

Lemna (The Duckweeds) with a Hand Lens

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Attempting to identify some of the species of *Lemna* in the field can prove to be a frustrating task. This is why most people do not even attempt it. Conventional keys start with identifying the number of veins within the frond. This is not something that can be accomplished in the field. It requires a good microscope with strong backlighting and a lot of luck. Very often, these veins are, admittedly, indistinct or even missing. All that most of us really want is a simple key that produces good results. With that in mind, I have developed the following key based on those physical characteristics that are visible with a good hand lens (or microscope). If followed carefully, it should give the user the desired results. Elias Landolt* in his landmark work on the *Lemnaceae* in 1986, advises that the most accurate way to identify many of the species of *Lemna* is to match all of the available characteristics. This key attempts to do just that. For each of the species, I have included those characteristics that will be of greatest help in separating them. Because many of the duckweeds share at least a few physical properties, the user is advised to carefully follow the key to arrive at a particular species and then match all of the stated characteristics to the field sample. With practice, what, at first, may seem to be very subtle differences will become more distinguishable. It should also be noted that most aquatic ecosystems are likely to contain more than one species of duckweed (possibly as many as four!). Care must be taken to look for and separate these. In addition, different parts of an ecosystem may have different species depending on the ecological conditions. Take several samples. Finally, species appear (or disappear) from the surface at different times during the growing season; samples should be taken several times throughout the growing season to insure a complete inventory.

1 – Fronds spatulate shaped forming short to long, branched chains that are connected through broad, green stipes (stipes short when flowering); the fronds submerged just below the surface except when flowering and fruiting *L. trisulca*

Fronds narrowly ovate, flat and thin; papules absent; the lower surface may have red coloring around the root node; it flowers in May mainly where very crowded. This species is relatively common throughout the year in shallow lakes, ponds and, especially, marshes.

1 – Fronds not spatulate shaped; not forming chains but coherent (connected directly with one another); the fronds generally floating on the surface (*L. valdiviana* may occasionally be submerged).

2 - At least a few air spaces on the underside of the frond very large, somewhat rectangular and bulging; upper surface flat, lower surface thickened to gibbous (inflated) *L. gibba*

Fronds medium to large (2 – 6 mm in length) with a low median ridge; papules small or absent; when the frond is thin the lower surface has a “quilted” look; when gibbous, the air spaces become somewhat rectangular giving the underside the appearance of a soccer ball; roots grow to 15 cm (6 in) long; the lower surface green or with a reddish margin (the red color starting at the apex of the frond). This species is rare in stable ponds and marshes. It appears in early spring and is present throughout the fall.

2 - Air spaces on the underside of the frond variable in size but never large, rectangular or bulging; the lower surface flat to somewhat gibbous (in *L. obscura*).

3 – Papules mostly small or absent, not easily seen with a hand lens; red pigmentation normally not present.

4 – Fronds ovate-lanceolate; 2 to 3 times longer than wide with the sides becoming parallel *L. valdiviana*

Fronds 1 to 5 mm long and up to 1 mm wide, sometimes ending in a point; upper surface generally flat; the fronds usually float but may occasionally be submerged; air spaces on the underside of the frond very small, not easily seen even with a hand lens; papules indistinct or absent; roots less than 1.5 cm (0.6 in) long; the underside of the frond green. It is rare in stable aquatic ecosystems.

4 – Fronds oval, oblong, ovate (widest at or below the middle) or obovate (widest above the middle); never more than 2 times longer than wide; the sides never parallel.

5 – Fronds medium to large (2 - 6+ mm long and more than 1.5mm wide), waxy, flat to slightly convex, thin to slightly thickened; roots longer than 1.5 cm long with a rounded tip; dark red pigmentation sometimes present on the upper surface of budding fronds in spring and fall *L. minor*

Fronds orbiculate to ovate; 1 to 2 times as long as wide: the upper surface flat to slightly concave or convex; fronds very thin or somewhat thickened; papules very small or absent; air spaces (look at the lower surface) hidden by a layer of opaque cells. This species is normally found in shaded, often calcareous ecosystems but also in slow moving rivers and streams; it can be found from very early spring to early winter (when it may be seen frozen in the ice). This is a frequently encountered species.

NOTE: This species is most often seen in one of two forms where they are either large (4+ mm), sub-orbiculate, flat and thin with no papules or medium size (2 – 4mm), obovate, slightly domed, somewhat thick (but not gibbous), with very small (indistinct) papules. Intermediate forms may occasionally be encountered!

5 - Fronds small (mostly 1 to 3 mm long and less than 1.5 mm wide); generally flat; roots short, less than 1.5 cm (0.6 in) long with a rounded tip; red pigmentation never present..... *L. minuta*

Fronds obovate and thin to somewhat thickened. It is uncommon in marshes and ponds where it is present at the surface throughout the year.

