

Although I have only dissected long-styled and short-styled flowers N. T. Sanderson and J. T. Waterhouse report (pers. comm.) three style types from field observations—long, medium and short. Medium-styled plants only were found in one pool and both long- and short-styled plants were found together in another. The medium-styled plants produced 3 or 4 of the smallest known seeds per capsule whereas the long- plus short-styled population produced 1 or 2 larger seeds per capsule. Observed populations are insufficient to determine if this distinction is constant.

***Nymphoides quadriloba* H. I. Aston, sp. nov.**

Nymphoides sp. nov. "P", Aston in litt.

Plantae annuae vel ?perennes. Laminae saepe foliorum hippocrepiformes vel late sagittiformes (1-)3-9.5(-11) x (0.8-)2-8 cm, late ellipticae ad \pm rotundae vel late deltoideae sed cum sino basali plerumque lato convexoque; lobae basales obtusae, marginibus interioribus vulgo concavis. Inflorescentia fasciculus pedicellorum densus, ad basin sinus folii ortus. Flores heterostyli, 4(5)-partiti. Corolla (6-)11-17(-19) mm diametro, vel alba vel pallide erubescens vel pallide malvinus-erubescens, fauce flavo; lobae cum duabus alis latis lateralibus profunde laciniatis, ab apice paene usque ad basin, atque cum carina verticali lata laciniata, longitudinali in superficie interiore; carina plerumque ab apice ad $\frac{1}{3}$ - $\frac{2}{3}$ lobae longitudinem, nonnumquam valde deminuta; loba et cum fimbria conspicua proxime super basin papillarum tenuium. Capsula ellipsoidea ad late-ellipsoidea, 2.5-5 x 1.7-3 mm. Semina (5-)10-44(-61) per capsulam, paene globosa sed compressa (typice superficiebus laevibus convexis cum protuberatione centrali, marginibus dense tuberculis brevibus obtusis velatis; tubercula nonnumquam desunt, nonnumquam autem et in superficiebus lateralibus et in marginibus tubercula adsunt), 0.67-1.02 x 0.6-0.95 x 0.35-0.57 mm (longitudo latitudinem \pm aequans, crassitie duplolongior), straminea ad atrofusca vel nigra maturitate; caruncula basalis, circularis, plerumque tenuis inconspicuaque.

Annual, perhaps perennial where water persists. *Petiole-like stems* few to many, arising from the plant base, slender, flexuose, 7 cm (plants on mud) to 85 cm (plants in water) long x 1 mm or less diam.; true petiole c. 1-3 mm long. *Leaf blades* very variable, typically horseshoe- or broad arrow-shaped, obtuse to rounded, entire-margined, broad-elliptic to \pm broad-deltoid in outline but with a shallow to deep, often broad, generally convex basal sinus (sinus mostly (25-)40-60% of the total blade length and of (30°-) 55°-100°(-130°) angle); basal lobes obtuse, their inner margins generally concave, their outer margins a continuation of the convex curve of the whole leaf edge; leaves (1-)3-9.5(-11) cm long x (0.8-)2-8 cm wide, (length =, >, or < width) green and shining above, not spongy. *Juvenile leaves* sometimes present on mature plants, submerged, near-sessile at the plant base, very thin-textured, deltoid to rhomboid. *Inflorescence* as for the "indica group". *Pedicels* (8-)14-25(-35), emerging erect through the sinus when in flower, very slender, 17-52 x <0.5(-1) mm. *Flowers* 4(5)-partite. *Calyx lobes* lanceolate to narrow-ovate, acute, thin-textured, greenish or purplish with translucent margins, outcurved at the apex in fruit, 2.5-4.5 mm long. *Corolla* (6-)11-17(-19) mm span, white or very pale pink or pale mauve-pink except for a yellow throat; colours also grading (see notes below). *Corolla lobes* broad-elliptic, emarginate; mid-section with a broad, lacinate, vertical keel on its upper surface and with a conspicuous transverse fringe of fine papillae just above its base; keel extending longitudinally down the distal one- to two-thirds of the lobe length and continuing proximally as a line of individual fine papillae, but sometimes (even on the same flower) reduced to a very small keel on the distal or near-central portion of the lobe; side-wings broad, undulate, deeply-lacinate, extending from the apex almost to the lobe base. *Corolla tube* papillae short, \pm thick and blunt, free and sessile or arising from the apex of a short thick common stalk. *Stamens* with filaments c. 0.5-0.75 and 1.2-1.3 mm long in long-styled and short-styled flowers respectively; anthers \pm broad-linear to elliptic, c. 1.5 times as long as broad, 0.7-1.3 mm long. *Gynoecium (long-styled flower)* c. 3-4.5 mm long; ovary ellipsoid to broad-ellipsoid, contracted into the style but not abruptly so; placentas 2, about one-quarter to one-third of the capsule length, positioned centrally down the ovary wall; ovules c. (16-)23-50(-62); style c. 1.5-1.8 mm long; stigmas 2, each a broad, papillate, irregularly-shaped and moderately lacinate wing c. 1 mm long. *Gynoecium (short-styled flower)* c. 2-3 mm long; style c. 0.3-0.6

