

# Identification of common aquatic water-primrose species, *Ludwigia*, in Florida

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A handful of primary features are useful for distinguishing water primrose (*Ludwigia*) from other plants. Understand what to look for, such as leaf arrangement and number of petals. Pairing morphological features with growth habit in the field quickly narrows down the thirty-odd species of water primrose in Florida to the handful most commonly found in the lakes, ponds, rivers and canals typically frequented by aquatic managers.

## How to recognize water-primrose

- Herbs/shrubs of aquatic, wetland places: ~30 species  
Habitat as species indicator, species show habitat preference.
- Genus name "*Ludwigia*"
- Flowers solitary, yellow
- Broad leaves, entire margin
- Plants often hairy
- Fruits capsules enclosing numerous seeds



This genus of plants was named after a German botanist may not have been happy over the Latinization of his name. Florida has about 30 species. Habitat serves as general indicator of species.

Outside the aquatic realm, yet important to know

### *Ludwigia peruviana*

- Driest habitat: ROW, shoreline, dykes
- Tall shrub, woody base
- Lvs alternate, strong venation, rough
- Petals 4(5)
- Capsules wide, blocky
- Dispersal agent tiny seeds: thousands released through end pore



*Ludwigia peruviana* is our most commonly seen species. Demonstrating little preference for an aquatic habitat, it forms tall thickets along roadside ditch banks and upper shorelines.

It recurs perennially from thick, woody stem bases. Its tough stems and rough, hairy leaves afford a level of upland tolerance to this non-native, invasive species.

## Aquatic Emergent *Ludwigia*

- Dispersal primarily by vegetative fragments
- May or may not be initially rooted in the substrate
- Later mats of stem and leaf biomass are supported by water
- Most biomass eventually exists hidden the under water surface



Most pertinent to aquatic managers in Florida are the emergent aquatics.

# Stand out features

## Stems Matter

- reservoirs of energy for maintaining and expanding populations



## Fibrous Roots Unite!

- bind submersed and floating stems into mats
- nutrient uptake



Stems are what gives these emergent species of aquatic habitats a special punch. They are reservoirs of energy used in maintaining, expanding, and recurring populations. With our emergent *Ludwigia*, stems are the most important plant feature in management.

Fibrous roots acquire nutrients and help bind the submersed and floating stems into dense mats that provide support for emergent stems.



# Aquatic adaptations

## Pneumatophores

- Spongy external structures from roots aid oxygenation in an anaerobic environment



## Aerenchyma

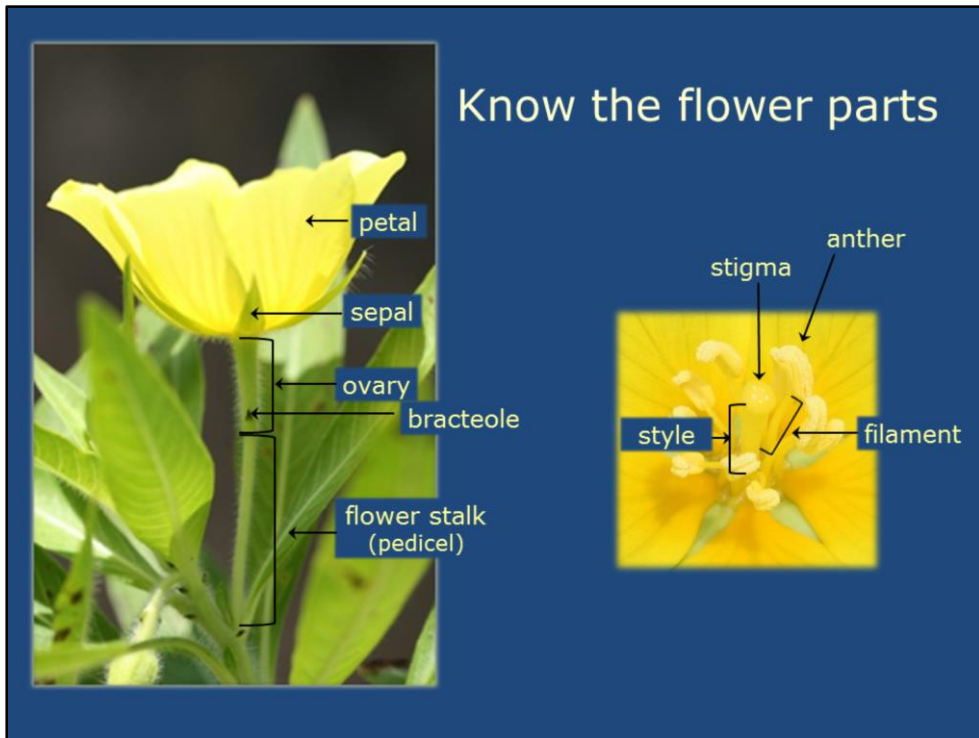
- Soft cellular tissue with large air spaces, here within the stem base help buoy and support emergent stems

Special aquatic adaptations for oxygenation in an anaerobic environment. It is common for aquatic *Ludwigia* species to display multiple shades of green and red.

## Identifying emergent aquatic *Ludwigia* 3 starting tips:

1. Observe arrangement of leaves on the stem
2. Count the number of stamens in the flower
3. Determine petal number, if petals have fallen, count the sepal number

Apply these three initial steps to eliminate species and to arrive at the emergent aquatic *Ludwigia* in Florida.



Interpret the flowers by knowing their parts.

First review the names needed for knowing the flowering plants.

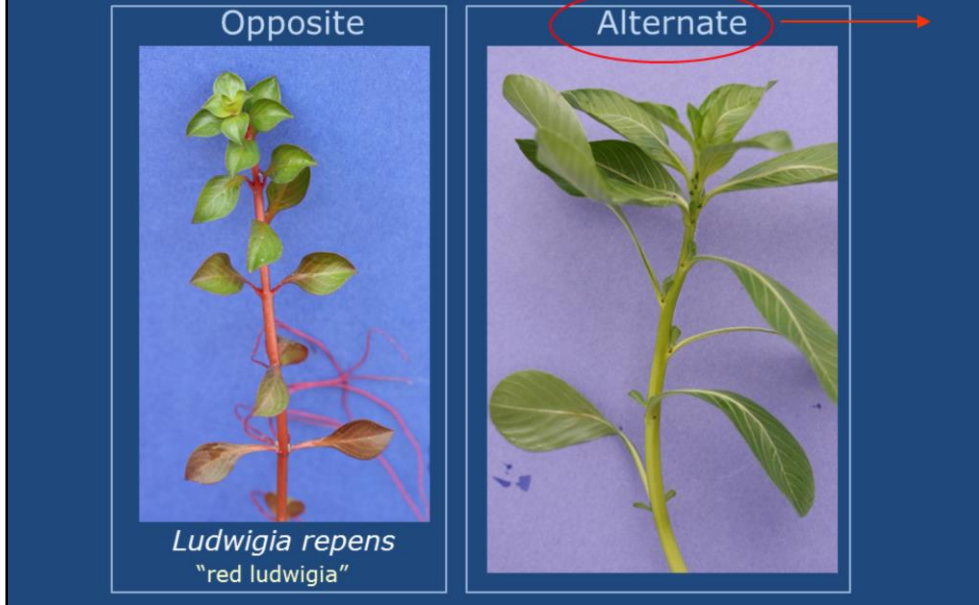
*Ludwigia hexapetala*, with the largest flowers among the emergent aquatic species of *Ludwigia* serve as a good model.

