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New combinations and names in *Lysimachia (Myrsinaceae)* for species of *Anagallis, Pelletiera* and *Trientalis*

Abstract

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New combinations are proposed for species of *Anagallis, Pelletiera* and *Trientalis* in accordance with the results of phylogenetic analyses of the *Lysimachia* complex, based on molecular and morphological data. These three genera as well as *Glaux* and *Asterolinon,* for the species of which names in *Lysimachia* are already available, have been found to be derived, specialized groups that have evolved within *Lysimachia.* The present classification therefore does not reflect our current understanding of evolutionary relationships within the *Lysimachia* complex. Merging all the genera in *Lysimachia* is here considered better than splitting the latter into several smaller genera. For *Anagallis crassifolia* and *A. filifolia* new names are validated and for *A. alternifolia* and *A. pumila* the names change since their epithets have already been used in *Lysimachia*. Lectotypes are selected for *A. filifolia, A. filiformis, A. kingaënsis, A. monelli, A. schliebenii, A. serpens* and *Pelletiera verna,* and a neotype is designated for *A. foemina*.

Additional key words: *Asterolinon, Glaux,* systematics, taxonomy, classification, relationships

Introduction

Anagallis L. has always been considered a genus closely related to *Lysimachia* L. and already Linnaeus (1753) had detected the morphological resemblance between the two, describing *Lysimachia tenella* L., which was later (Linnaeus 1771) changed to *Anagallis tenella* (L.) L. More recently, Anderberg & Ståhl (1995) commented the striking similarity of *Anagallis arvensis* L. and *Lysimachia serpyllifolia* Schreb., and Källersjö & al. (2000) pointed out that *Anagallis arvensis* is in several respects very similar to *Lysimachia nemorum* L. and a few other *Lysimachia* species, being distinguished merely by colour of the corolla and mode of capsule dehiscence. Källersjö & al. (2000) also stated that *Asterolinon* Hoffmanns. & Link and *Pelletiera* A. St.-Hil. are very similar to each other, but also that they share a number of derived features with other members of the tribe *Lysimachieae*. Like *Anagallis tenella, Asterolinon linum-stellatum* (L.) Duby was initially described in *Lysimachia* by Linnaeus (1753), and *Asterolinon* has also more recently been included in that genus (Leblebici 1978).

During the last years, the monophyly of *Lysimachia* has been questioned following several phylogenetic analyses. Källersjö & al. (2000) found, in analyses of morphological and molecular chloroplast data, *Anagallis arvensis* and *Lysimachia nemorum* as sisters and both as sister group to a few other *Lysimachia* species and *Glaux* L., indicating that *Lysimachia* was not monophyletic as circumscribed at that time. Analyses of ITS data (Martins & al. 2003) supported this conclusion and they also showed *Asterolinon* and *Pelletiera* to be nested within *Lysimachia*. The placement of *Glaux* embedded in *Lysimachia* was confirmed by combined analyses of chloroplast and ITS data by Hao & al. (2004). Based on the analyses by Källersjö & al. (2000), Martins & al. (2003) and Hao & al. (2004), Banfi & al. (2005) merged *Glaux* with *Lysimachia* and made the formal nomenclatural recombination.

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Our own, more recent analyses of ITS data, combined chloroplast data, and combined ITS and chloroplast data for an extended sampling of *Anagallis, Asterolinon, Pelletiera* and *Trientalis* L., and a large number of *Lysimachia* species (Manns & Anderberg 2005) show that *Anagallis, Asterolinon, Pelletiera* and *Trientalis* are derived groups evolved from ancestors within *Lysimachia*. The analyses also show that none of the genera *Anagallis, Asterolinon* or *Pelletiera* are monophyletic. Furthermore, analyses of ITS data and chloroplast data alone suggest different and conflicting placement of *Trientalis,* indicating its hybrid origin (Manns & Anderberg 2005). The conflicting signals in the different data sets, with regards to *Trientalis,* was shown to have negative influence on the support value for *Lysimachia ciliata* L. and *L. quadrifolia* L. as sister group to remaining *Lysimachia* (including also *Anagallis, Asterolinon* and *Pelletiera*). Consequently, the present generic circumscription does not account for the recent discoveries regarding evolutionary history of the *Lysimachia* generic complex, and thus a number of nomenclatural changes are necessary to meet the demand for strictly monophyletic taxa.

