

Utricularia in North America North of Mexico

By Peter Taylor

Introduction

Utricularia is, for the greater part, a genus of the tropical regions of the world, and is represented in the United States and Canada by only 19 of 214 species recognized worldwide. All of the rather few species which occur in Canada are also found in the United States, and within the latter country all of the 19 can be found in the eastern coastal states from Maine to Texas, although some extend further west and 6 species are recorded as growing in the Pacific northwest. Five species are endemic in the region, and one extends no further south than Cuba (just inside the tropic of Cancer). Four northern species are also found in temperate Europe or Asia (or both), two are very widespread pan-tropical species, while the rest are either more or less widespread in the eastern coastal plain and extend for varying distances southwards into the tropics, or are essentially tropical species which just reach the warmer southern states, and two of these get no farther north than Florida.

Those aquatic species that are more or less confined to the cooler northern regions, pass the winter as turions (sometimes called winter buds). These are small, globose or obovoid organs, which form at the apex of stolon branches in the latter part of the growing season. On examination they are found to consist of very numerous small, modified leaves, densely clustered on an abbreviated stolon. They are said to sink to the bottom during the winter, rising to near the surface in the spring, when they elongate and eventually produce new plants. The tropical aquatic species never have these turions but either vegetate continuously, or some species are known to produce tubers during dry periods. The terrestrial species either vegetate continuously, under permanently wet and warm conditions, or produce seed and behave as annuals. The flowers are adapted for pollination by insects but many, or possibly most, are autogamous (that is, self pollinating).

I have seen 15 of the 19 species growing in their natural habitats in the United States and am familiar in the field with two others (in Europe and tropical America). The remaining two, (*U. simulans* and *U. geminiscapa*), are known to me only as dried and pickled herbarium specimens. The key is based almost entirely on my own personal experience of the species. It allows for commonly encountered variations, and some are keyed out more than once, but many of the species are morphologically rather plastic, to a greater or lesser degree, and I am quite prepared to learn that atypical forms will not key out, especially when flowers are absent. It seems to be impossible to distinguish *U. juncea* from *U. cornuta* from vegetative material alone, although Kondo (1971) considered that there was a significant difference in seedling morphology.

In a few cases I have had to resort to microscopic characters in the "flower absent" part of the key, but only where I felt it was absolutely necessary (for instance, I cannot certainly distinguish sterile *U. geminiscapa* from *U. macrorhiza* in a similar condition, without looking inside the traps at the quadrifid glands). These glands, the function of which has been the subject of much speculation and discussion, are usually not difficult to observe with the aid of a microscope. They are present in all species, and are usually about one tenth of a mm long, or less, and are to be found on the inner side of the trap wall. In the case of *U. macrorhiza* and most other aquatic species, those near the trap mouth have two arms, those elsewhere have four. Darwin called them bifids and quadrifids. In some terrestrial species the number of arms is reduced to one and two respectively, while in one species, found in tropical America, all of the glands have a single arm. In order to examine them I usually cut a living or pickled trap in half longitudinally (under a low-power dissecting microscope), and put the trap, inner side

uppermost, under a cover slip and examine at a high magnification under a compound microscope. The arms vary, in different species, in their shape, their proportions (some are relatively long and thin, others short and fat), and especially in their disposition relative to each other. It must be stressed that their morphology cannot always be used to distinguish species, as glands that are the same or extremely similar are found in groups of related species, or sometimes in quite unrelated ones.

