

An account of the Lentibulariaceae of Thailand

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ABSTRACT. The Lentibulariaceae of Thailand is represented by one genus, *Utricularia*, with 22 native species, following revision of Thai and associated materials. One new species is described: it is endemic to Thailand. Two additional species, *U. stellaris* and *U. pierrei* are included in the account as they are likely to be present in Thailand, though specimens of the former appear not to have yet been collected and records for the latter are uncertain. Field experience suggests that many *Utricularia* species remain poorly known in Thailand. As the number of collections of Lentibulariaceae housed in herbaria are generally relatively few the distributional data given are, necessarily, incomplete.

INTRODUCTION

Lentibulariaceae comprises three genera and ca. 285 species: all are carnivorous. Taylor's monograph (Taylor, 1989) recognised 214 species. Since then a few extra species have been added and at the session on the Lentibulariaceae at the 2005 International Botanical Congress in Vienna, it was suggested that there were 215–220 species in the genus. Other published values for the number of species of *Utricularia* in the literature vary from 120 (Judd et al., 2002) to 180 (Mabberley, 1997). However, for a variety of reasons, Cheek (pers. comm.) strongly argues that these latter values should, in effect, be disregarded. *Pinguicula* contains ca. 46 species and is most diverse in tropical Mexico but extends to northern, temperate locations and reaches Tierra del Feugo. *Genlisea* contains 19 species and occurs in tropical America and Africa. *Polypompholyx*, a small Australian genus of two species, is now considered a synonym of *Utricularia* (Taylor, 1989). The family is cosmopolitan, being absent only from Antarctic, most arid regions and oceanic islands. It is closely allied to the Scrophulariaceae and appears monophyletic (Judd et al., 2002, Müller et al., 2000, 2001, Soltis et al., 2000, Jobson et al., 2003) based on evidence from *rbcL*, *matK*, *trnK* and morphology. However, currently its placement within the Lamiales and the families which are of closest affinity to it appear uncertain (Savolainen et al., 2000a,b). Amongst others, Jobson & Albert (2003) and Müller & Borsch (2005) investigated the phylogenetics of *Utricularia* using the chloroplast *trnK* intron and the latter demonstrated that there were three major clades. Müller & Borsch (2005) also suggest that, in the main, the sections recognised by Taylor (1989) are supported by *trnK/matK* topology.

The synonymy in Taylor (1989) indicates that, prior to his work, there was great difficulty in determining species limits and, a lack of consensus on them. This appears to be due to a number of factors. Firstly, the plants themselves are generally small and the

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morphological differences between species are, consequently, often difficult to see. Secondly, the vegetative morphology of the plants is highly unusual. As no true roots, or possibly even true leaves are present (Taylor, 1989; Jobson & Albert, 2001) a more than usually limited number of morphological characters are available to systematists. Even when blade possessing leaf-like organs are present they are always small (in Thai species), usually membranous and often single veined; so offering few characteristics. Thirdly, the plants are very delicate. Therefore, almost no matter how carefully fresh material is dried it is often damaged or, following mounting, so disposed on the herbarium sheet as to make observation of key characters altogether impossible without dissection and re-hydration. Fourthly, preserved (both liquid and dried) material is often inadequate as many collectors fail to collect root / stolon material. Finally, up until recently very little was known about the degree of variation in morphology both within and between plants and within and between populations - the only notable examples documenting within population variation in key *Utricularia* characters being Thor (1979, 1987, 1988) and Doyle & Parnell (2003). This combination of circumstances, leavened with a surprising degree of imagination and optimism, has led to many entities being falsely described as new species and hence an extensive synonymy (see Taylor, 1989).

As is well known, *Utricularia* catches small prey through its active trapping mechanism. Traps are thin-walled, globose or ovoid and vary in size from ≤ 0.2 mm to usually ≤ 8 mm in Thai species. Untripped traps are flat. When prey passes the entrance to the trap it is sprung, the trap inflates and the prey, together with surrounding water, is sucked into the trap through a hinged trap-door. The door then closes itself in ca. 1/500th of a second (Mabberley, 1997). The trapped organism is digested and the trap eventually resets itself. The trap's size, morphology and internal structure offer numerous, minute, taxonomic characteristics. Of particular importance are the shape and size of the hairs contained within the trap. These are most easily visualised by cutting open the trap before staining it with Toluidine Blue: the hairs appear as brightly and deeply stained (usually red) entities which stand out well against the more poorly stained cells of the walls of the trap. Two types of hair are often present in the traps: these bear either two or four arms. The four-armed hairs, sometimes called quadrifids, and in particular the angle, disposition, shape and size of their arms, are of taxonomic value (Doyle & Parnell, 2003). In some Thai species four-armed hairs are absent altogether and, occasionally, I have found their absence a useful confirmatory characteristic of species identity. The traps are borne in a variety of positions on the plant and what these positions are is also a useful taxonomic characteristic. Finally, the traps are ornamented by appendages which usually occur around the entrance to the trap. The detailed structure of these appendages is taxonomically important. However, because they are extremely fragile, they are often broken or damaged in herbarium material; indeed, in many herbarium specimens they may appear to be entirely absent, but this is an artifact caused by damage. The flowers vary in colour, size and shape and are spurred. The spur also varies, in size, shape and orientation and in the disposition of its internal nectarial glands. Whilst the latter characteristic has been extensively used in the delimitation of certain species in Europe it appears not to have been so far recorded for Thai material.

The seed-coat is of taxonomic value (Taylor, 1989) but its surface features are very difficult to see and, therefore, they have not been extensively used in this account. Unfortunately, the type of hair on the seed's surface is the only simple morphological

means of distinguishing between the three species of spathulate-leaved *Utricularia* in Thailand. As the seeds of these species are only 0.2–0.3 mm long and their surface hairs are correspondingly tiny (at an order of magnitude smaller) I have found a pocket microscope of 50 x magnification extremely useful. Similarly, features of the surface of the pollen are of great taxonomic value but are not large enough to be useful in a Flora account and so are omitted herein.

A survey of herbarium material in A, AAU, ABD, BK, BKF, BM, C, E, K, Biology Department, Khon Kaen University, L, M, P, S, SING, SINU and TCD yielded 998 herbarium sheets from Thailand of which a number are duplicates: so, in fact, these sheets represent only 580 individual collections. Therefore, the family is under-collected, certain species particularly so, and the distributional data given herein are tentative. Species descriptions are based on original observations, largely of herbarium material. As measurements have been taken from dried specimens they may differ slightly from fresh material. Occasionally, I have been unable to observe a particular feature in the Thai material I have studied and where that is the case I have drawn the appropriate information, which appears in the descriptions in **bold-face type**, from the literature - usually from Taylor (1978) - or from specimens from outside of Thailand.

Liquid preserved material is easier to use than dried herbarium material. Taylor (1978) suggests using a mixture of 50–55% alcohol, 40% water and 5–10% glycerine; the latter may be added later or omitted. Unfortunately, collections of liquid preserved material from Thailand are sparse and some of those that exist are not well-maintained. In general, therefore, it is best to supplement dried with liquid collections rather than relying solely on the latter. The impression that it is almost impossible to correctly identify dried herbarium material is inaccurate - nearly all of it can be identified. Rehydration of dried material is particularly effective in this genus, and I have found that traps from even the most decrepit and elderly specimens can be successfully rehydrated by 36 hours immersion in water at room temperature; the addition of detergent to the water is unnecessary. Nevertheless, the lack of large quantities of liquid preserved material is an impediment to work on this genus.

TAXONOMIC ACCOUNT

LENTIBULARIACEAE

Annual or perennial herbs. Specialised for the capture and digestion of small animals. *Specialised hairs* always present, usually secreting mucilage or digestive enzymes. *True roots* frequently absent. *Root-like rhizoides* and stolons often present. *Leaves* whorled or alternate or in basal rosettes, nearly always highly modified for the capture of small animals, sometimes highly divided. *Inflorescence* an ebracteate scape or bracteose raceme, flowers sometimes solitary. *Flowers* hermaphrodite, zygomorphic. *Sepals* 4–5, fused; calyx usually deeply 2–4–5-lobed, usually accrescent in fruit. *Petals* 5, fused, tube short; corolla often bright yellow or blue or purple, two lipped, the lower lip entire or lobed, often with a bump obscuring the throat of the corolla, clearly spurred, the spur producing nectar; the upper lip unlobed or 2-lobed. *Stamens* 2, filaments short, anthers dehiscent by a slit. *Carpels* 2, fused, style short, stigma unequally 2-lobed. *Fruit* a globose or ovoid, sometimes compressed capsule. *Seeds* minute, numerous, borne on a free, basal placenta.

Three genera (only *Utricularia* in Thailand) and about 245 species worldwide. Cosmopolitan, with the majority of the species tropical. One genus in Thailand.

The most important accounts for this genus in Thailand are: Janarthanam & Henry (1992), Taylor (1968, 1978, 1989), Maxwell (1985) and Pellegrin (1930). Both Taylor (1989) and Maxwell (1985) provide highly detailed accounts of the morphology of the species which include features which, in my judgement, most workers will never see as they are either very difficult to observe, or too small (being at the limits of resolution of all but the very best dissection microscopes) or very easily damaged; examples of these include the stamens, ovary and trap appendages. Therefore, I have omitted some of these features from my account and the descriptions herein are deliberately simplified. In Taylor's monograph (Taylor, 1989) of *Utricularia* there is a considerable discussion of the morphology of the genus. Following his pragmatic approach I have decided to use the term 'leaves' rather than that of 'foliar organs' used by Maxwell (1985).

This account excludes most literature records for *Utricularia* species where voucher specimens have not been seen by me. However, I have included a few published records where I have no reason to doubt the accuracy of the record itself but have, not seen the voucher - these include some records by Maxwell (1985, 1986) and Maxwell & Elliot (2001). All such records are indicated in the text as n.v. In some cases, I have not been able to be certain of the location of particular collections and these are indicated under the distribution of the appropriate species as unlocalised. All cited specimens have been seen and determined by the author.

1. UTRICULARIA

L., Sp. Pl. 1: 18. 1753; L., Gen. Pl. ed. 5. 11. 1754; A.DC. in A.DC., Prodr. 8: 3. 1844; Pellegr. in Lecomte, Fl. Gén. I.-C. 4: 467. 1930; P. Taylor in Fl. Mal. ser. I, 8: 275. 1977; Hô, Càyco Vietnam 3: 108. 1993; P. Taylor in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 173. 1995.

Carnivorous, annual or perennial herbs. Usually hairless. Thai material always small and delicate. Aquatic, to terrestrial, always growing in wet places. *Leaves*, diverse in form, often absent at flowering. In terrestrial and semi-aquatic species, the blade, when present, is delicate and few nerved. In aquatic and some semi-aquatic species, the leaves are finely divided into numerous, very thin, linear, hair-like or blood-capillary like segments, which are often microscopically setose and which have no distinct blade. *Traps* minute, ovoid or globular, present on leaves and / or stolons, capturing and digesting small, often microscopic organisms. *Bracts and bracteoles* either attached at the base or in the middle. *Inflorescence* a spike or raceme or, rarely, flowers solitary, occasionally twining (Thai species always twining in a sinistrose or clockwise manner). *Flowers* hermaphrodite, 5-merous, strongly zygomorphic, sometimes cleistogamous, borne above the surface of the water. *Sepals* fused, deeply 2-lobed, the lobes more or less free from each other and usually widely divergent. *Corolla* fused, two-lipped, spurred, with a very short tube: the lower lip often with a conspicuous bump (palate). The palate is often of different colour to the rest of the corolla and may almost close the mouth of the flower. *Stamens* 2, inserted on the corolla, filaments short and bent; anthers often connate. *Ovary* superior, of 2 carpels with a single locule; ovules numerous, on a free-central placenta. *Style* 1, long, stigma unequally bifid (in

some species it has been reported that the lobes of the stigma are either sensitive, closing when touched or after pollination: this, however, has, as far as I know, not yet been observed in Thai material). *Fruit* an usually vertically circumscissile globose or ovoid capsule. *Seeds* numerous, minute, almost dust-like in some species, with distinct and varied microscopic surface sculpturing.

Twenty-two native species in Thailand. Two additional species which are potentially present, but which are either unrecorded or doubtfully recorded, are also included.

1. Plants terrestrial, though often growing in wet places. Narrowly linear, hair-like or blood capillary-like leaves absent, and, therefore, never forming a dense mat-like structure 2
Plants aquatic or semi-aquatic. Narrowly linear, hair-like or blood capillary-like leaves present, sometimes forming a dense mat-like structure 25
2. Plants obviously and conspicuously hairy **12. *U. hirta*** 3
Plants not obviously and conspicuously hairy 3
3. Bracts, bracteoles and scales not attached at their base, attached above the base, often at, or about, the middle: therefore, with free basal and upper parts 4
Bracts, bracteoles and scales attached at their base: therefore, the basal part not free 9
4. Spoon-shaped leaves present at flowering. Plants epiphytic or lithophytic 5
Spoon-shaped leaves absent at flowering 7
5. Spur usually ca. 5 mm or more long. Seed surface lacking conspicuous glochidiate hairs, only with simple hairs which are confined to the thickened end (use microscope). Lower lip of corolla subentire to very shallowly 5-lobed. Doi Inthanon only **8. *U. garrettii***
Spur ca. 2–3(–4) mm long. Seed surface with conspicuous glochidiate hairs or seed surface entirely covered in hairs or projections (use microscope). Lower lip of corolla clearly, but shallowly 5-lobed or subentire 6
6. Leaves not pustulate. Seed surface with conspicuous glochidiate hairs (use microscope). Lower lip of corolla clearly, but shallowly 5-lobed **22. *U. striatula***
Leaves usually obviously pustulate. Seed surface entirely covered in club-shaped hairs or projections but lacking conspicuous glochidiate hairs (use microscope). Lower lip of corolla subentire. Ranong only **5. *U. corynephora***
23. *U. subulata* 8
7. Corolla yellow, inflorescence forming a zig-zag pattern
Corolla blue, lilac, or whitish, (rarely yellowish), inflorescence not forming a zig-zag pattern 8
8. Pedicels distinctly flexuose at least when in fruit, usually long and slender. Calyx not papillose **15. *U. limosa*** (use hand-lens)
Pedicels not flexuose, not particularly long or slender. Calyx distinctly papillose **4. *U. caerulea***
9. Inflorescence twining 10
Inflorescence erect 13
10. Corolla blue **7. *U. foveolata*** 11
Corolla yellow
11. Corolla 5(–10) mm long. Leaves absent at flowering **20. *U. scandens*** 12
Corolla 10–20 mm long. Leaves usually present at flowering
12. Spur somewhat curved. Pedicels ca. 10–20 mm. Bracts clearly longer than wide **13. *U. involvens***
Spur more or less straight. Pedicels 5–6 mm. Bracts almost as wide as long **18. *U. pierrei***
13. Fruiting pedicels strongly reflexed **2. *U. bifida*** 14
Fruiting pedicels not reflexed
14. Corolla yellow 15
Corolla blue or white 19
15. Leaves usually present at flowering and pedicels ≥ 7 –15 mm. (Islands of Ko Chang & Ko Kut only) **3. *U. bosminifera*** 16
Leaves absent at flowering. Pedicels usually 2–6 mm
16. Flowering plant ca. 5 cm tall or less 17
Flowering plant at least 5 cm tall 18
17. Traps without a ventral scale. Bracteoles much shorter than bracts. Spur usually strongly curved **14. *U. jackii***

- Traps with a ventral scale, Bracteoles about the same length as bracts. Spur weakly curved
20. *U. scandens*
18. Flowering pedicels no longer than flowering calyx (fruiting pedicels longer than calyx). Bracts ovate, acute \wedge or Λ , never subapiculate. Calyx lobes usually > 5 mm long, rarely 3 mm long. Palate with a ciliate margin, not papillose. Seeds ca. 0.5 mm
17. *U. odorata*
 Flowering pedicels at least as long as flowering calyx. Bracts broadly ovate, apex acute to subapiculate. Calyx lobes < 5 mm long. Palate papillose, its margin not ciliate. Seeds ≤ 0.3 mm
20. *U. scandens*
19. Corolla 10–25 mm long 20
 Corolla < 10 mm long 21
20. Flowering pedicels about the same length as the calyx-lobes. Leaves usually absent at flowering, 1-veined. Plant not-mat forming. Flowers densely crowded together at the top of the peduncle
6. *U. delphinioides*
 Flowering pedicels much longer than the calyx-lobes. Leaves usually present at flowering, 3-veined. Plant often mat-forming. Flowers clearly well-separated from each other along the peduncle
11. *U. graminifolia*
21. Flowers densely crowded together at the top of the peduncle **6. *U. delphinioides***
 Flowers clearly well-separated from each other along the peduncle 22
22. Flowering pedicels very long and clearly evident, much longer than the calyx lobes. Bracts much wider than bracteoles. Seed-coat largely composed of rectangular, elongated cells (use hand-lens)
11. *U. graminifolia*
 Flowering pedicels shorter or very slightly longer than the calyx lobes. Bracts and bracteoles similar in width or bracts much wider than bracteoles. Seed-coat largely composed of almost isodiametric cells (use hand-lens) 23
23. Pedicel as long as, or longer than, the subtending bract. Bracts much wider than bracteoles. Leaves often present on flowering. Margins of the calyx minutely denticulate (use microscope). Seed-surface strongly echinate in appearance (actually with very raised anticlinal cell walls)
24. *U. uliginosa*
 Pedicel about the same length as, or shorter than, the bract. Bracts and bracteoles similar in width. Leaves not present on flowering. Margins of the calyx not minutely denticulate. Seed-surface smooth or somewhat rough in appearance 24
24. Calyx lacking prominent nerves. Lower lip of calyx rounded to truncate. Spur clearly directed downwards and away from the upper lip of the corolla. Lower lip of corolla twice as long as upper lip. Plant usually < 6 cm tall, sometimes < 3 cm
16. *U. minutissima*
 Calyx usually with prominent nerves. Lower lip of calyx emarginate or three-toothed. Spur usually weakly directed downwards to almost horizontal; usually subparallel to the upper lip of the corolla. Lower lip of corolla about the same length as upper lip. Plant usually > 6 cm tall, always > 3 cm
9. *U. geoffrayi*
25. Flowers pink. Bracts and bracteoles not attached at the base, attached (obscurely so) in or about the middle or near to the base but not at it. Seed with a conspicuously dentate, membranous margin. Traps with four-armed hairs shaped or internally
19. *U. punctata*
 Flowers yellow. Bracts and bracteoles clearly attached at the base, not attached in or about the middle. Seed without a conspicuously dentate, membranous margin. Trap with four-armed hairs shaped or \searrow or \swarrow internally 26
26. Peduncle with a conspicuous whorl of 4–8 swollen, spongy, ovoid floats borne above the middle. Floats 1–4 cm long, relatively chubby, ca. 2 times as long as wide with capillary leaf segments at the apex only
21. *U. stellaris*
 Peduncle without a whorl of 4–8 swollen, spongy, ovoid floats borne above the middle. Floats usually absent or, if present, almost basal on the peduncle, relatively long and narrow, 20–30 times as long as wide, with capillary leaf segments borne, at intervals, along their length 27
27. Peduncles lacking scales. Bracts not squat, broadly ovate. Fruiting pedicels bent sharply downwards. Fruiting calyx-lobes considerably enlarged, patent. Seeds cuboid, angled, without a membranous margin. Quadrifids usually with arms unequally \searrow or \swarrow divergent or, rarely, more or less equally \times divergent. Floats rarely present
1. *U. aurea*
 Peduncles normally with at least 1 scale. Scales and bracts squat and blunt. Fruiting pedicels not bent downwards. Fruiting calyx-lobes not considerably enlarged, not patent. Seeds lens-shaped, not angled, with a membranous margin. Quadrifids with arms more or less equally \times or \times divergent. Floats never present
10. *U. gibba*

1. *Utricularia aurea* Lour., Fl. Cochinch. 26. 1790; A.DC. in DC., Prodr. 8: 8. 1844; Back. & Bakf.f., Fl. Java 2: 517. 1965; P. Taylor, Dansk Bot. Ark. 23: 529. 1968; in Fl. Males. ser. I, 8: 296. 1977; Rani & Matthew in Matthew, Fl. Tamilnadu Carnatic 2: 1111. 1983; Maxwell, Songklanakarin J. Sci. Tech. 7: 412. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 623. 1989; in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 198. 1995; Hô, Càyco Vietnam 3: 108. 1993; Noltie in Grierson & Long, Fl. Bhutan 2: 1339. 2001; Maxwell & Elliot, Veg. & Vasc. Fl. Doi Suthep - Doi Pui Nat. Park, Northern Thailand 106. 2001. Type: Vietnam, *Louriero* s.n. (not located).— *Utricularia flexuosa* Vahl, Enum. 1 198. 1804; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 329. 1885; Trimen, Handbk. Fl. Ceylon 3: 267. 1895; Craib, Bull. Misc. Inform. Kew 1911. 429. 1911; Craib, Contr. Fl. Siam 147. 1912; Ridl., Fl. Malay Penins. 2. 491. 1923; Pellegr. in Lecomte, Fl. Indo-Chine 4: 471. 1930. Type: India, *Koenig* s.n. (holotype C, not seen).— *Utricularia fasciculata* Roxb., Fl. Ind. 1: 143. 1820; Wight, Icon. Pl. Ind. Or. 4. t.1568. 1850. Type: India (not located).

Suspended aquatic. *Stolons* filiform, up to 1 m long, occasionally inflated. *Rhizoides* usually present at the base of the peduncle, branched. *Floats* rarely present at the base of the peduncle, borne in whorls, ca. 2–6 cm long by 3–5 mm wide, the surface with occasional scattered, branched, short filiform rhizoides. *Leaves* filiform, hair-like, much branched, 2–8 cm long. *Auricles* (at the base of the leaves) 2–4 mm long, divided into filiform segments, not easily distinguishable from the leaves. *Traps* usually numerous, ovoid, (1–)4 mm long; mouth lateral, with 2 very fragile appendages (often absent due to damage in dried specimens), often blackish. *Internal hairs* both 2-armed and 4-armed, the latter ∇ or ∇ , rarely \times in shape. *Inflorescence* erect, emergent, generally solitary, (5–)20(–30) cm long; peduncle hairless, sometimes reddish at base; 5–7-flowered; flowers widely spaced. *Scales* absent. *Bracts* ovate, attached at the base, 1–2 mm long, blunt or apiculate at tip, much shorter than pedicels. *Bracteoles* absent. *Pedicels* ca. 10 mm long and erect in flower; longer, thickened and strongly deflexed in fruit. *Calyx* lobes \pm equal, 2–3 mm long on flowering; up to 9 mm long, enlarging markedly (3 x–5 x) and widely spreading in fruit so that the lobes lie opposite, at 180°, to each other. The maturing fruit, lies between the two calyx lobes and almost always is topped by its style; the lobes and fruit form a three pointed star shape when seen in side view. *Corolla* bright yellow, 1–1.5 cm long; upper lip erect, smaller than lower lip, lower lip downwards facing, with purple guidelines near throat, palate prominent, often deeper yellow and with reddish lines or dots, spur 1–1.5 cm long, subparallel to lower lip, straight or slightly curved, shortly-pointed. *Seeds* flattened, disc-shaped, usually with 5 sides each with distinct ridged or winged edges, and with a distinct rounded dot-like scar in the middle of one of the flat faces, 1–2 mm long.