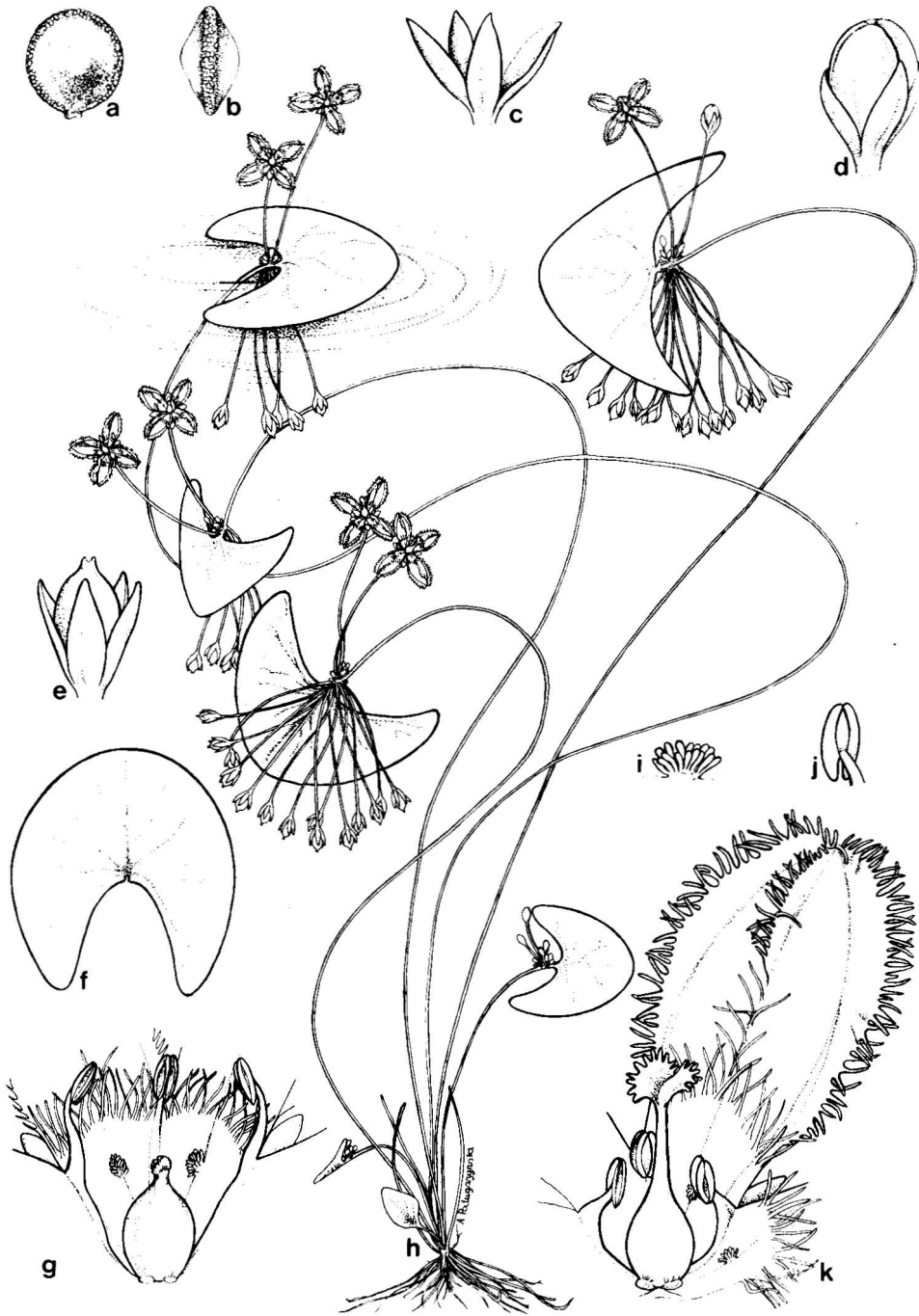


Fig. 3. *Nymphoides quadriloba*. a—seed, face view, x 22; b—seed, edge view, x 22; c—calyx, x 4; d—bud, x 4; e—capsule and persistent calyx, x 4; f—leaf, horseshoe-shaped, x 0.7; g—portion of short-styled flower showing relative positions of stamens and gynoecium, x 11; h—habit, plant with \pm arrow-shaped leaves, x 0.7; i—cluster of papillae from corolla tube, x 25; j—anther, dorsal view showing connective, x 16; k—portion of long-styled flower, x 11. f from Aston 1944 (MEL); remainder from Aston 1898 (MEL).

