

Miscellaneous taxonomic notes on *Elatostema* (Urticaceae) from China and its adjacent area

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Based on examination of specimens and field observations of *Elatostema* J. R. Forster & G. Forster (Urticaceae) from China and its adjacent area, one new species, *E. vietnamense* Q. Lin & L. D. Duan from Bach Ma Natl. Park, Thua Thien-Hue Province, Vietnam, is described and illustrated. *Pellionia ambigua* Wedd. from Khasi Hills, Churra, Assam (=Meghalaya), India and *P. rhizomatosa* Gagnep. from Annam, Vietnam are transferred as *Elatostema ambiguum* (Wedd.) Q. Lin and *E. rhizomatosum* (Gagnep.) Q. Lin, respectively. *Elatostema glochidioides* W. T. Wang from Guangxi and Guizhou and Provinces, China is regarded as a new synonym of *E. ramosissimum* Rein.

The genus *Elatostema* J. R. Forster & G. Forster (Urticaceae) contains ca 300 species worldwide, distributed in tropical and subtropical Africa, Asia and Oceania (Lin et al. 2003). *Elatostema* is characterized and distinguished from other genera of Urticaceae by its inflorescences of determinate capitula with receptacles and involucre. Taxonomically its closest relative is the genus *Pellionia* Gaudichaud-Peapré in Urticaceae, but it differs from the latter based on several characters (Table 1).

W. T. Wang (1980a) thought that *Pellionia* and *Elatostema* might have originated from the more ancestral *Pilea* Lindl., and that they have undergone parallel evolution along two different pathways, and furthermore, that *Pellionia* might be more primitive than *Elatostema*. The most recent infrageneric classification of *Elatostema* was proposed by W. T. Wang (Wang and Chen 1979, Wang 1980b, 1990), who divided the genus into five sections: *Pellionioides* W. T. Wang, *Weddelia* (H. Schroeter) W. T. Wang, *Laevisperma* (Hatusima) Yamazaki, *Elatostema* and *Androsyce* Weddell (Table 2).

After our taxonomic revision of *Elatostema* and *Pellionia* in China (Lin et al. 2003, 2005, 2010, Duan et al. 2006a,b, Lin 2008, Lin and Duan 2008, Duan and Lin 2010, Yang et al. 2011) and lectotypifications of forty-four names in the two genera from Asia (Lin et al. 2009, Lin and Yang 2010), we have examined the specimens of *Elatostema* from China and its adjacent area. One previously unknown species, *Elatostema vietnamense* Q. Lin & L. D. Duan sp. nov. (*Elatostema* sect. *Weddelia* (H. Schroeter) W. T. Wang) was found from Vietnam. This new species is very distinct when compared with the previously known species in the genus; it is described and illustrated in the present paper, and its phylogenetic relationships are discussed.

Further, we found several characters in the holotype of *Pellionia ambigua* Wedd., particularly the female inflorescences with discoid receptacle, that are more consistent with those of species of *Elatostema* than of *Pellionia*. In *Pellionia rhizomatosa* Gagnep., the male inflorescences have a simple involucre, consistent with species of *Elatostema* rather than species of *Pellionia*. So it is apparent that both species have been taxonomically misplaced and should be transferred to *Elatostema* under the new combinations *Elatostema ambiguum* and *Elatostema rhizomatosum*, respectively.

When we examined the type specimens of *Elatostema ramosissimum* Rein. and *E. glochidioides* W. T. Wang, and did field observations in the type locality of *E. glochidioides* W. T. Wang, *E. ramosissimum* Rein. and *E. glochidioides* W. T. Wang were found to be conspecific. *Elatostema ramosissimum* Rein might have been introduced from Samoa to southwestern China early on, and therefore *E. glochidioides* W. T. Wang is treated as a new synonym of *E. ramosissimum* Rein.

Material and methods

The morphological studies were based on ca 6000 specimens from the herbaria AU, BM, CCNU, CDBI, CSFI, E, FNU, FJSI, GFS, GXMI, GZAC, GZTM, HAST, HIB, HGAS, HHBG, HITBC, HNNU, IBK, IBSC, K, KUN, L, LBG, NAS, P, PE, SZ, TUS, YUKU, WH, WU and ZJFC. In addition, field studies were carried out during 2001–2009 in Guangdong, Guangxi, Guizhou, Hubei, Hunan, Sichuan and Yunnan Provinces. Morphological features of the new species and the two new combinations in the present study were compared with closely related species.

Table 1. Comparison of morphological characteristics for *Elatostema* and *Pellionia*.