Thailand.— NORTHERN: Chiang Mai [Chiang Mai, 30 km W. of, 8 Nov. 1958, *Sørensen, Larsen & Hansen* 6072 (C); Doi Suthep, 19 Aug. 1912, *Kerr* 2622 (BM, K); Mae Tang, 19 Oct. 1958, *Sørensen, Larsen & Hansen* 5769 (C, K); San Sai, 16 Sept. 1958, *Sørensen, Larsen & Hansen* 5017 (AAU, BKF 2 sheets, C 2 sheets, E, K, L, P)]; Nan [Nam Han Village, Pa Tong subdistrict, Ta Wang Pah, Pha Tong, 15 March 2000, *Maxwell* 00-131 (A, L)]; Lampang [Kaw Koh, Suran, nr Lampang, 14 Jan. 1916, *Annandale* 1843 (SING)]; Phitsanulok [Thung Salaeng Luang National Park (Thung Salaeng Luang), 18 Feb. 1964, *Hansen, Seidenfaden & Smitinand* 11195 (BKF, C 2 sheets, L); Ban Kek Yai, 17 Dec. 1966, *Prayad* 608 (BK)]; Nakon Sawan [Bora Pet pond, 17 Jan. 1975, *Sutheesoan (Suthusoen)* 3178 (BK)]; NORTH-EASTERN: Loei [Phu Kradueng, 7–9 Nov. 1970, *Charoenphol, Larsen & Warncke*

4844 AAU)]; Sakon Nakhon [Ban Nang Hian, Kok Su Suphan district, 24 Feb. 1993, *Chantaranonthai, Parnell, Middleton & Simpson* 900 (K, TCD)]; Nakhon Phanom [Paknam (Paknam Songkram), 7 Jan. 1958, *Sørensen, Larsen & Hansen* 94 (C, K)]; EASTERN: Chaiyaphum [Thung Kra Mang, 9 Aug. 1972, *Larsen, Larsen, Neilsen & Santisuk* 31632 (AAU, K, L); game reserve, ca. 80 km E. of Phetchabun, 7 Nov. 1984, *Murata, Phengklai, Mitsuta, Yahara, Nagamasu & Nantasana* T-41721 (BKF)]; Nakhon Ratchasima [Khao Yai National Park, Trend Camp, Pak Thong Chai, eastern part of, 11 Aug. 1968, *Larsen, Santisuk & Warncke* 3339 (AAU, BKF, E, L, L, P); Khao Yai, 1963, *Larsen* 10698 (C); Phi Mai, 12 Jan. 1967, *Smitinand* 10105 AAU, BKF, K, L); Phi Mai, N. of, 19 March 1958, *Sørensen, Larsen & Hansen* 2145 (AAU, BKF, C 3 sheets, E, L, K, P)]; Buri Ram [Near Ban Kruat about 55 km S. of Buri Ram city, 4 Oct. 1984, *Murata, Phengklai, Mitsuta, Nagamasu & Nantasana* T-37406 (A, AAU, BKF)]; Surin [Surin, 3 Dec. 1976, *Phengklai et al.* 3594 (BKF 2 sheets)]; Si Sa Ket [Kantharalak, en route from Si Saket city to Kantharalak about 10 km from Kantharalak, 8 Oct. 1984, *Murata, Phengklai, Mitsuta, Nagamasu & Nantasana* T-49719 (A, BKF)]; Ban Jea, Tai-ra-wee, Kantararoam, 28 March 1959, *Plermchit* 1574 (BKF); en route from Uthum Phon Phisai to Si Saket city, 7 Oct. 1984, *Murata, Phengklai, Mitsuta, Nagamasu & Nantasana* T-37779 (A, BKF)]; Ubon Ratchathani [8-9 km before Ubon Ratchathani (Ubol) on road from Sisaket, 29 Jan. 1978, *Cribb* 119 (K)]; SOUTH-WESTERN: Kanchanaburi [Gerng Gavia, 4 Feb. 1962, *Larsen* 9539 (BKF 2 sheets, C, K); road 343, Thong Pha Phum to Sangkhla Buri, start of reservoir, 7 Feb. 2002, *Parnell, Chamayarit, Pooma, Simpson, Suddee & De Wilde* 2049 (TCD); Kroengkawia non-hunting area, Thongphaphum District, 27 Nov. 1982, *Koyama, Terao, Niyomdham & Wongprasert* T30407 (BKF)]; Phetchaburi [Phetchaburi, 31 Dec. 1920, *Marcant* 527 (BM); Phetchaburi, 31 Dec. 1920, *Marcant* 537 (K)]; Prachuap Khiri Khan [Bangtaphan, 25 March 1890, *Keith* 412 (SING); Prachuap Khiri Khan, 22 March 1971, *Bognor* 412 (K)]; CENTRAL: Chai Nat [Chai Nat, West of Ta Kli towards Chai Nat (Chainart), 28 Nov. 1959, *Abbe & Abbe* 9232 (A)]; Ang Thong [Wat Ghalng, Howa Pie, Muang District, 11 Dec. 1971, *Maxwell* 71-787 (AAU, BK)]; Phra Nakhon Si Ayutthaya [Ayutthaya (Ayuthaya), 3 Dec. 1979, *Shimizu, Toyokuni, Koyama, Yahara & Niyomdham* T-26085 (BKF 2 sheets, L); Wang Noi, 16 Oct. 1984, *Murata, Phengklai, Mitsuta, Nagamasu & Nantasana* T-52619 (BKF); near Wang Noi, 65 km N. of Bangkok, 10 Dec. 1961, *Nicholson* 1601 (BK, K, L, P, SING)]; Saraburi [Klang Dong, 8 Aug. 1979, *Shimizu, Toyokuni, Koyama, Yahara & Niyomdham* 9479 (A, BM); Sam Lan Forest, Muang District, 30 June 1974, *Maxwell* 74-648 (AAU, BK); Saraburi, 30 Feb. 1982, *Ubolchalaket* s.n. (AAU)]; Krung Thep [Bangkok, 20 Oct. 1919 *Kerr* 3831 (BM, K); Bangkok, 24 Oct. 1920, *Marcant* 460 (BM, K); Bangkok, 8 Sept. 1923, *Anon.* BK17550 (BK); Bangkok, 30 Feb. 1982, *Ubolchalaket* s.n. (AAU); Bangkok, *Smith* 1007 (BK); Kasetsart University campus, Bang Khen, 5 Sept. 1995, *Parnell, Pendry, Jebb, & Boonthavikoon* 95-702 (K, TCD)]; SOUTH-EASTERN: Sa Kaeo [Aranyaprathet (Aran Prathet), 17 Oct. 1928, *Put* 2012 (BK, BM)]; Chon Buri [Near Thonburi Technical College, Ratburana District, 15 Nov. 1970, *Maxwell* 70-85 (AAU, BK); Laem Chabang swamp, 4 miles from Si Racha and 1 mile from sea, 9 Dec. 1927, *Collins* 1923 (A, ABD, BK, BM, SING)]; Rayong [Ban Phe, 16 Dec. 1974, *Geesink* 7873A (BK); Phe Arboretum, 23 Nov. 1979, *Shimizu, Toyokuni, Koyama, Yahara & Phanichaphol* T-23377 (BKF, L)]; Chanthaburi [Bo Rai, 50 km E. of Makham, 1 Sept. 1972, *Larsen, Larsen, Nielsen & Santisuk*, 32313 (AAU, BKF, K, L); [Makham, 5 Aug. 1973, *Geesink & Phengklai* 6330 (BKF, C, L); Makham, 5 Aug. 1973, *Geesink & Phengklai* 6333 (AAU, BKF, C, E, L)]; PENINSULAR: Ranong [Ranong, 7 Dec. 1918, *Kerr* 505 (BM, K, TCD)]; Surat Thani [Klong Saeng Wildlife Sanctuary, Chiao Lan Reservoir, Ban Takun (Ban Takhun), 16 Feb. 1994, *Maxwell* 94-230

(A); Khun Tale, 14 Jan. 1935, *Seidenfaden* 2353 (C, SING); Wat Soa, Bandon River, 8 Jan. 1935, *Seidenfaden* 2330 (C, SING); Phangnga [Takua Pa, S.E. of, 23 Feb. 1977, *Jacobsen* NJ77-92 (C)], Phuket [Ao Kamala, 12 April 1969, *Chermisrivathana* 1506 (BK)]; ?Ko Kaeo (Kow Kaw) 29 Jan. 1958, *Sørensen, Larsen & Hansen* 822 (C); Thung Ka (Tongah), Feb. 1903, *Haniff* 3860 (SING)]; Nakhon Si Thammarat [Thung (Tung) Song, 22 July 1929, *Rabil* 146 (BK, BM)]; Phatthalung [Nok Nam Thale Noi, (Talenoi) Lake, Talenoi Wildlife Sanctuary, Khuankhanum District, 9 Aug. 1993, *S.Th et al.* s.n. (BKF); Talenoi (Nok Nam Thale Noi) Lake, Talenoi Wildlife Sanctuary, Khuankhanum District, 20 Dec. 1979, *Shimizu, Toyokuni, Koyama, Yahara, & Santisuk* T-27729 (BKF, L)]; Trang [Kraphang, 1950, *Williams* 17025 (K 2 sheets)]; [Thalae Song Hong (Nong Thale Song Hong), 27 Jan. 1958, *Sørensen, Larsen & Hansen* 719 (C, K)]; Songkhla [along the highway ca. 2 km N.E. of Chana, Muang-Chana border Kuan Niang, 17 Jan. 1985, *Maxwell* 85-75 A, BKF]; Route 43 Hat Yai–Chana, 31 Jan. 2002, *Parnell, Simpson, Chayamarit, Pooma, Suddee & De Wilde* 1974 (TCD); Kuan Niang, Rattapoom, 9 Dec. 1986, *Maxwell* 86-1045, (BKF, C, L); N. end of Lake Songkhla, Talae Noi Waterfowl Reserve, Thale Noi Lake (Ta Lei Nawi), 28 Dec. 1978, *Congdon* 159 (A); Klong Roy Kong, W. of Taeng Loeng, 30 May 1985, *Maxwell* 85-548 (A, BKF, L); Tapa, 23 March 1928, *Kerr* 14728 (BK, BM)]; Pattani [Yaring, 15 March 1993, *Chantaranonthai, Parnell, Middleton & Simpson* 1163 (TCD)]; Narathiwat [Kok Dam peat swamp forest, 29 Feb. 1984, *Niyomdham* 807 (AAU); Narathiwat, S. of, 9 March 1974, *Larsen & Larsen* 33129 (AAU); Plaiwan, swamp forest station N. of Sungai Kolok, 17 Aug. 1995, *Larsen, Larsen, Tange, Moran, Niyomdham & Puudjaa* 45697 (AAU, BKF); Pa Wai, Sungai Pa Di (su Ngi Paadee), 4 Sept. 1987, *Niyomdham & Sriboonma* 1542 (AAU)]; UNLOCALISED: Kaw Koh Suwawn Lawpan, 14 Jan. 1916, *Annandale* 1843 (K); Huey Mot, 19 July 1941, *Kingdom Ward* 37565 (K, SING); Tung Song, 22 July 1929; *Rabil* 146 (BK, BM); Siam, 1859, *Schomburk* s.n. (K); *Smith* s.n. (BK); Noi Mao, *Anon.* BK17596 (BK).

Distribution.— India to Japan and Australia.

Ecology.— In still water in roadside ditches, rice paddies, freshwater swamps and marshes, ponds, reservoirs and canals; most frequently recorded from elevations below 200 m but reaching 1100 m. Flowering and fruiting throughout the year.

Vernacular.— Sali (สาลี่) (Peninsula).

Notes.— Possibly the commonest, certainly the commonest aquatic, *Utricularia* species in Thailand.

2. *Utricularia bifida* L., Sp. Pl. ed. 1. 1: 18. 1753; A.DC. in DC., Prodr. 8: 21. 1844; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 332. 1885; Trimen, Handbk. Fl. Ceylon 3: 270. 1895; Craib Bull. Misc. Inform. Kew 1911. 429. 1911; Craib, Contr. Fl. Siam 147. 1912; Ridl., Fl. Malay Penins. 2. 492. 1923; Pellegr. in Lecomte, Fl. Indo-Chine 4: 482. 1930; Back. & Bakh.f., Fl. Java 2: 518. 1965; P. Taylor, Dansk Bot. Ark. 23: 529. 1968; in Fl. Males. ser. I, 8: 281. 1977; Rani & Matthew in Matthew, Fl. Tamilnadu Carnatic 2: 1112. 1983; Maxwell, Songklanakarin J. Sci. Tech. 7: 413. 1985 (excl. var. *bosminifera*); P. Taylor, Kew Bull. Addit. Ser. 14: 307. 1989; in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 182. 1995; Hô, Càyco Viêtnam 3: 113. 1993; Noltie in Grierson & Long, Fl. Bhutan 2: 1340. 2001; Maxwell & Elliot, Veg. & Vasc. Fl. Doi Suthep - Doi Pui Nat. Park, Northern Thailand 106. 2001. Type: Guangdong, *Osbeck* s.n. (holotype LINN, not seen).—*Utricularia humilis* Vahl, Enum. 1: 203. 1804; Wight, Icon. Pl. Ind. Or. 4: t.1572. 1850 pro parte. Type: India Orientalis, *Koenig* s.n. (holotype C, not seen).

Usually terrestrial. *Stolons* infrequent, filiform. *Rhizoides* filiform, branched. *Floats* absent. *Leaves* linear, usually absent at flowering, 1–2 cm long, 1-nerved. *Auricles* absent. *Traps* usually numerous, reniform, 0.5–1 mm long; mouth basal, with 2 very fragile appendages (often absent due to damage in dried specimens), often blackish. *Internal hairs* 1-armed or 2-armed. *Inflorescence* erect, solitary, (3–)14(–20) cm long; peduncle hairless; usually 3–7(–15)-flowered; flowers widely spaced, and, when young, often held such that mouth of the flower is upright, the upper lip of the corolla and spur are arranged parallel to the peduncle and that part of the lower lip below the palate is held horizontally. *Scales* infrequent, similar to bracts. *Bracts* ovate, attached at the base, 1–1.5 mm long, blunt at tip, occasionally pinkish tinged. *Bracteoles* subulate, ca. 0.5 mm long. *Pedicels* ca. (1–) 3–4 mm in flower, and erect; strongly deflexed and enlarged in fruit. *Calyx* lobes subequal, 2–3 mm long on flowering, the lower sometimes with a shortly bifid/emarginate apex; sometimes reddish tinged, markedly expanded in fruit with the margins forming a conspicuous, flattened rim around the fruit. *Corolla* usually yellow; 6–10(–12) mm long; very rarely whitish-yellow, upper lip erect, much smaller than lower lip, lower lip spreading horizontally to erect, both occasionally with red markings, palate prominent, often deeper yellow; spur 3–4(–7) mm long, downward facing, straight to slightly curved, long-pointed. *Seeds* ovoid, often with one end clearly truncated, ca. 0.5 mm long.

Thailand.— NORTHERN: Mae Hong Son [Khun Yuam (Khun Yaem), 5 Sept. 1978, *Larsen & Larsen* 34143 (AAU, BKF, K)]; Chiang Mai [Bo Luang, 13 June 1973, *Geesink, Phanichapol & Santisuk* 5914 (BKF, L); Bo Luang (Ob Luang), W. of, 30 Jan. 1964, *Hansen, Seidenfaden, & Smitinand* 11006A (C); Bo Luang, km 35 from Bo Luang between Bo Luang–Om Koi, 8 March 1982, *Wongprasert* 62 (BKF); Doi Suthep, 31 March 1909, *Kerr* 569 (BM, K, L, P, TCD); Doi Suthep, 14 April 1958, *Sørensen, Larsen & Hansen* 2698 (C); Doi Suthep, 26 July 1958, *Sørensen, Larsen & Hansen* 4452 (C); Doi Suthep, 17 Sept. 1958, *Sørensen, Larsen & Hansen* 5084 (C); Doi Suthep, 18 Sept. 1958, *Sørensen, Larsen & Hansen* 5121 (C); Doi Suthep, 28 Sept. 1958, *Sørensen, Larsen & Hansen* 5317 (C); Doi Suthep, where brook by locality 1 crosses the rock, 30 Sept. 1958, *Sørensen, Larsen & Hansen* 5364 (C, K)]; [Chiang Mai, 12 Nov. 1960, *Umpai* 2354 (BK); Mae Sanam, pine improvement centre, 22 Feb 1979, *Koyama, Phengkklai, Niyondham, Tamura, Okada & O'Connor* 15490 (BKF 2 sheets); Om Koi, 20 Jan. 1964, *Hansen, Seidenfaden & Smitinand* 10845 (BKF, C); Omkoi (Om Koi), 20 Jan. 1964, *Hansen, Seidenfaden & Smitinand* 31182 (BK); 23 Dec. 1978, *Niyondham, Suangtho & Sangkhachand* 105 (AAU, BKF, K)]; Uttaradit [Phu Soi Dao (Doi), 28 Oct. 1998, *Parnell* 98/36 (TCD)]; Phitsanulok [Thung (Tuang) Salaeng Luang, 21 July 1966, *Larsen, Smitinand & Warncke* 682 (AAU)]; NORTH-EASTERN: Loei [Phu (Kao) Kradueng, 12 Feb. 1931, *Kerr* 20116 (BK); Phu Kradueng, 19 Aug. 1950, *Benpheng* 326 (BK, BKF, K); Phu Kradueng, 7 Aug. 1952, *Benpheng* 584 (BKF, K 2 sheets); Phu Kradueng, 1 Nov. 1954, *Smitinand* 2072 (AAU, BKF, K); Phu Kradueng, 25 Nov. 1958, *Sørensen, Larsen & Hansen* 6240 (C); Phu Kradueng, 8 July 1959, *Sørensen, Larsen & Hansen* 7364 (C); Phu Kradueng, 11 Sept. 1962, *Smitinand & Sleumer* 4782 (L); Phu Kradueng, 8 Sept. 1969, *Pinnin et al.* 48 (BKF); Phu Kradueng, 18 Dec. 1982, *Koyama, Terao & Wongprasert* T-31269 (BKF); Phu Kradueng, 31 Oct. 1984, *Murata & Phengkklai* T-42188 (A, BKF); Phu Kradueng, 31 Oct. 1984, *Murata & Phengkklai* T-42188A (L); Phu Luang, 15 Nov. 1968, *Chermsirivathana* 1106 (BK); Phu Luang, 8 Aug. 1968, *KB* 1725 (BKF); Phu Luang National Park, trail around top, S. of Kok Nok Krabi Ranger Station, 26 Oct. 1998, *Parnell* 98/26 (TCD)]; Sakon Nakhon [Lad Krachan, Skol Nokorn, 23 Nov. 1962, *Adisai*

142 (BK); Phu Phan National Park, 14 Dec. 1982, *Koyama, Terao & Wongprasert* T-31017 (BKF); Phu Phan Palace, Nov. 1997, *Sahas* s.n. (BKF); Phu Phan Royal Palace, 12 Dec. 1997, *Santisuk & Wongprasert* s.n. (BKF); Mukdahan [Mukdahan city, near joint of route 2104 and 212, along route 2104, ca. 30 km N.N.W. of, 16 Nov. 1984, *Murata, Phengklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-51432 (BKF)]; Khon Kaen [Nai Mueang, Ban Notum, 22 Dec. 1964, *Chermsirivatathana* 216 (BK)]; EASTERN: Chaiyaphum [Thung Kra Mang (Tungkamang), 14 Dec. 1971, *van Beusekom, Phengklai, Geesink, Wongwan* 4259 (BKF, C, K, L, P)]; Nakhon Ratchasima [Khao Yai National Park, Wand Ta Kong, 21 Oct. 1969, *van Beusekom & Charoenpol* 1782 (AAU, BKF, C, E, K, L, P)]; Buri Ram [Buri Ram, 27 Nov. 1976, *Phengklai et al.* 3477 (BKF)]; Ubon Ratchathani [Khong Chiem, Soi (Sroi) Sawan Waterfall, 15 Oct. 1998, *Niyomdham* 5574 (BKF)]; Sirindhorn Dam, Phibun Mangaahan District, 9 Dec. 1982, *Koyama, Terao & Wongprasert* T-30648 (BKF); Kaeng Tana National Park, 15 Jan. 1999, *Wongprasert* s.n. (BKF); Phranin Fall, Khong Chiam (Khongchien) District, 25 Oct. 1998, *Wongprasert* s.n. (BKF)]; CENTRAL: Nakhon Nayok [Khao Lon?, 27 Sept. 1969, *Chermsirivatathana* 1551 (BK 2 sheets)]; Khao (Kao) Lom, 24 Nov. 1953, *Suvatabendham* 484 (BK); Khao Yai National Park, Mao Sing to reservoir area, 12 Aug. 2000, *Maxwell* 00-354 (BK)]; SOUTH-EASTERN: Sa Kaeo [Wattana (Watana) Nakhon; 14 Oct. 1928, *Put* 2174 (BK, BM)]; Chon Buri [Khao Kiao (Khieo), 19 Oct. 1975, *Maxwell* 75-1030 (BK, L)]; Chanthaburi [Chanthaburi (Chantabun) 1936, *Visterdal* 4C (SING); Chanthaburi (Chantabun) 1936, *Visterdal* 9D (SING); Chanthaburi, along highway 3 ca. 14 km E. of, 17 Oct. 1971, *Maxwell* 71-552 (AAU, BK); Makham, E. of, 18 Jan. 1958, *Sørensen, Larsen & Hansen* 447 (C, K); Makham forest station, 26 Aug. 1966, *Larsen, Smitinand & Warncke* 1838 (AAU, K); Ban Ang, 5 Aug. 1954, *Bunnak* 137 (BK, K); Pong Nam Ron–Pailin, 28 Aug. 1972, *Larsen, Larsen, Nielsen & Santisuk* 32181 (AAU, BKF, K, L, P)]; Trat [Ban Saphan Hin, 4 Aug. 1973, *Murata, Fukuoka & Phengklai* T-17682 (BKF); Ko Chang, Klong Nan Si, 27 Sept. 1924, *Kerr* 9204 (BK, BM); along highway 318 at km 31, Mueang District, 4 Aug. 1973, *Maxwell* 73-372 (AAU, BK); off highway 318 at km 31, Mueang District, 4 May 1974, *Maxwell* 74-362 (BKF); Taphan Hill (Taphan Hin), 3 Aug. 1973, *Geesink, & Phengklai* 6324 (AAU, BKF, C, E, K, L, P); along highway 3, ca. 18 km W. of, Kew Sah Miang District, 23 Oct. 1972, *Maxwell* 72-533 (AAU, BK)]; PENINSULAR: Surat Thani [Khao Nawng (Kaw Nanwg), 3 Aug. 1927, *Kerr* 13143 (BK, BM)]; Phangnga [Ko (Koh) Yao Yai, 20 Feb. 1966, *Hansen & Smitinand* 11798 (C, K)]; Trang [Ban Nah Doh Ming, Muang District, 22 Nov. 1986, *Maxwell* 86-975 (BKF, C, L); Khao Chong (Khao Chang), 23 Jan. 1975, *Maxwell* 75-806 (BK); Khao Chong (Khao Chang), 15 Aug. 1975, *Maxwell* 75-867 (BK); Thale (Thalac) Song Hong, 21 Jan. 1958, *Sørensen, Larsen & Hansen* 720 (C); Thung Khai Botanical Garden, Yan dta Khao District, 16 Dec. 1995, *Mauric* 38 (BKF); Thung Khai, 25 Oct. 1993, *Larsen, Larsen, Norgaard, Pharsen, Puudjaa & Uerchirakan* 43980 (AAU)]; Satun [Khao Nang Dam, 3 Sept. 1982, *Shimizu, Konta, Wongprasert & Sangkhachand* T-29035 (BKF); Satul, 26 Jan. 1928, *Kerr* 14267 (BK, BM)]; Songkhla [Songkhla, La Tang Si near (Singora), 22? 1916, *Annandale* 1688 (SING); Songkhla, S. of, 8 Oct. 1988, *Larsen & Larsen* 70308 (AAU); Songkhla (Singora), 1 Feb. 1916, *Annandale* s.n. (SING); Songkhla (Singora), 1916, *Annandale* s.n. (SING); Songkhla, 7 April 1928, *Kerr* 15090 (BM)]; Narathiwat [Ko (Ku) Chum, Tak Bai, 14 Sept. 1987, *Niyomdham & Sriboonma* 1587 (AAU, BKF, C, E, K, L, P)]; UNLOCALISED: 19 Nov. 1968, *Chermsirivatathana* 1169 (BK); 24 Feb. 1961, *Chermsirivatathana* 174 (BK); Nam Rah Village, Tong Ngui subdistrict, 19 Aug. 1984, *Maxwell* 84-94 (A, BKF); Kao E To, 26 Dec. 1966, *S. & I.* 2010, (BK); 1899/1900, *Schmidt* 443 (C 2 sheets).