It may be argued that the genera should be maintained as presently circumscribed, as they can be separated from *Lysimachia* on distinct morphological characters: *Anagallis* having circumscissile capsules; *Asterolinon* with reduced flowers, with sepals much longer than petals, and non-persisting capsule valves, characters shared with *Pelletiera,* which is distinguished from *Asterolinon* solely by having choripetalous trimerous instead of pentamerous sympetalous corolla; and *Trientalis* with hexa- or heptamerous corolla and thin disintegrating capsule. However, if the distinct morphological features of *Anagallis, Asterolinon, Trientalis* and *Pelletiera* are used as arguments to preserve these at generic rank, none but *Trientalis* would represent monophyletic groups, and *Lysimachia* would remain paraphyletic.

The type of *Anagallis,* as well as the species of *Asterolinon* and *Pelletiera* belong to the same clade as the species of *Lysimachia* sect. *Lerouxia,* i.e. *L. nemorum* and *L. serpyllifolia*. This shows that the diagnostic characters of each of these genera as outlined above are found in one and the same clade, thus severely weakening their value to diagnose genera. To achieve monophyletic groups, a new genus would have to be proposed for *Lysimachia nemorum* and *L. serpyllifolia,* together with *Asterolinon adoënse* Kunze. Furthermore, *Pelletiera* would have to be transferred to *Asterolinon* (type: *A. linum-stellatum*), *Anagallis* (type: *A. arvensis*) delimited to *A. arvensis, A. foemina* Mill., and *A. monelli* L., and as a consequence *Centunculus* L. reestablished for all other *Anagallis*. The circumscissile capsules would no longer diagnose *Anagallis,* as it would also be found in all *Centunculus*.

A second alternative would be to include *Lysimachia nemorum, L. serpyllifolia, Asterolinon* and *Pelletiera* in *Anagallis*. This would, however, still require reestablishment of *Centunculus* if only strongly supported clades (Anderberg & al. 2007b; Manns & Anderberg 2005) are to be considered. *Lysimachia* is, among other genera in *Myrsinaceae,* recognized by its herbaceous habit and entire leaf margins, but also by the presence of oil-producing trichomes in various places on the corolla and the anther filaments (Anderberg & al. 2007b). It is, however, difficult to establish morphological characters to distinguish between different subgroups within *Lysimachia* and the morphological distinctiveness of these subgroups is not very high. Furthermore, the characters used to recognize *Lysimachia* are also present in *Anagallis* and to large extent also in *Asterolinon, Pelletiera* and *Trientalis*. Consequently, proposal of new genera for some *Lysimachia* (e.g. *L. nemorum* and *L. serpyllifolia*), or transfer of *L. nemorum* and allied taxa to *Anagallis* would inevitably result in poorly diagnosed genera. Choosing among alternatives, we find it better to merge the smaller segregate genera with *Lysimachia,* rather than splitting *Lysimachia* further. A consequence is that a number of new combinations must be made.

The number of names in *Anagallis* is considerable, but many have been considered to be synonyms. New combinations are here validated for species recognized in modern floras (Ferguson 1972; Kupicha 1983; Peltier 1981; Taylor 1958a), and in the revision of *Anagallis* in tropical East Africa by Taylor (1955, 1958b). In his revision, Taylor presents convincing arguments for delimitation of, and synonyms to, variable and problematic taxa. These species delimitations were found adequate in a morphological study of *Anagallis* and closely related genera (Manns & Anderberg 2007a). Type specimens, or photos of type specimens, were investigated for all names, except for *Anagallis ovalis* and *A. tsaratananae*. For some species valid names in *Lysimachia* already exist, *Anagallis alternifolia* (≡ *L. buxifolia* Molina), *A. tenella* (≡ *L. tenella* L.), *Asterolinon linum-stellatum* (≡ *L. linum-stellaum* L.), and *A. adoënse* (≡ *L. adoënsis* (Kunze) Klatt), and they are not listed below.

