

Traits for field identification of *Monochoria vaginalis* and species of *Heteranthera* at different growth stages.

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Three species of ducksalad (*Heteranthera*; Pontederiaceae) are currently described as being present in California rice fields. *Heteranthera limosa* (Sw.) Willd. is found in California as the white-flowered form of this species although other color variants exist in other regions. Identifying characteristics include individual flowers with six tepals equally separated to the top of the corolla tube, generally rigid petioles and rarely develops elongate stems. *Heteranthera rotundifolia* (Kunth) Griseb. is found in California as the blue-flowered form and some white variants although other colors exist in other regions. Identifying characteristics include individual flowers with six unequally separated tepals with the middle tepal of the upper three not separated all the way to the top of the corolla tube, has flexible petioles and commonly develops elongate stems that may produce roots at each node. A newly described species is *Heteranthera multiflora*, common name is Bouquet mud-plantain. Identifying characteristics include spikes that are longer than spathes, except on cleistogamous inflorescences; filament hairs are purple; spathes 3 or more times longer than subtending internode of flowering stem.

The 1976 Rice Field Day booklet notes ducksalad first recorded in Glenn County in 1948. It also notes a marked spread of the weed during the early 1970s. From anecdotal evidence this ducksalad was the white-flowered *H. limosa*. The first herbarium specimen of *H. limosa* was collected in Glenn County in 1966. The first blue-flowered specimen was collected in 1983 and initially identified as *H. limosa* by a botanist at UC Davis. A blue-flowered specimen was collected in 1991 and identified by Vern Oswald at California State University, Chico and confirmed by Charles N. Horn at Newberry College, South Carolina as *H. rotundifolia*. The 1983 specimen has just recently been re-examined by UC Davis herbarium curator Ellen Dean and reclassified as *H. rotundifolia*. One specimen of blue-flowered ducksalad located at California State University Chico that was originally identified as *H. limosa* has been re-examined by curator Lawrence Janeway and reclassified as *H. rotundifolia*. Several other specimens of blue-flowered ducksalad at other California institutions initially identified as *H. limosa* are also being re-examined for potential reclassification as *H. rotundifolia*.

Adding to the confusion between species of *Heteranthera* is the long term misidentification of *H. rotundifolia* as monochoria (*Monochoria vaginalis* (Burm. F.) Kunth) by most rice professionals and growers. It is unclear when this began, but is likely due to its blue flower color. *M. vaginalis* is documented as being present in California rice fields, but the extent of infestation is unclear. *M. vaginalis* is in the same family (Pontederiaceae), but has some very distinctive differences from *Heteranthera*. Characteristics that easily separate *M. vaginalis* from *Heteranthera* are: thin lanceolate early leaves, large waxy heart shaped adult leaves and clusters of light blue flowers that are not prominent and often open under water.

The blue-flowered ducksalad (*H. rotundifolia*) has largely displaced the white-flowered ducksalad (*H. limosa*) in most fields where it has been introduced. The displacement appears to happen within a few years after initial infestation. One possible explanation for the rapid spread is mid-season seed dispersal while flood water is moving through the field. Organic rice growers have expressed concern over the spread of the blue-flowered ducksalad due to the more aggressive creeping stem behavior. This creates a dense mat of plants that is more difficult to kill with the field dry down method of control. This creeping behavior also tends to pull the rice down at early stages of growth. Differential herbicide efficacy on the two *Heteranthera* species has not been examined.

Timeline of ducksalad infestations in the Sacramento Valley

- 1948 – White-flowered ducksalad reported in Glenn County¹
- 1954 - Earliest herbarium sample of monochoria collected at RES²
- 1966 - Earliest herbarium sample of white-flowered ducksalad collected in Glenn County²
- 1970's – White-flowered ducksalad infestations spread¹
- 1983 - Earliest herbarium sample of blue-flowered ducksalad collected near RES, initially identified as *Heteranthera limosa*²
- 1991 - Herbarium sample of blue-flowered ducksalad in Butte County collected near RES, identified as *Heteranthera rotundifolia*²
- 1990's – Blue-flowered ducksalad begins to be misidentified as monochoria³
- 1990's – 2000's – Blue-flowered ducksalad displacing the white-flowered biotype³
- 2004 - Herbarium sample of mixture of white- and blue-flowered ducksalad collected in Glenn County²
- 2007 – Bouquet mudplantain (*Heteranthera multiflora*) found on west side of Sacramento Valley⁴
- 2010 – Second population of *H. multiflora* identified near Bayliss, Ca in Glenn County

¹ 1976 Rice Field Day program, California Co-operative Rice Research Foundation, Inc.

² Consortium of California Herbaria available at: <http://ucjeps.berkeley.edu/consortium/>, August 8, 2007

³ Personal communications with rice producers

⁴ Sample delivered to RES by grower

Identifying characteristics of blue flowered ducksalad and monochoria

- White- and blue-flowered ducksalad (*Heteranthera limosa* and *H. rotundifolia*, respectively) have oval leaves with rounded tips and Bouquet mudplantain (*H. multiflora*) has kidney shaped leaves, while *Monochoria vaginalis* has very pointed lanceolate young leaves and pointed heart-shaped older leaves.
- Monochoria leaves are generally darker green and have a more waxy surface than ducksalad.
- Ducksalad has very prominent single blue flowers on long stalks, Bouquet mudplantain has several flowers on a prominent stalk, while monochoria has closely clustered blue flowers on a short stalk, often opening under water and not prominent.
- Ducksalad germinates soon after flooding, flowers in about 6 weeks then senesces in about 10 weeks while monochoria germinates later and only begins to flower in about 10 weeks, after ducksalad is mostly dead. Monochoria may remain present at harvest.

Ducksalad species found in Sacramento Valley rice fields

White-flowered

Heteranthera limosa
(Sw.) Willd.



Adult plant



Seedling



Leaves with rounded tips



Single white flower

Blue-flowered

Heteranthera rotundifolia
(Kunth) Griseb.



Adult plant



Seedling



Leaves with rounded tips



Single blue flower

Bouquet mudplantain

Heteranthera multiflora
(Griseb.) Horn



Immature and adult leaves



Seedling



Adult Leaves with deep lobes at petiole attachment



Multiple blue-purple flowers

Monochoria

Monochoria vaginalis
(Burm. F.) Kunth



Adult plant



Monochoria seedling



Leaves with pointed tips



Cluster of blue flowers