Distribution.— India to Japan and Australia.

Ecology.— Wet, marshy often sandy and often acidic ground, occasionally on wet rocks, rarely in shallow water; most frequently recorded from elevations between 300 and 600 m but ranging from (0–)200–1,300 m. Flowering and fruiting mainly between August and January.

Vernacular.— Soi suwanna (สร้อยสุพรรณิภา) (North-Eastern).

Notes.— Possibly the second commonest, certainly the commonest yellow-flowered terrestrial *Utricularia* species in Thailand. Maxwell (1985) treated *U. bosminifera*, which is endemic to Ko Chang and Ko Kut, as a variety of *U. bifida*, a view that Taylor (1989) disagreed with. I have decided to follow Taylor's treatment herein and give, below, my rationale for doing so.

When comparing *U. bifida* and *U. bosminifera* Taylor noted that 'the seeds are very similar the calyx is of quite a different shape, the pedicels up to three times as long as the calyx in fruit (much shorter than the fruit in *U. bifida*), both lips of the corolla are different, the leaves much wider and multinerved and the traps are sessile'. In addition, Maxwell (1985) noted that leaves are present at flowering in *U. bosminifera* and not in *U. bifida*. The type of *U. bosminifera* (C) exhibits all of the character states attributed to it and therefore the differences noted above are accurate. However, some material appears intermediate between these species; notably, *Charoenphol, Larsen, & Warncke* 5100 (AAU & BKF, K, L, P). This collection from the island of Ko Kut, which is adjacent to Ko Chang, has many of the characters of *U. bosminifera* - leaves present at flowering, large flowers with longer pedicels (up to 7 mm long in flower) and more acute calyx lobes (especially the upper), ovoid, non-truncate seeds and, in the specimen in P, traps which are clearly sessile. However, the leaves are uninerved, the stems are robust and upright and not, as is usual, weakly straggling and the pedicels relatively short—all characteristics of *U. bifida*. But, *Geesink & Phengklae* 6288 in L which is clearly *U. bosminifera* also has more robust, upright stems. Therefore, *Charoenphol, Larsen, & Warncke* 5100 differs from *U. bosminifera* only in its uniformly single nerved leaves and on that basis I have included it in that species and amended the description accordingly. In addition, some material of *U. bifida* has long pedicels and large flowers and is reminiscent of *U. bosminifera* (e.g. *Santisuk & Wongprasert* s.n. from Phu Phan, Sakon Nakhon in BKF). However, I do not believe that the presence of rare intermediates is frequent enough to justify Maxwell's merging of the two species. The material from Ko Kut requires further investigation.

The province for *Maxwell* 86-975 (BKF, C, L) is extrapolated from the database cited in Parnell et al. (2003).

3. *Utricularia bosminifera* Osten., Feddes Repert. 2: 68. 1906; Osten., Fl. Koh Chang 9: 334. 1909; Craib, Bull. Misc. Inform. Kew 1911. 429. 1911; Craib, Contr. Fl. Siam 147. 1912; Pellegr. in Lecomte, Fl. Indo-Chine 4: 474. 1930; P. Taylor, Kew Bull. Addit. Ser. 14: 317. 1989.— *U. bifida* L. var *bosminifera* (Osten.) Maxwell, Songklanakarin J. Sci. Tech. 7: 412. 1985. Type: Thailand, Ko Chang, *Schmidt* 704a (lectotype C!; isolectotype K!).

Usually terrestrial. *Stolons* infrequent, filiform. *Rhizoides* filiform, branched. *Floats* absent. *Leaves* rosulate, shortly petiolate, laminar to oblong to spatulate, 2–5 cm long, 3–

5-nerved (1-nerved on Kho Kut), present and conspicuous on flowering. *Auricles* absent. *Traps* usually few, reniform, 0.5–1 mm long; mouth basal, with 2 very fragile appendages (often absent due to damage in dried specimens). *Internal hairs* 2-armed (1-armed, not seen). *Inflorescence* erect, but sometimes straggling and weak, solitary, (8–)15(–30) cm long; peduncle hairless; usually 3–7(–10)-flowered; flowers widely spaced, and, when young, often held such that mouth of the flower is upright; the mouth of the flower widely gaping. *Scales* infrequent, similar to bracts. *Bracts* ovate, attached at the base, 1.5–2 mm long, acute to acuminate. *Bracteoles* subulate, ca. 0.5 mm long. *Pedicels* ca. 7–15 mm in flower, and erect; deflexed and enlarged in fruit. *Calyx* lobes unequal, the lower smaller, ca. 2.5–3.5 mm long on flowering, sometimes with a shortly bifid/emarginate apex, the upper ca. 4 mm on flowering, acute or apiculate; markedly expanded in fruit with the margins forming a conspicuous, flattened rim around the fruit. *Corolla* yellow; 7–10(–15) mm long; upper lip erect, smaller than lower lip, lower lip spreading horizontally to erect, palate prominent, often deeper yellow; spur 5–6 mm long, downward facing, slightly curved, long-pointed, slightly scented. *Seeds* ovoid, often with one end clearly truncated, ca. 0.5 mm long.

Thailand.— SOUTH-EASTERN: Trat [Ko Chang, Khlong Kai Bae, 4 May 1955, *Sangkhachand* 436 (BKF, K); Ko Chang, Klong Inagom, 2 April 1923, *Kerr* 6828 (ABD, BM, K, P); Chang Island, Klong Mayom, 9 May 1974, *Maxwell* 74-435 (BK); Chang Island, Klong Mayom, 22 Oct. 1972, *Maxwell* 72-508 (AAU, BK, BKF, K); Ko Chang, Klong Mayom, 2 April 1923, *Kerr* 6828 (BK); Ko Chang Islands National Park, Klong Phlu Fall, 29 March 2000, *Wongprasert* s.n. (BKF); Ko Chang, South side, 17 Nov. 1970, *Charoenphol, Larsen & Warncke* 4974 (AAU, BKF, K, L); Ko Chang, South side, 18 Nov. 1970, *Charoenphol, Larsen & Warncke* 5005 (AAU); Ko Chang, 8 March 1900, *Schmidt* 704a (K); Ko Chang, 2 April 1923, *Marcant* 1235 (ABD, BM); Ko Chang, 3 Aug. 1973, *Geesink & Phengklai* 6288 (BKF, L); Ko Chang, 4 Sept. 1992, *Niyomdham* 3222 (BKF); Ko Chang, 8 May 1900, *No collector* 7079 (C); 18 JAN. 1900, *No collector* s.n. (C); Ko Kut, SW, 21 Nov. 1970, *Charoenphol, Larsen & Warncke* 5100 (AAU, BKF, K, L, P)]; UNLOCALISED: 1899/1900, *Schmidt* 61 (C); 1899/1900, *Schmidt* 679b (C); 1899/1900, *Schmidt* 704a (C); 19 Sept. 1974, *Umpai* 519 (BK); 5 Jan. 1900, no collector s.n. (C).

Distribution.— Endemic.

Ecology.— Sandy banks, wet rocks and paddy fields; 0–150 m. Flowering and fruiting mainly between March and May and September to November.

Notes.— For discussion of the distinction between this and *U. bifida* see the notes under that latter species. Not previously recorded from Ko Kut.

4. *Utricularia caerulea* L., Sp. Pl. ed. 1. 1: 18. 1753; A.DC. in DC., Prodr. 8: 19. 1844; Wight, Icon. Pl. Ind. Or. 4: t. 1583. 1850; P. Taylor, Dansk Bot. Ark. 23: 530. 1968; in Fl. Males. ser. I, 8: 287. 1977; Rani & Matthew in Matthew, Fl. Tamilnadu Carnatic 2: 1112. 1983; Maxwell, Songklanakarin J. Sci. Tech. 7: 414. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 187. 1989; in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 180. 1995; Hô, CÂYCO VIỆT NAM 3: 109 (as *U. coerulea*). 1993; Noltie in Grierson & Long, Fl. Bhutan 2: 179. 2001; Maxwell & Elliot, Veg. & Vasc. Fl. Doi Suthep - Doi Pui Nat. Park, Northern Thailand 106. 2001. Type: Ceylon, *Hermann* s.n. (holotype BM, not seen).— *Utricularia nivea* Vahl, Enum 1: 203. 1804; Wall.

in Roxb., Fl. Ind. 1: 144. 1820; Back. & Bakh.f., Fl. Java 2: 518. 1965; Trimen, Handb. Fl. Ceylon 3: 268. 1895. Type: Ceylon, *Koenig* s.n. (holotype C, not seen).— *Utricularia rosea* Edgw., Proc. Linn. Soc. 1: 352. 1847; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 331. 1885; Pellegr. in Lecomte, Fl. Indo-Chine 4: 485. 1930. Type: W. Bengal, *Edgeworth* s.n. (not located).— *Utricularia kerrii* Craib, Bull. Misc. Inform. Kew 1911. 429. 1911; Craib, Contr. Fl. Siam 147. 1912; Pellegr. in Lecomte, Fl. Indo-Chine 4: 485. 1930. Type: Thailand, Chaing Mai, Doi Suthep, *Kerr* 793 (holotype K!; isotypes BM!, C!, TCD!).— *Utricularia sootepensis* Craib, Kew Bull. 1911. 430. 1911; Craib, Contr. Fl. Siam 148. 1912; Pellegr. in Lecomte, Fl. Indo-Chine 4: 487. 1930. Type: Thailand, Chiang Mai, Doi Suthep, *Kerr* 918 (holotype K!; isotype TCD!).— *Utricularia ophirensis* Ridl., J. Bot. 33: 10. 1895; Ridl., Fl. Malay Penins. 2. 495. 1923; Pellegr. in Lecomte, Fl. Indo-Chine 4: 487. 1930. Type: Peninsular Malaysia, *Ridley* 10091 (holotype K!; isotype SING, not seen).

Terrestrial. *Stolons* infrequent, filiform. *Rhizoides* infrequent filiform, branched. *Floats* absent. *Leaves* rosulate or solitary, obscurely petiolate, laminar to oblong-spathulate, (0.4–)1 cm long, 1-nerved, usually absent at flowering. *Auricles* absent. *Traps* usually few, 0.5–1.5 mm long; mouth appearing almost apical, the rim with minute projecting glands, with, in larger traps, a projecting beak-like appendage, which may be substantial. *Internal hairs* 2-armed only; 4-armed hairs not seen. *Inflorescence* erect, solitary, (8–)15–22(–37) cm long; peduncle hairless and wiry; usually 7–20-flowered; flowers widely spaced, if present low down but always crowded near the apex, and often held such that mouth of the flower is horizontal. *Scales* frequent, similar to bracts. *Bracts* attached \pm in the middle, 2–4 mm long, both ends free and acute, often minutely papillate. *Bracteoles* similar, falsely appearing to be attached at the base (in reality attached above the base), ca. 0.5 mm long, the upper portion as long as the upper portion of the bract, acute, the lower portion very short often minutely papillate. *Pedicels* ca. 1 mm in flower, and erect; spreading to deflexed in fruit, often minutely papillate. *Calyx* lobes somewhat unequal, ca. 1.5–3 mm long on flowering, strongly convex, especially in fruit, acute or apiculate; clearly, but minutely, papillate, the papillae especially evident in fruit, when the calyx forms a cup enclosing the fruit. *Corolla* usually blue or white, occasionally lilac, pink or, very rarely, yellowish, occasionally with yellow or blue guidelines; 4–10 mm long; upper lip erect very much smaller than lower lip, lower lip spreading horizontally to erect, palate prominent, yellow, white or orange; spur 4–6 mm long, subparallel to the lower lip, curved, long-pointed, sometimes minutely papillose. *Seeds* ovoid, smooth to papillose, ca. < 0.3 mm long.

Thailand.— NORTHERN: Mae Hong Son [Khun Yuam, 5 Sept. 1974, *Larsen & Larsen* 34144 (AAU)]; Chiang Mai [Bo Luang, Plakan (tableland), 20 Sept. 1958, *Sørensen, Larsen & Hansen* 5249 (C); Bo Luang, 26 Feb. 1959, *Sørensen, Larsen & Hansen* 7039 (C); Bo Luang tableland, 14 Dec. 1969, *van Beusekom & Phengkklai* 2509 (AAU, BKF, C, E, K, L, P); Doi Suthep, 31 March 1909, *Kerr* 570 (BM, K, TCD); Doi Suthep, 5 Sept. 1909, *Kerr* 793 (BM, TCD); Doi Suthep, 2 Jan. 1910, *Kerr* 918 (BM, C, K, TCD); Doi Suthep, 19 Nov. 1912, *Kerr* 2661 (BM, K); Doi Suthep, 24 Oct. 1914, *Kerr* s.n. (BM 2 sheets); Doi Suthep, 1958, *Sørensen, Larsen & Hansen* 5160 (C); Doi Suthep, 20 Sept. 1958, *Sørensen, Larsen & Hansen* 5421 (C); Doi Suthep, 28 Sept. 1958, *Sørensen, Larsen & Hansen* 5316 (C); Doi Suthep, 2 Oct. 1958, *Sørensen, Larsen & Hansen* 5425 (C); Ban Pong Noi, Amphoe San Pa Tong, 10 Jan. 1986, *Paisuksantivatana* Y 1741-86 (BK); Chiang Mai, Doi Inthanon (Doi Angka), Mae Wang drainage, 27 Sept. 1910, *Garrett* 55 (ABD, C, K 2 sheets, L, P, TCD);

path, Doi Inthanon (Doi Angka), Me Sa Pauh to ridge of about N.E. by N. of the Pah Ageam, 27 Sept. 1910, *Garrett* 58 (BM); Om Koi, 20 Jan. 1964, *Hansen, Seidenfaden & Smitinand* 10844 (BKF, C 2 sheets); Omkoi, 23 Dec. 1978, *Niyomdham, Suangtho, & Sangkhachand*, B106 (AAU, BKF 2 sheets); Uttaradit [Phu Soi Dao (Phu Soi Doi), 28 Oct. 1998, *Parnell* 98/37 (TCD)]; NORTH-EASTERN: Loei [Phu Kradueng, 5 Nov. 1947, *Benpheng* 3151 (K); Phu Kradueng, 1 Sept. 1950, *Benpheng* 337B (BK); Phu Kradueng, 1 Sept. 1950, *Benpheng* 3151 (K); Phu Kradueng, 4 Nov. 1952, *Benpheng* 620 (AAU, BK, BKF); Phu Kradueng, 17 Nov. 1949 *Benpheng* 292d (BKF, K); Phu Kradueng, top area of, *Koyama, Terao & Wongprasert* 29 Oct. 1954, T-31234 (BKF); Phu Kradueng, 29 Oct. 1954, *Smitinand* 2057 (AAU, BK, BKF, K); Phu Kradueng, 1 Nov. 1954, *Smitinand* 2070 (BKF); Phu Kradueng, 1 Nov. 1954, *Smitinand* 2071A (BK); Phu Kradueng, 19 March 1958, *Sørensen, Larsen & Hansen* 2250 (C); Phu (Poo) Kradueng, 24 Nov. 1958, *Sørensen, Larsen & Hansen* 6151 (K); Phu (Poo) Kradueng, 26 Nov. 1958, *Sørensen, Larsen & Hansen* 6243 (C); Phu Kradueng, 14 Dec. 1963, *Umpai* 129 (BK); Phu Kradueng, 7–9 Nov. 1970, *Charoenphol, Larsen & Warncke* 4692 (AAU, BKF, L); Phu Kradueng, 31 Oct. 1984, *Murata & Phengklai* T-42171 (A, BKF, L); Phu Luang, 15 Nov. 1968, *Chermsirivathana* 1105 (BK); Phu Luang National Park, trail around top, S. of Kok Nok Krabi Ranger Station, 26 Oct. 1998, *Parnell* 98/25 (TCD); Phu Luang National Park, trail around top, South of Kok Nok Krabi Ranger Station, 26 Oct. 1998, *Parnell* 98/27 (TCD); Phu Ruea, *Umpai* 306 (BK); Phu Ruea National Park, 4 Dec. 2004, *Sawai & Fennelly* s.n. (TCD)]; Sakhon Nakhon [Phu Phan National Park, 15 Nov. 1984, *Mitsuta, Yahara, Nagamasu & Nantasan* T-50412 (BKF); Phu Phan Royal Palace, 12 Dec. 1997, *Santisuk & Wongprasert* s.n. (BKF)]; Mukdahan [Phu in Toeb, 17 Nov. 1984, *Murata, Phengklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50836 (BKF)]; EASTERN: Chaiyaphum [Thung Kra Mang (Tungkamang), 19 Dec. 1971, *van Beusekom, Phengklai, Geesink, Wongwan* 4258 (BKF, L)]; Nakhon Ratchasima [Kao Yai, Sawat Falls, Feb. 1966, *Chermsirivathana* 617 (BK)]; Ubon Ratchathani [Phranin Falls, Khongchien District, 25 Oct. 1998, *Wongprasert* s.n. (BKF); Soi (Sroi) Sawan Waterfall, Khong Chiem, 19 Oct. 1998, *Niyomdham* 5572 (BKF); Soi (Sroi) Sawan Waterfall, Khong Chiem, 19 Oct. 1998, *Niyomdham* 5573 (BKF)]; SOUTH-WESTERN: Kanchanaburi [Kanchanaburi, 3 Aug. 1927, *Kerr* 13146 (BK, BM)]; Thong Pha Phum, Kwai River Valley, 21 Dec. 1984, *Dransfield* 6217 (K)]; CENTRAL: Saraburi [Sahm Lahn Forest, Muang District, 9 Oct. 1973, *Maxwell* 73-441 (AAU, BK)]; Sam Lan Forest, Muang District, 7 Sept. 1974, *Maxwell* 74-890 (BK)]; SOUTH-EASTERN: Sa Kao [Aranyaprathet (Aran Pratet), 8 Aug. 1930, *Kerr* 19570 (BK, BM)]; Prachin Buri [Ban Ang; Ban Keng, Krabin, 10 Nov. 1930, *Marcan* 2570 (ABD, BM, K)]; Chon Buri [Khao Kieo (Khieo), 15 Nov. 1975, *Maxwell* 75-1070 (L)]; Chanthaburi [Ban Ang (Aeng), Makhham District, 21 Aug. 1954, *Bunnak* 190 (BK, BKF, K); Chanthaburi (Chathaboon), 1936, *Visterdal* 7-S (SING); Chanthaburi, ca. 14 km E. of, 17 Oct. 1971, *Maxwell* 71-570 (AAU, BK); Chanthaburi, along highway 3; ca. 14 km E. of, 17 Oct. 1971, *Maxwell* 71-537 (BK); Makhham Forest Station, 26 Aug. 1966, *Larsen, Smitinand & Warncke* 1840 (AAU, K)]; Trat [Khao (Kao) Saming, 27 Nov. 1924, *Kerr* 9438 (A, ABD, BK, BM 2 sheets, SING); Khlong Yai, 18 km N. of, 2 Sept. 1972, *Larsen, Larsen, Nielsen & Santisuk* 32342 (AAU, BKF, K, L, P); *Larsen, Larsen, Nielsen & Santisuk* 32358 (AAU); Ko Chang, Klawni, Man Si, 27 Sept. 1924, *Kerr* 9202 (BK, BM); Taphan Hin, 3 Aug. 1973, *Geesink & Phengklai* 6326 (BKF, L)]; PENINSULAR: Ranong, Nov. 1974, *Geesink* 7550 (BK); Surat Thani [Surat, 6 Jan. 1927, *Kerr* 11291 (BK, BM); Khun Tale Lake, Krat, 13 Jan. 1935, *Seidenfaden* 2327 (C)]; Phangnga [Ko Yao Yai, 20 Feb. 1966, *Hansen & Smitinand* 11799 (K); ?Kao Kao (Koh Kaw Khao Island), 15 July 1972,

Larsen, Larsen, Neilsen & Santisuk 30990 (AAU); Nakhon Si Thammarat [Ta Samet, 28 Jan. 1928, *Kerr* 14291 (BK, BM)]; Trang [Ban Nah Doh Ming, Muang District, *Maxwell* 86-974 (BKF, C, L); Ban Nah Doh Ming, Muang District, *Maxwell* 86-976 (AAU, BK, C); Khao Chang, 15 Aug. 1975, *Maxwell* 75-868 (BK); Thung Khai, 25 Oct. 1993, *Larsen, Larsen, Norgaard, Pharsen, Puudjaa & Uerchirakan* 43979 (AAU); Thung Khai Botanical Garden, Yan dta Khao District, 16 Dec. 1995, *Mauric* 39 (BKF); Thung Khai Botanic Garden, Yan Ta Khao, 31 Jan. 2002, *Parnell, Chamayarit, Pooma, Simpson, Suddee & De Wilde* 2116 (TCD)]; Satun [Padang Besar (Besar), 24 Dec. 1927, *Kerr* 13599 (BK, BM, K); Satul, 26 Jan. 1928, *Kerr* 14266 (BK, BM)]; Songkhla [Dton Nga Chang, Rattapoom, 13 Aug. 1984, *Maxwell* 84-41 (A, BKF)]; [Songkhla (Singgora), 1 Feb. 1916, *Annandale* s.n. (SING)]; Songkhla (Singgora), 23 June 1916, *Annandale* s.n. (SING); Songkhla (Songkla), 23 March 1928, *Kerr* 15753 (BM); Songkhla, S. of, 8 Oct. 1988, *Larsen & Larsen* 70308 (AAU); *Larsen & Larsen* 70309 (AAU); Tow Pliew near Ton Nga Chang, West of Ton Nga Chang, 13 Oct. 1991, *Larsen, Larsen, Niyomdham, Ueachirakan & Sirirugsa* 42347 (AAU)]; Narathiwat [Paawai, Su Ngi Paadu, 11 Feb. 1988, *Niyomdham* 1674 (BKF)]; UNLOCALISED: 22 Oct 1972, *Maxwell* 72-507 (AAU, BK); 24 Nov. 1958, *Sørensen, Larsen & Hansen* 615b; no date, *Titley* s.n. (SING); ?Chantaboon, 1936, *Westerdal* 7 (SING).

Distribution.— Madagascar, India, Bangladesh, Burma, Sri Lanka, Nepal, Cambodia, Laos, Vietnam, China, Hong Kong, Korea, Japan, Sumatra, Borneo, Java, Phillipines, New Guinea, Australia.

