Introduction to *Callitriche* ID

The water starworts

INSTITUTE OF TECHNOLOGY TRALEE
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What are the *Callitriche?*

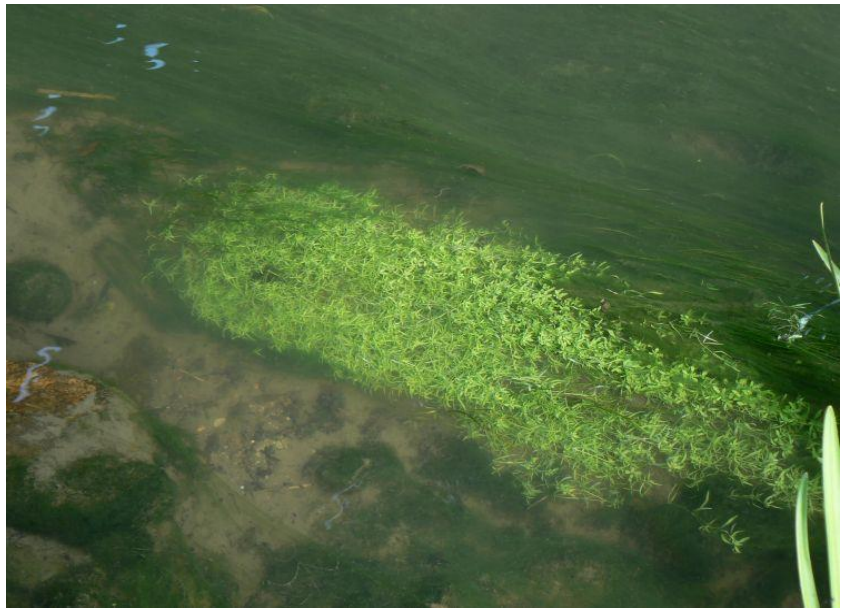
Family: *Callitrichaceae*

Approx. 75 species in the world…so far

In Ireland?
7 species and 3 subspecies

Aquatic and **amphibious** plants
Some can successfully grow as **terrestrials** in damp conditions, at least for a period of time