To the prevailing description of *Lysimachia,* a few characteristics referring to capsule dehiscence as well as colour and size of the corolla and corolla lobes need to be added to accommodate also the amended circumscription.

Lysimachia L., Sp. Pl.: 146. 1753. – Lectotype (Hitchcock in Hitchcock & Green 1929: 129): *L. vulgaris* L.
= *Anagallis* L., Sp. Pl.: 148. 1753. – Lectotype (Hitchcock in Hitchcock & Green 1929: 129): *A. arvensis* L.
= *Centunculus* Sp. Pl.: 116. 1753. – Type: *C. minimus* L.
= *Glaux* L., Sp. Pl.: 207. 1753. – Type: *G. maritima* L.

= *Trientalis* L., Sp. Pl.: 344. 1753. – Lectotype (Hitchcock in Hitchcock & Green 1929: 149): *T. europaea* L.
= *Asterolinon* Hoffmanns. & Link, Fl. Portug. 1: 332. 1813-20. – Type: *A. stellatum* Hoffmanns. & Link, nom. illeg. (≡ *Lysimachia linum-stellatum* L.)
= *Pelletiera* in Mém. Mus. Hist. Nat. 9: 365. 1822. – Type: *P. verna* A. St.-Hil.

Description. — Perennial or annual herbs, or rarely shrubs. *Leaves* alternate, opposite, or sometimes whorled, entire. *Flowers* solitary in axils of upper leaves, in panicles or racemes, sometimes head-like, sometimes on curved pedicels. *Calyx* deeply lobed; lobes usually 5 (or rarely 3, or 6-9). *Corolla* white or yellow, rarely pink, red, blue or greenish, rotate or campanulate, deeply 5 (or rarely 3, or 6-9)-lobed; corolla lobes longer or sometimes shorter than calyx; contorted in bud. One species apetalous with pink calyx. *Stamina* with anther filaments free or connate into a ring or tube at base and ± adnate to corolla tube; anthers basifixed, dorsifixed or versatile opening by apical pores or by lateral slits. *Capsule* subglobose, opening with united valves or with valves falling apart, or a lid, rarely disintegrating or indehiscent.

New names and combinations

Lysimachia acuminata (Welw. ex Schinz) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis acuminata* Welw. ex Schinz in Bull. Herb. Boissier 2: 221. 1894. – Holotype: Angola, Mossamedes, Huilla, *Welwitsch 275* (Z; isotypes: BM, K).

Lysimachia angustiloba (Engl.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis quartiniana* var. *angustiloba* Engl. in Bot. Jahrb. Syst. 28: 447. 1901 ≡ *Anagallis angustiloba* (Engl.) Engl. in Bot. Jahrb. Syst. 30: 372. 1902. – Holotype: Tanganyika, Morogoro District, *Goetze 294* (B, destroyed), neotype (designated by Taylor 1958a: 14): Tanganyika, Morogoro District, *Drummond & Hemsley 1569* (K; isoneotypes: BR (2), UPS).

Lysimachia arvensis (L.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis arvensis* L., Sp. Pl.: 148. 1753. – Lectotype (designated by Dyer 1963: 14): Herb. Linn. 208.1 (LINN [photo seen]).

Lysimachia barbata (P. Taylor) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis pumila* var. *barbata* P. Taylor in Kew Bull. 10: 345. 1955 ≡ *Anagallis barbata* (P. Taylor) Kupicha, Fl. Zambes. 7(1): 195. 1983. – Holotype: Tanganyika, Tanga District, *Faulkner 1230* (K; isotype: UPS).