Ecology.— In wet places, often amongst grass in a variety of habitats including ditches, marshes, swamp margins and savannah; 0–1600 m. Flowering and fruiting (August–) September–December (–February).

Vernacular.— Ya khem (หญ้าเข็ม).

Notes.— Taylor (1989) suggests that *U. caerulea* differs from *U. limosa* in its lack of papillose pedicels. However, *U. caerulea* is extremely variable and in a number of specimens, *Niyomdham, Suangtho, & Sangkhachand* 106 (AAU, BKF) for example, the pedicels are evidently papillose. Some of *Larsen, Larsen, Neilsen & Santisuk* 32342 (K, P) has a congested inflorescence, all have very large flowers with the corolla up to 1.3 cm long, but they appear to be merely an exceptionally large form of *U. caerulea*, (vide Taylor, in K). The locations of *Geesink* 7550 (BK), *Maxwell* 86-974 (BKF, C, L) and *Maxwell* 86-976 (AAU, BK, C) are extrapolated from the database cited in Parnell et al. (2003).

5. *Utricularia corynephora* P. Taylor, Kew Bull. Addit. Ser. 14: 489. 1989. Type: Burma, *Keenan, U Tun Aung & Rule* 1450 (holotype E!; isotype K!).

Terrestrial. *Stolons* common, filiform. *Rhizoides* frequent, filiform, wiry, branched, terminating in a minute papillose swelling. *Floats* absent. *Leaves* spatulate to narrowly obovate, 0.3–0.5 cm long, present at flowering, often pustulate, ± absent at fruiting. *Auricles* absent. *Traps* numerous, on stolons, ca. 1–2 mm long; mouth lateral, with two, long (almost as long as the body of the trap itself) unbranched appendages (considered by Taylor to be a single appendage which is divided to its base) each bearing multicellular glands at the base. *Internal hairs* 2-armed only. *Inflorescence* erect, solitary, 5–7(–10) cm long; peduncle hairless; usually 3–4(–6)-flowered; flowers widely spaced seemingly usually held such

that mouth of the flower is upright, elongating considerably at seed set. *Scales* absent. *Bracts* attached above the base, ovate, ca. 1.5 mm long, both ends free, apex obtuse, base erose. *Bracteoles* similar, but smaller. *Pedicels* 4–5 mm in flower and fruit, flattened, usually spreading. *Calyx* lobes unequal, the upper much larger ca. 2–3 mm long on flowering, circular; the lower circular or avate. *Corolla* largely blue to mauve with a deep yellow palate, surrounded by a paler yellow rim; 6–7 mm long; upper lip very small and parallel to spur, lower lip spreading, obscurely shallowly 5-lobed, palate not prominent; spur 3 mm long, downward pointing, weakly curved to straight, long-pointed, very much longer than lower calyx lobe. *Seeds* obovoid, the surface \pm entirely covered with small, short, club-shaped processes, ca. 0.2–0.3 mm long.

Thailand.— PENINSULAR: Ranong [Oom, *Mat* s.n. (SING); Ngao waterfall, 8 Dec 1979, *Shimizu, Toyokuni, Koyama, Yahara & Niyomdham* T-26569 (BKF)].

Distribution.— Burma.

Ecology.— Moist rock (on wet granite rock-face in Burma); 180 m.

Notes.— Only known from three collections; two from Thailand. One, probably both, of the Thai collections is from a much lower altitude than the collection from Burma (640–760 m) and one, probably both, are from considerably further South. *Shimizu, Toyokuni, Koyama, Yahara & Niyomdham* T-26569 (BKF) has absolutely no location data on the label. However, by using the database of collections (Parnell et al. 2003) I have been able to find a number of specimens collected by *Shimizu, Toyokuni, Koyama, Yahara & Niyomdham* with numbers exceeding and less than T-26569; in particular T-26561 which is a member of the Euphorbiaceae and was collected on the same day as T-26569. T-26561 was collected on Ngao Waterfall and so it appears a reasonable presumption that T-26569 was too. Habitat details for the Thai collections are sparse. The seeds are distinctive and allow instant separation from the much more common *U. striatula*. I have checked the seeds of all relevant collections from the peninsula between Kanchanaburi and Ranong (\pm across the entire latitudinal range for the species from the type which was found at Dawei (Tavoy) to Ranong) and all bar the two cited can be assigned to *U. striatula*. Therefore, *U. corynephora* appears very rare and its distribution discontinuous. Both *U. striatula* and *U. corynephora* occur at Ngao Waterfall. See discussion under *U. striatula* for distinctions between this species and other spatulate-leaved *Utricularia* species in Thailand. The above description is largely based on the Burmese type. The material from Oom is in fruit, bears no flowers, nor as far as I can tell leaves, and shows a densely clumped growth habit: the latter not being evident from the other collections. *U. corynephora*, *U. garrettii* and *U. striatula* all belong to section *Phyllaria* of Taylor (1986) and are all lithophytic or, in the case of *U. striatula*, sometimes epiphytic. This may be a useful distinguishing character in the field as few other Thai species (notably *U. bosminifera*) are lithophytic.

6. *Utricularia delphinioides* Thorel ex Pellegr., Bull. Mus. Paris 26: 180. 1920; Pellegr. in Lecomte, Fl. Indo-Chine 4: 476. 1930; P. Taylor, Dansk Bot. Ark. 23: 529. 1968; Maxwell, Songklanakarin J. Sci. Tech. 7: 415. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 365. 1989; Hô, Càyco Vietnam 3: 110. 1993. Type: Cambodia, *Harmand* 12 (holotype P!).

Terrestrial. *Stolons* infrequent, filiform. *Rhizoides* infrequent filiform, branched. *Floats*

absent. *Leaves* rosulate or solitary, obscurely petiolate, laminar to oblong-spathulate, 1–2.5 cm long, 1-nerved, usually absent at flowering. *Auricles* absent. *Traps* usually few at flowering, though sometimes numerous, mostly on leaves and stolons, 1–2 mm long; mouth lateral, with 2 long, very fragile appendages (often absent due to damage in dried specimens). *Internal hairs* 2-armed. *Inflorescence* erect, solitary, (3–)10–35(–53) cm long; peduncle hairless; usually 7–20-flowered; flowers widely spaced (or absent) low down and few, always crowded and numerous near the apex, usually held such that mouth of the flower is horizontal. *Scales* frequent, similar to bracts. *Bracts* attached at the base, ovate, 2.5–6 mm long. *Bracteoles* linear, ca. 2–3 mm long. *Pedicels* (1–)4–6(–12) mm in flower, and erect. *Calyx* lobes subequal, ca. 6–8 mm long on flowering; both acute or the lower sometimes emarginate. *Corolla* usually blue (amethyst to indigo and often somewhat metallic), blue-violet or purple; 4–10 mm long; upper lip erect, smaller than lower lip, lower lip spreading, metallic silvery deep blue on inner surface, horizontally to erect, palate prominent, sometimes hairy, sometimes with a white streak on either side; spur 4–6 mm long, downward pointing, slightly curved, long-pointed, usually very slightly longer than lower calyx lobe and parallel with it; pale to deep lilac. *Seeds* ovoid, smooth, ca. 0.3 mm long.

Two varieties may be recognised.

Plants on average 20 cm tall and never less than 9 cm tall; spur ca. 7 mm long and never less than 5 mm. Flowers crowded, at the top of the inflorescence and scattered flowers present lower down the peduncle

var. **delphinioides**

Plants on average 6 cm tall and never more than 12 cm tall; spur ca. 4 mm long and never more than 5.5 mm. Flowers crowded, at the top of the inflorescence. Phu Kradueng only.

var. **minor**

var. **delphinioides**

Thailand.— NORTHERN: Phitsanulok [Ban Tang, Phitsanulok, 17 Dec. 1905, *Hosseus* 711 (BM, E, M, K); Phu Hin Rongkla National Park, Lan Hin Pum, 2 Oct. 1990, *Chantaranothai*, Parnell & Simpson 90/530 (KKU, TCD)]; NORTH-EASTERN: Loei [Sakhon Nakhon [Phu Phan, 14 Oct. 1990, *Chantaranothai*, Parnell & Simpson 90/710 (KKU, TCD)]; Phu Phan, 14 Oct. 1990, *Chantaranothai*, Parnell & Simpson 90/711 (TCD)]; Phu Phan Royal Palace, 12 Dec. 1997, *Santisuk & Wongprasert* s.n. (BKF); Phu Phan Royal Palace, Nov. 1997, *Sohas* s.n. (BKF)]; Mukdahan [Mukdahan, 18 km S. of city, 17 Nov. 1984, *Murata*, *Phengkhilai*, *Mitsuta*, *Yahara*, *Nagamasu & Nantasan* T-50831 (A, AAU, BKF); Mukdahan, 18 km S. of city, 17 Nov. 1984, *Murata*, *Phengkhilai*, *Mitsuta*, *Yahara*, *Nagamasu & Nantasan* T-51436 (A, BKF); Lardkrachai, 23 Nov. 1962, *Adisai* 159 (BK)]; [Sakon (Sakol) Nakhon, 10 Dec. 1980, *Umpai* 576 (BK)]; EASTERN: Ubon Ratchathani [Phranin Fall, Khongchien District, 25 Oct. 1998, *Wongprasert et al* s.n. (BKF)]; [Soi (Sroi) Sawan Waterfall, Khong Chiem, 15 Oct. 1998, *Niyomdham* 5571 (BKF)]; CENTRAL: Bangkok [Krung Thep, 7 Nov. 1970, *Kasem* 1570 (BK); Krung Thep, 31 Oct. 1969, *Chermsirivathana* 1570 (BK)]; SOUTH-EASTERN: Chanthaburi [Amphoe Klung; 12 Nov. 1954, *Sangkhachand* 307 (BK, BKF, K; the BKF duplicate is labelled Ma Pai and not Amphoe Klung); Khao Soi Dao, foot of, 12 Nov. 1969, *van Beusekom & Smitinand* 2166 (AAU, BKF, E, P, L); Makham, 9 Dec. 1924, *Kerr* 9579 (BM); Makham, 9 Dec 1924, *Kerr* 95279 (BK); Makham, 22 June 1930 *Lakshanakara* 473 (ABD 3 sheets, BK, BM, K); Makham, 1958, *Sørensen, Larsen & Hansen* 7900 (C); Okphok Makham, 25 Oct. 1956, *Smitinand* 3606 (BK, BKF, K); Na Glom, 1 Dec. 1964, *Sakol*

287 (BK)]; Trat [Kao Kuap, 21 May 1930, *Put* 2921 (ABD, BK, BM, K, L); Kao Kuap, 22 July 1929, *Noe* 17682 (ABD, K, TCD; the TCD specimen is labelled as collected in December); Kao Kuap, 22 Dec. 1929, *Kerr* 17682 (BK, BM; this and the preceding specimen probably represent the same collection despite the different dates on the labels); Klong Yai district, Thai-Cambodian border off Highway 318 at km 65, 5 May 1974, *Maxwell* 74-367 (BK)]; UNLOCALISED: Khao E-to, Prachinburi, 7 Nov. 1960, *Chermsirivathana* s.n. (BK).

Distribution.— Laos, Cambodia and Vietnam.

Ecology.— In wet, usually open, places, often amongst grass or on rocks in a variety of habitats including paddy fields; 0–1300 m. Flowering and fruiting mainly from October through till December.

Vernacular.— Dusita (ดุสิตา), Ya khao kam noi (หญ้าขากำน้อย), Ya khem (หญ้าเข็ม).

Notes.— See discussion under var. *minor*.

var. **minor** Pellegr. in Lecomte, Fl. Indo-Chine 4: 477. 1930. Type: Cambodia, *Geoffray* 343 (holotype P!, drawing K!).

Thailand.— NORTH-EASTERN: Loei [Phu Kradueng, 16 Feb. 1952, *Bunpheng* 619 (AAU, BK, BKF, K); Phu Kradueng, 17 Nov. 1949, *Bunpheng* 292 μ (BKF); Phu Kradueng, 15 Jan. 1965, *Smitinand* 2056 (AAU, BK, BKF, K); Phu Kradueng, 7–9 Nov. 1970, *Charoenphol*, *Larsen & Warncke* 4790 (AAU, BKF, K, L); Phu Kradueng, 31 Oct. 1984, *Murata & Phengklai* T-42208, (A, BKF 2 sheets); Phu Kradueng, 2 & 3 Nov. 1984, *Murata*, *Phengklai*, *Mitsuta*, *Yahara*, *Nagamasu*, & *Nantasan* T-42792 (BKF); Phu Kradueng, 2 & 3 Nov. 1984, *Murata*, *Phengklai*, *Mitsuta*, *Yahara*, *Nagamasu* & *Nantasan* T-42825 (L); SOUTH-EASTERN: Trat [Kao Kuap, 5 Nov. 1947, *Bunpheng* 61 (K)].

Distribution.— Endemic.

Ecology.— In wet, usually open places, in pine forest and elsewhere; 1100–1300 m. Flowering and fruiting mainly from October–November.

Notes.— The very smallest Thai specimens, all collected from Phu Kradueng (e.g. *Charoenphol*, *Larsen & Warncke* 4790 (AAU, BKF, K, L); *Bunpheng* 292 μ (BKF); *Bunpheng* 619 (AAU, BK, BKF, K); *Murata & Phengklai* T-42208 (A, BKF); *Murata*, *Phengklai*, *Mitsuta*, *Yahara*, *Nagamasu* & *Nantasan* T-42825 (L); *Murata*, *Phengklai*, *Mitsuta*, *Yahara*, *Nagamasu*, & *Nantasan*, T-42792 (BKF)) and *Smitinand* 2056 (AAU, BK, BKF, K)) together with *Bunpheng* 61 (K) from Kao Kuap appear distinctive as they are uniformly small (on average 6 cm tall as compared with an average of 21 cm for other material measured), with corresponding exceptionally small flowers (average spur length 4 mm as compared with an average of 7 mm for other material measured) all of which are congregated at the top of the inflorescence.

Such small material corresponds with *Utricularia delphinooides* Thorel ex Pellegr. var. *minor* Pellegr. which is distinguished solely on the basis of its small size. However, neither Taylor (1989) nor Maxwell (1985) consider this variety as meriting recognition. Both Taylor (1989) and Maxwell (1985) state that *U. delphinooides* exhibits a continuous range in size from large to small: however, neither present any supporting data. Measurements of the height and corolla spur length of 293 specimens of *U. delphinooides* material in A,

AAU, ABD, BK, BKF, C, E, TCD showed that the range of height is indeed continuous but with two very distinct peaks, rather little overlap in size between dwarf material from Phu Kradueng and elsewhere, and some outliers (Fig. 1). An F-test showed that the dwarf material from Phu Kradueng is statistically significantly different in height from other material sampled ($F=534.33$; $P \leq 0.0001$; $df=291$), being much shorter. Spur length showed an even more marked separation between dwarf material from Phu Kradueng and elsewhere (Fig. 2). Another F-test showed that the dwarf material from Phu Kradueng is statistically significantly different in spur size from other material sampled ($F=73.5$; $P \leq 0.0001$; $df=33$), being much shorter. Spur length can be considered as a proxy for overall corolla size and, therefore, it is possible to state that the flowers of the dwarf material found on Phu Kradueng are substantially smaller than those found elsewhere. As the dwarf material also has a more condensed inflorescence with all flowers congregated at the top of the peduncle (none appearing lower down the peduncle) there does appear to be a stronger case for the recognition of *Utricularia delphinioides* Thorel ex Pellegr. var. *minor* Pellegr. than previously has been recognised and until contrary evidence appears I have decided to do so in this account.

The small specimens from Phu Kradueng are, in size, generally similar to *Utricularia polygaloides* Edgew. a taxon confined to India and Sri Lanka. *Utricularia polygaloides* is separable from *U. delphinioides* only on the basis of the less cuneate base to its calyx lobes, its less congested inflorescence and geographical separation (Taylor, 1989). Material of *U. polygaloides* identified as such by Taylor (e.g. *Wight* 2409 in K and *Jayasee* 26399 in K, both from Sri Lanka) does exhibit more broadly ovate calyx lobes and a somewhat more open inflorescence than *U. delphinioides*. In addition, in *U. polygaloides* the mouth of the trap appears to be somewhat more basally positioned than it is in *U. delphinioides* (Taylor, 1989). However, the aforementioned difference in the shape of the base of the calyx is very far from obvious. In addition, a number of collections (e.g. *Matthew* 26280 in K and *Cameron* s.n. in K) have congested inflorescences. Therefore, it appears that the differences between *U. polygaloides* and *U. delphinioides* can be relatively minor.

7. *Utricularia foveolata* Edgew., Proc. Linn. Soc. 1: 351. 1847; P. Taylor, Kew Bull. Addit. Ser. 14: 394. 1989. Type: N. Bengal, *Kurz* s.n. (neotype CAL, not seen).— *Utricularia baoulensis* A. Chev., Mém. Soc. Bot. Fr. 8: 186. 1912; Back. & Bakh.f., Fl. Java 2: 517. 1965; P. Taylor in Fl. Males. ser. I, 8: 284. 1977; Maxwell, Songklanakarin J. Sci. Tech. 7: 413. 1985. Type: Côte d'Ivoire, *Chevalier* 22247 (holotype P, not seen).— *Utricularia scandens* Oliver in J. Linn. Soc. Bot. 3: 181. 1859 non Benj. (1847); sensu C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 332. 1885; sensu Maxwell & Elliot, Veg. & Vasc. Fl. Doi Suthep - Doi Pui Nat. Park, Northern Thailand 106. 2001. Type: Madras, *Hooker* s.n. (holotype K, not seen).

Terrestrial. *Stolons* infrequent, filiform. *Rhizoids* infrequent filiform, branched. *Floats* absent. *Leaves* obscurely petiolate, laminar to weakly spatulate, 1–3 cm long, 1-nerved, usually absent at flowering. *Auricles* absent. *Traps* usually few, mostly on leaves and stolons, ca. 1 mm long; mouth basal, with 2 long, branched, glandular appendages. *Internal hairs* 2-armed. *Inflorescence* twining or rarely erect, solitary, 10–20 cm long; peduncle hairless; usually 4–8-flowered; flowers widely spaced, usually held such that mouth of the flower is near to the horizontal at anthesis, drooping in fruit. *Scales* infrequent, similar to bracts. *Bracts* attached at the base, ovate, ca. 1 mm long. *Bracteoles* linear, ca. ≤ 0.5 mm

long, hidden by bracts. *Pedicels* 2–4 mm in flower, and erect, later drooping. *Calyx* lobes subequal, ca. 3 mm long on flowering; both ovate and acute to subacute, effectively clasping and often largely enclosing the corolla. *Corolla* bluish-purple to blue; ca. 3 mm long; upper lip suberect, parallel and adjacent to the upper lip of the calyx, occasionally almost enclosed by it, lower lip reflexed in the middle so that in small flowers the limb lies parallel to the spur and lower calyx lobe, in larger flowers the limb exceeds the calyx, palate prominent, sometimes whitish; spur ca. 3 mm long, downward pointing, usually only marginally longer than lower calyx lobe and parallel with it. Fruits pendulous. *Seeds* ovoid, reportedly smooth when fresh, but with clear, long underlying longitudinal striae, very shiny, ca. 0.3 mm long.

Thailand.— NORTH-EASTERN: Khon Kaen [Ban Notoom, Nai Muang, 22 Dec. 1964, *Chermisrivathana* 216 (BK, K)].

Distribution.— Old World Tropics from West Africa to Australia, though not recorded for Laos, Cambodia, Vietnam or Burma.

Ecology.— In wet, usually open places, often amongst grass probably in a variety of habitats certainly including paddy fields; Altitude not recorded for Thailand. Flowering and fruiting mainly in December.

Notes.— Known from only one collection in Thailand and also apparently uncommon throughout its wide range. The unique combination of blue flowers, twining habit and pendulous fruits make this species easily identifiable.

8. *Utricularia garrettii* P. Taylor, Kew Bull. 41: 13. 1986; Kew Bull. Addit. Ser. 14: 487. 1989. Type: Thailand, Doi Angka, Pha Ngeam, north rock, c. 18° 37'N., 98° 28'W, *Garrett* 80 (holotype K!; isotype K!, 3 sheets).

Terrestrial. *Stolons* few to moderately common, filiform. *Rhizoides* infrequent filiform, branched. *Floats* absent. *Leaves* spatulate, 0.3–0.5 cm long, usually present at flowering. *Auricles* absent. *Traps* numerous, on stolons, ca. 1 mm long; mouth lateral, with a bifid appendage bearing minute glands. *Internal hairs* 4-armed only, forming a χ shape, no 1-armed hairs seen. *Inflorescence* erect, solitary or 2 or more together, 3–6 cm long; peduncle hairless; usually (1–)3–4-flowered; flowers widely spaced usually held such that mouth of the flower is upright. *Scales* absent. *Bracts* attached just above the base, lanceolate, 1 mm long, both ends free, apex and base acute. *Bracteoles* similar, but smaller. *Pedicels* 4–5 mm in flower, usually spreading. *Calyx* lobes unequal, the upper larger ca. 3–4 mm long on flowering, circular; the lower ovate and erose, papillose. *Corolla* largely blue to mauve with a yellow palate with a central greenish-white streak or blue with a greenish-white palate and yellow streak; 5–11(–20) mm long; upper lip parallel to spur, lower lip spreading, shallowly lobed, only the basal lobes ever prominent, palate prominent; spur 4–6(–10) mm long, downward pointing, weakly curved to straight, long-pointed, very much longer than lower calyx lobe. *Seeds* obovoid, with some of the surface at the thicker end with long processes which are blunt-ended, not glochidiate, approximately 0.02 mm thick at the base, ca. 0.3 mm long.

Thailand.— NORTHERN: Chiang Mai [Doi Inthanon (Doi Angka), Pha Ngeam N., 22 Oct. 1910 *Garrett* 80 (K 3 sheets); Doi Inthanon (Doi Angka), Pha Ngeam N., 22 Oct. 1910 *Garrett* 84 (BM)].

Distribution.— Endemic.

Ecology.— On steep rocks in open wet situations; 2170–2180 m.

Notes.— Only known from two collections from Doi Angka (= Doi Inthanon) both collected by Garrett on the same day of October. Material from close to the type locality (*Larsen, Larsen, Tange & Sookchaloem* 46540 in AAU) has weakly glochidiate seeds and a small spur to the corolla and is, therefore, referable to *U. striatula*. Other material from nearby (*Chantaranothai, Parnell, Simpson & Pooma* 90/621 in TCD) has a mixture of characters of *U. striatula* and *U. garrettii*. For example, some of its seeds have blunt-ended non-glochidiate processes but these processes are only 0.01 mm thick, one flower has a spur 4 mm long but the lower lip of the corolla is deeply lobed and relatively small (much of the type collection in K is exceptionally large flowered). Taylor (1989) expresses surprise that there is only a single collection of *U. garrettii*. However, I am less surprised, given the large size of Doi Inthanon and the relative paucity of collections (4) of *U. striatula* from it. Examination of a single trap from the type specimen showed that the internal hairs in the traps were all 4-armed. Whether the 1-armed hairs present in section *Phyllaria* (Taylor, 1989) are indeed rare, or possibly absent, in this species in the section requires further study. See under *U. striatula* for discussion of the distinctions between this species and other spatulate-leaved *Utricularia* species in Thailand.

9. *Utricularia geoffrayi* Pellegr., Bull. Mus. Paris 26: 181. 1920; Pellegr. in Lecomte, Fl. Gén. I.-C. 4: 481. 1930; P. Taylor, Dansk Bot. Ark. 23: 529. 1968; Maxwell, Songklanakarin J. Sci. Tech. 7: 416. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 177. 1989. Type: Cambodia, *Geoffray* 432 (lectotype P!; isolectotype K!).