Key to Species of *Utricularia* Occurring in America North of Mexico

(P. T. October 1990)

1. Plant complete, with vegetative parts and inflorescence, including flowers.
2. Lateral lobes of the lower lip of the corolla saccate; leaves verticillate on the stolons, each divided into verticillate segments; traps terminal on all or most of the leaf-segments, the mouth with no appendages, but the door with a central fascicle of gland-tipped hairs (aquatic with bracts that are usually basiosolute but sometimes basifixed; corolla pink) *purpurea*
2. Lateral lobes of the lower lip not saccate; leaves not verticillate
3. Bract peltate, corolla either chasmogamous, yellow, with a distinctly 3-lobed lower lip, or cleistogamous, whitish or pinkish, very small and bud-like; traps with 2, dorsal, sparsely branched appendages (terrestrial, leaves simple, narrowly linear) *subulata*
3. Bract not peltate, basifixed, but may be more or less auriculate.
4. Calyx lobes, bracts and bracteoles with deeply fimbriate margins; traps with a simple dorsal and a 2-fid ventral appendage (terrestrial; leaves simple, narrowly linear; corolla yellow) *simulans*
4. Calyx lobes, etc, not fimbriate; traps other than above.
5. Bract tubular, encircling the pedicel; leaves filiform, terete, septate; (terrestrial or affixed shallow water aquatic; flower solitary, corolla pink; traps with 2, dorsal, setiform, branched appendages and several simple ventral setae) *resupinata*
5. Bract not tubular; leaves not septate
6. Leaves simple, spatulate; bract and bracteoles basally connate, forming what appears to be a 3-fid bract; traps with 2 dorsal, narrowly deltoid (triangular) appendages, which are densely beset with curved, gland-tipped hairs; capsule dorsiventrally 2-valvate (terrestrial; corolla yellowish, white or violet, the lower lip 3-lobed, shorter than the spur) *amethystina*
6. Leaves not spatulate; bracteoles, if present, free from the bract; capsule never dorsiventrally 2-valvate

7. Bracteoles present, much narrower than the bract; terrestrial; leaves simple, narrowly linear; traps without appendages; corolla yellow
8. Corolla 1,5-2 cm long; inflorescence usually short, congested, few-flowered
cornuta
8. Corolla 0,2-1 cm long; inflorescence elongate, lax, several-to-many-flowered
juncea
7. Bracteoles absent; suspended or affixed aquatic; leaves absent or compound, dichotomously or pinnately divided into filiform segments, the segments usually with apical and lateral setae; traps with 2, dorsal, setiform, more or less branched appendages and often also with ventral setae; corolla yellow or white.
9. Leaves always absent, the stolons bearing only traps; minute suspended aquatic, often growing among other aquatic plants, including other species of *Utricularia*; peduncle extremely short, the pedicels appearing to arise directly from the stolon; corolla whitish, about 2 mm long, the spur saccate; calyx margin entire in flower, denticulate in fruit; capsule elongate, indehiscent, 1-seeded
olivacea
9. Leaves present; suspended or affixed aquatic, peduncle well developed; corolla yellow, more than 5 mm long unless cleistogamous; calyx margin never denticulate; capsule globose, circumscissile or indehiscent, several-to-many-seeded.
10. Peduncle with a whorl of floats; lower lip of corolla 3-lobed; (each leaf with two primary segments, thus dividing it into two halves; suspended aquatic)
11. Floats tapering gradually from the base to the widest point at or near the middle; the two halves of the leaf unequal in size and shape; bracts longer than wide, entire; flowers mostly 9-14, the corolla with spur apex 2-fid.
inflata
11. Floats more or less parallel for most of their length, tapering abruptly to the base; leaves with the two halves equal in size and shape; bracts wider than long, with apex 3-dentate; flowers mostly 3-4, the corolla with spur apex almost always entire
radiata
10. Peduncle without a whorl of floats
12. Chasmogamous inflorescence with one or more cleistogamous flowers at the base or chasmogamous inflorescence sometimes absent and only cleistogamous flowers present; lower lip of chasmogamous corolla 3-lobed; bract relatively narrow, about 3 times as long as wide; seeds disk-shaped, not winged (suspended aquatic)
geminiscapa
12. Chasmogamous inflorescence never with cleistogamous flowers at its base; lower lip of corolla entire, the apex rounded or emarginate; bract wider than long or not more than 2 times as long as wide.