Aquatic form



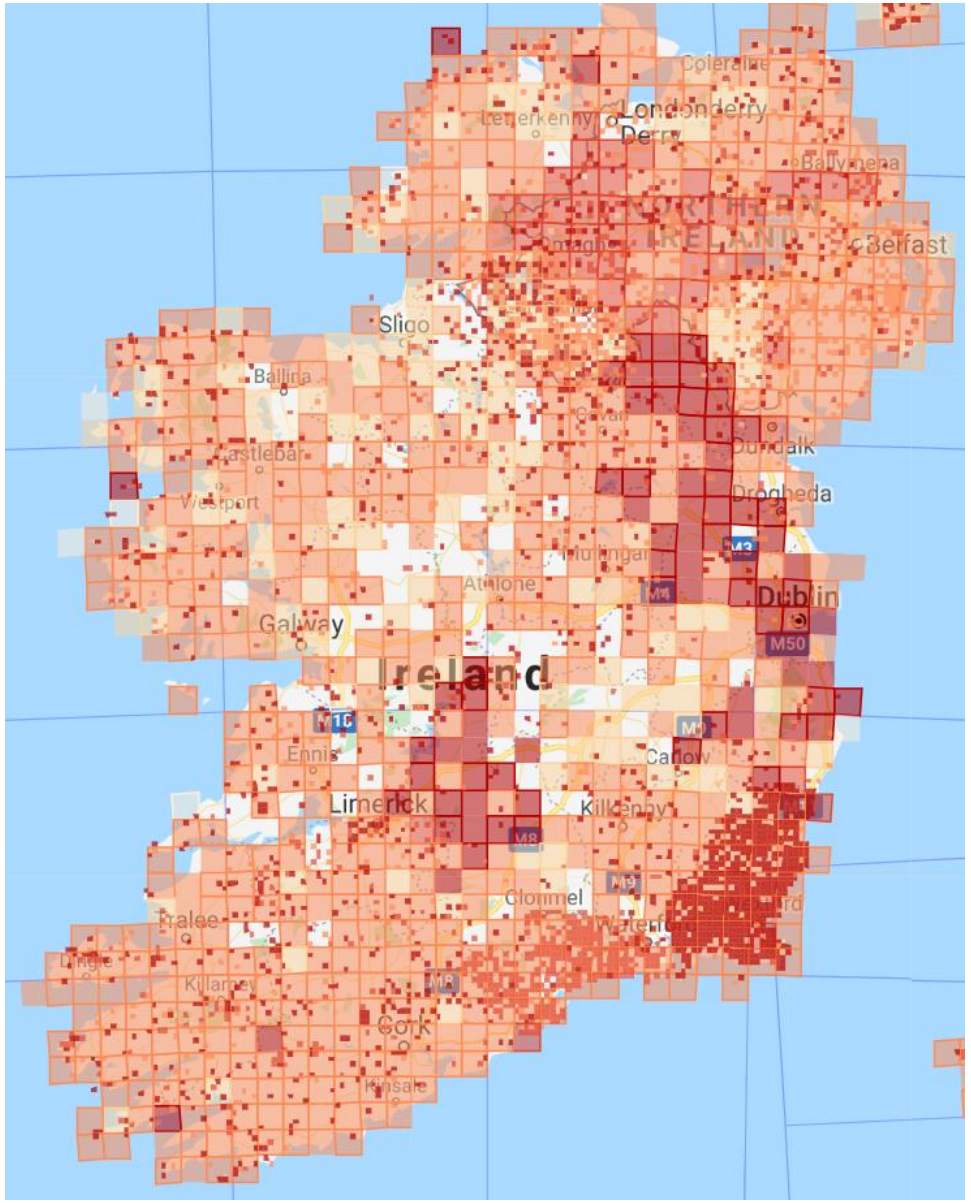
Terrestrial form

Distribution of *Callitriche?*

Widespread in aquatic/wet environments

Some species very common
Others frequent to very rare

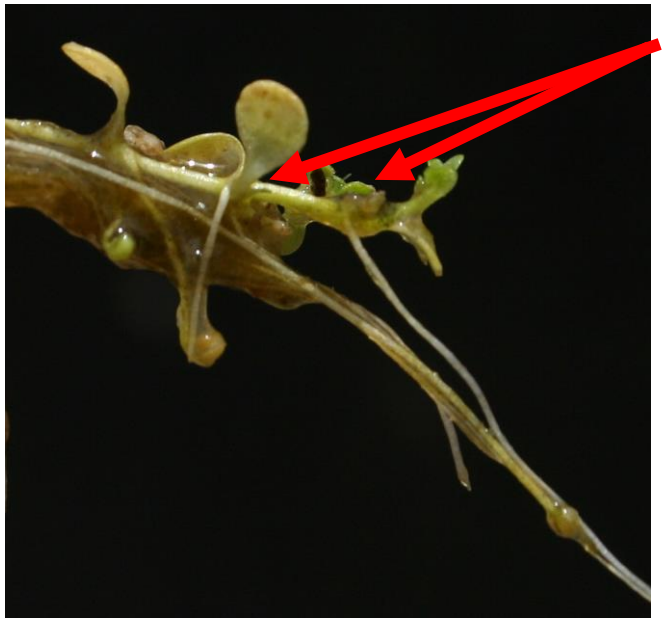
Found in Freshwater:
Still, flowing, and margins
Oligotrophic to Eutrophic
(Some are indicators)
Ditches, ponds/pools



Species distribution maps from
https://bsbi.org/maps

General structure of *Callitriche*

Relatively small herbs



Can grow large stands in rivers by rooting at the nodes

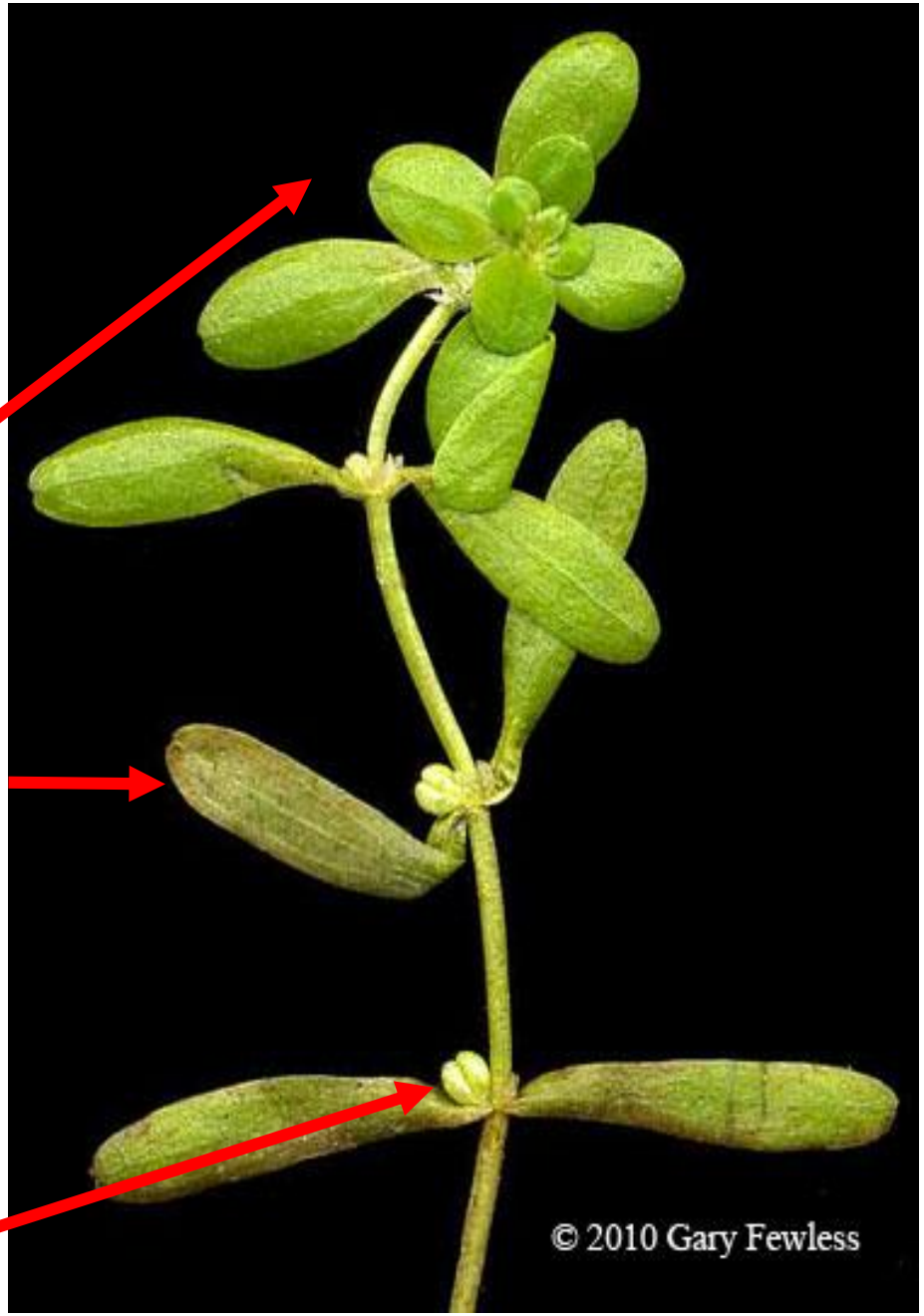
Leaves notched at apex

Leaves variable:

Floating leaves often broader

Submerged leaves often narrower or linear

Flowers and fruits in axils of leaves



General structure of *Callitriche*

Flowers tiny

In leaf axils

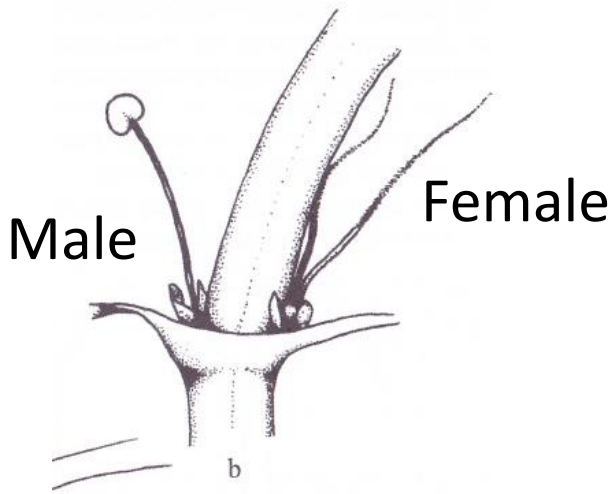
Mostly solitary in leaf axil

Sometimes male and female together in same axil

No petals

Sometimes bracts but often fall off

Often only anthers and stigmas noticed after close examination

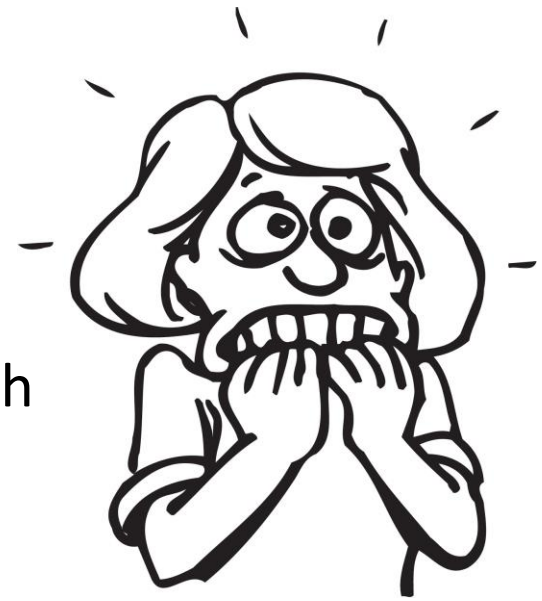


Flowers found between May and September

Identification issues with Callitriche - Known to be a difficult group

Species very variable:

Most species capable of living either submerged in water or on land in damp mud – vegetative features like leaves very variable



Fruits needed to confirm ID in field

Fruits not always present, sometimes hard to find

Very small

C. brutia subsp. *brutia* and *C. brutia* subsp. *hamulata* – fruit still not enough

Flowers useful too

Angles of stamens and carpels

Flowers tiny and not always present

Bract shape useful – but deciduous

Plant if submerged might not flower at all

Pollen

Essential to separate some of the subspecies but perhaps beyond the scope of most of us

SO as a result……

Still a fair bit of confusion and variety of opinions on ID among botanists

Taxonomic issues:

Changes in species allocation over the years

Species that were considered separate species then merged as subspecies or varieties

Example:

Callitriche brutia and *C. hamulata* ……became…. *Callitriche brutia var. brutia* and *C. brutia var. hamulata* ……..then… *Callitriche brutia subsp. brutia* and *C. brutia subsp. hamulata*……most field botanists ID them to one species only - C. brutia

Challenge for producing reliable distribution maps

Can be misidentifications

Many surveyors record as Callitriche spp.

Some species may be under-recorded as a result

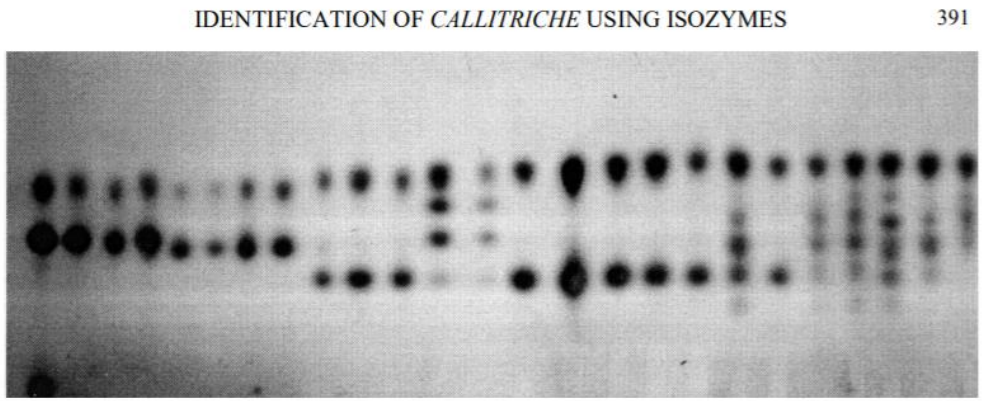
Any other ID methods?

Genetics?

Found that no *Callitriche* species has a unique chromosome number
(Exceptions - *C. brutia* and *C. hamulata*)
This evidence cannot be used alone to determine identity.

Isozymes?

Isozymes are enzymes in the plant that catalyse the same reaction but have different amino acid sequences
Investigations similar to DNA fingerprinting
Recent research would suggest that isozyme data is reliable for identification for many species



How do we identify Callitriche in the field then???