Note. — *Anagallis barbata* was treated as a variety of *A. pumila* by Taylor (1955, 1958b), but raised to species rank by Kupicha (1983). Here we follow Kupicha, although it must be pointed out that the distinction between *Anagallis pumila* and *A. barbata* is not entirely clear and intermediates between the two taxa are not uncommon (Taylor 1955; Manns pers. obs.).

Lysimachia borealis (Raf.) U. Manns & Anderb., **comb. nov.** ≡ *Trientalis borealis* Raf. in Med. Repos., ser. 2, 5: 354. 1803 ≡ *Trientalis europaea* Michx., Fl. Bor.-Amer. 1: 220. 1803, non L. 1753. – Type: not designated.

Lysimachia brevipes (P. Taylor) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis brevipes* P. Taylor in Kew Bull. 13: 135. 1958. – Holotype: Tanganyika, Southern Highlands Province, *Greenway & Brenan 8278* (K; isotype: EA, PRE).

Lysimachia cubangensis U. Manns & Anderb., **nom. nov.** ≡ *Anagallis filifolia* Engl. & Gilg, Kunene-Sambesi Exped.: 325. 1903 [non *Lysimachia filifolia* C. N. Forbes & Lydgate]. – Holotype: Angola, Kubango, *Baum 906* (B, destroyed), lectotype (designated here): [isotype at] S; isolectotypes: BM, E, K, M, W.

Note. — The new epithet refers to the place where it was collected.

Lysimachia djalonis (A. Chev.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis djalonis* A. Chev. in J. Bot. (Morot) 22: 115. 1909. – Holotype: French Guinea, Fouta Djalon, *Chevalier 18876* (P [photo seen]; isotype: K).

Lysimachia elegantula (P. Taylor) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis elegantula* P. Taylor in Kew Bull. 10: 341. 1955. – Holotype: Angola, Huilla, *Welwitsch 276* (Z; isotypes: BM, G, K, PRE).

Lysimachia europaea (L.) U. Manns & Anderb., **comb. nov.** ≡ *Trientalis europaea* L., Sp. Pl.: 344. 1753 ≡ *Lysimachia trientalis* Klatt in Linnaea 37: 499. 1872, nom. illeg. – Type: not designated.

Lysimachia filiformis (Cham. & Schltdl.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis filiformis* Cham. & Schltdl. in Linnaea 1: 225. 1826. – Lectotype (designated here): [Uruguay, Provincia Cisplatina] "Montevideo" (HAL [photo seen]).

Note. — No information on where type material of *Anagallis filiformis* was deposited is provided in the protologue. Schlechtendal was in 1826 active in Berlin (B) and most likely deposited type material there, which is now destroyed. However, when he came to Halle in 1833 he brought collections, including type material, with him (Uwe Braun (HAL), pers. comm.). The lectotype selected here is from material that can be linked to the protologue of *A. filiformis* based on information supplied on the original label, although the collector's name [i.e. Sellow] is not written on the label.

Lysimachia foemina (Mill.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis foemina* Mill., Gard. Dict., ed. 8: 177. 1768. – Neotype (designated here): Italy, Sicily, *Segelberg 18559/5b* (S).

Note. — Based on molecular and morphological data (Manns & Anderberg 2007b), *A. foemina* is given species rank although it is sometimes considered a subspecies of *A. arvensis* (Marsden-Jones & Weiss 1938; Taylor 1955; Kollmann & Feinbrun 1968). Molecular data show *A. foemina* to be closer to *A. monelli* than to *A. arvensis* (Manns & Anderberg 2007b). However, Miller (1768) does not supply any information on type material and no specimen in the Miller collection, held at the Natural History Museum herbarium (BM), is labelled as or can be determined to *A. foemina*. Therefore, we have chosen to select a specimen in the Swedish Museum of Natural History (S) as neotype. This specimen was also used as voucher for DNA sequences in Manns & Anderberg (2007b).