All *Ludwigia* have delicate petals that are tacky to the touch and short lived, no more than 2 days.



3 tips to identifying emergent aquatic *Ludwigia*

1. Leaves should be alternate on the stem



For all emergent aquatic *Ludwigia* leaves are arranged in an alternate fashion on the stem.

The most common species with opposite leaves is *Ludwigia repens*, called "red ludwigia" but remember that all *Ludwigia* can display red coloration.

*Ludwigia repens* grows mostly submersed with upper stem portions floating. When water withdraws, rooted portions will grow in a low creep along the damp, moist substrate.

All of our emergent aquatic species however have alternate leaves. Consider only plants with alternate leaves as our first step in this course to species identification.

2. Stamens should number 2x petals  
8 or 10(12)



3. Petal number should be 4 or 5(6)

4-petal group



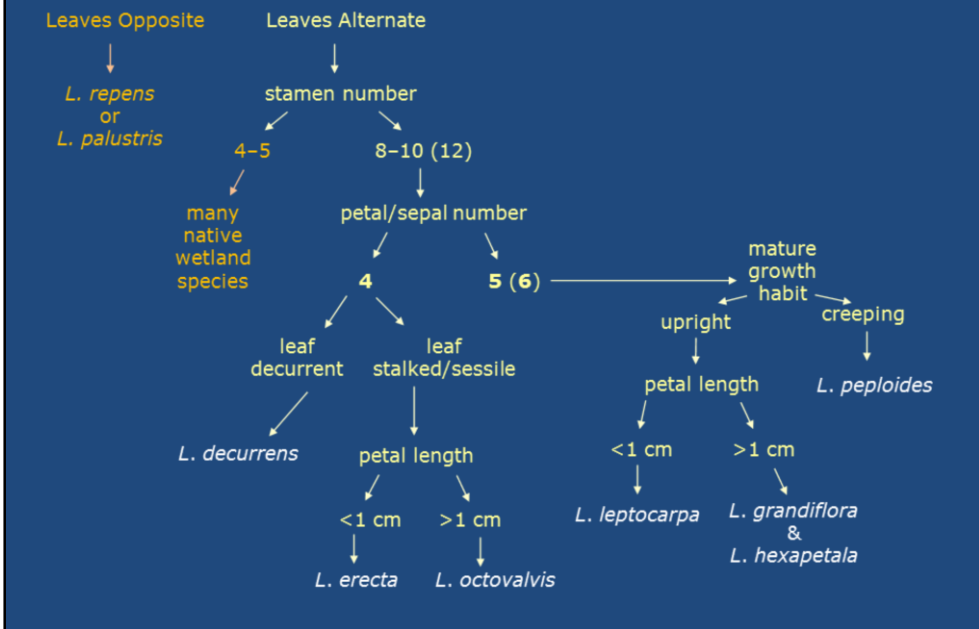
5(6)-petal group



Each stamen consists of a filament that holds the anther. The anther is the pollen containing sac. To identify the emergent aquatic species of *Ludwigia* count the number of stamens.

The number of stamens should be twice the number of petals. The petals number either 4 or 5. Often 5 petaled species have 6 petals.

## Generalized chart to common aquatic emergent *Ludwigia*



Use this flow chart as a general introduction to species identification of common *Ludwigia* occurring in territories of aquatic managers in Florida.

If the leaves are opposite or if the number of stamens equals the number of petals, the plant is not an aquatic emergent species.

## Key to 4-petal aquatic emergent *Ludwigia*

Note: all have growth habit erect

seeds free in capsule, no corky cover

1. Stems angled with narrow wings; leaves decurrent (running down into stem); plants without hair ..... *L. decurrens*
1. Stems angled to rounded, not winged; leaves having a short stalk; plants with or without hair ..... 2.
  2. Plant without hair, annual growth habit, petal tiny 0.4-0.5 cm long; sepals narrow, <0.5 cm long; capsules <2 cm long ... *L. erecta*
  2. Plant hairy, perennial or annual habit, petal 1-2 cm long; sepals wide, 0.5 cm long; capsules >2 cm long ..... *L. octovalvis*

Key to the 4-petal group.

The leaves of species within this group tend to be rugose (surface uneven due to strongly impressed venation). Species in the 5-petal group have a relatively smooth leaf surface.

4-Petal  
*Ludwigia decurrens*



Leaves extend into the stem (decurent)

Plants without hair



Stems strongly angled, narrowly winged



petals 0.8 to 1.2 cm  
sepals 0.7 to 1. cm

capsules short stalked, sepals narrow

Entire plant is without hair (glabrous).

4-Petal  
*Ludwigia erecta*

Seedlings abundant  
under dry down



Petals 0.4 - 0.5 cm  
Sepals 0.2 - 0.5 cm

Capsule  
nearly lacking  
a stalk



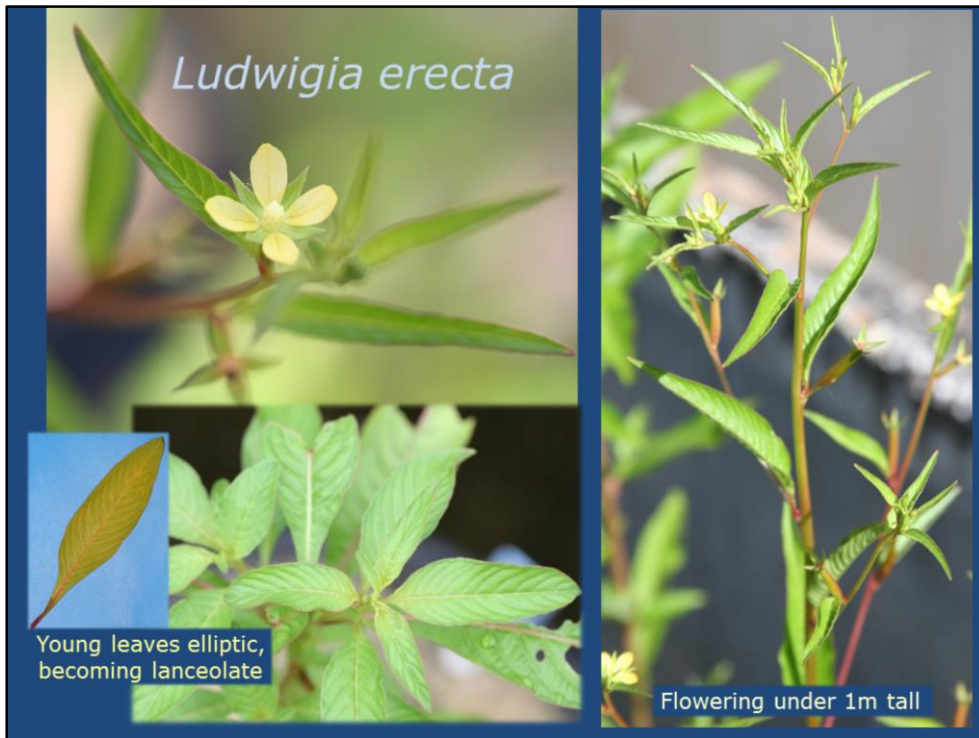
Seeds 0.5mm, free in  
capsule, no corky cover



Capsules barely 1.2 cm long,  
here shredding when dry

An annual species, especially of shorelines that annually dry down in spring. The flowers of *Ludwigia erecta* are so small, the entire flower measures no more than 1 cm across.