NOTE: This species can easily be confused with the smaller form of *L. minor*. Other than the number of veins (*L. minuta* has 1 while *L. minor* has 3-5), root length of mature fronds (given above) and the number of attached fronds (usually 2 in this species and more than 2 in *L. minor*) may be of help in separating them.

3 – One or more papules distinct, easily seen with a hand lens; red pigmentation often present.

6 – Two or three papules clustered over the root node; other, smaller papules sometimes scattered over the surface of the frond, which is green and waxy on both surfaces *L. perpusilla*

Fronds small to medium size (1.5 to 3 mm in length and more than 1.5mm wide), thin, relatively flat and waxy; red pigmentation never present; the longest roots less than 3.5 cm (1.4 in) with a sharp pointed tip; the sheath at the base of the root winged (usually very hard to see without a microscope). It is uncommon in a variety of aquatic ecosystems where it appears in late spring and can be found throughout the summer into fall.

6 – A single distinct papule located over the root node with others in a line along the central part of the frond.

7 - Frond with no red pigmentation; the papule above the root node quite large and distinct, others smaller; root short, less than 3 cm (1.2 in) long; root sheath winged *L. aequinoctialis*

Fronds generally large (1 – 7 mm long and up to 4.5 mm wide), thin and flat; root with a sharp pointed tip (most easily seen in dry specimens). Very rare (I have not seen this species in the wild!).

7 – Red pigmentation usually present; papule at the apex of the frond distinct, others variable; roots much longer than 3 cm; root sheath not winged.

8 – Red pigmentation is darkest on the lower surface of all fronds throughout the growing season.

9 – All papules of equal size; fronds somewhat convex on the upper surface and slightly thickened (not gibbous); distinct, olive to brown, rootless turions sometimes present in spring or fall; *L. turionifera*

Fronds generally small to medium in size (1 – 4 mm in length and more than 1.5mm wide); upper surface of the frond shiny and dark green; roots grow up to 15.0 cm (6 in) long with a rounded tip; air spaces on the underside of the frond relatively large and easily seen with a hand lens; distinct, overwintering turions (0.8 – 1.6 mm in diameter, lozenge shaped, generally rootless, olive to brown buds) may be produced in October to early November and reappear in May or June to produce new fronds. It is very common in a variety of aquatic ecosystems and is present from early spring until late fall.

NOTE: *Spirodela polyrhiza* also produces turions that are very similar (but larger) during the same period.

9 – One papule at the apex of the frond very large and often tilted towards the apex, the others less distinct; fronds usually convex and thick (rarely gibbous); turions not present; *L. obscura*

Fronds small (1.0 – 3.5 mm long and less than 1.5 mm wide), although specimens from cool shaded ponds may be somewhat larger; roots grow to 15 cm (6 in) long with a rounded tip; air spaces on the underside of the frond relatively large and easily seen with a hand lens (but not bulging or rectangular as in *L. gibba*). This species is uncommon in a variety of aquatic ecosystems.

8 – Red pigmentation darkest on the upper surface of younger, budding fronds during cold weather in early spring and late fall.

10 –Air spaces on the lower surface of the frond visible (easily seen with a hand lens); papules distinct, of equal size; olive to brown, rootless turions produced (sometimes present in spring or fall); *L. turionifera*

Fronds generally small to medium in size (1 – 4 mm in length and more than 1.5mm wide); upper surface of the frond shiny and usually dark green; all papules of equal size; upper surface of the frond somewhat raised, slightly thickened (not gibbous); red pigmentation usually present, darkest on the lower surface during the warm season and on the upper surface of new fronds in the cold water of spring and fall; roots grow up to 15.0 cm (6 in) long with a rounded tip; distinct, overwintering turions [small (0.8 – 1.6 mm in diameter, lozenge shaped, generally rootless, olive to brown buds) may be produced in October to early November and reappear in May or June to produce new fronds. It is very common in a variety of aquatic ecosystems and is present from early spring until late fall.

NOTE: *Spirodela polyrhiza* also produces turions that are very similar (but larger) during the same period.

10 –Air spaces on the lower surface of the frond not visible even with a hand lens (hidden by a layer of opaque cells); papules small (of varying sizes) or absent; turions never produced *L. minor*

Fronds medium size (2 - 4 mm long and more than 1.5mm wide), orbiculate to ovate; 1 to 2 times as long as wide; papules not present or very small; fronds shiny, slightly convex, slightly thickened; dark red pigmentation occasionally seen on the upper surface of the new (budding) fronds in spring and fall; fronds somewhat thickened; roots longer than 1.5 cm long with a rounded tip; this variation is normally found in open, sunny ecosystems where it can be seen at any time of the year (sometimes frozen in the ice during winter). This variation is often encountered in a variety of habitats.

*Landolt E., 1986: *The family of Lemnaceae – a monographic study (volume 1)*, Veröffentlichungen des Goebotanaschen Institutes der ETH, Stiftung Rubel, Zurich, 71. Heft