Lysimachia gracilipes (P. Taylor) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis gracilipes* P. Taylor in Kew Bull. 13: 135. 1958. – Holotype: Southern Rhodesia, Eastern Division, *Exell, Mendonça & Wild 304* (BM; isotypes: SRGH, UPS).

Lysimachia hexamera (P. Taylor) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis hexamera* P. Taylor in Kew Bull. 10: 339. 1955. – Holotype: Kenya, Rift Valley Province, *Williams & Piers 560* (K; isotype: EA).

Lysimachia huerneri (H. E. Hess) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis huerneri* H. E. Hess in Ber. Schweiz. Bot. Ges. 67: 80. 1957. – Holotype: Belgian Congo, Lukumbi, *Hürner 58* (Z).

Lysimachia huttonii (Harv.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis huttonii* Harv. in Proc. Dublin Univ. Zool. Bot. Assoc. 1: 141. 1859. – Holotype: Cape Province, Albany Division, *H. Hutton* (TCD [photo seen]; isotype: K).

Lysimachia kingaënsis (Engl.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis kingaënsis* Engl. in Bot. Jahrb. Syst. 30: 371. 1902. – Holotype: Tanganyika, Kinga Mountains, *Goetze 958* (B, destroyed), lectotype (designated here): [isotype at] BR [photo seen].

Lysimachia kochii (H. E. Hess) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis kochii* H. E. Hess in Ber. Schweiz. Bot. Ges. 63: 213. 1953. – Holotype: Angola, Serra da Chela, *Hess 52/1830* (Z; isotype: K).

Lysimachia minima (L.) U. Manns & Anderb., **comb. nov.** ≡ *Centunculus minimus* L., Sp. Pl. 1: 116. 1753 ≡ *Anagallis minima* (L.) E. H. L. Krause in Sturm, Deutschl. Fl., ed. 2, 9: 251. 1901. – Lectotype (designated by Bizzarri in Jarvis 2007: 403): Herb. Linn. 147.1 (LINN [photo seen]).

Lysimachia monelli (L.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis monelli* L., Sp. Pl. 1: 148. 1753. – Lectotype (designated here): Hort. Cliff. 52.2 (BM [photo seen]).

Note. — Ali (1976) suggested Herb. Linn. 208.2 as type specimen for *Anagallis monelli*. However, this specimen has "Algir" written near the base of the sheet, which links it with a batch of specimens sent to Linnaeus by Erik Brander, which did not reach Sweden until 1756. As this post-dates the publication of the name, it cannot be original material (Charlie Jarvis (BM), pers. comm.). Instead, we suggest Hort. Cliff. 52.2 as lectotype of *Anagallis monelli*. Linnaeus came in contact with this specimen during his work with Hortus Cliffortianus (Linnaeus 1737), and also refers to it in Species Plantarum (Linnaeus 1753).

Lysimachia nummularifolia (Baker) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis nummularifolia* Baker in J. Linn. Soc. Bot. 20: 196. 1884. – Holotype: Central Madagascar, *Baron 2148* (P; isotype, K).

Lysimachia oligantha (P. Taylor) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis oligantha* P. Taylor in Kew Bull. 13: 137. 1958. – Holotype: Nyasaland, Mt. Mlanje, *Newman & Whitmore 454* (BM).

Lysimachia ovalis (Ruíz & Pav.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis ovalis* Ruíz & Pav., Fl. Peruv. 2: 8. 1799. – Type: Peru, Jeguan. *Ruíz & Pavon 97* (K [not seen], considered part of type material by Taylor (1955), although with some hesitation).
= *Anagallis pumila* Sw., Prodr. 1: 40. 1788 [non *Lysimachia pumila* Franch. (1890)]

Lysimachia peploides (Baker) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis peploides* Baker in J. Linn. Soc. Bot. 20: 196. 1884. – Holotype: Central Madagascar, *Baron 2135* (K; isotype: P).