Realistically:

If we don't have fruit…….we can't ID not certain

If we have the fruit……. we can Except for some subspecies

Fruit can be found between June to October

BUT on the other hand……

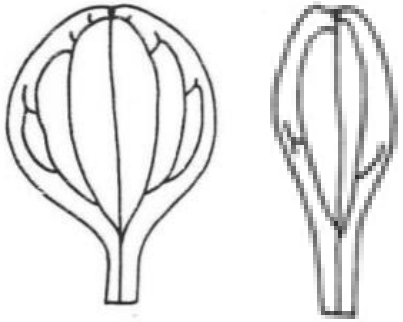
Without fruit:

Leaf shape can **indicate** the species present but for definite ID - **not conclusive**

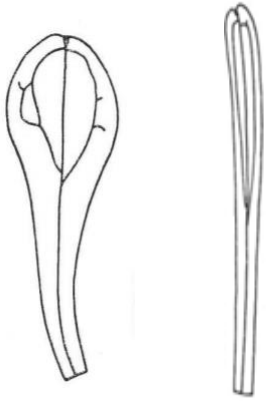
Can be **fairly** sure though **IF** the species is **growing in stable conditions**

where water fluctuations are rare and flow/lack of flow is generally uniform

General rule on leaf shape:



Most floating leaves are broad - ovate, obovate in shape
Most submerged leaves are narrower or linear



Importance of environmental stability on leaf shape:
This rule is generally true if environmental conditions are **stable**

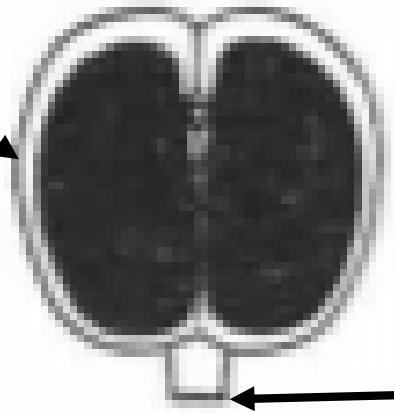
BUT
Herbert Jones in *Watsonia* article: http://archive.bsbi.org.uk/Wats3p186.pdf
Experimented with fluctuations of water levels - can cause leaves to vary in shape and size and order in which they appear

Fruit features to be familiar with for identification:

Herbert Jones explains fruit features well**:**

Keel (called 'wing' BSBI book)

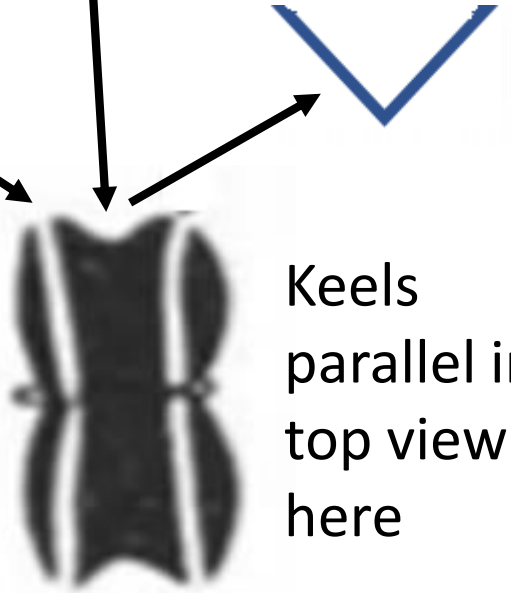
Fruit can be winged



peduncle

Groove (angle important)

Keel (wing)



Keels parallel in top view here

Fruit in leaf axil

Fruit (face view)

Fruit top view

An overview and ID of Irish Species

Note:

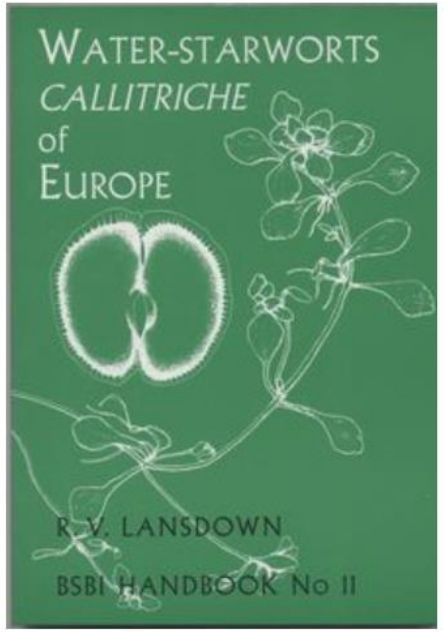
ID is generally based upon a combination of features

But here it is simplified to main highlights only – Fruits and leaves

In following slides*: Italic bold – key features for ID*

Keel used to describe translucent border around fruit

Wing used to describe a keel with extended thin wing-like margin

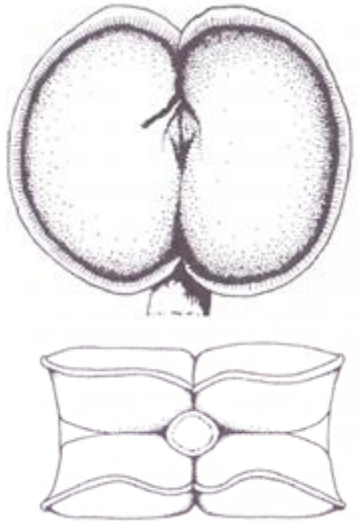


Water Starworts: Callitriche of Europe. Lansdown. BSBI Handbook No. 11 (Summerfield books)

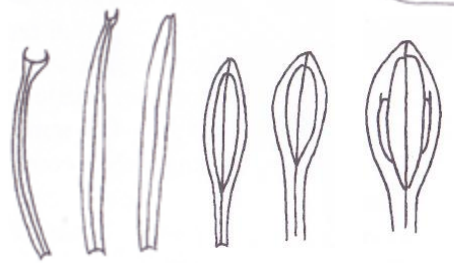
Recommended for more details

Callitriche brutia

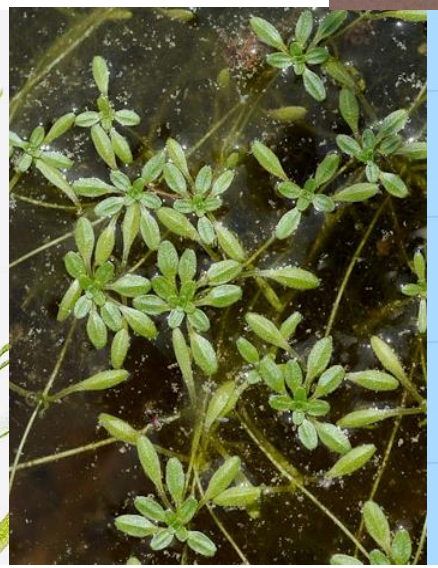
Fruit:
1.-1.5mm long by 1-1.6mm wide
Face view: ***As wide as long***
Thin keel all way around fruit
Sessile or stalked with peduncle (fruit stalk)
Top view: ***Grooves hardly present, slightly concave***