Terrestrial. *Stolons* infrequent, filiform. *Rhizoides* numerous filiform, unbranched. *Floats* absent. *Leaves* long petiolate and narrowly obovate, almost linear, 1–1.5 cm long. *Auricles* absent. *Traps* usually few, mostly on leaves and rhizoids, ca. 0.4 mm long; mouth lateral, with 2 rows of glandular hairs near the stalk and a single appendage on the opposite side of the mouth. *Internal hairs* 2-armed. *Inflorescence* erect, solitary, (3–)10–15(–28) cm long; peduncle hairless, thin, fragile and sometimes somewhat zig-zag near apex; usually 3–7(–15)-flowered; flowers widely spaced, usually held such that mouth of the flower is horizontal. *Scales* frequent, similar to bracts. *Bracts* attached at the base, narrowly ovate, 1–3 mm long, sometimes almost acuminate. *Bracteoles* similar, but usually smaller. *Pedicels* <1 mm in flower. *Calyx* lobes subequal, ca. 1.7–3 mm long on flowering; either obtuse or acute, the lower sometimes emarginate or trifid; both with 5–7 prominent nerves. *Corolla* usually blue or purple, rarely white; 4–6 mm long; upper lip subparallel to lower lip, ± horizontal, and much smaller, palate sometimes yellow; spur ca. 3 mm long, subparallel to lower lip. *Seeds* ovoid, smooth, ca. 0.2 mm long.

Thailand.— NORTH-EASTERN: Loei [Phu Kradueng, 1 Sept. 1950, *Bunpheng* 8325/337 (BK, K 2 sheets); Phu Kradueng, 1 Nov. 1954, *Smitinand* 2071 (AAU, BK, BKF, K 2 sheets); Phu Kradueng, 26 Nov. 1958, *Sørensen, Larsen & Hansen* 6241 (C); Phu Kradueng, 7 Nov. 1970, *Charoenphol, Larsen & Warncke* 4787 (AAU, K); Phu Kradueng, 31 Oct. 1984, *Murata & Phengklai* T-42172 (A, BKF, L); Phu Rua, 12 Dec. 1966, *Umpai* 305A (BK)]; Sakhon Nakhon [Phu Phan National Park, S.W. of Sakon Nakhon city, 14 Nov. 1984, *Murata*,

Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan T-50522 (BKF); Phu Phan National Park, S.W. of Sakon Nakhon city, 14 Nov. 1984, *Murata, Phengkhlai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50883 (BKF); Phu Phan National Park, 30 km S.W. of Sakon Nakhon city, 15 Nov. 1984, *Mitsuta, Yahara, Nagamasu & Nantasan* T-50319 (BKF); Phu Phan National Park, trail to Laan Sao, 19 Oct. 1990, *Chantaranothai & Parnell* 90/797 (KKU, TCD); Phu Phan National Park, trail N. of Centre, 20 Oct. 1988, *Parnell* 98/1 (TCD); Phu Phan Palace, 14 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50877 (BKF); Sakon Nakhon, 10 Dec. 1980, Umpai 615 (BKF); Mukdahan [Mukdahan city, 18km South of, 17 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50822 (BKF); Mukdahan city, 18 km S. of, 17 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50822 (A, BKF)]; EASTERN: Nakhon Ratchasima [Chan Tuk (Chua Tuk), 18 Dec. 1923, *Kerr* 8056 (BK, K)]; SOUTH-EASTERN: Prachin Buri [Prachantakam (Prajantakorm), 28 Dec. 1966, *Sakol* 2048 (BK); Chon Buri [Khao Khiao, n.v.; Nong Klang doang near Sri Racha, 7 Dec. 1930, *Collins* 2248 (ABD, K)]; Chanthaburi [Ban Phluang (Bam Pluang), 24 Nov. 1930, *Lakshanakara* 527 (BK, K); Pong Nam Ron (Lom), Na Glom, 1 Dec. 1964, *Sakol* 284 (BK)]; Trat [Dan Chumphon (Ban Dan Chumpol), 9 Dec. 1929, *Kerr* 17617 (BK); Kao Saming, 26 Nov. 1924, *Kerr* 9425 (BK)]. UNLOCALISED: River mouth of Ubon, *Thorel* s.n. 1866–1868 (P).

Distribution.— Laos, Cambodia and Vietnam.

Ecology.— In wet places, often on sandy soil, occasionally on rocks, in paddy fields and in wet places in dry Dipterocarp and evergreen forests; 20–1,400 m. Flowering and fruiting mainly from September through till December, but mainly in November and December.

Notes.— All material of this species seen from the adjacent undercollected (see Parnell et al., 2003) provinces of Sakhon Nakhon (NE21) & Mukdahan (NE23) corresponds to the type from Cambodia and appears distinctive from most material collected from the rest of its range in Thailand. Specimens from various localities, notably Phu Kradueng, differ in that: the inflorescences are less than, sometimes much less than, 10 cm in length (normally much more in the type variety); there are often many fewer flowers in an inflorescence (ca. 3–6) than in the type (though Taylor (1989) suggests the normal number to be between 3 and 6); the spur is much shorter than in type material (wherein it is usually ca. 5 mm long) and forms a smaller proportion of the length of the flower as the flowers are about the same size. Initially, I thought that such material might be separable as a distinct variety. However, the presence of intermediates (e.g. *Collins* 2248 in BM) dissuaded me.

10. *Utricularia gibba* L., Sp. Pl. 18. 1753; P. Taylor, Dansk Bot. Ark. 23: 529. 1968; Kew Bull. Addit. Ser. 14: 572. 1989; in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 195. 1995; Noltie in Grierson & Long, Fl. Bhutan 2: 179. 2001. Type: USA, Virginia, *Clayton* s.n. (holotype BM, not seen).— *Utricularia exoleta* R.Br., Prodr. Nov. Holl. 430. 1810; A.DC. in DC., Prodr. 8: 7. 1844; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 329–330. 1885; Trimen, Handb. Fl. Ceylon 3: 268. 1895; Craib, Bull. Misc. Inform. Kew 1911. 429. 1911; Craib, Contr. Fl. Siam 147. 1912; Pellegr. in Lecomte, Fl. Indo-Chine 4: 473. 1930; Ridl., Fl. Malay Penins. 2. 491. 1923; P. Taylor in Fl. Males. ser. I, 8: 294. 1977; Rani & Matthew in Matthew, Fl. Tamilnadu Carnatic 2: 1114. 1983; Maxwell, Songklanakarin J. Sci. Tech. 7: 416. 1985; Maxwell & Elliot, Veg. &

Vasc. Fl. Doi Suthep - Doi Pui Nat. Park, Northern Thailand 106. 2001.— *Utricularia gibba* L. subsp. *exoleta* (R.Br.) P. Taylor Mitt. Bot. Staatss. Muchen 4: 98. 1961; Back. & Bakh.f., Fl. Java 2: 517. 1965; Hô, Câyco Vietnam 3: 113. 1993. Type: Australia, New South Wales, *Brown* s.n. (holotype BM, not seen).— *Utricularia diantha* Roxb. ex Roem. & Schult., Mant. 1: 169. 1822; Wight, Icon. Pl. Ind. Or. 4: t.1569. 1850. Type: USA, Carolina, *Fraser* s.n. (holotype P, not seen).

Aquatic. *Stolons* numerous, filiform, branched, usually mat-forming. *Rhizoides* numerous filiform, branched. *Floats* absent. Leaves filiform, hair-like, much branched, 0.5–1.5 cm long. *Auricles* absent. *Traps* usually few, mostly on leaves, ca. 0.5–1.5 mm long; mouth lateral, with 2 long, very fragile, branched appendages (often absent due to damage in dried specimens) and, sometimes with numerous shorter ones. Internal hairs 2-armed and 4-armed, the latter with arms more or less equally divergent \times or \times in shape. *Inflorescence* erect, solitary, ca. 5–15 cm long; peduncle hairless; usually 3–7-flowered; flowers widely spaced, usually held such that mouth of the flower is horizontal. *Scales* infrequent sometimes absent, similar to, but wider than bracts. *Bracts* attached at the base, ovate, ca. 1 mm long, obtuse, truncate or dentate, clasping at the base. *Bracteoles* absent. Pedicels ca. 1 cm long in flower. *Calyx* lobes subequal, ca. 1–3 mm long on flowering; broadly ovate. *Corolla* yellow; 3–6 mm long; upper and lower lips ovate, upper lip slightly smaller than lower lip, palate bright yellow, spur ca. 3 mm long, usually \pm as long as lower lip. *Seeds* lenticular, with a broad wing, the margin irregularly and shallowly denticulate, ca. 1 mm long.

Thailand.— NORTHERN: Chiang Mai [Bo Luang, west of, 30 Jan. 1964, *Hansen, Seidenfaden & Smitinand* 11007 (C); Doi Inthanon, near Guest House (RS-15), *Tsugara* T-61738 (A, BKF); Doi Saket, 26 July 1958, *Sørensen, Larsen & Hansen* 4308 (K); Doi Suthep, 19 April 1905, *Hosseus* 511 (K, M); Doi Suthep, 14 April 1958, *Hansen, Seidenfaden & Smitinand* 2700 (C); Doi Suthep, 15 April 1958, *Hansen, Seidenfaden & Smitinand* 2765 (C); Doi Suthep, at the foot of, 4 April 1909, *Kerr* 574 (K)]; NORTH-EASTERN: Loei [Phu (Kao) Kradung, 4 April 1948, *Suvataband* 214 (BK); Phu Kradueng, 1 Nov. 1954, *Smitinand* 2076 (BKF, K)]; Sakon Nakhon [Phu Phan National Park, 23 Feb. 1993, *Chantaranothai, Parnell, Middleton & Simpson* 966 (K); Phu Phan National Park, An Gop, 23 Feb. 1993, *Chantaranothai, Parnell, Middleton & Simpson* 968 (K)]; CENTRAL: Lop Buri [Supcham Pa Hill, 19 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasana* T-50927 (A, BKF)]; PENINSULAR: Songkhla [Lake Songkhla, N. end of, Talae Noi Waterfowl Reserve, 28 Dec. 1978, *Congdon* 159 (AAU)]; UNLOCALISED: Klong Bagatae, 5 Nov. 1919, *Kloss* 6576 (K 2 sheets); [Pak Raw, 18 Jan 1918, *Annandale* 1656 (SING).

Distribution.— Widespread, essentially Pantropical, extending northward into eastern and western America, and into south-western Europe and the eastern Mediterranean, China, Japan and South America.

Ecology.— In ponds, ditches, marshes; 2–1,300 m. Flowering and fruiting throughout the year.

Notes.— Traditionally, material in S.E. Asia treated in this account as *U. gibba* has been known under the name of *U. exoleta*. However, Taylor (1989) examined type material of both species and much material of *U. gibba* from its type continent of North America as well as a similarly huge numbers of specimens from elsewhere, and much material of *U. exoleta*. On the basis of his extensive worldwide experience Taylor (1989) presented a

convincing argument for the sinking of the latter in the former. Having examined the extensive collections of these taxa in K I can see no reason to divert from his view.

11. *Utricularia graminifolia* Vahl, Enum. 1: 195. 1804; A.DC. in DC., Prodr. 8: 16. 1844; P. Taylor, Dansk Bot. Ark. 23: 531. 1968; Rani & Matthew in Matthew, Fl. Tamilnadu Carnatic 2: 1116. 1983; Maxwell, Songklanakar J. Sci. Tech. 7: 417. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 370. 1989; in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 188–190. 1995. Type: India Orientalis, *Koenig* s.n. (holotype C, not seen).— *Utricularia caerulea* Oliver in J. Linn. Soc. Bot. 3: 179. 1879 pro major parte excl. *U. squamosa* & *U. smithiana*; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 331. 1885 pro major parte excl. var. *squamosa* et var. *smithiana*; Trimen, Handb. Fl. Ceylon 3: 268. 1895.— *Utricularia conferta* Wight in Hook. J. Bot. & Kew Gard. Misc. 1: 372. 1849; Wight, Icon. Pl. Ind. Or. 4: 1575. 1850. Type. India, Tamil Nadu, *Wight* 2417 (holotype K, not seen).— *Utricularia uliginoides* Wight in Hook. J. Bot. & Kew Gard. Misc. 1: 372. 1849; Wight, Icon. Pl. Ind. Or. 4: 1573. 1850. Type. India, Tamil Nadu, *Wight* 2415 (holotype K, not seen).— *Utricularia pedicellata* Wight in Hook. J. Bot. & Kew Gard. Misc. 1: 373. 1849; Wight, Icon. Pl. Ind. Or. 4: t.1578 (right-hand specimen, but not seeds only). 1850. Type. India, Tamil Nadu, *Wight* s.n. (holotype K, not seen).— *Utricularia uliginosa* Wight in Hook. J. Bot. & Kew Gard. Misc. 1: 372. 1849; Wight, Icon. Pl. Ind. Or. 4: t.1574 (left-hand specimens only), 1850. Type. India, Tamilnadu, *Wight* 2417 (holotype K!).

Terrestrial. *Stolons* numerous, often mat forming, filiform. *Rhizoides* numerous, filiform, branched. *Floats* absent. *Leaves* linear, obovate to spatulate, 1–2(–4) cm long, 3-many-nerved, usually present at flowering. *Auricles* absent. *Traps* usually few, mostly on leaves, ca. 0.5–1.5 mm long; mouth basal, with 2 glandular appendages (often absent due to damage in dried specimens). *Internal hairs* largely 2-armed, 1-armed seemingly less frequent. *Inflorescence* erect or twining, solitary, ca. 10–20 cm long; peduncle hairless; usually few (1–3)-flowered; flowers widely spaced, usually held such that mouth of the flower is horizontal. *Scales* similar to bracts. *Bracts* attached at the base, ovate, ca. 1–3 mm long, acute. *Bracteoles* setaceous, slightly shorter than the bracts. *Pedicels* ca. 0.5–1.2 cm long in flower. *Calyx* lobes subequal, ca. 3–6 mm long on flowering; broadly ovate, the upper acute, the lower sometimes emarginate. *Corolla* lilac or purple, rarely white; 3–15 mm long, upper lip much smaller than lower lip, palate colour not known; spur ca. 3–6 mm long, usually held parallel to lower lip of calyx, curved. *Seeds* ovoid, with the testa cells conspicuously long and narrow, ca. 0.5 mm long.

Thailand.— NORTHERN: Chiang Mai [Bo Luang, near, 1 Feb. 1954, *Hansen, Seidenfaden & Smitinand* 11459 (C); Doi Inthanon (Doi Angka), 25 Oct. 1927, *Garrett* 490 (K); Doi Inthanon (Doi Angka), 25 Oct. 1927, *Garrett* 491 (BK, K); Doi Inthanon, 7 May 1958, *Sørensen, Larsen & Hansen* 3265 (C); Doi Inthanon (Doi Angka), 7 May 1958, *Hansen, Seidenfaden & Smitinand* 11459 (K, drawing only); Doi Inthanon, 19 Jan. 1969, *Nooteboom, Tantisewie & Phengklai* 774 (BKF, L); Mae Ya waterfall, 28 Feb. 1979, *Koyama, Phengklai, Niyomdham, Tamura, Okada & O'Connor* 15590 (BKF); Me Tun?, 5 July 1922, *Kerr* 6247 (ABD, L)]; NORTH-EASTERN: Loei [Phu Kradueng, 20 March 1958, *Sørensen, Larsen & Hansen* 2323 (C)]. UNLOCALISED: Nam Ngat, 25 April 1893, *Smiles* s.n. (K).

Distribution.— India, Sri Lanka, Burma, China.

Ecology.— On rocks in streams and rivers; 800–1,100 m. Flowering and fruiting throughout the year.

Notes.— The specimens on which the Me Tun record is based are not absolutely determinable and therefore this record requires confirmation.

12. *Utricularia hirta* Klein ex Link, *Jahrb. Gewächsk.* 1: 55. 1820; A.DC. in DC., *Prodr.* 8: 25. 1844; C.B. Clarke in Hook.f., *Fl. Brit. Ind.* 4: 332. 1885; Craib, *Bull. Misc. Inform. Kew* 1911. 429. 1911; Craib, *Contr. Fl. Siam* 147. 1912; Pellegr. in Lecomte, *Fl. Indo-Chine* 4: 479. 1930; P. Taylor, *Dansk Bot. Ark.* 23: 531. 1968; in *Fl. Males. ser. I*, 8: 287. 1977; Rani & Matthew in Matthew, *Fl. Tamilnadu Carnatic* 2: 1116. 1983; P. Taylor, *Kew Bull. Addit. Ser.* 14: 174. 1989; Hô, *Câyco Viêtنام* 3: 111. 1993. Type: India, *Klein* s.n. (holotype B-W, not seen, photo K!).— *Utricularia hirta* Klein ex Link var. *elongata* Pellegr. in Lecomte, *Fl. Gén. I.-C.* 4: 479. 1930. Type: Rivière d'Ubon, *Thorel* s.n. (holotype P, not seen, photo K!).

Terrestrial. *Stolons* few, not much branched, filiform. *Rhizoides* numerous, filiform. *Floats* absent. *Leaves* very long-petiolate (petiole usually much longer than the blade), obovate to spatulate, ca. 1–2 cm long, 1-nerved, usually absent at flowering. *Auricles* absent. *Traps* usually many, mostly on leaves, ca. 0.2 mm long; mouth lateral, with a glandular projection. *Internal hairs* 2-armed and 4-armed. *Inflorescence* erect, solitary, ca. 4–15 cm long; peduncle hairy, the hairs multicellular, 0.2–1(–2–4) mm long, spreading, but often tangled together and forming a layer around the peduncle of radius 0.5 mm; usually few (1–5)-flowered; flowers widely spaced, usually held such that mouth of the flower is vertical. *Scales* similar to bracts. *Bracts* attached at the base, ovate, ca. 1 mm long, acute, hairy. *Bracteoles* similar to and about the same length as the bracts, sometimes narrower, hairy. *Pedicels* ca. 1–3 cm long in flower. *Calyx* lobes subequal, ca. 1.5–3 mm long on flowering; narrowly ovate, hairy. *Corolla* blue or purple; 3–10 mm long; upper lip much smaller than lower lip, palate yellow or white; spur ca. 4 mm long, usually held ± horizontally, parallel to, but much longer than the lower lip, slightly curved, hairy. *Seeds* ovoid, ca. 0.2 mm long.

Thailand.— NORTHERN: Chiang Mai [Doi Suthep, 26 Oct. 1912, *Garrett* 2753 (K); Doi Suthep, 20 Sept. 1958, *Sørensen, Larsen & Hansen* 5421 (C); Bo Luang, Doi Suthep, 2 Jan. 1910, *Kerr* 922 (K, TCD); Bo Luang, 26 Feb. 1959, *Sørensen, Larsen & Hansen* 2510 (A, AAU, BKF, C, E, K, L, SING)]; NORTH-EASTERN: Loei [Phu Kradueng, 17 Nov. 1949, *Bunpheng*, 292d (BKF); Phu Kradueng, 1 Sept. 1950, *Bunpheng*, 337A (BK); Phu Kradueng, 1 Nov. 1954, *Smitinand* 2070 (BKF, K); Phu Kradueng, 23 Dec. 1971, *van Beusekom, Phengkklai, Geesink & Wongwan* 4499 (BKF, L); Phu Kradueng, *Anon.* 6242 (K, drawing only)], Sakon Nakhon [Phu Phan National Park, S.W. of Sakon Nakhon city, 14 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50531 (BKF); Phu Phan National Park, S.W. of Sakon Nakhon city, 14 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50880 (BKF); Phu Phan National Park, S.W. of Sakon Nakhon city, 14 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50888 (BKF); Phu Phan, Ban Lad-ta-Chep, 22 Nov. 1962, *Phloenchit* 1930 (BKF)]; Mukdahan [Mukdahan, near joint of route 2104 and 212, along route 2104, ca. 30 km N.N.W. of, 16 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-51430 (A, BKF)]; EASTERN: Surin [Surin, 3 Dec. 1976, *Phengkklai, C. et al.* 3555 (BKF)], Ubon Ratchathani [Muang District, along route 217 20 km West from Ubon, 9 Nov. 1982, *Koyama, Terao &*

Wongprasert T-30609 (BKF)]; SOUTH-WESTERN: Phetchaburi [Tung Luang, 11 Dec. 1931, *Kerr* 20643 (BK, BM)]; SOUTH-EASTERN: Chon Buri [Khao Kieo, n.v.], Chanthaburi [Chanthaburi, along Highway 3, 14 km E. of, 17 Oct. 1971, *Maxwell* 71-571 (AAU, BK)]; Kaeng [Klung, 4 Dec. 1924, *Kerr* 9542 (BM)]; Makhham [Makam, 12 Jan. 1958, *Sørensen, Larsen, & Hansen* 174 (C)]; Makam, 28 June 1966, *Larsen, Smitinand & Warncke* 1833 (BK)]; Trat [Khlung Yai, 18 km N. of, 2 Sept. 1972, *Larsen, Larsen, Neilsen & Santisuk* 32345 (AAU)]; PENINSULAR: Satun [Satul, 20 Dec. 1927, *Kerr* 13709 (BK, BM)]; Songkhla [Songkhla, S. of, 8 Oct. 1988, *Larsen & Larsen* 70307 (AAU)].

Distribution.— India, Bangladesh, Sri Lanka, Cambodia, Laos, Vietnam, Borneo (Sarawak).

Ecology.— Damp sandy or muddy ground, by paddy fields; 100–1000 m. Flowering and fruiting November–December.

Notes.— The only conspicuously hairy species of *Utricularia* in Thailand. *U. minutissima* occasionally bears inconspicuous, minute hairs (which are usually all less than 1 mm long). These are much smaller and much more inconspicuous than the smallest hairs of *U. hirta* (which are usually at least 2 mm long), and almost never extend to the calyx lobes which they do in *U. hirta*. Additionally, *U. minutissima* entirely lacks the very long hairs (which are up to 6 mm long) occasionally found in *U. hirta*.

13. *Utricularia involvens* Ridl., *J. Bot.* 33: 11. 1895; Ridl., *Fl. Malay Penins.* 2. 493. 1923; P. Taylor in *Fl. Males.* ser. I, 8: 279. 1977; *Kew Bull. Addit. Ser.* 14: 314. 1989. Type: Malay Peninsula, *Ridley* s.n. (holotype SING!).

Terrestrial. *Stolons* branched, long. *Rhizoides* few. *Floats* absent. *Leaves* obovate to narrowly oblong, ca. 1–3 cm long, 3- many-nerved, usually absent at flowering. *Auricles* absent. *Traps* few, mostly on stolons and leaves, ca. 0.5–1 mm long; mouth basal, with 2 long, appendages, the stalk with a swelling near the trap reminiscent of an ‘Adams Apple’. *Internal hairs* 2-armed and 4-armed. *Inflorescence* twining, solitary, up to 40 cm long; peduncle hairless; usually few (1–5)-flowered; flowers widely spaced. *Scales* similar to bracts, though sometimes somewhat smaller. *Bracts* attached at the base, ovate, ca. 1.5–2 mm long, acute. *Bracteoles* similar to and about the same length as the bracts, subulate. *Pedicels* ca. 1–2 cm long in flower. *Calyx* lobes subequal, ca. 3–5 mm long on flowering; narrowly ovate, the lower sometimes emarginated; markedly expanding (at least doubling in size) and becoming broadly ovate and membranous in fruit. *Corolla* yellow; 10–15 mm long; upper lip smaller than lower lip, palate yellow; spur ca. 5–7 mm long, usually held ± vertically, and parallel to the lower lobe of the calyx, curved. *Seeds* ovoid, ca. 0.5 mm long.