mm long; stigmas 0.2-0.65 mm long, condensed, rather lobed and undulate. *Capsule* ellipsoid to broad-ellipsoid, from a little < to a third as much again as the calyx, 2.5-5 x 1.7-3 mm. *Seeds* (5-)10-44(-61) per capsule, shaped as described below, 0.67-1.02 mm long x 0.6-0.95 mm wide x 0.35-0.57 mm thick, cream-straw to brown-black or black when mature, with a circular basal caruncle. *Seed from typical populations* near-globose but moderately laterally-compressed with the faces smooth and convex and with a pronounced central bulge, the edges densely covered with short obtuse tubercles which are directed diametrically outwards and together give a \pm square-cut appearance to the edge; may be modified by absence of the tubercles to give a fully-smooth seed or by greater spread of the tubercles so that they cover the side-faces (rarely also the centre-faces) as well as the edges; caruncle \pm thin and inconspicuous. *Seeds from Carpentaria populations* (see distribution and notes) have faces uniformly biconvex instead of centrally-bulged; tubercles mostly moderately to densely placed over the whole surface but variously reduced in extent, sometimes almost absent thus giving smooth seeds; caruncle usually thick and conspicuous.

TYPE COLLECTION:

About 3 miles NNE. of Katherine, Northern Territory, 10.iv.1967, *Adams 1747* (Holotype: CANB 172340. Isotypes: CANB 172339, K, NSW, NT 39334, also (not seen) at A, E, L, US). The locality on the K and NT sheets, and probably also on the unseen isotypes, is given as about 2 miles north of Katherine, but this has been corrected on the CANB sheets to that cited above. The location is on the property of L. J. Phillips (Adams, pers. comm.).

PARATYPE:

Property of L. J. Phillips, about 5-8 km NNE. of Katherine, c. 14°25'S, 132°18'E, Northern Territory, 7.v.1976, *Aston 1898* (BRI, CANB, MEL 1505244-45, PERTH).

SELECTED SPECIMENS EXAMINED (total 27):

Western Australia—Lake Gilbert, North Beverley Springs Homestead, West Kimberley, 16°35'S, 125°29'E, 1.ix.1974, *Kenneally 2193* (PERTH).

Northern Territory—Arnhem Highway, 10 km ESE. of its junction with the Stuart Highway, 12°36'S, 131°11'E, 18.v.1976, *Aston 1940* (MEL 1505242-43, NT). Survey Creek, 10.iii.1970, *Byrnes 1818* (DNA 2767, NT 24449). 2.5 miles SW. of Fountain Head, 17.iii.1961, *Chippendale 7697* (MEL 1505250, NT 7697). 12°36'S, 133°15'E, 19.ii.1973, *Craven 2286* (CANB 240521-22, MEL 537848). Lagoon west of Round Billabong, Kapalga study area, 12°27'S, 131°19'E, 1.vii.1977, *Craven 4511* (CANB 271651). Cox River Station, lagoon near Arnold River, 15°49'S, 134°36'E, 30.vi.1977, *Henshall 1567* (MEL 521380, NSW, NT 52204). Arnhem Highway, 2 km east of Mary River, 12°39'S, 131°50' [240] E, 5.iii.1978, *Henshall 1938* (NT 54816). 4 km west of Fogg Creek Dam, 12°18'S, 131°16'E, 30.v.1974, *Jacobs 1771* (MEL 1505248, NSW). c. 12 miles NE. of Edith River Siding, 9.iii.1965, *Lazarides & Adams 122* (CANB 160506, NT 39416).

Queensland—About 40 km from Normanton on the Croydon road, c. 17°55'S, 141°20'E, 19.iv.1975, *Craven 3308 A* (CANB; MEL 1519900). Corinda, 17°53'S, 138°35'E, 6.v.1974, *Jacobs 1484* (MEL 565162, NSW).

DISTRIBUTION:

Typical populations occur in the Northern Territory from the Darwin to Mary River region south to the Daly River and Katherine, with an eastern record from the vicinity of the East Alligator River. Six populations from areas south of the Gulf of Carpentaria, from the Arnold River, Northern Territory, to the Normanton/Croydon region, Queensland, are somewhat different from the typical. *Kenneally 2193* from West Kimberley, Western Australia, agrees with those from the Gulf country. Six other widespread Kimberley collections are at present only doubtfully referable to *N. quadriloba*. See under notes, also seed descriptions.