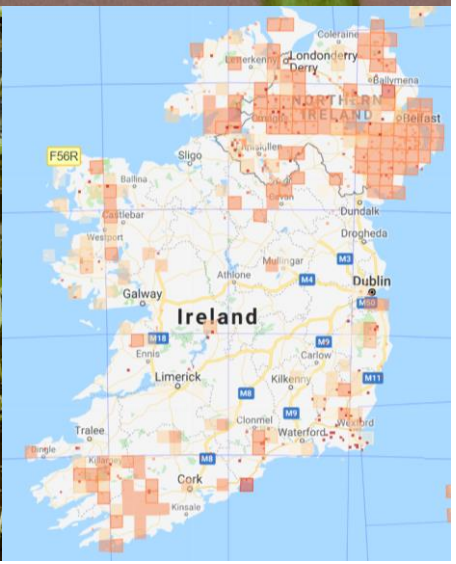


Leaves:
Linear and broad leaves
Floating leaves obovate
Linear leaves narrow with ***spanner shaped tips***
Intermediate shaped leaves in between



Ecology:
Still or slow to moderate flowing waters that tend to be oligotrophic

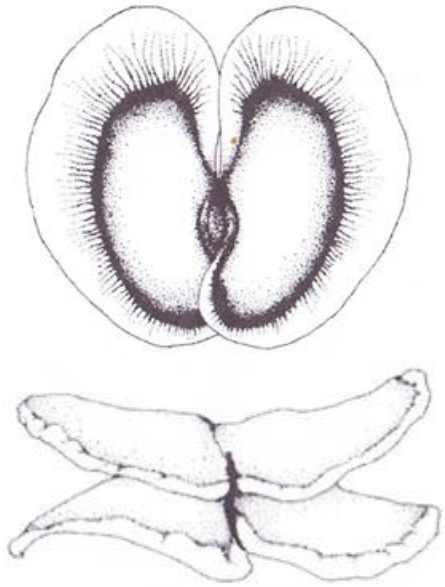




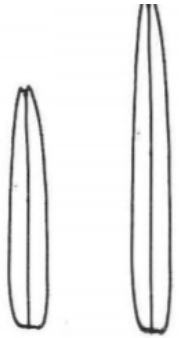
Callitriche brutia subsp. brutia
Pollen differentiates this subspecies
Callitriche brutia subsp. hamulata
Pollen differentiates this subspecies

Callitriche hermaphroditica

Fruit:
1.2-2.4mm long by 3mm wide - ***LARGE***
Face view: Narrowed slightly towards the base
Noticeably winged – Wings as broad as the seeds
Sessile – no peduncle (fruit stalk)
Top view: ***Grooves deep and acute angle***

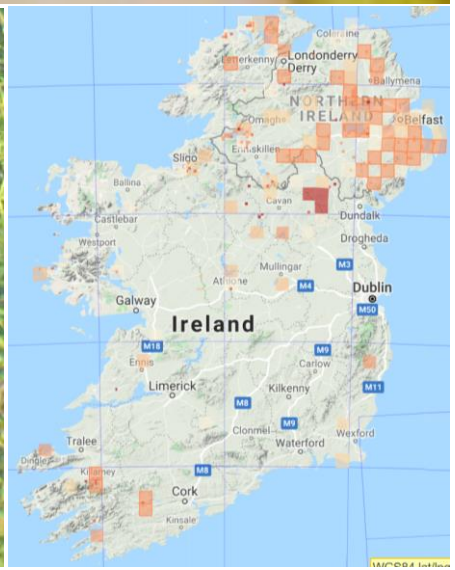


Leaves:
Linear leaves only
The leaf is broader at the base than at the tip
No spanner shaped tips



Ecology:
Still or slow flowing mesotrophic waters

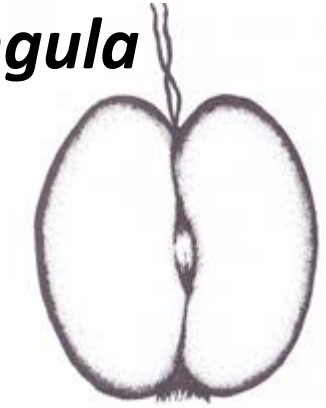
Callitriche hermaphroditica subsp. macrocarpa
Seems to only differ in fibrils in fruit wings (strengthening lines)
Very rare – one record(?) Near Cavan border

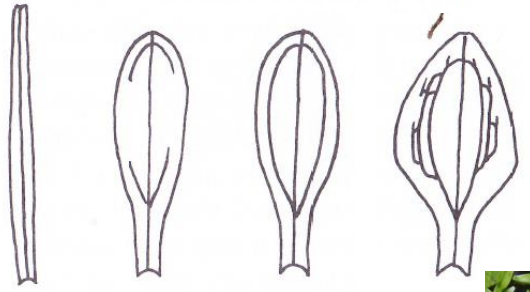


Can be variable species – **debate on possible varieties**

Callitriche obtusangula

Fruit:
1.1-1.8mm long by 1.1-1.7mm wide
Face view: ***Longer than wide when ripe***
No keels
Sessile – no peduncle (fruit stalk)
Top view: ***Grooves hardly present – quite flat***





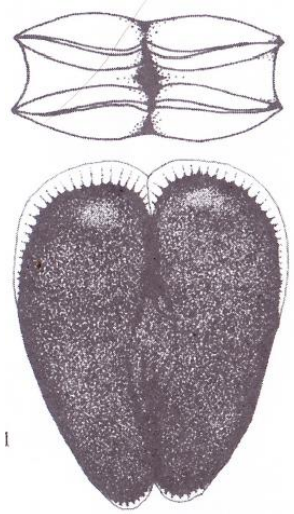
Leaves:
Broad and linear leaves
Broad surface leaves often ***rhomboid*** appearance
Broad leaves often with ***prominent raised veins***
Submerged leaves linear

