak 99 (WAG); AM900633
- **Temnotropex sericea** 2 Hook. f.; Equatorial Guinea; Wieringa & Haegens 2266 (WAG); AM900634
- **Trichostachys** sp.; Cameroon; Sonke 1725 (UPS); AM900595
- **Urophyllum arboreum** (Reinw. ex Blume) Korth.; Sumatra; Boeae 7878 (S); AM900617
- **Urophyllum blumeanum** (Wight) Hook. f.; Thailand; Puff & Sridith 930724 (AAU); AM900629
- **Urophyllum britannicum** Wernham; Papua New Guinea; Gideon & al. 76915 (K); AM900623
- **Urophyllum ceylanicum** (Wight) Thwaites; Sri Lanka; Klackenberg 214 (S); AM900620
- **Urophyllum congestiflorum** Ridl.; Brunei; Wong 1057 (K); AM900621
- **Urophyllum cypanderum** Staf.; Borneo; Beaman & al. 9549 (K); AM900618
- **Urophyllum ellipticum** (Wight) Thwaites; Sri Lanka; Lundqvist 11085 (UPS); AM900619
- **Urophyllum glaucescens** Valeton; Papua New Guinea; Danas 58925 (K); AM900625
- **Urophyllum leucomphalum** Ridl.; Malaysia; Stone 12658 (AAU); AM900626
- **Urophyllum longifolium** (Wight) Hook. f.; Thailand; Larsen & Larsen 33340 (AAU); AM900616
- **Urophyllum palicouraeoides** Staf.; Borneo; Beaman 11523 (K); AM900624
- **Urophyllum Schmidtii** C.B. Clarke; Thailand; Geesink & al. 6592 (AAU); AM900627
- **Urophyllum sp. 1; Borneo; Beaman 7501 (S); AM900630
- **Urophyllum sp. 2; Singapore; Axelius 177 (S); AM900631
- **Urophyllum sp. 3; Philippines; Ingle 725 (AAU); AM900615
- **Urophyllum streptopodium** 1 Wall. ex Hook. f.; Sumatra; Boeae 7766 (S); AM900622
- **Urophyllum streptopodium** 2 Wall. ex Hook. f.; Malaysia; Maxwell 81-141 (AAU); AM900628