*Ludwigia erecta* is a small, upright, sparsely foliated plant, here flowering under 1m tall.

4-Petal

*Ludwigia octovalvis*

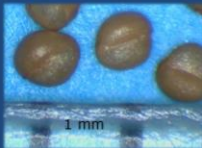


Across the entire state, the phenotype of this species varies little between populations, yet it is a very common species.

Recognize *Ludwigia octovalvis* for its petals having the base constricted, sepals wide and shorter than the petals, and ribbed capsules that are long and narrow.

4-Petal  
*Ludwigia octovalvis*

This species can form creeping or horizontal floating stems especially in its early life stage



Seeds <1mm, free in capsule, not encased in corky layer



Floating stem



Young emerging stem

The early life stage form with its elongated terminal rosette of floating leaves could be confused easily be confused with the early floating life stage of *Ludwigia grandiflora* (see slide 29).

## Key to 5-Petal Aquatic Emergent *Ludwigia*

Note: all have seeds within a corky cover and flat sides

1. Flowering stems horizontal, creeping or the tips ascending, but never growing strongly erect or more than ankle to calf high, stems remaining soft, succulent, easy to snap; leaves, stems, capsules glossy, without hair; flower stalk usually much longer than the ovary ..... *L. peploides*

1. Flowering stems emerging to grow upright and erect, commonly to 1m tall, later becoming resilient, tough, hard to snap; leaves, stems, capsules not glossy having sparse to abundant hair; flower stalk shorter than, equal to or only slightly longer than the ovary ..... 2

2. Stems angled or rounded, flower stalk shorter than ovary, petals <1 cm long, sepals often as long as petals, capsule ribbed, 3-5 cm long, seed partially covered with horseshoe-shaped corky layer *L. leptocarpa*

2. Stems rounded, flower stalk equal to or slightly longer than ovary, petals >1 cm long, sepals always shorter than petals, capsule smooth, 1.2 or 2-2.5 cm long, seed completely encased in a thick corky layer ...

3 Flowers present - slide 24

3 Flowers absent - slide 24

Take your time going through this key: lots of words but the contents are simple.

Examples of the two types of growth habit  
at flowering (following the 5-petal key)

Horizontal



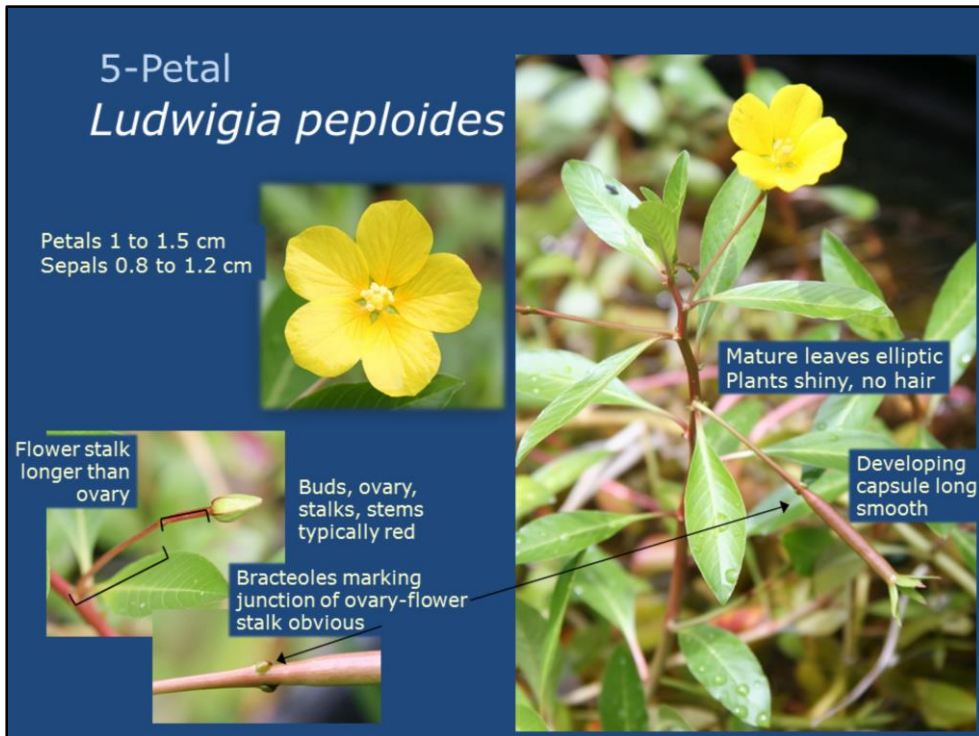
*Ludwigia peploides*

ERECT



*Ludwigia grandiflora*





Easy to recognize as the overall smallest 5-petal *Ludwigia* species, *L. peploides* is a more delicate and comparatively smaller plant which lacks hair. The stem tip pictured on the right measures 5mm wide. It is ascending no more than 12 cm above the its horizontally floating portion, which has already flowered.



5-Petal  
*Ludwigia peploides*



Photo credit: Kris Campbell

Creeping flowering stems  
ankle to calf high




Illustrated here are characters noted in the 5-petal key: flower stalks longer than the ovary, bracteoles obvious, capsules long, slender, cylindrical; hairs absent; petal length 1.5 cm; capsule length >3 cm, capsule width 3mm, stalk of capsule 3.5 cm.