Characters	<i>Elatostema</i>	<i>Pellionia</i>
Female flower	4 or 5 perianth lobes which are much shorter than ovary, or strongly reduced, not corniculate at apex	3–5 perianth lobes which are longer than ovary, usually corniculate below apex
Male inflorescence	usually with receptacle, rarely cymose	cymose
Female inflorescence	discoid receptacle and bracteoles along margin	cymose or capitate on a globose receptacle
Achene	6–10-ribbed	tuberculate or striate, rarely smooth, never ribbed

Elatostema ambiguum (Wedd.) Q. Lin comb. nov. (Fig. 1)

Basionym: *Pellionia ambigua* Wedd., Arch. Mus. Hist. Nat. 9 (1856, p. 285). **Type:** India. Assam (= Meghalaya): Khasi Hills, Churra, 11 Jun 1850, J. D. Hooker and Thomson 458 (holotype: P 00369873!, isotype: K!).

Perennial herb, monoecious or dioecious, 10–25 cm tall. Stems erect or ascending, simple, glabrous. Leaves alternate; stipules linear, 3–5 mm long, 1 mm wide; petiole 0–2 mm long; leaf blade obliquely elliptic or obliquely oblong-lanceolate, 2–12 cm long, 1.0–3.5 cm wide, papery, major basal lateral veins asymmetric, 1 basal, the other arising above base, glabrescent, cystoliths absent or obscure, linear, sparse, random; base with broader half obtuse or nearly cordate, margin coarsely serrate, apex acuminate; nanophylls linear-lanceolate or subulate, 3–10 mm long. Male inflorescences axillary, solitary, branched, 5–11 mm in diameter; peduncle 3–6 cm long; receptacle absent; bracts alternate, narrowly oblong or subulate, 1.0–1.5 mm long; bracteoles spatulate-linear; male flowers 5-merous. Female inflorescences axillary, solitary, 5–7 mm in diameter, multiflorous; sessile; receptacle flat, 3–5 mm in diameter; bracts subulate or triangular; bracteoles linear; female flowers 5-merous. Achenes ellipsoid.

Distribution, habitat and phenology

Only known from the type locality and type collection: Khasi Hills, Churra, Assam (= Meghalaya), India. Flowering occurs in June.

Similar species

Elatostema ambiguum appears to be closely related to the sympatric but more widespread (northern India and Xizang) *E. laxicymosum* W. T. Wang (Wang and Chen 1979) in *Elatostema* sect. *Pellionioides* W. T. Wang, but differs from the latter by the following features: cystoliths absent or obscure, sparse (vs conspicuous, dense), nanophylls present, linear-lanceolate or subulate (vs absent), flowers 5-merous (vs 4-merous). A more detailed morphological comparison between the two species is provided in Table 3.

Elatostema ramosissimum Rein. in Bot. Jahrb. Syst. 25 (1898, p. 624) (Fig. 2)

Type: Samoan Is. Savaii: Lepaega, an Bäumen der Kraterwand, Sep 1894, Reinecke 610 (holotype: WU, isotype: WU!).

Taxonomic synonym: *Elatostema glochidioides* W. T. Wang in Acta Phytotax. sin. 32 (1993, p. 172, Fig. 2: 5–7) syn. nov. **Type:** China. Guizhou: Libo, Weng'ang, 800 m a.s.l., 27 Apr 1984, Q. H. Chen et al. 2217 (holotype: HGAS!).

Table 2. Comparison of morphological characteristics of the five sections in *Elatostema* proposed by W. T. Wang (Wang and Chen 1979, Wang 1980b, 1990).

Section	Characters
Sect. <i>Pellionioides</i> W. T. Wang	Leaf blade with major basal lateral veins asymmetric, 1 basal, the other arising above base, or major basal lateral veins absent and venation pinnate. Male inflorescences cymose, branched; receptacle absent; involucre absent; bracts alternate. Female inflorescences small, multiflorous; receptacle flat.
Sect. <i>Weddelia</i> (H. Schroeter) W. T. Wang	Leaf blade with both major lateral veins inserted at base, or major basal lateral veins asymmetric, 1 basal, the other arising above base, or major basal lateral veins absent and venation pinnate. Male inflorescences simple, involucre; receptacle small, obscure. Female inflorescences multiflorous; receptacle conspicuous or obscure. Achenes small, ribbed.
Sect. <i>Laevisperma</i> (Hatusima) Yamazaki	Herbs. Leaf blade with both major lateral veins inserted at base. Male inflorescences simple, pedunculate, pauciflorous; receptacle obscure. Female inflorescences sessile, with 1–10 flowers, involucre; receptacle obscure. Achenes smooth.
Sect. <i>Elatostema</i>	Leaf blade with both major lateral veins inserted at base, or major basal lateral veins asymmetric, 1 basal, the other arising above base, or major basal lateral veins absent and venation pinnate. Male inflorescences simple, involucre; receptacle conspicuous, discoid. Female inflorescences multiflorous, involucre; receptacle conspicuous, flat. Achenes small, ribbed.
Sect. <i>Androsyce</i> Wedd.	Leaf blade with major basal lateral veins absent and venation pinnate. Male inflorescences simple; receptacle conspicuous, pyriform when young, papilionaceous when mature; involucre obscure. Female inflorescences small, involucre, multiflorous; receptacle conspicuous, flat. Achenes small, ribbed.