Thailand.— SOUTH-EASTERN: Sa Kaeo [Aranyaprathet (Aran Pratet), 8 Aug. 1930, *Kerr* 19564 (BK, BM, K)]; PENINSULAR: Ranong [Ngao Falls, 10 Dec. 1974, *Indrapong* 83 (BKF, K)]; Ngao Falls, 6 Dec. 1976, *Santisuk* 772 (BKF)]; Ngao waterfall, 20 km S. of Ranong, 8 Dec. 1979, *Shimizu, Toyokuni, Koyama, Yahara & Niyomdham* (BKF, C, L)].

Distribution.— Burma, Peninsular Malaysia and N. Australia.

Ecology.— Mossy and grassy slopes by stream and in evergreen forest; 100 m. Flowering and fruiting December.

Notes.— This species occurrences in peninsular Thailand represent the only known locations for it in the whole of the Malay peninsula. The gap in the distribution of this species between Ranong and Sa Kaeo is quite substantial, but does occur for other species in the Thai Flora and may be related to rainfall patterns (Middleton, pers. comm.). The larger disjunction in its distribution between peninsular Malaysia and northern Australia is somewhat more remarkable but may reflect low collecting densities in the intervening regions. Unfortunately, no recent collections from Sa Kaeo exist and, therefore, this species may now be confined to a single locality in Thailand. On the other hand, Middleton (pers. comm.) assures me that the area is still heavily forested, and so this species may still occur there.

Kerr 19654 (BM) has been drawn by Taylor (K!) and correctly identified by him as *U. involvens*. The same collection (BK!) was identified by Maxwell as *U. pierrei* and may be the basis for his including the latter species in his account (Maxwell, 1985). However, the drawing of the BM specimen by Taylor clearly shows that it is not (in calyx shape) the same as the type of *U. pierrei*; that the seed is rougher and that the pedicels are shorter: the specimen in BK is identical to that in BM. See under *U. pierrei* for further discussion of this issue.

14. *Utricularia jackii* J. Parn. sp. nov. *Utriculariae vitellinae* Ridl. affinis sed floribus minoribus, corollae labio inferiore non lobato, palatum manifeste, calcare brevissimo leviter incurvato quandoque, radice bulbifero, utriculis protuberantibus minimis infra orificium interdum separatis differt. Type: Thailand, Chiang Mai [Doi Angka (Doi Inthanon), Pha Ngem S. peak, 2200 m, 5 Sept. 1927, *Garrett* 437 (holotypus BM!; isotypus K!)]. Figs. 3–5.

Terrestrial. *Stolons* infrequent, filiform, sparsely branched, a few cm long, 0.1 mm thick. *Rhizoides* filiform, very thin, infrequently branched or unbranched, sometimes with small oval, white bulbils ca. 0.4 mm across. *Florets* absent. *Leaves* infrequent, linear, sometimes present at flowering, 0.4–0.6 cm long, 1-nerved, apex acute, petiole indistinct, approximately 0.2 cm long. *Auricles* absent. *Traps* few, reniform, on stolons, 0.5–1 mm long; mouth basal, with 2 short appendages, the stalk and base of the trap forming a usually prominent swelling reminiscent of an over-large ‘Adams Apple’ type structure but smaller than that of *U. scandens*. *Internal hairs* unknown. *Inflorescence* erect, simple, solitary, 3–4 cm long; peduncle more or less terete but sometimes with a few low-lying, inconspicuous ridges when dry, hairless, ca. 0.4 mm thick; usually 1(–2)-flowered; scales usually only 1 per inflorescence, borne about half-way down the inflorescence stalk, similar to bracts. *Bracts* ovate, attached at the base, ca. 1.5 mm long, acute to weakly apiculate at the tip. *Bracteoles* narrowly linear-subulate, ca. 0.5 mm long. *Pedicels* 2–3 mm long, 0.15 mm wide, bent-over or curved such that mouth of the flower is \pm horizontal. *Calyx* lobes unequal, ovate, the upper broadly ovate with the apex acute, ca. 2.5–3 mm long on flowering, the lower more narrowly ovate, sometimes with a shortly and inconspicuously bifid / emarginate apex. *Corolla* yellow; ca. 6 mm long; upper lip erect, much smaller than lower lip and slightly larger than the upper lip of the calyx, obovate, lower lip spreading horizontally, palate prominent, sometimes weakly ciliate, the apex very weakly lobed / dentate; spur (3–)3.5–4 mm long, downward facing, slightly to moderately curved, long-pointed, clearly diverging from the lower lip (Fig. 4). *Filament* \pm straight, ca. 0.3–0.4 mm long, anthers distinct divergent at

maturity. *Ovary* ovoid, style short but distinct. *Pollen* 3-colporate, slightly ovoid, ca. 27.5 by 29 μm (Fig. 5). *Capsule and seeds* not seen.

Thailand.— NORTHERN: Chiang Mai [Doi Inthanon (Doi Angka), Pha Ngeam South peak, 5 Sept. 1958, *Garrett* 437 (holotype BM; isotype K)]; NORTH-EASTERN: Loei [Phu Kradueng, 27 Oct. 1958, *Sørensen, Larsen & Hansen* 6280 (C)].

Distribution.— Endemic.

Ecology.— Wet rocks at high altitude, sometimes in evergreen forest, 2,200 m. Flowering and fruiting September–November.

Notes.— Named in honour of my late father John ('Jack') Thomas Mackie Parnell without whose support I would not have been able to follow my chosen career as a plant systematist.

This rare species was first noted as potentially distinct by Taylor (in K): however, although he kept the sole representative of *U. jackii* in K in a separate folder to all the other species from Thailand he never formally described it. Taylor's very brief notes suggested that he believed that this species was closely related to *Utricularia vitellina* Ridley and clearly there are morphological similarities. Taylor (1989), in his excellent monograph, correctly synonymised a large number of species and I was initially unwilling to describe as new a taxon he was aware of but chose not to describe. However, having examined isotype material of *U. vitellina* and other material of that taxon in K as well as many other collections from Asia I am convinced that *U. jackii* is sufficiently distinct to warrant recognition, using the same species criteria that Taylor (1989) used and I am using. *Utricularia jackii* is distinct from *U. vitellina* as it has small bulbils at the base of the plant, has smaller flowers than *U. vitellina*, and the upper and lower lips of the corolla are of quite different shape and outline (the lower lip, for example, being less deeply lobed than in *U. vitellina* but with a prominent palate which is lacking in *U. vitellina* and though *U. jackii* has a prominent curved spur it is shorter and less curved than that of *U. vitellina*). In addition, the traps are similar to those of *U. scandens* in that they possess an 'Adams Apple' but lack the ventral scale of that species. Given the disjunction in range of *U. jackii* and the presence of intermediate suitable, but undercollected localities, I am confident that this species will be found elsewhere in Thailand.

15. *Utricularia limosa* R. Br., Prodr. Nov. Holl. 432. 1810; P. Taylor in Fl. Males. ser. I, 8: 292. 1977; Kew Bull. Addit. Ser. 14: 550–553. 1989. Type: Australia, *Banks & Solander* s.n. (holotype BM, not seen).— *Utricularia verticillata* Benj., Linnaea 20: 312. 1847; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 333. 1885; Ridl., Fl. Malay Penins. 2. 493. 1923; Pellegr. in Lecomte, Fl. Indo-Chine 4: 483. 1930. Type: Malacca, *Griffith* 4079 (holotype K, not seen).

Terrestrial. Stolons few. *Rhizoides* moderately numerous, short, sparingly branched. *Florets* absent. *Leaves* narrowly linear, ca. 1–2.5 cm long, 1-nerved, usually absent at flowering. Auricles absent. Traps few, mostly on stolons and leaves, ca. 0.5–1 mm long; mouth lateral, with 2 long, hairy, fragile appendages. Internal hairs 2-armed and 4-armed. *Inflorescence* erect, solitary, up to 20 cm long; peduncle hairless; usually few (2–)3–6-flowered; flowers widely spaced. Scales similar to bracts. Bracts attached more or less in the middle or slightly below the middle, both ends free and acute, ovate, ca. 1.5–2 mm long.

Bracteoles absent. Pedicels ca. 2 mm long in flower, distinctively flexed-sinuate in the middle, minutely papillose (use microscope), much longer than the calyx, lengthening in fruit to ca. 6 mm. Calyx lobes unequal, the upper ca. 1 mm long on flowering, the lower ca. 1.5 mm long on flowering; ovate, the lower sometimes emarginate or erose; expanding in fruit and exhibiting a distinct membranous margin. *Corolla* pale violet, purple or white; 4–6 mm long; upper lip much smaller than lower lip, lower lip deeply bilobed, palate yellowish; spur ca. 3–4 mm long, usually held \pm subvertically, and parallel to the lower lobe of the calyx, curved in the lower portion. *Seeds* ovoid, ca. 0.25 mm long, prominently reticulate.

Thailand.— EASTERN: Trat [Muang District, Along Highway 318 at km 31, 4 Aug. 1973, *Maxwell* 73-369 (BK)]; PENINSULAR: Trang [Ban Nah Doh Ming, 22 Nov. 1986, *Maxwell* 86-975 (C, BK, L) Note: this location may or may not be in Trang; Thale (Thalac) Song Hong, 21 Jan. 1958, *Sørensen, Larsen & Hansen* 720 (K)]; Thale [Thalac) Song Hong, 21 Jan. 1958, *Sørensen, Larsen & Hansen* 721 (C, K)]; Songkhla [Songkhla (Singgora), 1 Feb. 1916, *Annandale* s.n. (SING)]; Songkhla (Singgora), Lla Tang Si near, 7 April 1928, *Kerr* 15088 (BK, BM)].

Distribution.— Laos, Vietnam, Peninsular Malaysia, New Guinea, Australia.

Ecology.— Moist, sandy soil; 100 m. Flowering and fruiting December.

Notes.— The flexuous-sinuate, rather slender and long, pedicel which is papillose represents an unique combination of features which allow immediate identification of this species. Known from 10 collections made in four localities in two widely separated regions in Thailand. *Sørensen, Larsen & Hansen* 720 (K) is recorded as having yellow flowers; however, this is unlikely, and at most the lower lip may have a yellow spot on it near the centre (*Annandale* s.n. (SING)). The fruit is reported as yellowish-green in *Maxwell* 73-369 (BK).

16. *Utricularia minutissima* Vahl, Enum. 1: 204. 1804; A.DC. in DC., Prodr. 8: 16. 1844; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 334. 1885; Ridl., Fl. Malay Penins. 2. 492. 1923; P. Taylor, Dansk Bot. Ark. 23: 531. 1968; in Fl. Males. ser. I, 8: 286. 1977; Rani & Matthew in Matthew, Fl. Tamilnadu Carnatic 2: 1117. 1983; Maxwell, Songklanakarin J. Sci. Tech. 7: 419. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 170. 1989; in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 177. 1995; Hô, Câyco Vietnam 3: 111. 1993. Type: Malay Peninsula, *Koenig* s.n. (holotype C, not seen).— *Utricularia siamensis* Ostenf., Feddes Repert. 2: 68. 1906; Craib, Bull. Misc. Inform. Kew 1911. 429. 1911; Craib, Contr. Fl. Siam 148. 1912; Pellegr. in Lecomte, Fl. Indo-Chine 4: 476. 1930. Type: Thailand, Ko Chang, *Schmidt* 704 (holotype C!; isotype K!).— *Utricularia lilliput* Pellegr., Bull. Mus. Nat. Hist. Paris 26: 181. 1920; Pellegr. in Lecomte, Fl. Indo-Chine 4: 476. 1930. Type: Vietnam, *Bon* 1825 (holotype P, not seen).— *Utricularia evrardii* Pellegr. in Lecomte, Fl. Indo-Chine 4: 476. 1930. Type: Vietnam, *Evrard* 267 (holotype P, not seen, drawing K!).— *Utricularia brevilabris* Lace var. *parviflora* Pellegr. in Lecomte, Fl. Indo-Chine 4: 481. 1930. Type: Vietnam, *Thorel* 777 (holotype P!).

Terrestrial. *Stolons* few. *Rhizoides* few, short, unbranched. *Floats* absent. *Leaves* narrowly linear, ca. (0.6–)1–2.5 cm long, 1-nerved, absent at flowering. *Auricles* absent. *Traps* numerous, mostly on stolons and leaves, ca. 0.5–1 mm long; mouth lateral, with a single, apical appendage and numerous protruding glands. *Internal hairs* 2-armed and 4-

armed. *Inflorescence* erect, solitary, usually less than 6 cm long; peduncle rarely hairy, hairs less than 0.1 mm long; usually few 1–3(–6)-flowered; flowers widely spaced. *Scales* similar to bracts. *Bracts* attached at the base, narrowly ovate, ca. 1 mm long. *Bracteoles* similar but narrower. *Pedicels* ca. 1(–1.5) mm long in flower, about as long as the bract. *Calyx* lobes \pm equal, 2–3.5 mm long on flowering; ovate, the lower sometimes truncate or emarginate or erose. *Corolla* blue, purple, pink or white; 2–3(–6) mm long; upper lip very much smaller than lower lip, palate yellow, throat white; spur ca. 2–3 mm long, usually pointing downwards, slightly longer than lower lip, straight. *Seeds* ovoid, ca. 0.25 mm long, prominently and coarsely reticulate.

Thailand.— NORTHERN: Chiang Mai [Doi Suthep, 26 Oct. 1912, *Garrett* 2753 (ABD); Doi Suthep, 4 Dec. 1912, *Kerr* 2800 (BM, K); Doi Suthep, 26 July 1958, *Sørensen, Larsen, & Hansen* 4451 (C)]; NORTH-EASTERN: Loei [Phu Kradueng, 1 Sept. 1950, *Bunpheng* 337 (BKF)]; EASTERN: Ubon Ratchathani [Muang District, along route 217 20 km W. from Ubon, 9 Dec. 1982, *Koyama, Terao & Wongprasert* T-30609 (BKF)]; SOUTH-WESTERN: Kanchanaburi [Thong Pha Phum, Kwai River Valley, 21 Dec. 1984, *Dransfield* JD6216 (K)]; SOUTH-EASTERN: Sa Kaeo Aranyaprathet, 8 Aug. 1930, *Kerr* 19569 (BK, BM 2 sheets); Watthana Nakhon (Watana), 15 Oct. 1928, *Put* 1942 (BK, BM)]; Chon Buri Khao Khieo, 15 Nov. 1075, *Maxwell* 75-1068 (L)]; Chanthaburi [Chanthaburi, Makam forest station, 26 Aug. 1966, *Larsen, Smitinand & Warncke* 1836 (AAU, K); 14 km E. of Chantaburi, along Highway 3, 17 Oct. 1971, *Maxwell* 71-540 (AAU, BK, K); Pong Nam Ron, Pailin, 28 Aug. 1972, *Larsen, Larsen, Nielsen & Santisuk* 32182 (AAU)]; Trat [Kao Kuap, 25 Sept. 1929, *Kerr* 17777 (BK, BM 2 sheets, K); Highway 318, km 31, 4 Aug. 1973, *Maxwell* 73-373 (AAU, BK, K); off highway 318 at km 31, Muang District, 4 May 1974, *Maxwell* 74-364 (BK); Ko Chang, 1890-1900, *Schmidt* (K); Taphan Hin, 3 Aug. 1973, *Geesink & Phengkhilai* 6325 (AAU, BKF, C, L)]; PENINSULAR: Surat Thani [Bandon, Aerodrome Road, 1 Jan. 1935, *Seidenfaden* 2060 (SING)]; Phangnga [Ko (Koh) Yao Yai, 20 Feb. 1966, *Hansen & Smitinand* 11797 (C, K)]; Songkhla [Hat Yai, 22 Dec. 1927, *Kerr* 13534 (BK, BM 2 sheets)]; Pattani [Khok Pho, 7 April 1928, *Kerr* 15089 (BK, BM)]; Narathiwat [Tak Bai, Ku Chum, 14 Sept. 1987, *Niyomdham & Sriboonma* 1586 (AAU, BKF, K, L); 6 Feb. 1988, *Niyomdham* 1658 (BKF)].

Distribution.— India, Sri Lanka, Burma, Laos, Cambodia, Vietnam, China, Japan, Peninsular Malaysia, Sumatra, Borneo (Sarawak, Sabah), Philippines, New Guinea, Australia.

Ecology.— Moist or wet open areas usually on sandy soil; 0–1,300 m. Principally flowering and fruiting from August to December.

Notes.— The black, small, patent hairs, fairly frequently present on specimens of this species are in fact fungal growths and not hairs. However, some material, *Garrett* 2753 (ABD), is truly hairy and in this latter specimen the multicellular hairs do reach the calyx lobes; this specimen therefore is very difficult to separate from *U. hirta*, though it does lack any long (> 0.2 mm) multicellular hairs, Taylor's (1989) suggestion that the hairs in *U. minutissima* never reach the calyx lobes, therefore, appears a slight oversimplification. Despite its minute size this species is variable in morphology, as is witnessed by the synonymy; some material e.g. *Bunpheng* 337 (BKF) appears intermediate between *U. minutissima* and *U. geoffrayi*, being < 6 cm in height, but having a more or less horizontal spur, and a corolla with the lower lip only a little longer than the upper lip. *Kerr* 17777 (BK (one of two collections with that number), BM (both collections with that number) and K)

from Kao Kuap, Trat province has a corolla twice the normal size and is exceptionally tall (10-11 cm tall) but in all other ways is identical to 'normal' *U. minutissima*.

17. *Utricularia odorata* Pellegr. in Bull. Mus. Nat. Hist. Paris 26: 182. 1920; Pellegr. in Lecomte, Fl. Indo-Chine 4: 483. 1930; Hô, Cáyco Viêtnam 3: 114. Type: Cambodia, *Godfrey* 464 (holotype P, not seen; fragment K!).

Terrestrial. *Stolons* moderately numerous. *Rhizoides* moderately numerous. *Floats* absent. *Leaves* narrowly linear, ca. 0.5–0.7 cm long, 1-nerved, sometimes present at flowering. *Auricles* absent. *Traps* numerous, mostly on stolons and leaves, ca. 0.5–1 mm long; mouth lateral, with 2 short, unbranched appendages. *Internal hairs* 1-armed and 2-armed. *Inflorescence* erect, solitary, up to 20(–40) cm long, robust or somewhat floppy; peduncle hairless; usually few (2–)3–10-flowered; flowers sometimes crowded at the top of the inflorescence and widely spaced lower down or widely spaced throughout. *Scales* similar to bracts. *Bracts* attached at the base, ovate, ca. 2–3 mm long. *Bracteoles* subulate and shorter than bracts. *Pedicels* ca. 4–6 mm long in flower, much longer than the calyx, lengthening in fruit to ca. 8 mm, broadly winged. *Calyx* lobes subequal, ovate, ca. 3–5 mm long on flowering the lower somewhat smaller than the upper, yellow or reddish, decurrent on pedicel, expanding in fruit. *Corolla* yellow sometimes deep red outside (e.g. *Maxwell* 74-369 in K); 10–15 mm long; upper lip smaller than lower lip, palate dark yellow, hairy; spur ca. 5–8 mm long, usually held \pm subvertically, and parallel to, but much exceeding, the lower lobe of the calyx, curved in the lower portion. *Seeds* ovoid, ca. 0.5 mm long, prominently elongately reticulate.

Thailand.— NORTH-EASTERN: Sakon Nakhon [Phu Phan National Park, 14 Nov, 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50884 (BKF); Phu Phan National Park, 14 Nov, 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50886 (A, AAU); Phu Phan National Park, 23 Feb. 1993, *Chantaranonthai, Parnell, Middleton & Simpson* 864 (TCD); Phu Phan, Lad-Ka-Chep, 26 Nov. 1962, *Phernchit* 1957 (BKF); Phu Phan National Park, An Gop, 26 Feb. 1993, *Chantaranonthai, Parnell, Middleton & Simpson* 967 (K, KKU 3 sheets); Phu Phan National Park, An Gop, 26 Feb. 1993, *Chantaranonthai, Parnell, Middleton & Simpson* 967a (K); Phu Phan National Park, trail N. of centre, 20 Oct. 1988, *Parnell* 98/2 (TCD); Phu Phan National Park, trail to N. of Phu Khio, 20 Oct. 1988, *Parnell* 98/8 (TCD)]; Mukdahan [Mukdahan, 18 km S. of city, 17 Nov. 1984, *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-50828 (A, AAU, BKF), T-50843 (BKF), T-50868 (BKF)]; EASTERN: Surin [Surin, 9 Jan. 1924, *Kerr* 8244 (BK, BM, K); Surin, 4 Dec. 1976, *Phengkklai et al.*, 3608 (BKF)]; Si Sa Ket [Ban Toon, Kantararome (Kanthanarom) 13 Feb. 1959, *Phloenchit* 1459 (BKF)]; SOUTH-EASTERN: Trat [Khlung Kut, near, 5 May 1974, *Geesink, Hattink & Phengkklai* 6566 (K); Thai-Cambodian border off Highway 318 at km 65, Klong Yai district, 5 May 1974, *Maxwell* 74-369 (AAU, BK, K)].

Distribution.— Laos, Cambodia and Vietnam and N. Australia.

Ecology.— Wet places, on rocks by streams, by paddy fields, sometimes on sandy soil; 100–400 m. Flowering and fruiting May till November.

Notes.— Reportedly, the flowers are sometimes fragrant. *Chantaranonthai, Parnell, Middleton, & Simpson* 967A (K) and *Chantaranonthai, Parnell, Middleton, & Simpson*

967 (TCD, KKU) from Phu Phan was identified as *U. scandens* by Taylor; however, the traps lack a ventral scale and the typical 'Adams Apple' of that species and appear most similar to the traps of *U. odorata* as, for example, figured in Taylor (1989). The fairly congested inflorescence and marginally ciliate palate are typical of that species. However, the flowers are exceptionally small with the calyx segments only 4–4.5 mm long and the spur is ca. 4 mm long. *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu, & Nantasan* T-50884 (BKF), T-50886 (A, AAU), *Chantaranonthai* 967 (KKU, TCD), *Parnell* 98/2, 98/8 (TCD) all from Phu Phan, and *Murata, Phengkklai, Mitsuta, Yahara, Nagamasu, & Nantasan* T-50828 (A, AAU, BKF), T-50843 (BKF), and T-50868 (BKF), all from Mukdahan, are similar to the above. They all have flattened to winged pedicels which are relatively long and occasionally decurved, the flowers are borne in inflorescences some of which are lax with the flowers well-separated and others of which are congested. The seeds vary; some have one end truncate and are therefore similar to those sometimes found in *U. odorata*, whilst others are ovoid and seem more similar to those found in *U. scandens*. I have assigned all these collections to *U. odorata* as that seems the closest available taxon. However, their confined distribution and very unusual morphology suggest that they may well warrant separate status. They are much less robust, indeed almost floppy, when compared with much material of *U. odorata* (e.g. *Poilane* 23133 (P)). Further collections are required.

Phengkklai et al. 3608 (BKF), *Phloenchit* 1459 (BKF) and *Kerr* 8244 (BK, BM, K) all approach *U. delphinioides* in habit and stature in that they have exceptionally large flowers, on relatively short pedicels, borne clustered together at the top of the inflorescence.