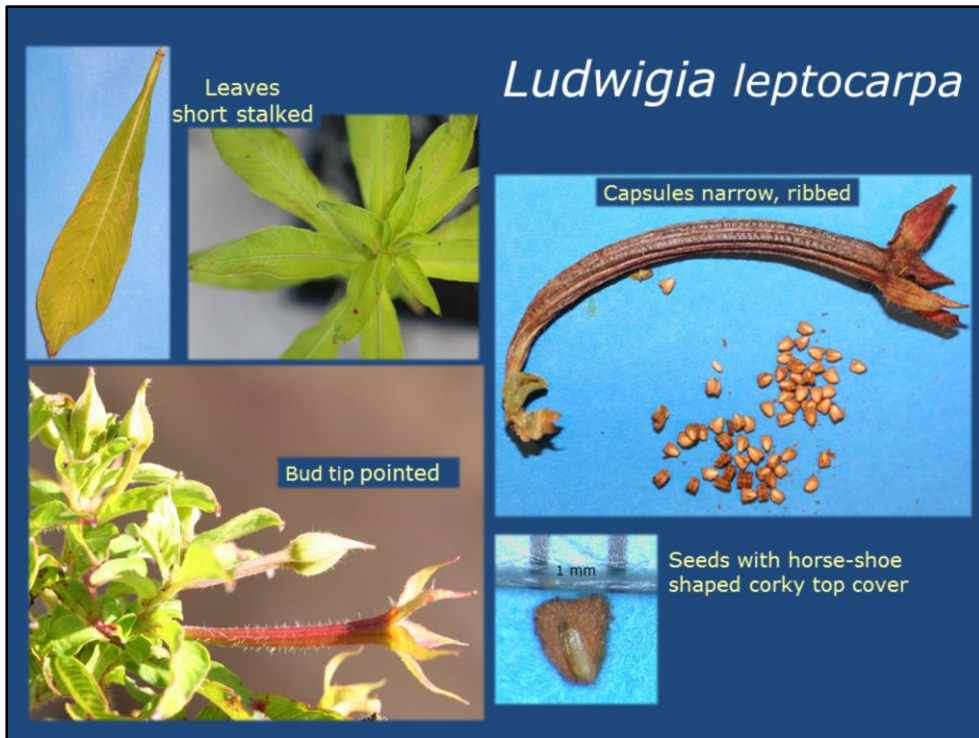
5-Petal  
*Ludwigia leptocarpa*



Petals .5 to 1 cm,  
narrowed at base for  
teardrop shape  
Sepals .5 to 1 cm, tip  
pointed

Stems strongly erect with shaggy hair. Here taller, leaves longer, more drooping and more yellow in color than surrounding *L. grandiflora*. *Ludwigia grandiflora* flower marked in .

There are only a few native emergent species of *Ludwigia* that we commonly work among that may initially be confused with our new invasive group (*L. hexapetala* and *L. grandiflora*). The primary offender is *L. leptocarpa*, because it is the 5 petaled species that often grows with *L. grandiflora* in the Kissimmee Chain of Lakes. Here any comparison stops. *L. leptocarpa* has much smaller petals and flowers overall. Also, its petals are teardrop in shape as they narrow at the petal base while the leaves of *L. hexapetala* and *L. grandiflora* are more blocky in shape (slide 41). The leaves of *L. leptocarpa* tend to carry a yellow cast.



The flower buds of *Ludwigia leptocarpa* display a pointed tip. Once fertilized, its ovary forms narrow capsules with ribs. They are smaller than the capsules of *L. octovalvis* and you will know them as well for the five, rather than four sepals remaining on the end of the capsule. The capsules of *L. leptocarpa*, *grandiflora*, and *hexapetala* are all hairy. The capsules of *L. peploides* are without hair.

## Key to 5-Petal Aquatic Emergent *Ludwigia* (cont.)

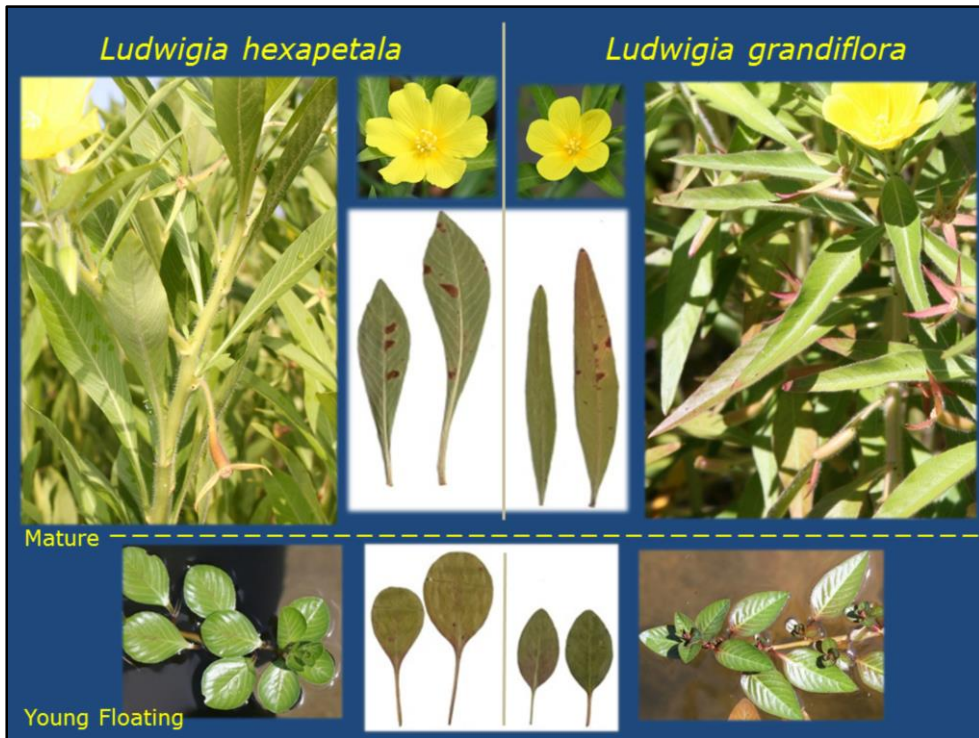
3. **Flowers present** (use Appendix I: guide to measure, slide 31)
  4. Petal length  $\leq 2.5$  cm, filament  $\leq 6.5$  mm, style  $\leq 8$  mm, sepal  $\leq 1.5$  cm, ovary  $\leq 1$  cm, flower stalk  $< 2$  cm; capsules 1.2 cm long; distance from leaf base to widest width/leaf ln  $< 0.5$  (lanceolate) *L. grandiflora*
  4. Petal length  $> 2.5$  cm, filament  $> 6.5$  mm, style  $> 8$  mm, sepal  $> 1.5$  cm, ovary  $> 1$  cm, flower stalk  $> 2$  cm; capsules 2-2.5 cm long; distance from leaf base to widest width/leaf ln  $> 0.5$  (oblanceolate) *L. hexapetala*
3. **Flowers absent** (use illustrated slides that follow)
  5. Upright stems stiff, hairs sticky, lower nodes not obviously swollen; leaf shape lanceolate to lanceolate-elliptic, tips gradually taper to a long point. Floating stems end in elongated foliar rosettes, leaves ovate to oblong, tips narrowly rounded to a point; leaf stalk shorter than the leaf, axillary buds prominent *L. grandiflora*
  5. Upright stems flexible, hairs smooth, lower nodes swollen, leaf shape oblanceolate to oblanceolate-elliptic, tips abruptly end in a short point. Floating stems end in radially compact foliar rosettes, leaf shape orbicular to spatulate, tips broadly rounded to nearly flat; leaf stalk as long as the leaf, axillary buds inconspicuous *L. hexapetala*

If flowers are present, follow the quantitative key to fertile features using Appendix I as a guide to how to measure the flower parts (side 31).