Figure 1. Photograph of the holotype of *Pellionia ambigua* Wedd. (J. D. Hooker & Thomson s. n., P). Photographed by Q. Lin.

Perennial herb, monoecious or dioecious, 20–30 cm tall. Stems ascending or erect, carnos, branched, ferruginous-furfuraceous, glabrous. Leaves alternate; nanophylls absent; stipules narrowly triangular, ca 0.6 mm long, 0.2 mm wide, glabrous; petiole 0–0.8 mm; leaf blade lanceolate, oblong-lanceolate, narrowly ovate, or elliptic, 1.1–3.0 cm long, 0.4–0.9 cm wide, papery after drying, major basal lateral veins both arising at base of leaf blade, abaxial surface glabrous, adaxial surface strigillose along veins, cystoliths conspicuous, linear, dense, random on adaxial surface, base with broader half rounded or auriculate, margin entire, apex attenuate or acute. Male inflorescences axillary, solitary,

simple, 2–3 mm in diameter; peduncle ca 0.5 mm long; receptacle very small; bracts connate, triangular; bracteoles linear-lanceolate, or linear; male flowers 4-merous. Female inflorescences axillary, solitary, 2.5–4.0 mm in diameter; peduncle ca 0.5 mm long; receptacle small, ca 1.8 mm in diameter; bracts connate, triangular; bracteoles linear-ob lanceolate or linear; Achenes almost ovoid, ca 7-ribbed.

Distribution, habitat and phenology

Southern Guizhou and northern Guangxi, China, and Samoan Islands, Pacific Ocean (maybe introduced from

Table 3. Comparison of morphological characteristics of *Elatostema ambiguum* comb. nov. and *E. laxicosum*.

Characters	<i>E. ambiguum</i>	<i>E. laxicosum</i>
Stipule	linear, 3–5 mm long, 1 mm wide	subulate, 4–7 mm long, 0.1–0.2 mm wide
Leaf blade	obliquely elliptic or obliquely oblong-lanceolate, 2–12 cm long, 1.0–3.5 cm wide	obliquely elliptic or obovate-elliptic, 5.5–13.0 cm long, 2.5–5.0 cm wide
Cystolith	absent, or obscure, sparse	conspicuous, dense
Nanophyll	present, linear-lanceolate or subulate	absent
Flower	5-merous	4-merous
Male inflorescence	5–11 mm in diameter; peduncle 3–6 cm long; receptacle absent	10–22 mm in diameter; peduncle 3.0–6.5 cm long; receptacle absent
Female inflorescence	5–7 mm in diameter, multiflorous; sessile; receptacle 3–5 mm in diameter	5–11 mm long, 4–7 mm wide; peduncle ca 1.2 mm long; receptacle 7–8 mm long, 5–6 mm wide
Achenes	ellipsoid	narrowly ovoid

Samoan Islands), occurring under forests in limestone valleys. Flowering occurs in Apr–Sep.

Notes

When *Elatostema ramosissimum* Rein. was published, the author provided the following description: “*Monoicum. Caule glaberrimo, tenero, carnosio; foliis subsessilibus, ovato-lanceolatis, basi attenuatis, obliquis, integerrimis, subtus and nervos primarios strigulosos, subpenninerviis, supra cystolithis linearibus in statu sicco bruneri sparsis. Stipulis minimis, caducis. Floribus ♂ in cymiscapitatis, axillaribus brevissime pedunculatis. Perigonio 4-partito, laciniis infra apicem breviter aristatis. Antheris 4, filamentis perigonio leviter adnatis. Fl. ♀ in cymis ex axillis foliorum inferiorum orientibus, pedunculatis, perigonio 3- rarius 4-phylo. Ovario ovato, acuminato*”.