13. Upper lip of corolla larger, or at least as large as, the lower, shallowly 3-lobed; leaf-segments terete; capsule laterally 2-valvate; seeds lenticular, smooth or verrucose, with an irregular wing; bract wider than long.
14. Leaves of two quite distinct kinds, some with more or less numerous green segments and few or no traps, others, usually below the substrate, with fewer whitish segments and numerous traps; inflorescence usually more than 2-flowered.
15. Terrestrial or shallow water affixed aquatic with green leafy shoots superficial, usually not more than 10 cm long and 2 cm total width; peduncle erect, straight, mostly 10-25 cm long, almost entirely emergent; seeds verrucose, but the wing margin not dentate. *striata*
15. Deep water aquatic, anchored in mud in water up to 1 m deep, with green leafy shoots submerged, up to 40 cm long and 5 cm total width; peduncle flexuous, up to 1 m long, only the apical 10 cm emergent; seeds verrucose and the wing margin conspicuously dentate. *floridana*
14. Leaves all more or less the same, green, with few segments and few traps; inflorescence usually not more than 2-flowered; shallow water aquatic or terrestrial on mud; seeds smooth or sometimes verrucose. *gibba*
13. Upper lip smaller than the lower, not 3-lobed, the apex rounded or emarginate; bract longer than wide; leaf segments terete or flattened; capsule circumscissile or indehiscent.
16. Stolons flattened; capsule indehiscent; seeds thinly lenticular with a narrow regular wing (robust suspended aquatic; pedicels decurved after flowering) *foliosa*
16. Stolons terete; capsule circumscissile; seeds polygonal, narrowly winged on all the angles.
17. Spur of corolla short, subsaccate, wider than long when viewed laterally (small affixed aquatic of shallow water in bogs, some leaf-segments flattened; bract auriculate) *minor*
17. Spur longer than wide; the apical half cylindrical or narrowly conical.
18. Leaves of one kind only, with numerous terete segments and bearing traps; apex of spur curved upwards; bract not, or scarcely, auriculate; deep water suspended aquatic *macrorhiza*
18. Leaves of two kinds, some superficial, with flattened green segments bearing few or no traps, others more or less buried in the substrate and bearing traps; apex of spur not curved upwards; bract auriculate; shallow water affixed aquatic.
19. Green leaf-segments with apex obtuse and lateral margins not toothed but bearing numerous (9-20) short setae; corolla with spur about as long as the lower lip. *intermedia*

19. Green leaf-segments with apex acute and lateral margins with few (4-9) distinct teeth, each bearing a short spical seta or setae; corolla with spur considerably shorter than the lower lip. *ochroleuca*
1. Vegetative parts only present.
20. Leaves simple; affixed terrestrial or subaquatic.
21. Leaves spathulate (terrestrial) *amethystina*
21. Leaves linear or filiform.
22. Leaves terete, filiform, septate (terrestrial or shallow water affixed aquatic) *resupinata*
22. Leaves flattened, narrowly linear, not septate.
23. Traps with oral appendages.
24. Traps with 2 dorsal, subulate, sparsely branched appendages (terrestrial, but sometimes in shallow water) *subulata*
24. Traps with 1 dorsal, subulate appendage and 1 deeply 2-fid ventral appendage (terrestrial) *simulans*
23. Traps without appendages (terrestrial, but often in shallow water) (It is not possible to distinguish these two species on vegetative characters) *cornuta & juncea*
20. Leaves absent or divided into terete or narrow flattened segments; suspended or affixed aquatic.
25. Leaves absent, only traps arising from the stolons (minute suspended aquatic) *olivacea*
25. Leaves present.
26. Leaves verticillate and divided into verticillate segments, all or most of which bear terminal traps with no oral appendages (suspended aquatic). *purpurea*
26. Leaves not verticillate, nor with terminal traps.
27. Stolons flattened (robust suspended aquatic) *foliosa*
27. Stolons terete.
28. Suspended aquatic; leaves of one kind only.
29. Leaves with traps lateral on terete leaf-segments and also a few, somewhat different, smaller traps present at the very base of the primary segments.