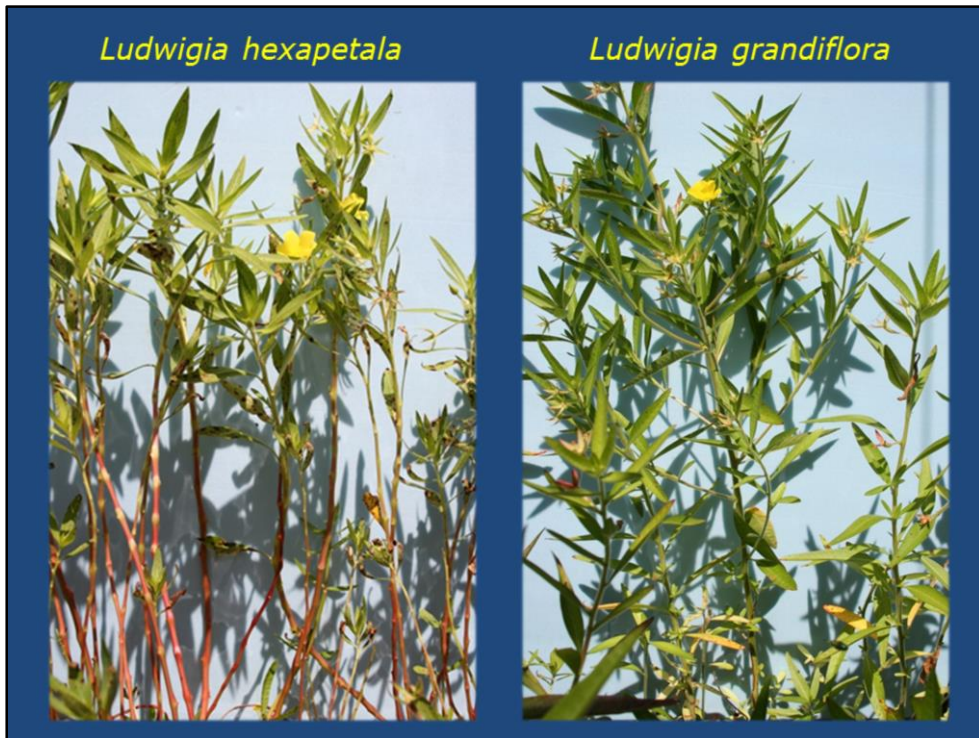
If flowers are absent, follow the descriptive key to vegetative features and growth habit. Use the illustrations on slides 25 to 32 as examples of what to look for.

Use as many characters as possible when using any key to identification. Lanceolate leaves are wider below the leaf mid-point. Oblanceolate leaves are wider above the mid-point of the leaf.



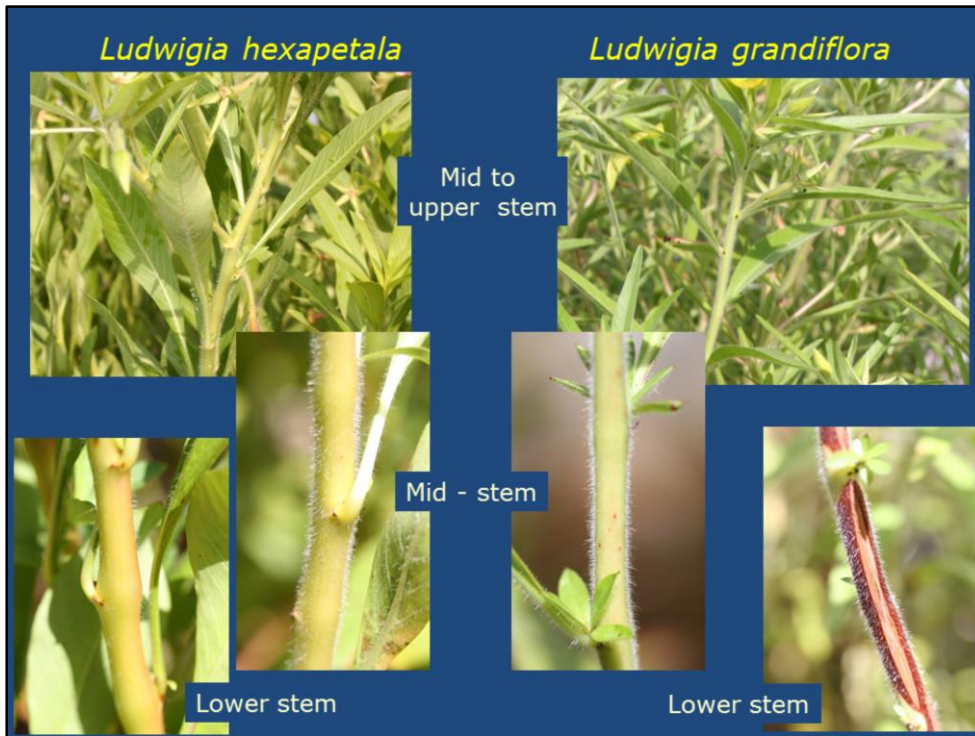


A sampling of comparative characteristics of *Ludwigia hexapetala* and *Ludwigia grandiflora* mentioned in the descriptive key, slide 24.



Stems and nodes as mentioned in the descriptive key, slide 24.





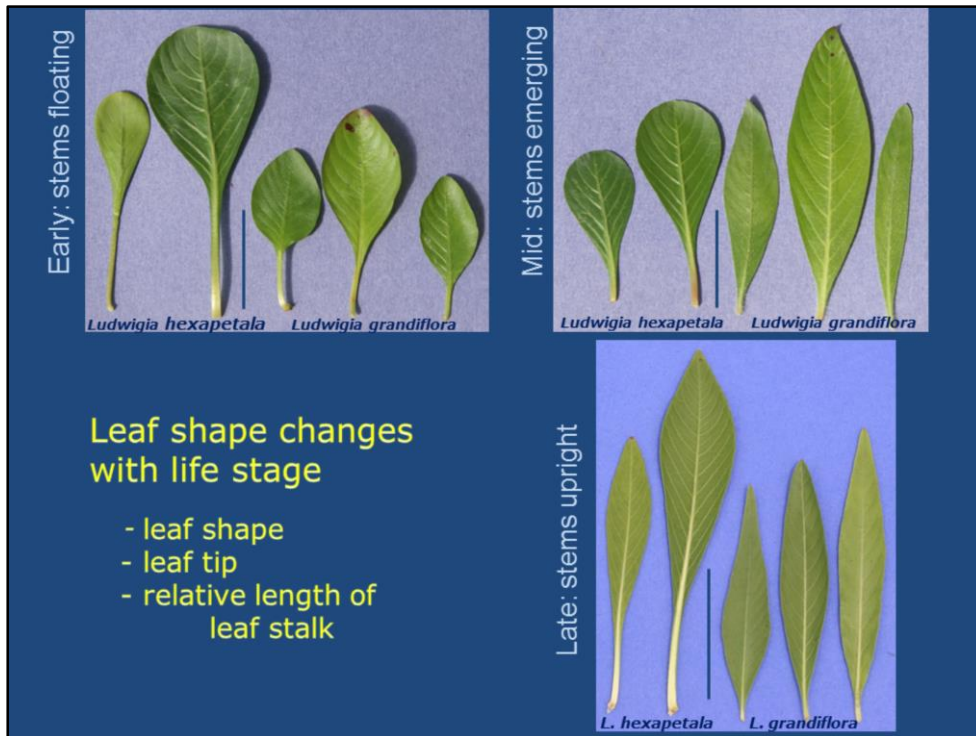
Leaves attached at the mid to lower portions of upright stems best represent the mature leaf shape.

species will have hairs, but the hairs are usually more dense on *L. grandiflora*.