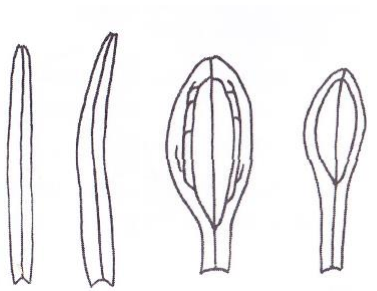
Ecology:
Still or slow flowing mesotrophic to eutrophic alkaline waters.
Lowland species and can tolerate brackish waters
Can be in terrestrial form

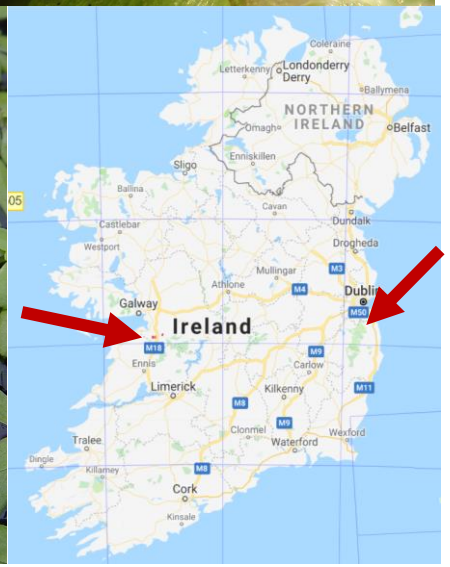
Callitriche palustris

Fruit:
0.9-1.4mm long by 0.8-1.1mm wide
Face view: ***Longer than wide – widening towards top***
Keels thin all around seeds but broader on the top
Strikingly black when ripe
Sessile – no peduncle (fruit stalk)
Top view: Grooves hardly present – quite flat
Leaves:
Broad and linear leaves
Broad leaves often rounded, submerged broad leaves often shaped like ***small spoons***
Submerged leaves linear often wider in middle

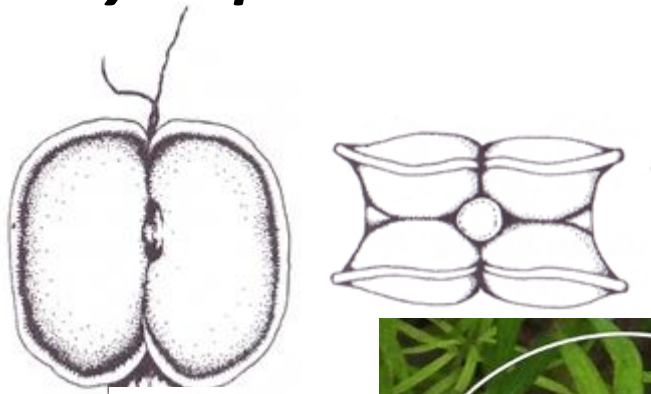
Ecology:
Still or slow flowing oligotrophic waters neutral to slightly alkaline waters
Can be in terrestrial form
Very rare



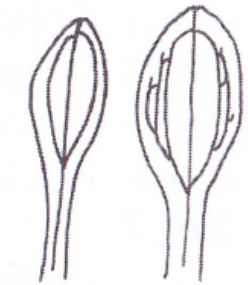


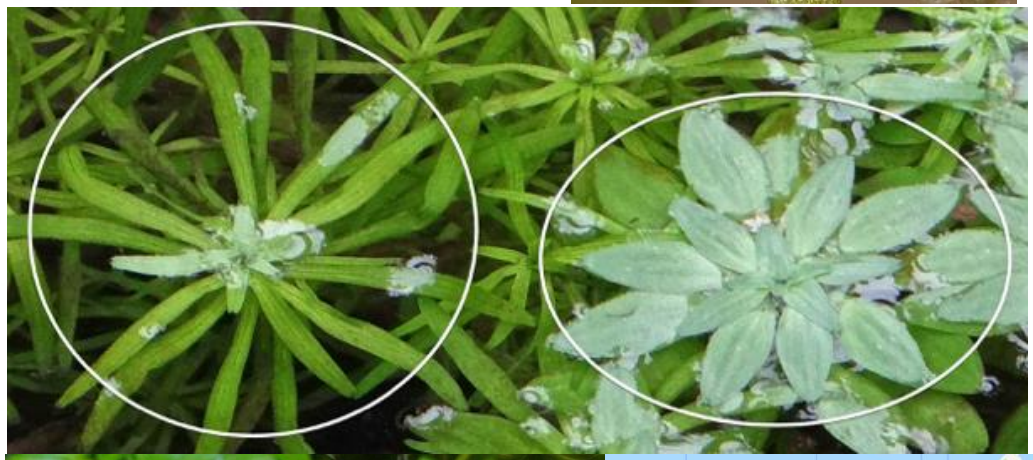


Callitriche platycarpa



Fruit:
1.3-1.7mm long by 1.4-1.8mm wide
Face view: ***As long as wide***
Keel even all around
Sessile or rarely short peduncle (fruit stalk)
Top view: Grooves concave curve/fairly flat