30. Quadrid glands inside the proximal part of the trap with the two pairs of arms parallel or almost so. *geminiscapa*
30. Quadrid glands inside the proximal part of the trap with the two pairs of arms divergent. *macrorhiza*
29. Leaves with traps lateral on terete or flattened leaf-segments but never with different traps at the base of the primary segments.
31. Leaves with few segments (usually not more than 4, but sometimes up to 8) (a common form of this, normally affixed, shallow water aquatic, which rarely produces flowers) *gibba*
31. Leaves with more than 10 segments.
32. Leaves each with two primary segments and thus divided into two halves.
33. Leaves with the two halves equal, the primary segments longer than the subsequent ones. *radiata*
33. Leaves with the two halves markedly unequal, one, at least, of the two primary segments not longer than the subsequent ones. *inflata*
28. Affixed aquatic, in deep or shallow water or mud or sometimes in floating rafts of living or dead plants.
34. Leaves not clearly of 2 distinct kinds, all green and usually bearing more or less numerous traps.
35. Leaves with few segments (usually not more than 4, but sometimes up to 8). *gibba*
35. Leaves with more than 10 segments.
36. Plant bearing numerous small tuber-like organs on shoots which descend into a mud substrate; leaf segments terete, with lateral setae (a form of this, normally deep water aquatic, induced when stranded on mud) *inflata*
36. Plant not bearing tuber-like organs; leaf segments terete or flattened, without lateral setae (quadrid glands inside the proximal part of the trap with one pair of arms reflexed so that all 4 arms point in the same direction) *minor*
34. Leaves of two quite distinct kinds, some green with few or no traps, others whitish, bearing more or less numerous traps and buried in the substrate.
37. Deep water affixed aquatic, anchored in mud up to 1 m below the water surface; green leaves on long plume-like shoots, up to 40 cm long, and 5 cm total width, the segments terete. *floridana*

37. Shallow water affixed aquatic with the green leafy shoots superficial, the segments terete or flattened.
38. Leaf-segments with apical, but without lateral, setae; quadrifid glands inside the proximal part of the trap with one pair of arms reflexed, so that all four arms point in the same direction. *minor*
38. Leaf-segments with apical and with lateral setae; quadrifid glands not with all four arms pointing in the same direction.
39. Green leaf-segments terete, the margins not toothed, but bearing 3-6 short setae. *striata*
39. Green leaf-segments flattened.
40. Green leaf-segments with apex obtuse, the margins not toothed, but bearing 9-20 short setae; quadrifid glands inside the proximal part of the trap with both pairs of arms parallel. *intermedia*
40. Green leaf-segments with apex acute, the margins with 4-9 distinct teeth, each terminating in a short seta or setae; glands inside the proximal part of the trap with both pairs of arms divergent. *ochroleuca*

Notes on Distribution of North American *Utricularia*

1. *U. amethystina* St. Hil.

This tropical species has been found on two occasions in peninsular Florida. Elsewhere it has a very wide distribution in America from Mexico to Peru. It grows in wet sand or peat in open vegetation, although it will tolerate more shade than most terrestrial species. First discovered in the USA by Jeanette P. Standley near Fort Meyers and described by Barnhart as *Calpidisca standleyae*. Subsequently it was found again by Len Brass in Collier County. Don Schnell has searched for it in recent years, but has so far failed to locate it. The spatulate leaves, which are almost invariably present at flowering time, and the connate bract and bracteoles, are both diagnostic among North American species.

2. *U. cornuta* Michx

This occurs in north America, Bahamas & Cuba. In Canada it is found from Newfoundland and Nova Scotia westwards to Alberta, and in the United States in all of the eastern states and westwards to Minnesota, Wisconsin, Michigan, Illinois and Arkansas ("Washington" is included in my monograph, but this is a mistake, specimens exist so labelled, but almost certainly in error). It grows in wet soil or shallow water up to about 10 cm deep in fens, marshes and swamps, probably usually on acid soil. This species is very similar to *U. juncea* and often confused with it. Kondo, in his key to the North American *Utricularia* species,