Notice nodes and general flexibility on touching the mid stems.

Look for signs of lignification, plants appearing woody at the base tend to be *L. grandiflora*. The base of *L. hexapetala* stems will only appear more swollen at the nodes.

Always go back to the key, referencing it several times to become familiar with which characters to look for.



### Leaf shape changes with life stage

- leaf shape
- leaf tip
- relative length of leaf stalk

Be aware of the importance of life stage in leaf shape and make comparisons between potential species at the same growth phase. Characters to focus on are leaf shape, leaf tip, and length of leaf stalk.

Early life stage— floating stems and leaves. *L. hexapetala* leaves have a long stalk, more spoon-shape with generally broad to flattened tip. while *L. grandiflora* leaves have a short leaf stalk and leaves more ovate to oblong with tips more narrow.

Mid life stage – young emerging stems are transitional and extremely variable leaf shape

Late life stage - the stems become upright and flower, most stable stage for leaf shape.

Mature leaves of *L. hexapetala* are oblanceolate or range from oblanceolate to elliptic with tips abruptly tapering to a short point. Mature leaves of *L. grandiflora* are lanceolate in shape or range from lanceolate to lanceolate-elliptic with tips gradually tapering to a long point. Assess mature leaf shape using leaves mid-way down the stem.

*Ludwigia hexapetala*



Early, floating life stage

- terminal rosettes
- leaf shape
- leaf stalk length
- axillary buds

*Ludwigia grandiflora*



Floating stems of *L. hexapetala* end in radially compact foliar rosettes, floating leaf shape is orbicular to spoon-shape with tips broadly rounded to nearly flat, leaf stalk as long as the leaf, and axillary buds inconspicuous.

Floating stems of *L. grandiflora* end in elongated foliar rosettes that extend down the stem, leaf shape is ovate to oblong with tips narrowly rounded to a point, leaf stalk shorter than the leaf, and axillary buds prominent.

*Ludwigia hexapetala*



*Ludwigia grandiflora*

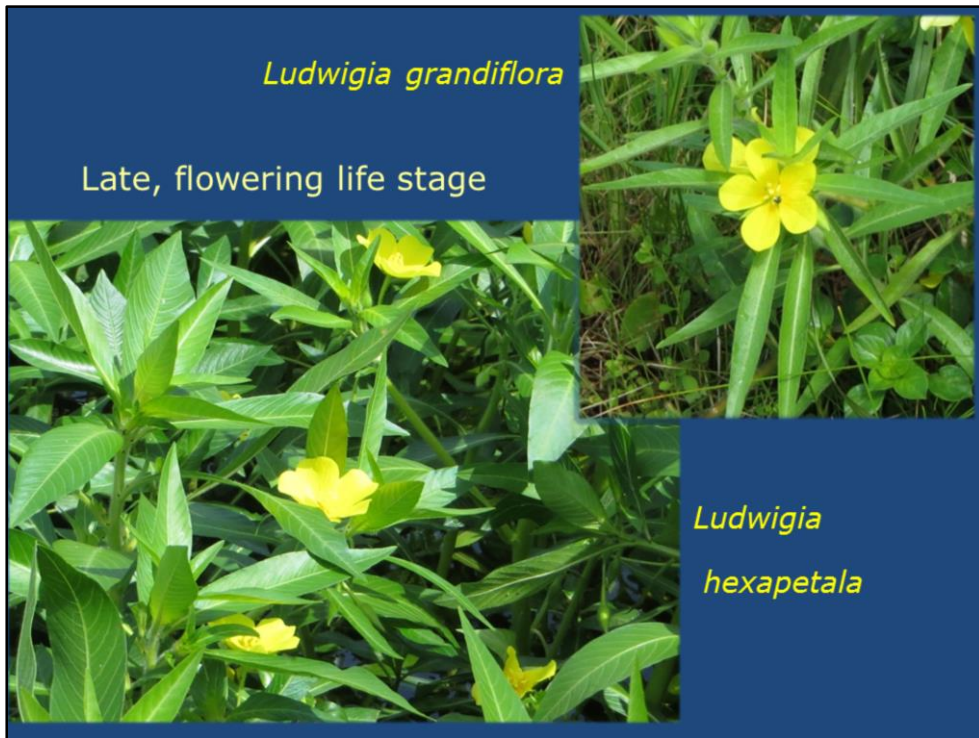


Mid, emerging life stage

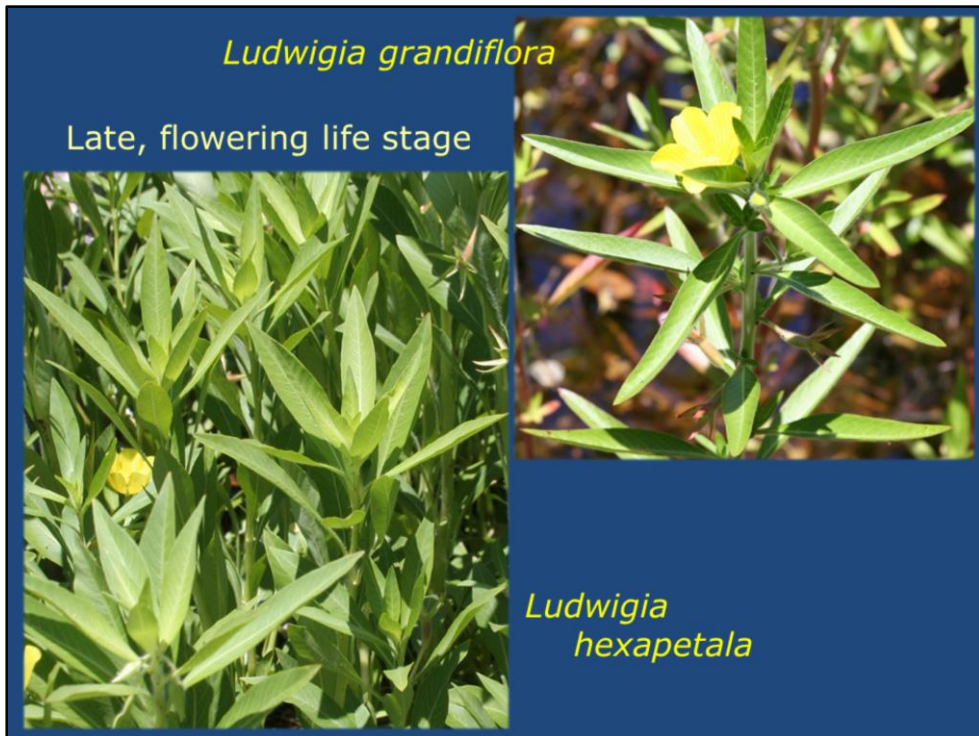
- variable
- stem hair
- leaf shape

Life stage of greatest overall variability is the emerging stage. Stem hair begins developing on *L. grandiflora*; not so soon on *L. hexapetala*.