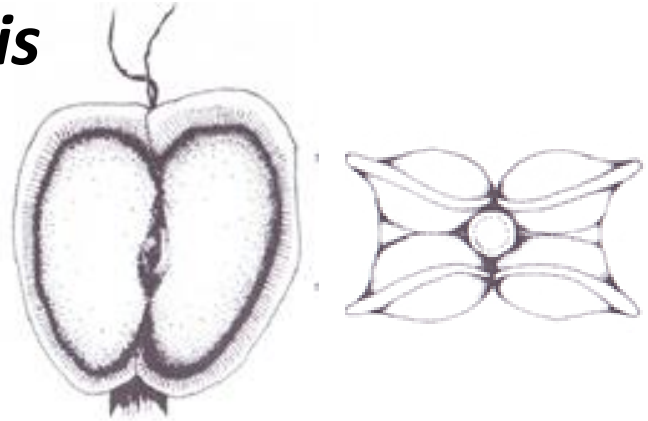
Leaves:
Broad and linear leaves
Broad surface leaves often obovate
Submerged leaves linear – ***no*** spanner shaped tips
Tapering gradually to tips

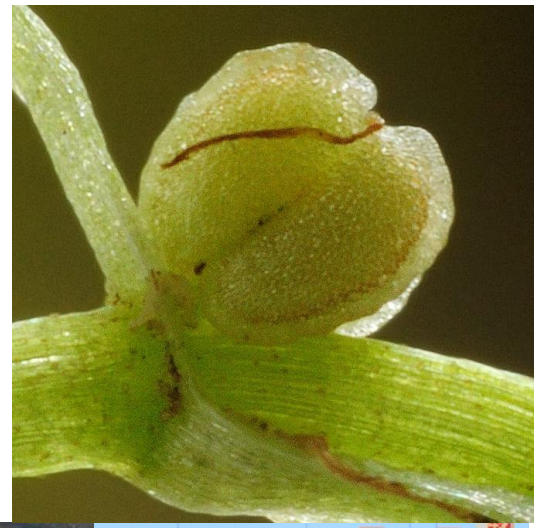
Ecology:
Still or slow flowing mesotrophic to eutrophic waters. pH 6-9
Can be in terrestrial form

Note: Could be under-recorded, confused with C. stagnalis (see that species)

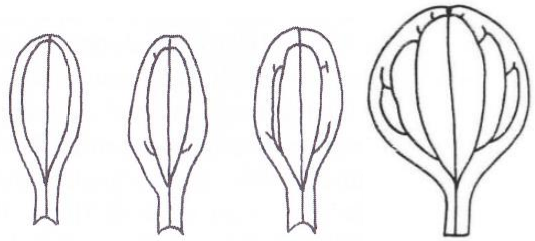
Callitriche stagnalis

Fruit:
1.1-1.8mm long by 1.1-2.1mm wide
Face view: Narrowed slightly towards the base
Broad keel/wing – all around seeds & slightly wider at top
Sessile or with short peduncle (fruit stalk)
Top view: Grooves wide angle

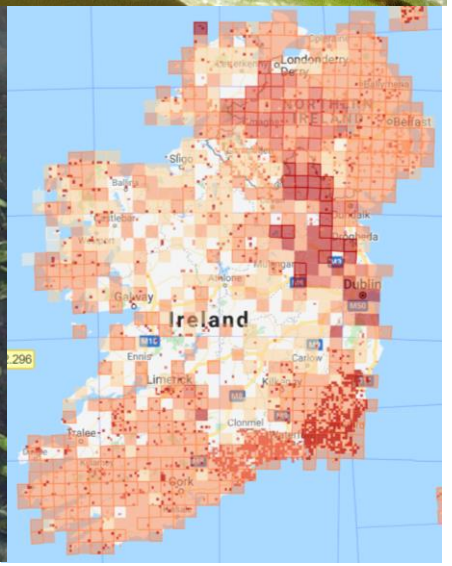




Leaves:
Broad leaves only - Rounded
Leaf on surface ~1 cm long and ~7 mm wide
Leaf submerged – more obovate



Ecology:
Still, slow or moderate flowing mesotrophic to eutrophic waters
Also in pools and ditches and has a terrestrial form



Note: Sometimes hard to tell apart from *C. platycarpa* even with fruit if keel particularly narrow in *C. stagnalis.*
Pollen needed to confirm if overlap of features

Callitriche truncata

Fruits:

0.9-1.5mm long by 1.1-1.9mm wide

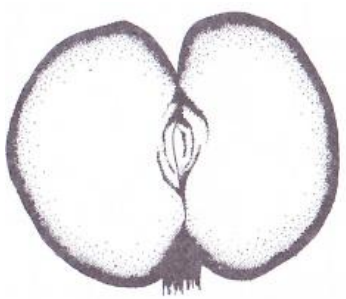
Face view: *Wider than long*

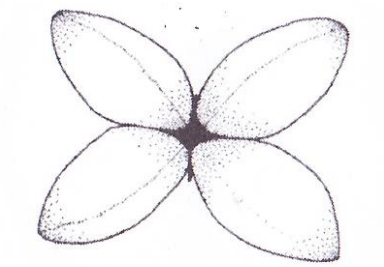
Keels present or absent

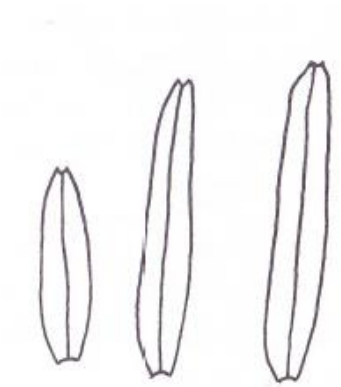
Peduncle (fruit stalk) 0.2-3.4mm

Top view: *Grooves deep and almost 90°*

Seeds in fruit look like shape of a cross







Leaves:

Linear leaves only

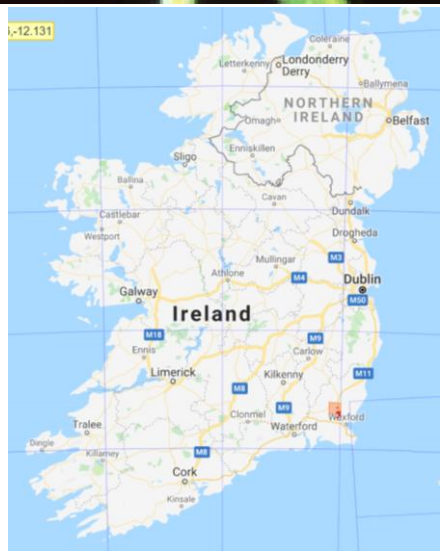
The leaf normally broader in the middle

No spanner shaped tips

Ecology:

Still or slow flowing mesotrophic to eutrophic waters

Subspecies not known in Ireland but a range of subspecies in Europe



Essential equipment

Bathyscope

Buoyancy aid

Metre/stick

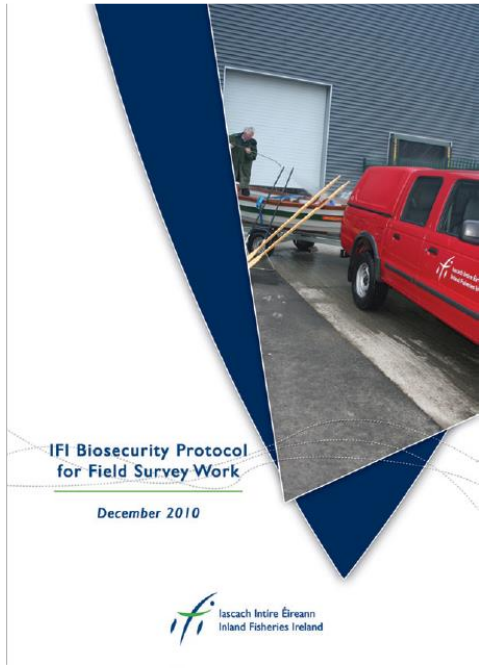
Waders

IMPORTANT

Inland Fisheries Ireland's Biosecurity Protocol

http://www.fisheriesireland.ie/Biosecurity/biosecurity-protocol-for-field-survey-work.html

BIOSECURITY VERY IMPORTANT

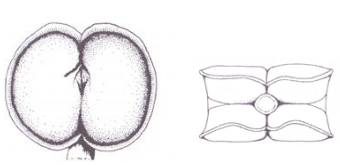
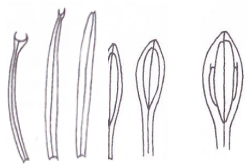
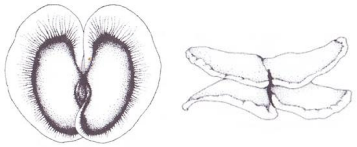
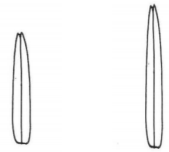
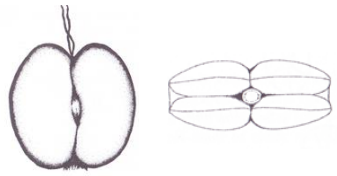
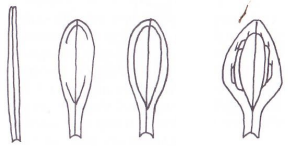
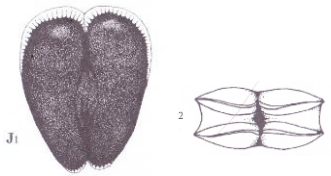
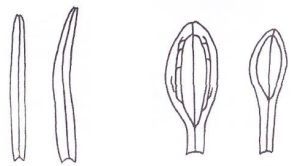
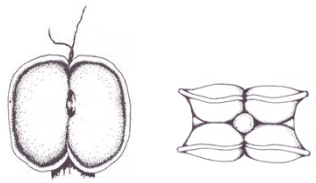
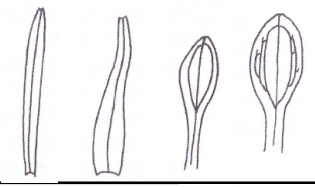
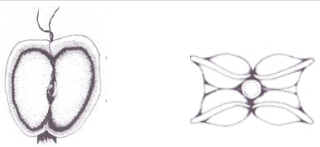
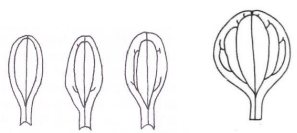
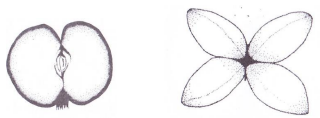
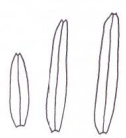


Virkon Aquatic

http://www.therapeuticresource.ca/CVS/virkoninfopack.pdf

Gloves if Water quality in question

Hibiscrub
Hand wash

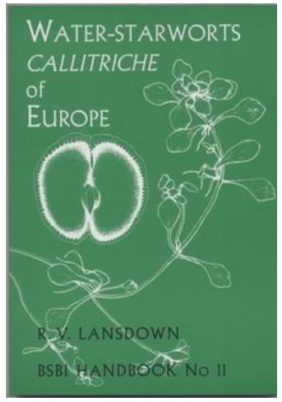
	Fruit	Leaves
Callitriche brutia		
Callitriche hermaphroditica		
Callitriche obtusangula		
Callitriche palustris		
Callitriche platycarpa		
Callitriche stagnalis		
Callitriche truncata		

Summary:

Fruit and leaves

Resources:

NOTES ON THE IDENTIFICATION OF SOME BRITISH SPECIES OF CALLITRICHE By HERBERT JONES
http://archive.bsbi.org.uk/Wats3p186.pdf



Summerfield Books: Water Starworts: Callitriche of Europe. Lansdown. BSBI Handbook No. 11

https://www.summerfieldbooks.com/water-starworts:-callitriche-of-europe.-bsbi-handbook-no.-11~1894

BSBI Plant Crib Summerfield Books:

Research papers in to isozymes:

B. O. L. DEMARS and R. J. GORNALL 2003 Norfolk – Isozymes
https://www.researchgate.net/publication/235868248_Identification_of_British_species_of_Callitriche_by_means_of_isozymes

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www.researchgate.net/publication/234094190_Isozyme_patterns_of_Callitriche_cophocarpa_C_stagnalisand_C_platycarpa_from_13_Polish_rivers