HABITAT:

Lagoon edges and ephemeral swamps, in still shallow freshwaters; once recorded from irrigation channels of rice bays and once from clear, slow-flowing water

in a creek. On sand and sandy-humus substrates; rarely grey mud or grey clay. Flowers and fruits well in water 5-50 cm deep and where stranded on saturated soil. Fl. and Fr. recorded 31 January–20 July, with one record 1 September.

NOTES:

Readily recognised as a member of the “indica group” by the white/pale pink/pale mauve flowers (yellow only in the throat) and the clustered inflorescence arising from the apparent petiole close against the leaf blade. It differs from all other species of that group in having keeled corolla lobes and in the characteristic seed of typical populations. The mostly 4-partite flowers, the deeply lacinate margins of the corolla-lobe wings and keel, the varied leaf shape with convex basal sinus and, when present, the pale pink or mauve colour of the corolla are also important characters.

The epithet *quadriloba* refers to the four-lobed corolla which is very noticeable in the field.

Corolla colour varies between and within populations and there is sometimes intergrading of colours on the same flower. Corollas of *Aston 1944* were wholly white except for the yellow throat, while those of the paratype population were “very pale pink grading to deeper mauve-pink at base of lobes and upper throat; yellow in the throat. Occasionally the deeper mauve-pink absent and corolla then very very pale pink (or almost white) with yellow throat”.

In edge view the seed of typical populations from the Northern Territory is top-shaped and distinctive. That of Carpentaria populations (see distribution, also seed descriptions) is broadly and evenly biconvex in cross-section and, together with the larger caruncle, often similar to seed of *N. spongiosa*. There is some gradation between the two seed types of *N. quadriloba* and the regional distinction may prove more apparent than real when further fully-adequate collections are available.

Several collections from the Kimberleys which have seeds with more clustered, dome-based tubercles possibly belong to *N. quadriloba* but material seen is inadequate for conclusions.

Nymphoides spongiosa H. I. Aston, sp. nov.

Nymphoides sp. nov. “M”, Aston in litt.

Plantae annuae. Laminae foliorum ellipticae-oblongae ad late ovatae, integrae, profunde cordatae, (1-)2-5.5 x (0.8-)1.5-4.5 cm, infra spongiosae sed laeves (haud rugosae). Inflorescentia fasciculus pedicellorum densus, ad basin sinus folii ortus. Flores heterostyli, (4)5(6)-partiti. Corolla (7-)10-18(-20) mm diametro, alba, fauce flavo; lobae late ellipticae, alis lateralibus undulatis integris, fimbriaque transversa proxime super basin lobae papillarum tenuium formata, praeditae. Ovarium ± globosum, in stylam abrupte contractum. Capsula latissime ellipsoidea ad ± globosa, 2.25-4 x 1.75-3 mm. Semina (5-)8-14(-25) per capsulam, ± globosa, parce compressa, tuberculis convexis brevissimis dense velata (vel tubercula nonnisi in marginibus seminum) 0.65-1.1 x 0.6-0.97 x 0.35-0.7 mm (longitudo latitudinem aequans, crassitie sesquilingior ad duplongior), straminea ad pallide cinereo-fusca maturitate: caruncula basalis, circularis, typice crassa conspicuaque.

Apparently annual. *Petiole-like stems* few to many, arising from the plant base, slender, flexuose, 3 cm (plants on mud) to 90 cm (plants in water) long x 1 mm or less diam.; true petiole minute or apparently absent. *Leaf blades* elliptic-oblong to broad-ovate in outline, deeply cordate (the lobes mostly (30-)40-50% of the total blade length and separated by a sinus of 40°-70°(-90° angle), obtuse, entire, (1-)2-5.5 x (0.8-)1.5-4.5 cm, green and shining above, white-translucent and spongy beneath; spongy tissue thickest at the centre and grading to thin or absent at the blade edges, smooth-surfaced, not rugose. *Inflorescence* as for the “indica group”; pedicels subtended by ± ovate, membranous, translucent bracts 3-6 mm long. *Pedicels* (10-)12-30, emerging erect through the sinus when in flower, very slender, (8-)14-40 x < 0.5 mm. *Flowers* (4)5(6)-partite. *Calyx lobes* lanceolate, acute, membranous, mostly purplish-translucent, usually slightly outcurved at the apex particularly in fruit. *Corolla* (7-)10-18(-20) mm span, white with a yellow throat. *Corolla lobes* broad-elliptic; mid-section glabrous except for a conspicuous transverse fringe of fine papillae just above its base; side-wings broad, undulate, entire (1-few