Lysimachia rhodesica (R. E. Fr.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis rhodesica* R. E. Fr., Wiss. Erg. Schwed. Rhodesia-Kongo-Exp. 1911-1912, 1: 253. 1916. – Holotype: Northern Rhodesia, Kali, *Fries 634* (UPS; isotype: K).

Lysimachia rubricaulis (Duby) U. Manns & Anderb., **comb. nov.** ≡ *Micropyxis rubricaulis* Duby in Candolle, Prodr. 8: 72. 1844. – Holotype: Madagascar, prope Tananarivou, *Bojer 594* (G-DC; isotypes: K, P).

Lysimachia schliebenii (R. Knuth & Mildbr.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis schliebenii* R. Knuth & Mildbr. in Notizbl. Bot. Gart. Berlin-Dah-

lem 11: 672. 1932. – Lectotype (designated here): Tanganyika, Njombe District, *H. J. Schlieben 1420* (B-10 0160521; isolectotypes: B, BM, BR, EA, K, M, MO, P, PRE, S).

Lysimachia serpens (Hochst. ex A. DC.) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis serpens* Hochst. ex A. DC., Prodr. 8: 668. 1844. – Lectotype (designated here): Ethiopia, *Schimper 547* (S; isolectotypes: BM, K, M, P, WAG).

Note. — In contrast to Taylor (1955), we do not recognize any subspecies within this species. The proposed morphological difference, i.e. opposite versus alternate leaves, between subsp. *serpens* and subsp. *meyeri-johannis* cannot be confirmed (U. Manns, pers. obs.). The leaves are always alternate, although sometimes seemingly opposite, and can vary in a single individual.

Lysimachia tenuicaulis (Baker) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis tenuicaulis* Baker in J. Bot. 20: 172. 1882. – Holotype: Madagascar, Betsileo-land, *Baron 240* (K; isotype: P).

Lysimachia tsaratananae (M. Peltier) U. Manns & Anderb., **comb. nov.** ≡ *Anagallis tsaratananae* M. Peltier, Fl. Madagasc., Fam. 162-163: 10. 1981. – Holotype: Madagascar, massif du Tsaratanana, *Perrier de la Bâthie 6562* (P [not seen]).

Note. — The type specimen of *Anagallis tsaratananae* has not been localized by the Paris herbarium (P). However, although Peltier (1981) refers to *Perrier de la Bâthie 6562* as type specimen, another specimen (i.e. *Humbert 18341* (P), paratype) is also cited in the protologue, to specify the habitat for *A. tsaratananae*. This other specimen has been investigated and found to be in agreement with the description of *A. tsaratananae*. Since both specimens were available to Peltier, when he described *A. tsaratananae* there is, in our opinion, no reason to believe that the identity of the type specimen is incorrect.

Lysimachia tyrrhenia U. Manns & Anderb., **nom. nov.** ≡ *Anagallis crassifolia* Thore, Essai Chloris: 62. 1803 [non *Lysimachia crassifolia* C. Z. Gao & D. Fang]. – Holotype: France. "ex. herb Thore" (FI [photo seen]).

Note. — The new name refers to the distribution of this species in the western Mediterranean region.

Lysimachia verna (A. St.-Hil.) U. Manns & Anderb., **comb. nov.** ≡ *Pelletiera verna* A. St.-Hil. in Mém. Mus. Hist. Nat. 9: 365. 1822. – Lectotype (designated here): Uruguay, Montevideo, *Commerson s.n.* (P-00552867 [photo seen]; isolectotype P [photo seen]).

Lysimachia wildpretii (Valdés) U. Manns & Anderb., **comb. nov.** ≡ *Pelletiera wildpretii* Valdés in Candollea 35: 645. 1980. – Holotype: Spain, Gran Canaria, *Webb s.n.* (FI [photo seen]).

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