18. *Utricularia pierrei* Pellegr. in Bull. Mus. Nat. Hist. Paris 26: 183. 1920; Pellegr. in Lecomte, Fl. Indo-Chine 4: 483. 1930; Hô, Càyco Viêt-nam 3: 114. 1993.— Type: Vietnam, *Pierre* 1865 (holotype P!).

Terrestrial. *Stolons*, not seen. *Rhizoides* not seen. *Floats* presumably absent. *Leaves* not seen. *Auricles* presumably absent. *Traps* not seen. *Inflorescence* twining, up to 30 cm long; peduncle hairless; usually few (2–)4-flowered; flowers widely spaced. *Scales* similar to bracts. *Bracts* attached at the base, broadly ovate, ca. 2–3 mm long. *Bracteoles* subulate and shorter than bracts. *Pedicels* ca. 5–6 mm long in flower, much longer than the calyx, winged, lengthening in fruit. *Calyx* lobes subequal, narrowly ovate, ca. 5 mm long on flowering the lower minutely bifid, the upper acute, expanding in fruit. *Corolla* yellow; 10–17 mm long; upper lip smaller than lower lip; spur ca. 7–8 mm long, usually held ± subvertically, and at right angles to the lower lip of the corolla, more or less straight. *Seeds* ovoid, ca. 0.3 mm long, smooth.

Thailand.— Doubtfully recorded from SOUTH-EASTERN: Sa Kaeo (Aranyaprathet) see notes below.

Distribution.— Vietnam & Cambodia.

Ecology.— On wet sand (*Pierre* 3348 (P)).

Notes.— Reportedly, the flowers are sometimes fragrant.

This species has been reported by Maxwell (1985) from Aranyaprathet. This record is almost certainly based on *Kerr* 19564 (BK) which Maxwell incorrectly identified as this

taxon. However, Taylor correctly identified a duplicate collection of this specimen in BM as *U. involvens*, which has shorter pedicels and rougher seeds than *U. pierrei* and which has bracts which are narrower than they are long (as opposed to as wide as long). Examination of the type of *U. pierrei* and other collections in P shows that these differences, though small and difficult to detect, are consistent and it is likely that the record of *U. pierrei* is therefore an error. None of the collections of *U. pierrei* I have seen are from very near Thailand, however, there are very few collections of this species in total. So, despite my doubts I have included this species in my account as it is just possible that it does occur in Thailand. The above description is based on the type (*Pierre* 1865). I have not located the duplicate sheet of which a photocopy is at K.

19. *Utricularia punctata* Wallich ex A.DC. in DC., Prodr. 8: 5. 1844; Wight, Icon. Pl. Ind. Or. 4. t1570. 1850; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 329. 1885; Ridl., Fl. Malay Penins. 2. 491. 1923; P. Taylor, Dansk Bot. Ark. 23: 531. 1968; in Fl. Males. ser. I, 8: 293. 1977; Kew Bull. Addit. Ser. 14: 569. 1989; Hô, Càyco Vietnam 3: 109. 1993. Type: Burma, *Wallich* 2121 (lectotype G-DC, not seen; isolectotype K, not seen).

Suspended aquatic. *Stolons* filiform, up to 0.2 m long, occasionally inflated. *Rhizoides* absent. *Floats* (modified stolons) occasionally present at the base of the peduncle, ca 2–6 cm long by 2–5 mm wide, the surface with scattered, branched, leaf-segments. *Leaves* filiform, hair-like, much branched, 2–6 cm long. *Auricles* absent. *Traps* moderately numerous, ovoid, (1–)2 mm long; mouth lateral, with 2 small, fragile, branched hairs (often absent due to damage in dried specimens). *Internal hairs* both 4-armed, 2-armed hairs, not seen, the former ♡ or in shape. *Inflorescence* erect, emergent, solitary, (10–)15–20 cm long; peduncle hairless; (2–)5–7(–12)-flowered; flowers widely spaced. *Scales* similar to bracts, infrequent. *Bracts* attached (obscurely so) in or about the middle or near to the base but not at the base (basal section usually much smaller than the upper and closely appressed to base of pedicel), 2–3 mm long, both ends free and acute (upper much more acute than lower which may appear blunt), much shorter than pedicels. *Bracteoles* absent. *Pedicels* ca. 8–15 mm long in flower; longer but remaining erect in fruit. *Calyx* lobes ± equal, 1–2 mm long on flowering. *Corolla* purple, violet, mauve or, rarely, white, sometimes with ochrish yellow patch on base of upper lip, 3–6 mm long; upper lip erect, slightly smaller than lower lip, lower lip ± horizontal, palate prominent, spur 1–2 mm long, subparallel to lower lip, straight or slightly curved, bluntish. *Seeds* lenticular, with a broad wing, the margin irregularly and deeply dentate or lobed, ca. 2 mm long.

Thailand.— SOUTH-EASTERN: Rayong [Ban Phe, 16 Dec. 1974, *Geesink & Hiepko* 7873 (AAU, BK, C, K, L)]; Chanthaburi [Makam, 2 Nov. 1922, *Kerr* 6507 (BK, BM)]; PENINSULAR: Surat Thani [Khun Thale (Tale) Lake, 14 Jan. 1935, *Seidenfaden* 2358 (C, SING)]; Phangnga [Kopah, Bukit Tuiggi, 11 Dec. 1917, *Haniff* 2903 (SING)]; Kopah, Pak Kok, 15 Dec. 1927, *Haniff* 2953 (K); Kopah, Pak Kok, 15 Dec. 1927, *Haniff* 2953 (K, SING)]; Phuket [Ko Kaeo (Koh Kaw), 29 Jan. 1958, *Sørensen, Larsen & Hansen* 821 (C)]; Trang [Thale Song Hong, Kow Kaw, 27 Jan. 1958, *Sørensen, Larsen & Hansen* 718 (C, K)]; [Trang, 8 Feb. 1950, *Williams* 17076 (C, K 2 sheets, L)]; Narathiwat [Ban Khok Kraduk Mu, Khlong Nam Bang, Chalerm Phra Kiet Wildlife Sanctuary, 1 Feb. 2002, *Parnell, Chayamarit, Pooma, Simpson, Suddee & De Wilde* 1993 (TCD)].

Distribution.— Burma, Vietnam, China, Peninsular Malaysia, Sumatra, Borneo.

Ecology.— Still water in marshes and canals (klongs), by the edges of swamp forest; 0–50 m. Flowering and fruiting December to March.

20. *Utricularia scandens* Benj. in *Linnaea* 20: 309. 1847; P. Taylor, *Dansk Bot. Ark.* 23: 531. 1968; P. Taylor in *Fl. Males.* ser. I, 8: 283. 1977 excl. t. 2a; Rani & Matthew in *Matthew, Fl. Tamilnadu Carnatic* 2: 1120. 1983; Maxwell, *Songklanakarín J. Sci. Tech.* 7: 421. 1985; P. Taylor, *Kew Bull. Addit. Ser.* 14: 379. 1989; Hô, *Câyco Viêt-nam* 3: 114. 1993; P. Taylor in *Dassanayake & Clayton, Rev. Handb. Fl. Ceylon* 9: 190. 1995; Maxwell & Elliot, *Veg. & Vasc. Fl. Doi Suthep - Doi Pui Nat. Park, Northern Thailand* 106. 2001. Type: Tamil Nadu, *Chuter* s.n. (holotype K, not seen).— *Utricularia wallichiana* Wight, *Icon. Pl. Ind. Or.* 4. t.1572 left. 1850; Pellegr. in *Lecomte, Fl. Indo-Chine* 4: 484. 1930. Type: India, Tamil Nadu, *Wight* s.n. (holotype K, not seen; isotype C, not seen).

Terrestrial. *Stolons* numerous, capillary. *Rhizoides* numerous, capillary, shortly branched. *Floats* absent. *Leaves* linear, petiolate, ca. 1–2 cm long, 1-nerved, usually absent at flowering. *Auricles* absent. *Traps* infrequent, mostly on stolons, ca. 0.5–1 mm long; mouth basal, with 2 appendages, the stalk and base of the trap forming a swelling reminiscent of an over-large ‘Adams Apple’ type structure. *Internal hairs* 2-armed only. *Inflorescence* erect or twining, solitary, thin, usually less than 5–15 cm long (short when not twining); peduncle hairless; usually few 1–3(–6)-flowered (few-flowered when not twining); flowers widely spaced, usually held such that mouth of the flower is vertical. *Scales* similar to bracts. *Bracts* attached at the base, narrowly ovate, ca. 1–1.5 mm long, acute to acuminate to subapiculate. *Bracteoles* subulate, approximately the same length as bracts. *Pedicels* ca. 3–4 mm long in flower, much longer than the bract, reportedly up to 15 mm long in non-Thai material, widely spreading in fruit. *Calyx* lobes subequal, ca. 2.5–3 mm long on flowering; broadly ovate, acute, decurrent on pedicel, the lower sometimes truncate or emarginate, markedly expanded in width but also in length (to ca. 4 mm long) in fruit (which is usually about half the length of the calyx), sometimes pale fawn. *Corolla* lemon-yellow; ca. 6 mm long; upper lip smaller than lower lip, palate yellow; spur ca. 4 mm long, usually pointing downwards, longer than lower lip, weakly curved to straight. *Seeds* ovoid, ≤ 0.3 mm long, faintly elongately reticulate.

Thailand.— NORTHERN: Chiang Mai [Bo Luang, 26 Feb. 1959, *Sørensen, Larsen & Hansen* 7039 (C); Bo Luang Tableland, 14 Dec. 1969, *van Beusekom & Phengklai* 2512 (AAU, BKF, C, E, L, P); W. of Bo Luang at km 51, 30 Jan. 1964, *Hansen, Seidenfaden & Smitinand* 11006B (C); Doi Suthep, 14 April 1905, *Hosseus* 571 (BM, E); Doi Suthep, Om Koi, 20 Jan. 1964, *Hansen, Seidenfaden & Smitinand* 10846 (BKF, C 2 sheets)]; NORTH-EASTERN: Loei [Phu (Kho) Kradung, 12 Feb. 1931, *Kerr* 20116 (BK, BM); Phu (Kho) Kradung, 11 Feb. 1931, *Kerr* 20112 (BM); Phu Kradueng, 2 Nov. 1984, *Murata, Phengklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-42880 (BKF); Phu Kradueng, on the plain at its summit, 4 Sept 1967, *Shimizu, Hutch & Chaiglom* T8868 (BKF, L)]; Udon Thani [Phu Kao, Non-Sung District, 11 Jan. 1968, *KB* 1542]; Sakon Nakhon [Phu Phan National Park, 23 Feb. 1993, *Chantaranothai, Parnell, Middleton & Simpson* 864 (K); Phu Pan National Park, park HQ to Laan Sao, 14 Oct. 1990, *Chantaranothai & Parnell* 90/728 (KKU, TCD)]; Phu Phan National Park, An Gop, 23 Feb. 1993, *Chantaranothai, Parnell, Middleton & Simpson*

968a (K)]; Mukdahan [Mukdahan, near joint of route 2104 and 212, along route 2104, ca. 30 km N.N.W. of Mukdahan city, 16 Nov. 1984, *Murata, Phengklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-51435 (A, BKF)].

Distribution.— Africa, Madagascar, India, Bangladesh, Sri Lanka, Nepal, Burma, Vietnam, China, Peninsular Malaysia, New Guinea, Aru Island.

Ecology.— Muddy, wet or wet grassy open habitats; 900–1,100 m. Principally flowering and fruiting from October to January.

Notes.— *Faden, Faden & Jayasuriya* 76/538 in K from Sri Lanka has leaves present on flowering and these are 3-nerved, a feature unreported by Taylor (1978). The tangle of rhizoids and stolons at the foot of these specimens is impossible to dissect without severe damage, so it is possible that the leaves belong to another *Utricularia* species which is not flowering and growing mixed in with the *U. scandens*. *Murata, Phengklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-42880 (BKF) and *Shimizu, Hutch & Chaiglom* T8868 (BKF, L) are very likely to be *U. scandens* but are very difficult to determine for certain given their degree of preservation.

21. *Utricularia stellaris* L.f., Suppl. 86. 1781; Roxb., Fl. Ind. 1: 143. 1820; A.DC. in DC., Prodr. 8: 3. 1844; Wight, Icon. Pl. Ind. Or. 4. t.1567. 1850; C.B. Clarke in Hook.f., Fl. Br. Ind. 4: 328. 1885; Trimen, Handb. Fl. Ceylon 3: 267. 1895; Pellegr. in Lecomte, Fl. Indo-Chine 4: 470. 1930; P. Taylor in Fl. Males. ser. I, 8: 278 (key only). 1977; Rani & Matthew in Matthew, Fl. Tamilnadu Carnatic 2: 1122. 1983; P. Taylor, Kew Bull. Addit. Ser. 14: 631. 1989; Hô, Càyco Vietnam 3: 109. 1993; P. Taylor in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 199. 1995. Type: India Orientalis, *Koenig* s.n. (holotype BM, not seen).

Suspended aquatic. *Stolons* filiform, up to 1 m long, sometimes bearing long, capillary air-shoots. *Rhizoides* absent. *Floats* present at the base of the peduncle, borne in whorls of 3–8, spongy, ovoid, ca 0.5–2 cm long by 3–5 mm wide, the apex topped by a group of branched, filiform leaves. *Leaves* filiform, hair-like, much branched, 1–6 cm long. *Auricles* (at the base of the leaves) 1–2 mm long, divided into filiform segments, not easily distinguishable from the leaves. *Traps* usually numerous, ovoid, (1–)3 mm long; mouth lateral, with or without 2 tiny appendages. *Internal hairs* both 2-armed and 4-armed, the latter ♣ in shape. *Inflorescence* erect, emergent, generally solitary, (3–)30(–30) cm long; peduncle hairless; 2–12-flowered; flowers widely spaced. *Scales* absent. *Bracts* ovate, attached at the base, 1–2 mm long, blunt or apiculate at tip, much shorter than pedicels. *Bracteoles* absent. *Pedicels* ca. 10–15 mm long and erect in flower; longer, thickened and strongly deflexed in fruit. *Calyx* lobes ± equal, 2–3 mm long on flowering; enlarging markedly and spreading in fruit but still, at least partly, clasping the capsule. *Corolla* bright yellow, 0.7–1 cm long, hairy; upper lip erect, smaller than lower lip, lower lip ± horizontal, palate prominent, spur shorter than and held subparallel to lower lip, straight, shortly-pointed. *Seeds* flattened, disc-shaped, usually with 4–6 sides each with distinct ridged or winged edges, and with a distinct rounded dot-like scar in the middle of one of the flat faces, ca. 1 mm long.

Thailand.— Not yet recorded.

Distribution.— Africa, India, Sri Lanka and Nepal to northern Australia, with a discontinuous distribution in SE Asia (see below).

Ecology.— Elsewhere in its range, still or flowing water of various depths; most commonly at low altitude.

Notes.— A species recorded from Burma and Vietnam (Chaudoc or An Giang) and therefore, quite likely to occur in Thailand, though it has not yet been recorded from the country.

22. *Utricularia striatula* Sm. in Rees, Cyclop. 37: No 17. 1819; A.DC. in DC., Prodr. 8: 16. 1844; Ridl., Fl. Malay Penins. 2. 495. 1923; Pellegr. in Lecomte, Fl. Indo-Chine 4: 474. 1930; Back. & Bakh.f., Fl. Java 2: 517. 1965; P. Taylor, Dansk Bot. Ark. 23: 532. 1968; P. Taylor in Fl. Males. ser. I, 8: 289. 1977; Rani & Matthew in Matthew, Fl. Tamilnadu Carnatic 2: 1123. 1983; Maxwell, Songklanakarin J. Sci. Tech. 7: 421. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 479. 1989; in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 192. 1995; Hô, CÂYCO VIỆT NAM 3: 112. 1993; Noltie in Grierson & Long, Fl. Bhutan 2: 1337. 2001; Maxwell & Elliot, Veg. & Vasc. Fl. Doi Suthep - Doi Pui Nat. Park, Northern Thailand 106. 2001. Type: Sierra Leone, *Afzelius* s.n. (holotype L, not seen).— *Utricularia glochidiata* Wall. ex A.DC. in DC., Prodr. 8: 16. 1844; Wight, Icon. Pl. Ind. Or. 4. t. 1581. 1850; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 334. 1885; Trimen, Handb. Fl. Ceylon 3: 271. 1895; Craib, Bull. Misc. Inform. Kew 1911. 430. 1911; Craib, Contr. Fl. Siam 148. 1912. Type: Nepal, *Wallich* 1500 (holotype G-DC, not seen; isotype K, not seen).

Terrestrial, epiphytic or lithophytic. *Stolons* numerous, capillary, unbranched. *Rhizoides* few, capillary, unbranched. *Floats* absent. *Leaves* spatulate or blade obovate with a long petiole, ca. 0.3–0.8(–1) cm long, many-nerved, nearly always present at flowering, the lower or upper surface sometimes minutely pustulate. *Auricles* absent. *Traps* numerous, mostly on stolons, ca. 0.5–0.75 mm long; mouth lateral, with 2 short appendages, bearing multicellular glands and appearing thick and blob-like. *Internal hairs* 4-armed, X in shape. *Inflorescence* erect, solitary, peduncle sometimes fluted when dry, usually ca. 2–7(–15) cm long, occasionally purple, hairless; usually few (1–)2–6(–10)-flowered; flowers widely spaced, usually held such that mouth of the flower is vertical and the lower lip spreading horizontally. *Scales* absent or few, similar to bracts. *Bracts* attached near to, but not at their base, therefore, with a larger apical and much smaller, basal portion (the latter may be very difficult to see without a microscope), 1–2 mm long, both ends free, acute or the lower denticulate. *Bracteoles* similar to, but smaller than, the bracts. *Pedicels* ca. 3–8 mm long in flower, much longer than the bract, decurrent or pendulous in fruit. *Calyx* lobes very unequal, the upper lobe almost circular, ca. 2 mm in diameter, the lower lobe much smaller (less than half as big), narrowly ovate to elliptic on flowering; both blunt to emarginated to erose, both markedly expanded in fruit, the upper clasping the fruit, the lower spreading. *Corolla* blue, pale purple or white; ca. 5 mm long, though sometimes longer; upper lip much smaller than lower lip, which is spreading and usually 5-lobed, palate yellow, throat purple; spur ca. 3–4 mm long, pointing downwards, very much longer than the calyx lobe, weakly curved to straight. *Seeds* ovoid, ca. 0.3 mm long, at least the fatter end covered with glochidiate hairs, approximately 0.01 mm thick at the base.

Thailand.— NORTHERN: Chiang Mai [Doi Chiang Dao, 2 Nov. 1922, *Kerr* 6507 (BK, BM); Doi Chiang Dao, 13 Sept. 1967, *Tagwa, Shimizu, Hutoh, Koyama & Nalampoon* T-89926 (AAU, BKF, K, P, L); Doi Chiang Dao, below the summit, 14 Sept. 1967, *Shimizu*,

Koyama & Nalampoon T10020 (BKF, L)]; Doi Inthanon, 2 Nov. 1920, *Put* 3336 (BK, BM); Doi Inthanon, 11 Sept. 1974, *Larsen & Larsen* 34434 (AAU, K); Doi Inthanon, 16 Sept. 1995, *Larsen, Larsen, Tange & Sookchaloem* 46540 (AAU); Doi Inthanon, forest trail at km 42 along summit road, 7 Oct. 1990, *Chantaranothai & Parnell* 90/621 (TCD); Doi Suthep, 22 Feb. 1910, *Kerr* 787 (K); Doi Suthep, 25 Sept. 1910, *Kerr* 1418 (BM, K, TCD); Doi Suthep, 1 Sept. 1912, *Kerr* 2687 (BM, K); Doi Suthep, 18 Oct. 1914, *Kerr* 3415 (BM, K); Doi Suthep, 18 Sept. 1958; *Sørensen, Larsen & Hansen* 5122 (C); Doi Suthep, middle elevation, *Shimizu, Hutch & Chaiglom* T10556 (BKF); Doi Suthep (Doi Pui), 17 July 1968, *Larsen, Santisuk & Warncke* 2587 (AAU); Pa Dum, 1 Sept. 1912, *Kerr* s.n. (BM); Pa Dum, 8 Oct. 1914, *Kerr* s.n. (BM); Nan [Doi Phu Kha, Roadside ca. 23 km from Pua, Doi Phu Kha National Park, 17 Aug. 1995, *Parnell, Pendry, Jebb & Pooma* 95-192 (TCD)]; Phitsanulok [Thung Salaeng Luang, Kaeng Sopa Waterfall, 22 Oct. 1984, *Murata, Phengklai, Mitsuta, Yahara, Nagamasu & Nantasan* 38506 (BKF)]; NORTH-EASTERN: Loei [Phu Kradueng, 29 Oct. 1954, *Smitinand* 2058 (BKF, K); Phu Kradueng, 25 Nov. 1958, *Sørensen, Larsen & Hansen* 6218 (C); Phu Kradueng, Phen Phop wf. (RS-15) to Khoon Phong wf. (RS-25) to the junction (RS-26) to Doi Mon, 9 Sept. 1988, *Takahasi & Tamura*, T-63472 (A, AAU, BKF)]; EASTERN: Nakhon Ratchasima [Khao Khieo, 12 Oct. 1969, *Kasem* 628 (BK); Khao Khieo, near top, 11 Aug. 1974, *Maxwell* 74-785 (BK)]; [Khao Yai, 31 Oct. 1970, *Kasem* 655 (BK); Khao Yai, Near Nong Khing in Khao Yai National Park, 13 Oct 1984, *Murata, Phengklai, Mitsuta, Yahara, Nagamasu & Nantasan* T-52251 (BKF)]; SOUTH-WESTERN: Kanchanburi [Rintin near Kin Sayok, about 140 km N.W. of Kanburi, 27 July 1946, *Kostermans* 1383 (A)]; CENTRAL: Nakhon Nayok [Nahng Rawng (Nang Rong) Falls, Muang district, 16 Sept. 1972, *Maxwell* 72-367 (AAU, BK)]; SOUTH-EASTERN: Chanthaburi [Khao Kitchakut National Park, 11 Jan. 1999, *Wongprasert* s.n. (BKF)]; [Makam forest station, 26 Aug. 1966, *Larsen, Smitinand & Warncke* 1850 (AAU); Pliew waterfall, next to a waterfall, 30 Aug. 1969, *Maxwell* s.n. (AAU, BK)]; Trat [Ban Saphan Hin, Waterfall 3 km N.E. of the village, 8 Nov. 1993, *Larsen, Larsen, Norgaard, Pharsen, Puudjaa & Uerchirakan* 44307 (AAU); Ko Chang, Klawn Non Si, 26 Sept. 1924, *Kerr* 9179 (BK, BM); Ko Kut, 21 Nov. 1970, *Charoenphol, Larsen & Warncke* 5116 (AAU)]; PENINSULAR: Ranong [Ngao waterfall, 6 Dec. 1976, *Santisuk* 782 (BKF)], Satun [Adang, E. of H.Q., 22 Oct. 1979, *Congdon* 76 (A); Pliew waterfall, 17 Oct. 1971, *Maxwell* 71-581 (AAU, BK); Songkhla [Boripath Waterfall, 19 Oct. 1991, *Larsen, Larsen, Niyomdham, Ueachirakan & Sirirugsa* 42375 (AAU)].

Distribution.— Africa, Madagascar, India, Bangladesh, Sri Lanka, Nepal, Burma, Vietnam, China, Peninsular Malaysia, New Guinea, Aru Island.