Be sure to make comparisons between potential species at the same growth phase.



This is the time to measure flower parts for quantitative determination of species. See the key to *Ludwigia hexapetala* and *L. grandiflora*, slide 24.



## Appendix I: guide to character measurement in *Ludwigia* identification

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How to measure the characters for using flower parts to separate *Ludwigia hexapetala* from *L. grandiflora*.

## Flower measurement: petal length



1. With thumb & forefinger at base of petal, gently pull from the receptacle, keeping delicate tissue intact.

3. Imagine a line across the farthest margin of the petal.

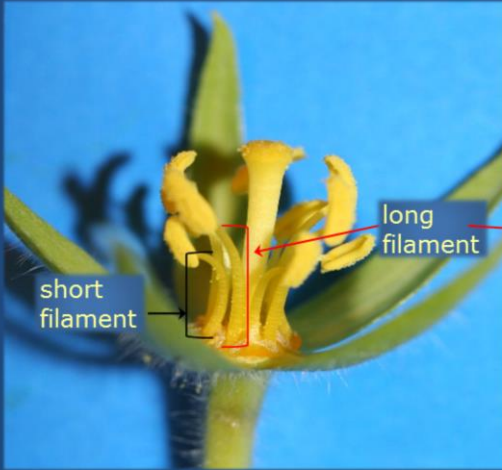


2. The narrowed petal base is called the spur.

4. Measure up from the base of the spur to the outer margin of the petal.

5. This *Ludwigia hexapetala* petal measures just under 2.9 cm long.

## Flower measurement: filament length

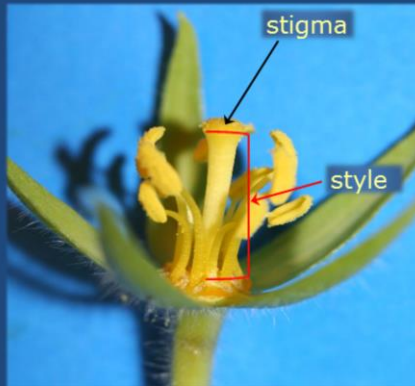


1. Filaments are the stalks that hold the anthers (pollen sacs). Filaments occur as a long inner whorl and a short outer whorl around the style. Using forceps, snap off a long filament at its base.

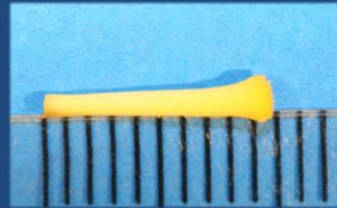
2. Without stretching the filament, measure from its base to its junction with the anther.

3. This long filament from *Ludwigia hexapetala* measured just over 7 mm.

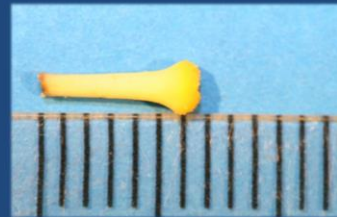
## Flower measurement: style length



1. Measure from the base of the style up to the rim of the stigma. Typically the style does not need to be cut out before measuring. Here, styles were excised to illustrate species difference.



*Ludwigia hexapetala*, 9.25mm long

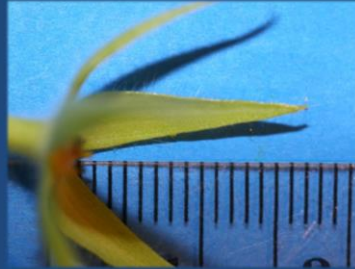


*Ludwigia grandiflora*, 6mm long

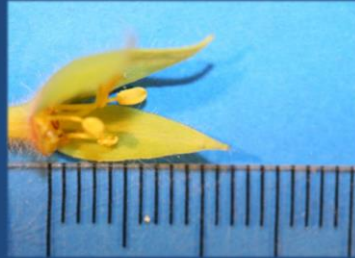
## Flower measurement: sepal length



1. Sepals form the outer whorl of the flower and remain attached long after the petals fall. They are easily measured from base to tip, sometimes by removing an adjacent sepal.

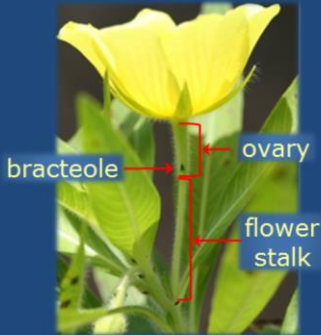


*Ludwigia hexapetala*, 1.7 cm long



*Ludwigia grandiflora*, 1.2 cm long

## Flower measurement: ovary Length, flower stalk length



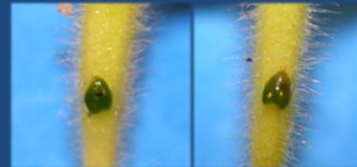
Measure the ovary, or floral tube, from the base of the receptacle to just below the bracteoles, where it narrows into the flower stalk. Measure the flower stalk from the ovary base down to its point of emergence from the stem node.

These characters are to be measured during flower, before petals fall. After pollination, the ovary rapidly expands into a seed containing capsule.

### Characteristic Bracteoles by Species



*Ludwigia hexapetala*



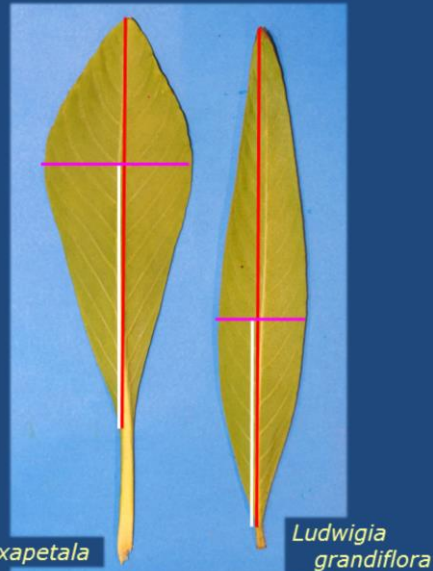
*Ludwigia grandiflora*

Bracteoles are not included in the key because it is difficult to define differences and they are often absent or reduced. Here the shriveled tip characteristic of bracteoles on *L. hexapetala* while those on *L. grandiflora* are usually larger, continuously green and plump. Floral hairs are as abundant on *L. hexapetala* as they are on *L. grandiflora*.