Based on examination of the type specimens of *Elatostema ramosissimum* Rein. and *E. glochidioides* W. T. Wang, and field observations in Weng’ang (holotype locality of *E. glochidioides* W. T. Wang), Libo County, Guizhou Province, we found no difference in morphological characters between the two species, while their distributions in China/Samoa is extraordinary. Therefore, we referred to the related literature (Botanical Society of China 1994) and found many collectors, such as P. Perny, H. Perny, E. M. Bodinier, W. Mesny, F. L. Seguin and J. P. Cavalerie and so on, who collected plants in southern Guizhou (including Libo) and northern Guangxi before Sep 1894, apparently without finding *E. ramosissimum*, indicating that this species, now widely distributed on stones in dark damp forests in southern Guizhou and northern Guangxi might be introduced from the Samoan Islands, therefore *E. glochidioides* W. T. Wang is regarded as a new synonym of *E. ramosissimum* Rein.

Elatostema ramosissimum Rein. is closely related to *E. myrtilloides* (Lévl.) Hand.-Mazz., but it differs from the latter by its leaf blade margin being entire (vs serrate) and female flowers being without perianth lobes (vs with small perianth lobes).

Additional specimens examined

China. Guangxi: Huanjiang, Mulun, 14 Jul 2003, L. D. Duan, Q. Lin & B. F. Yao 2002143 (PE (× 2)). Guizhou: Libo, Weng’ang, 27 Apr 1984, Q. H. Chen et al. 2217

(HGAS), the same locality, 14 Jun 2003, L. D. Duan & Q. Lin 2002121 (PE (× 6)), the same locality, 21 Jan 2009, Q. Lin 1036 (PE (× 4)). Samoan Is. Savaii: Lepaega, an Bäumen der Kraterwand, Sep 1894, Reinecke 610 (WU (× 2)).

Elatostema rhizomatosum (Gagnep.) Q. Lin comb. nov. (Fig. 3)

Basionym: *Pellionia rhizomatosa* Gagnep. in Bull. Soc. Bot. France 75 (1928, p. 924).

Type: Vietnam. Annam: col des Nuages près Tourane, 500 m a.s.l., 9 Sep 1923, M. Poilane 7909 (lectotype: designated by Q. Lin and Z. R. Yang in 2010, P!).

Perennial herb, dioecious, 20–30 cm tall, glabrous, long rhizomatose. Stems ascending or erect, simple. Leaves alternate; stipules subulate, 3–4 mm long; petiole 2–3 mm long; leaf blade membranaceous or papery, narrowly oblanceolate, 2–6 cm long, 1.2–1.5 cm wide, major basal lateral veins asymmetric, 1 basal, the other arising above base, base long attenuate-acute, margin entire or undulate, apex attenuate-acuminate; cystoliths conspicuous, linear, dense, random on adaxial surface; nanophylls absent. Male inflorescences axillary, solitary, simple, nearly globose, 5–10 mm in diameter; peduncle 0–2 mm long; receptacle very small, obscure; bracts 6, connate, unequal, the 2 outer ones ovate, 6–8 mm long, 3–5 mm wide, the 4 inner ones broadly lanceolate, 4–5 mm long, 2–3 mm wide; bracteoles narrowly triangular or linear-triangular; male flowers 4-merous. Female inflorescences unknown.

Distribution, habitat and phenology

Only known from the type locality: col des Nuages près Tourane, Annam, Vietnam, occurring in mountain forests at 500 m a.s.l. Flowering occurs in September.

Similar species

Elatostema rhizomatosum appears to be closely related to *E. attenuatum* W. T. Wang (1980b) in *Elatostema* sect. *Weddelia* (H. Schroeter) W. T. Wang, but differs from the latter in the following features: dioecious (vs monoecious), leaf blade 2–6 cm long, 1.2–1.5 cm wide (vs 9–15 cm long, 2–4 cm wide), male inflorescences solitary (vs



Figure 2. Photograph of the isotype of *Elatostema ramosissimum* Rein. (Reinecke 610, WU). Photographed by Q. Lin.

in pairs or 2-clustered). A more detailed morphological comparison between the two species is provided in Table 4.

Elatostema vietnamense Q. Lin & L. D. Duan sp. nov. (Fig. 4) Inflorescentia E. rhizomatoso (Gagnep.) Q. Lin valde simili, sed plantis suffruticosis (non herbaceis), foliis ad marginem crenatis (non integris neque undulatis) differt.

Type: Vietnam. Thua Thien-Hue Province, Bach Ma Natl. Park, 19 Oct 1998, H. N. Qin, H. Zhu, M. L. Zhang and T. G. Gao 156 (holotype: PE!).