Ecology.— Wet, mossy rocks in evergreen forest; 0–2,350 m. Principally, flowering and fruiting from September to November.

Notes.— An unmistakable and highly attractive species. Of Thai *Utricularia*, only *U. corynephora*, *U. garrettii* and *U. striatula* possess spatulate leaves. The surface of the seeds of all three species show diagnostic apomorphies; the surface bearing glochidiate hairs in *U. striatula*, bearing long cylindrical processes in *U. garrettii* and being entirely covered in small club-shaped processes in *U. corynephora*. In addition, both the latter species are very rare and *U. corynephora* has conspicuously pustulate leaves.

23. *Utricularia subulata* L., Sp. Pl. 1: 18.1753; A.DC. in DC., Prodr. 8: 16. 1844; P. Taylor, Dansk Bot. Ark. 23: 532. 1968; in Fl. Males. ser. I, 8: 292–293. 1977; Maxwell, Songklanakarín J. Sci. Tech. 7: 422. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 524. 1989. Type: USA, Virginia, Clayton 31 (holotype G, not seen).

Terrestrial or lithophytic. *Stolons* sometimes numerous, capillary, branched. *Rhizoides* few, capillary, unbranched. *Floats* absent. *Leaves* linear, petiole not distinct, ca. 1–2 cm long, uni-nerved, usually absent at flowering. *Auricles* absent. *Traps* numerous, mostly on stolons and leaves, ca. 0.2–0.6 mm long; mouth lateral, with 2 appendages. *Internal hairs* 1-armed and 4-armed, rarely 2-armed. *Inflorescence* erect, solitary, peduncle sometimes minutely, but distinctly papillose (use microscope), usually ca. 5–15 cm long, occasionally purple, hairless; few (1-) to many flowered; flowers widely spaced, often forming a zig-zag inflorescence pattern, each usually held such that mouth of the flower points upwards and the lower lip and parallel spur are at 45° to vertical. *Scales* present, similar to bracts, though sometimes ciliate when the bracts are not. *Bracts* attached in the middle, both ends free, apical portion often long acute, basal portion smaller, sometimes truncate, ca. 1/3rd as long as apical portion, 0.5–1 mm long. *Bracteoles* absent. *Pedicels* ca. 1–8 mm long in flower. *Calyx* lobes subequal, ovate, ca. 1.5 mm in length; both lobes often with 3–5 prominent raised veins each, sometimes purple. *Corolla* yellow; ca. 7 mm long; upper lip much smaller than lower lip, palate yellow; spur ca. 3–4 mm long, pointing horizontally to downwards, very much longer than the calyx, weakly curved to straight. *Seeds* ovoid, ca. 0.3 mm long.

Thailand.— NORTH-EASTERN: Loei [Phu Kradueng, 10 July 1949, Floto 7481 (C)]; EASTERN: Nakhon Ratchasima [Khao Yai National Park, 7 July 1966, Larsen, Smitinand & Warncke 13 (K, drawing only)]; [Khao Khieo, near top, 31 Aug. 1974, Maxwell 74-874 (BK)]; SOUTH-EASTERN: Trat [Thai-Cambodian border off Highway 318 at km 65, Klong (Khlóng) Yai district, 5 May 1974, Maxwell 74-368 (BK)]; PENINSULAR: Nakhon Si Thammarat [Ta Samet, 29 Jan. 1928, Kerr 14338 (BK, BM, K, drawing only)].

Distribution.— Almost pantropical but very rare in India and absent from Sri Lanka; Australia, eastern North America, South America to Argentina and Uruguay and Portugal (possibly introduced).

Ecology.— Open, wet, moist and sandy areas, sometimes on rock; 50–1,200 m. Flowering and fruiting from May to August and in January.

Notes.— In branched specimens the zig-zag inflorescence is distinctive and unique in Thai *Utricularia*. The most widespread species of *Utricularia* in the world but easily overlooked and rarely recorded from Thailand.

24. *Utricularia uliginosa* Vahl, Enum. 1: 203: 1804; A.DC. in DC., Prodr. 8: 15. 1844; P. Taylor, Dansk Bot. Ark. 23: 532. 1968; in Fl. Males. ser. I, 8: 282. 1977; Maxwell, Songklanakarín J. Sci. Tech. 7: 422. 1985; P. Taylor, Kew Bull. Addit. Ser. 14: 333. 1989; in Dassanayake & Clayton, Rev. Handb. Fl. Ceylon 9: 183. 1995; Hô, Cáyco Viêt Nam 3: 112. 1993. Type: India Orientalis, Koenig s.n. (holotype C, not seen).— *Utricularia affinis* Wight, Hook. J. Bot. & Kew Gard. Misc. 1: 373. 1849; Wight, Icon. Pl. Ind. Or. 4: t.1580 left-hand drawings. 1850; C.B. Clarke in Hook.f., Fl. Brit. Ind. 4: 330. 1885; Trimen, Handb. Fl. Ceylon 3: 269. 1895; Pellegr. in Lecomte, Fl. Indo-Chine 4: 479. 1930; Back. & Bakh.f., Fl. Java 2: 518. 1965;. Type:

India, Tamilnadu, *Wight* s.n. (holotype K, not seen).— *Utricularia brachypoda* Wight, Hook. J. Bot. & Kew Gard. Misc. 1: 373. 1849; Wight, Icon. Pl. Ind. Or. 4: t.1578 left-hand drawings. 1850. Type: India, Kerala, *Wight* 2411 (holotype K, not seen).— *Utricularia griffithii* Wight in Hook. J. Bot. & Kew Gard. Misc. 1: 373. 1849; Ridl., Fl. Mal. Pen. 2. 492. 1923; Wight, Icon. Pl. Ind. Or. 4: t.1576. 1850. Type: Malaysia, Malacca, *Griffith* s.n. (holotype K, not seen; isotype TCD!).

Terrestrial, sometimes in shallow water. *Stolons* numerous, capillary, branched. *Rhizoides* few, capillary, branched. *Florets* absent. *Leaves* lanceolate to oblong, petiolate, up to 5 cm long and up to 0.5 cm wide, 3-many-nerved, usually present at flowering, conspicuous and often numerous. *Auricles* absent. *Traps* sometimes numerous, more commonly infrequent, mostly on stolons and leaves, ca. 0.7–1.6 mm long; mouth basal, with 2 appendages, each bearing numerous, fine, long multi-cellular glands. *Internal hairs* 2-armed, 1-armed hairs, not seen. *Inflorescence* erect, solitary, peduncle sometimes fluted especially when dry, usually ca. (4–)10–18(–25) cm long; peduncle hairless; usually few (1–)2–6(–10)-flowered; flowers widely spaced, usually held such that mouth of the flower is subvertical and the lower lip spreading horizontally. *Scales* similar to bracts. *Bracts* attached at their base, ovate, acute, 2–3 mm long. *Bracteoles* similar to, but smaller than, the bracts, sometimes subulate. *Pedicels* ca. 2–3 mm long in flower, only slightly longer than the subtending bract. *Calyx* lobes subequal, ovate to almost circular, ca. 3–5 mm in diameter, markedly expanded in fruit, minutely (microscopically) denticulate. *Corolla* blue; ca. 6–8 mm long; upper lip much smaller than lower lip, which is spreading, palate sometimes whitish, prominent; spur ca. 3–4 mm long, pointing downwards, very much longer than the calyx, strongly curved. *Seeds* ovoid, ca. 0.3 mm long, with the coarse reticulations clearly visible.

Thailand.— NORTHERN: Chiang Mai [Bo Luang, 27 Aug. 1973, *Geesink, Phanichapol & Santisuk* 5913 (BKF, L), Doi Inthanon, 19 Jan. 1969, *Nooteboom, Tantisewie, & Phengkklai* 774 (C); Me Tun?, 5 July 1922, *Kerr* 6247 (ABD, BK, BM 2 sheets, L)]; SOUTH-EASTERN: Chanthaburi [Chanthaburi, off highway 3. ca. 14 km E. of the town of Chanthaburi, 17 Oct. 1971, *Maxwell* 71-572 (AAU, BK, K); Makam, 18 Jan. 1958, *Sørensen, Larsen & Hansen* 446 (C, K); *Geesink & Phengkklai* (AAU, BKF, C, L); Ban Ang, 5 Aug. 1954, *Sangkha Chand (Bunnak)* 138 (BK, BKF, K)]; off highway 317 at km 10, 5 Aug. 1973, *Maxwell* 73-386 (AAU, BK, K)]; Trat [Ban Saphan Hin, ca. 60 km S.E. from Trat, 4 Aug. 1973, *Murata, Fukuoka & Phengkklai* T-17683 (BKF); Ko Chang, Sulak Kawk, *Kerr* 9219 (BK, BM); near Klong Mah Yom, 3 Aug 1973, *Maxwell*, 73-331 (AAU, BK, K); Muang District, off highway 318 at km 31, 4 Aug. 1973; *Maxwell* 73-368 (BK); 4 May 1974, *Maxwell* 74-363 (BK); Ta Sen Falls, between Trat and Khlung Yai, 27 Sept. 1972, *Larsen, Larsen, Neilsen & Santisuk* 32382 (K)]; PENINSULAR: Nakhon Si Thammarat [Thung Song, In the suburb, 27 Aug. 1967, *Shimizu, Fukuoka & Nalampoon* T8137 (BKF, L)]; Songkhla [Kopah, Abandoned mining lands, 9 Dec. 1927, *Haniff* 2579 (K, L, SING); Ton Nga Chang reserve, Hat Yai, 21 Dec. 1985, *Maxwell* 85-1146 (A, BKF, L)].

Distribution.— India, Sri Lanka, Burma, Vietnam, China, Peninsular Malaya, Korea, Japan, Sumatra, Java, Borneo, New Guinea, New Caledonia, Australia.

Ecology.— Open, wet, moist and sandy areas, marshes and swamps, rarely on rock in streams; 50–500(–1,200) m. Flowering and fruiting from May to August and occasionally through until January.

Notes.— *Kerr* 6247 (ABD, BK, BM 2 sheets, L) is the source of the Me Tun record. These materials are all sterile but have linear leaves which are usually 3-nerved (rarely 1-nerved), but narrow (ca. 1.5 mm wide). The stolons and leaves bear numerous traps with a basal mouth and very long appendages some of which (BM specimen) bear long multicellular hairs. Taylor identified the duplicate in L as *U. bifida* but I believe this to be unlikely as his monograph states that this taxon has uni-nerved leaves and its traps do not bear such long appendages. The leaves are exceptionally narrow for *U. uliginosa* but just within the range of acceptable variation. Further flowering collections of this taxon from Me Tun are required.

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REFERENCES

- Doyle, A.M. & Parnell, J. (2003). Geometry and bladderworts; quadrifids of Irish *Utricularia* species. *Irish Naturalists' Journal* 27: 213–222.
- Janarthanam, M.K. & Henry A.N. (1992). *Bladderworts of India*. Flora of India series 4. Botanical Survey of India. 144 pp.
- Jobson, R.W. & Albert, V.A. (2001). Molecular rates parallel diversification contrasts between carnivorous plant sister lineages in Lentibulariaceae. Abstract of Botany 2001. Plants and People Conference, Albuquerque. Botanical Society of America. <http://www.botany2001.org/section12/abstracts/168.shtml>.
- Jobson, R.W. & Albert, V.A. (2002). Molecular rates parallel diversification contrasts between carnivorous plant sister lineages. *Cladistics* 18: 127–136.
- Jobson, R.W., Playford, J., Cameron, K.M & Albert, V.A. (2003). Molecular phylogenetics of the Lentibulariaceae inferred from plastid *rps16* intron and *trnL-F* DNA sequences: implications for character evolution and biogeography. *Systematic Botany* 28: 157–171.
- Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. & Donoghue, M.J. (2002). *Plant systematics. A Phylogenetic Approach*. 2nd ed. Sinauer Associates, Inc. Sunderland, Massachusetts, U.S.A. 576 pp.
- Mabberley, D.J. (1997). *The Plant Book*. 2nd ed. Cambridge University Press. 858 pp.
- Maxwell, J.F. (1985). Taxonomic revision of *Utricularia* L. (Lentibulariaceae) in Thailand. *Songklanakarin Journal of Science and Technology*, 7: 409–424.
- Maxwell, J.F. (1986). Vascular Plant Flora of Khao Khieo Wildlife Sanctuary, Chonburi Province, Thailand. *Natural History Bulletin of the Siam Society*, 34: 1–34.
- Maxwell, J.F. & Elliot, S. (2001). Vegetation and Vascular Flora of Doi Suthep-Pui National Park, Northern Thailand. *Thai Studies in Biodiversity* No. 5. Biodiversity Research

- and Training Programme. 205 pp.
- Müller, K., Borsch, T., Legendre, L., Porembski, S. & Barthlott, W. (2000). A phylogeny of Lentibulariaceae based on sequences of *matK* and adjacent noncoding regions. *American Journal of Botany* 87 (6 suppl.): 145–146.
- Müller, K., Borsch, T., Legendre, L., Fischer, E., Porembski, S. & Barthlott, W. (2001). The evolution of carnivory in the Lamiales: evidence from *matK* and adjacent noncoding regions. Abstract of Botany 2001. Plants and People Conference, Albuquerque. Botanical Society of America. <http://www.botany2001.org/section12/abstracts/150.shtml>
- Müller, K. and Borsch, T. (2005). Phylogenetics of *Utricularia* (Lentibulariaceae) and molecular evolution of the *trnK* intron in a lineage with high substitution rates. *Plant Systematics and Evolution* 250: 39–67.
- Parnell, J.A.N., Simpson, D.A., Moat, J., Kirkup, D.W., Chantaranothai, P., Boyce, P.C., Bygrave, P., Dransfield, S., Jebb, M.H.P., Macklin, J., Meade, C., Middleton, D.J., Muasya, A.M., Prajaksood, A., Pendry, C.A., Pooma, R., Suddee, S. & Wilkin, P. (2003). Plant collecting spread and densities; their potential impact on biogeographical studies in Thailand. *Journal of Biogeography* 30: 1–18.
- Pellegrin, F. (1930). Lentibulariaceés (Utriculariaceés). In: H. Lecompte (ed), *Flore Générale de l'Indo-Chine* 4: 467–487.
- Savolainen, V., Chase, M.W., Hoot, S.B., Morton, C.M., Soltis, D.E., Bayer, C., Fay, M.F., de Bruin, C.M., Sullivan, S. & Qui, Yin-Long. (2000a). Phylogenetics of flowering plants based on combined analysis of plastid *atpB* and *rbcL* gene sequences. *Systematic Biology* 49: 306–362.
- Savolainen, V., Fay, M.F., Albach, D.C., Backlund, A., van der Bank, M., Cameron, K.M., Johnson, S.A., Lledo, M.D., Pintaud, J.-C. Powell, M., Seaham, M.C. Soltis, D.E., Soltis, P.S., Weston, P., Whitten, W.M., Wurdack, K.J. & Chase, M.W. (2000b). Phylogeny of the eudicots: a nearly complete familial analysis based on *rbcL* gene sequences. *Kew Bulletin* 55: 257–309.
- Soltis, D.E., Soltis, P.S., Chase, M.W., Mort, M.E., Albach, D.C., Zanis, M., Savolainen, V., Hahn, W.H., Hoot, S.B., Fay, M.F., Axtell, M., Swensen, S.M., Prince, L.M., Kress, W.J., Nixon, K.C. & Farris, J.S. (2000). Angiosperm phylogeny inferred from 18S *rDNA*, *rbcL*, and *atpB* sequences. *Botanical Journal of the Linnean Society* 133: 381–461.
- Taylor, P. (1968). Lentibulariaceae. *Studies in the Flora of Thailand*, 47. *Dansk Botanisk Archiv*, 23: 527–532.
- Taylor, P. (1978). Lentibulariaceae. In C.G.G.J. Van Steenis (Ed.) *Flora Malesiana*, 8: 275–300. Sijthoff & Noordhoff, Alphen Aan den Rijn, The Netherlands.
- Taylor, P. (1989). The genus *Utricularia* - a taxonomic monograph. *Kew Bulletin Additional Series*, XIV. Her Majesty's Stationary Office, London. 724 pp.
- Thor, G. (1979). *Utricularia* i Sverige, speciellt de förbisedda arterna *U. australis* och *U. ochroleuca*. *Svensk Botanisk Tidskrift* 73: 381–395.
- Thor, G. (1987). Sumpbläddra, *Utricularia stygia*, enny svensk art. *Svensk Botanisk Tidskrift* 81: 273–280.
- Thor, G. (1988). The genus *Utricularia* in the Nordic countries with special emphasis on *U. stygia* and *U. ochroleuca*. *Nordic Journal of Botany* 8: 213–225.

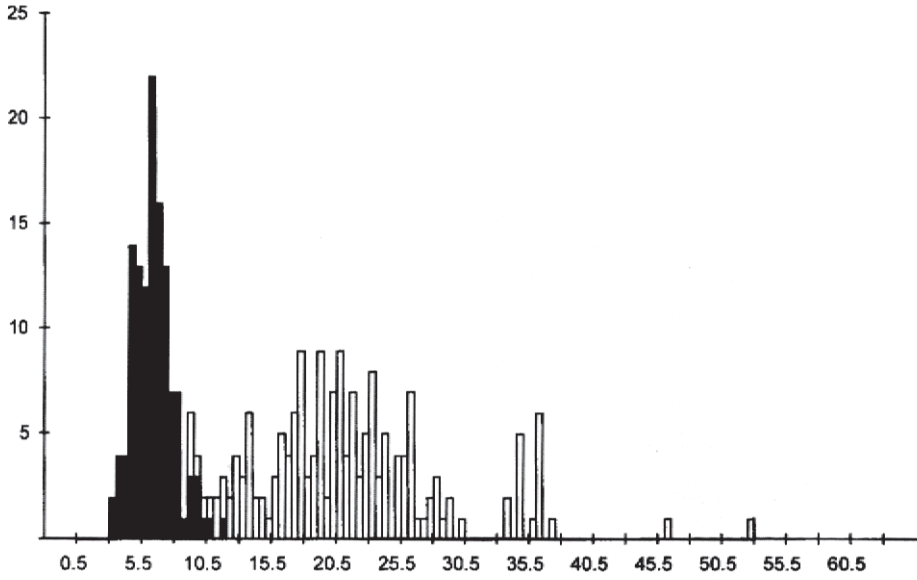


Fig. 1. Histogram of plant heights of *Utricularia delphinooides*. Black bars indicate dwarf material from Phu Kra dueng.

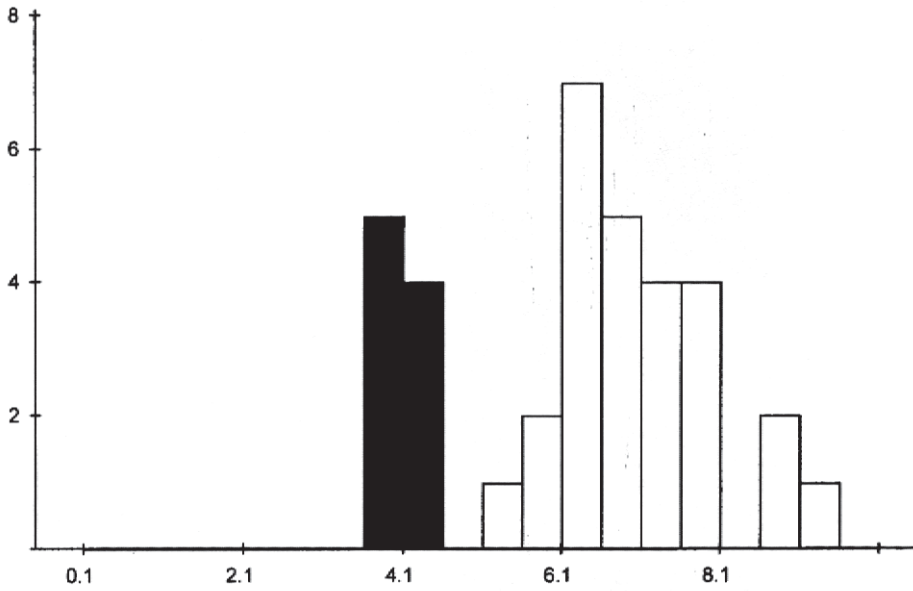


Fig. 2. Histogram of spur length of *Utricularia delphinooides*. Black bars indicate dwarf material from Phu Kra dueng.

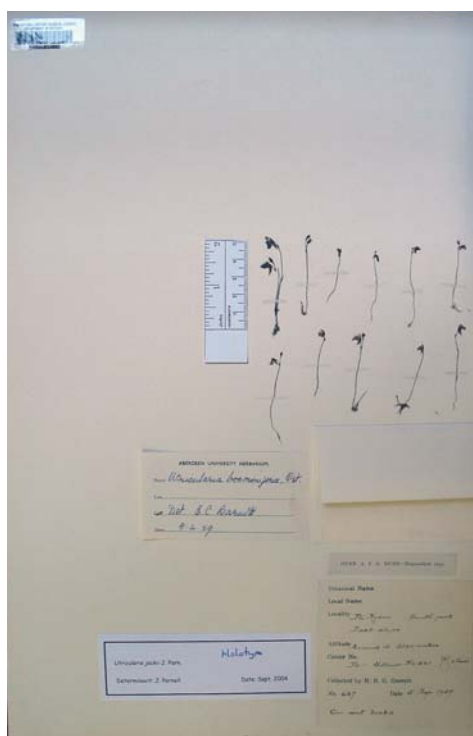


Figure 3. Holotype of *Utricularia jackii* J. Parn. Figure 4. Close-up of holotype of *Utricularia jackii*.

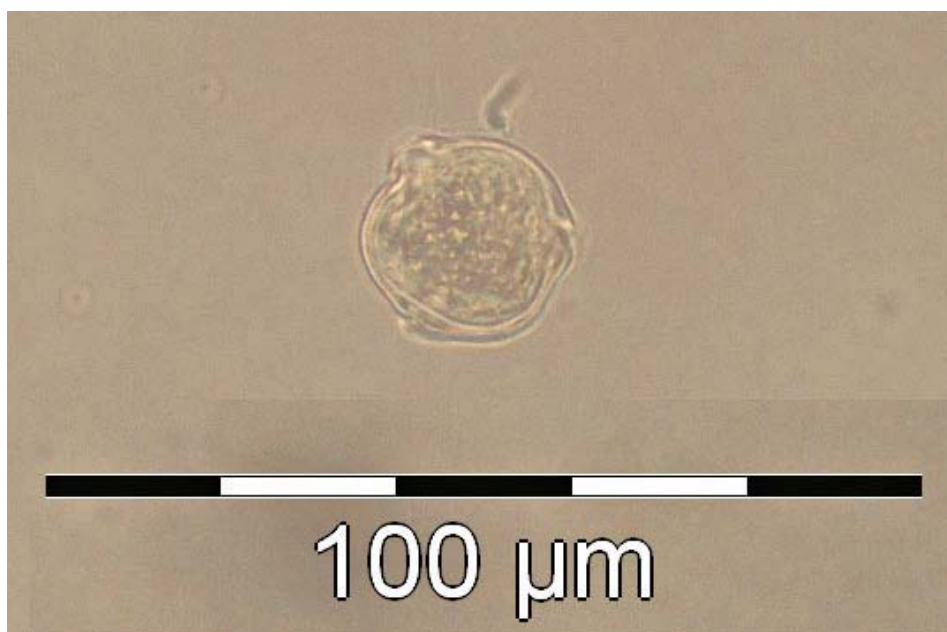


Figure 5. Pollen of *Utricularia jackii* from type sheet showing three pores.