## Leaf measurement: quantitatively determine shape of mature leaves

- 1) Measure in cm the leaf length from its base to tip
- 2) Run a ruler horizontally up from the base of the leaf until you first hit its widest width. Mark this line.
- 3) Measure the distance in cm from the leaf base to its widest width.
- 4) Divide value 3 (distance to width) by 1 (leaf length). If the result is  $>0.5$ , usually .6 - .8, leaves have the more oblanceolate shape of *L. hexapetala*. If the result is  $\leq 0.5$ , usually .5 - .3, leaves have the more lanceolate-elliptic to lanceolate shape of *L. grandiflora*.



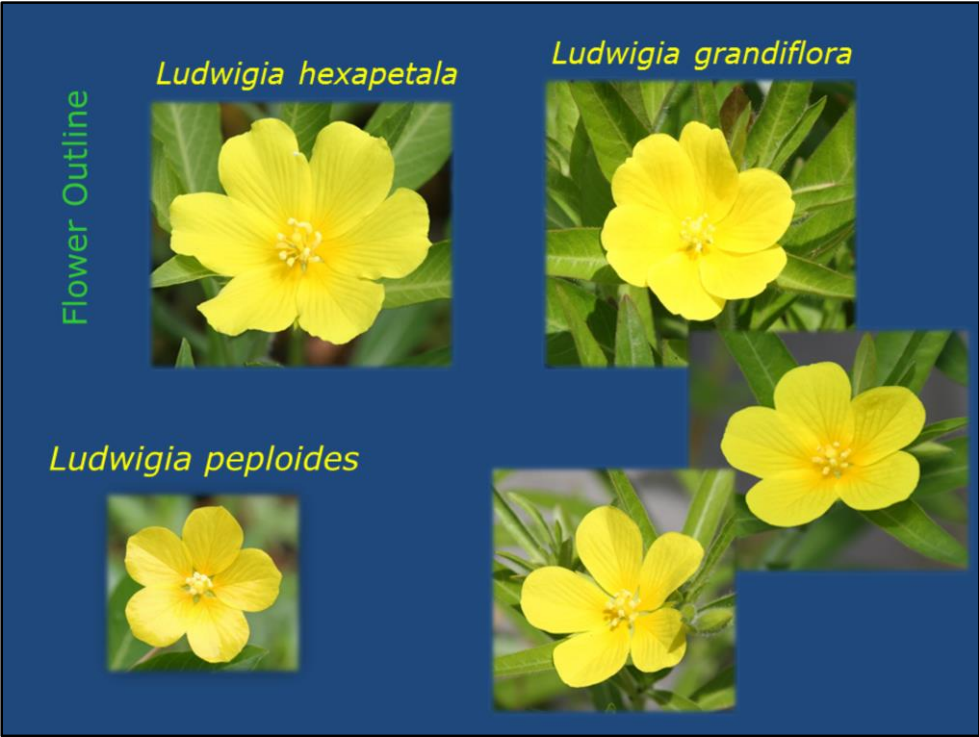
Remember that leaves are one of the most plastic, changing features of aquatic plants. Expect variation even in mature leaves and go for the norm.

Other tips: When sampling leaves always pick those 1/3 to mid-way down the stem which have had time to expand into their ultimate shape. Most leaves look elliptic when young or still developing. Avoid the leaves at and near stem tips.

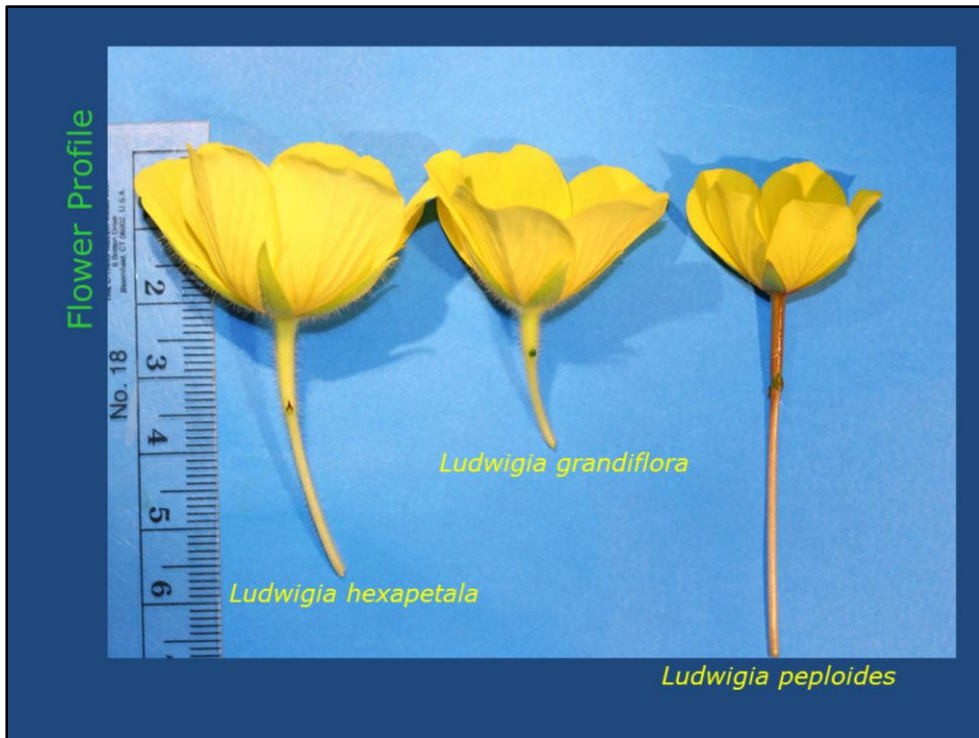
Especially wide leaves of *L. grandiflora* may commonly have values of 0.5 - 0.6.

Appendix II: Illustrative Guide to Character Comparison in the Distinction of *Ludwigia hexapetala*, *L. grandiflora* and *L. peploides*

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General Flower Outline



Notice for ID: Hair – present or absent  
Relative length of sepal  
Bracteole – shape and size  
Relative length of flower stalk

Fertile Features Profile



*Ludwigia hexapetala*    *Ludwigia grandiflora*    *Ludwigia peploides*

If you have missed the petals, note the sepals. Is hair present or absent? Lack of hair will separate *L. peploides* from the other two species. Next measure sepal length as in slide 37.





Besides standing out as the smallest of the three species, the far margin of the *Ludwigia peploides* petal has a shallow point.

Floral Bracteoles



*Ludwigia hexapetala*



*Ludwigia grandiflora*



*Ludwigia peploides*

Floral bracteole shape, presence or absence of hairs.

It is not uncommon for floral bracteoles to be absent.

Bracteoles of *L. grandiflora* can be indistinguishable from those of *L. peploides*.

## Look again: It's Fungal leafspot not Over-spray!

*Pseudocercospora* leafspot affects all species, yet is most destructive on *Ludwigia hexapetala* and *L. peploides*. During hot, rainy periods, this naturally occurring fungus induces early leaf drop on mature stems and can severely knock back the recurring new growth of floating rosettes.

*Pseudocercospora*  
advances in  
concentric rings, here  
restricted by secondary  
veins.



Challenger Slide!

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