Dioecious or monoecious subshrubs, 30–100 cm tall, glabrous. Stems erect, branched. Leaves alternate; stipules linear-lanceolate or subulate, 2.5–5.0 mm long, with cystoliths; petiole 1.5–5.0 mm long; leaf blade chartaceous or papyraceous, obliquely long elliptic or obliquely obovate-elliptic, 6–15 cm long, 2–6 cm wide, the pair of major basal lateral veins asymmetric, 1 basal, the other arising above base, base cuneate, margin crenate, apex acuminate; cystoliths conspicuous, linear, dense, random on the adaxial surface, obscure on the abxial surface; nanophylls absent. Male inflorescences axillary, solitary, simple, almost



Figure 3. Photograph of the lectotype of *Pellionia rhizomatosa* Gagnep. (M. Poilane 7909, P). Photographed by Q. Lin.

globose, 0.9–1.5 cm in diameter; peduncle 2–9 mm long; receptacle very small; bracts 6, connate, unequal, the 2 outer ones cymbiform-ovate or ovate, 6–11 mm long, 4–6 mm wide, with corniculus 3–6 mm long, the 4 inner ones broadly lanceolate, 4–6 mm long, 2–3 mm wide; bracteoles linear-lanceolate, 3.0–4.5 mm long; male flowers 4-merous. Female inflorescences axillary, solitary, simple, almost globose, 2–3 mm in diameter; sessile; receptacle very small; bracts 6, connate, unequal, the 2 outer ones ovate or lanceolate, 1.5–2.0 mm long, 1.0–1.2 mm wide, the 4 inner ones broadly lanceolate, ca 1.5 mm long, 1 mm wide; bracteoles linear. Achenes unknown.

Distribution, habitat and phenology

Only known from three collections from the type locality: Bach Ma Natl Park, Thua Thien-Hue Province, Vietnam, occurring in mountain or valley forests. Flowering occurs in October.

Similar species

Elatostema vietnamense Q. Lin & L. D. Duan is closely related to *E. rhizomatosum* (Gagnep.) Q. Lin. These species share the following characters: dioecious, glabrous; male bracts 6, connate, unequal, the 2 outer ones large, the 4 inner ones small; male flowers 4-merous. However *E.*

Table 4. Comparison of morphological characteristics of *Elatostema rhizomatosum* comb. nov., *E. vietnamense* sp. nov. and *E. attenuatum*.

Characters	<i>E. vietnamense</i>	<i>E. rhizomatosum</i>	<i>E. attenuatum</i>
Habit	subshrub, monoecious or dioecious	herb, dioecious	herb, monoecious
Stipule	linear-lanceolate or subulate, 2.5–5.0 mm long	subulate, 3–4 mm long	lanceolate, 5–15 mm long, 3–4 mm wide
Leaf blade	obliquely long elliptic or obliquely obovate-elliptic, 6–15 cm long, 2–6 cm wide, margin crenate	narrowly oblanceolate, 2–6 cm long, 1.2–1.5 cm wide, margin entire or undulate	oblanceolate, 9–15 cm long, 2–4 cm wide, margin entire
Male inflorescence	solitary, 9–15 mm in diameter; pedun- cle 2–9 mm long; receptacle very small, obscure; bracts 6, connate, unequal, 2 outer ones large, 4 inner ones small	solitary, 5–10 mm in diameter; peduncle 0–2 mm long; peduncle 0–2 mm long; receptacle very small, obscure; bracts 6, connate, unequal, 2 outer ones large, 4 inner ones small	solitary, in pairs or 2-clustered, 5–6 mm in diameter; peduncle 1–2 mm long; receptacle 4– 5 mm in diameter; bracts 5–6, connate, equal
Female inflorescence	solitary, 2–3 mm in diameter; sessile; receptacle very small	unknown	solitary, in pairs or 2-clustered, 4–8 mm in diameter; peduncle ca 1 mm long; receptacle 4–7 mm in diameter



Figure 4. Line drawing of *Elatostema vietnamense* sp. nov. (A) habit, (B) male inflorescence (ventral view), (C) female inflorescence (ventral view). (H. N. Qin et al. 156, PE) Drawing by Ai-Li Li.

vietnamense differs from *E. rhizomatosum* in being a subshrub (vs herb) with leaf blade margin crenate (vs entire or undulate). A more detailed morphological comparison between the two species is provided in Table 4.

Additional specimens examined

Vietnam. Thua Thien-Hue Province, Bach Ma Natl. Park, 19 Oct 1998, H. N. Qin, H. Zhu, M. L. Zhang and T. G. Gao 147 (PE), 205 (PE!).

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