

A Study of *Festuca ovina* agg. In Ireland



Introduction

- *Festuca ovina* agg. (Sheep's-fescue).
- Evolutionarily, ecologically and economically important group.
- c. 100 species in Europe, 9 in Britain, 5 in Ireland (more than half of the c. 170 species of *Festuca* in Europe) (Kerguélen & Plonka 1989, Markgraf-Dannenberg 1980).
- Within subgenus *Festuca*, the group comprises species with characteristic intravaginally branching tillers (Fuente *et al.* 2001).

Stace *et al.*
(1992)

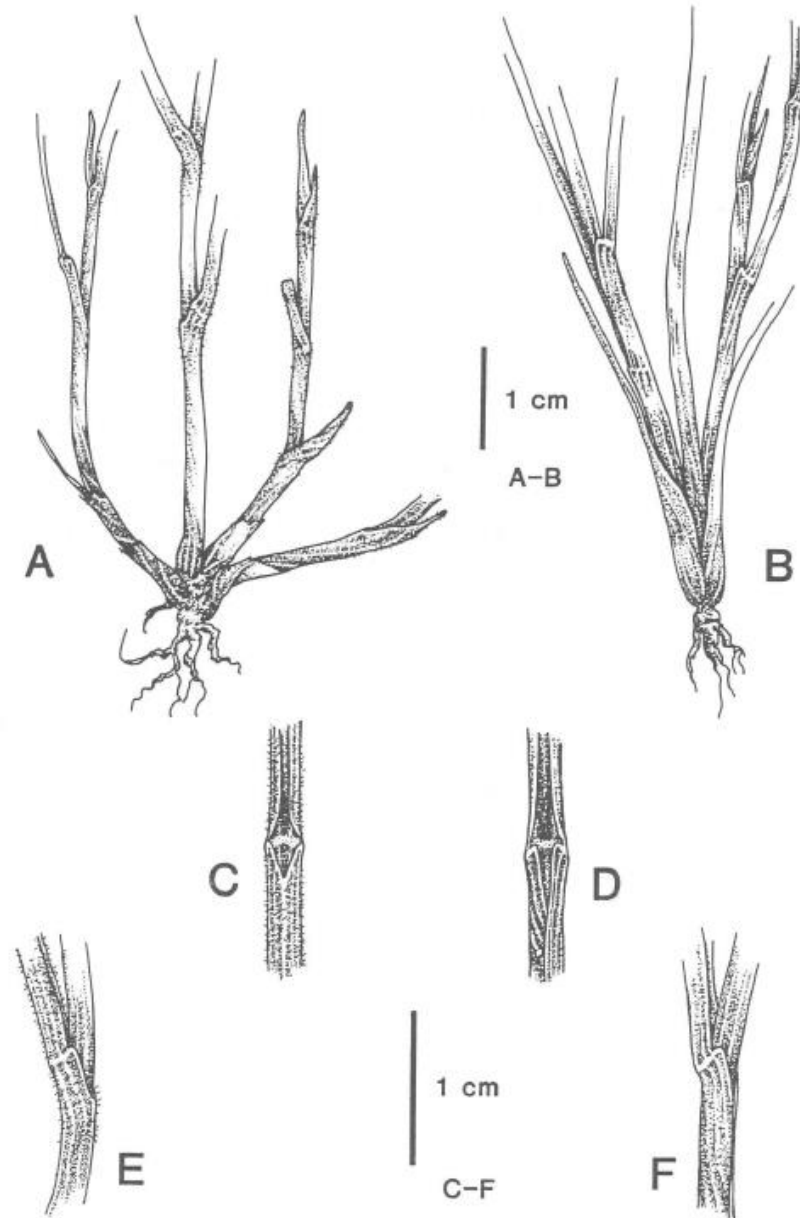


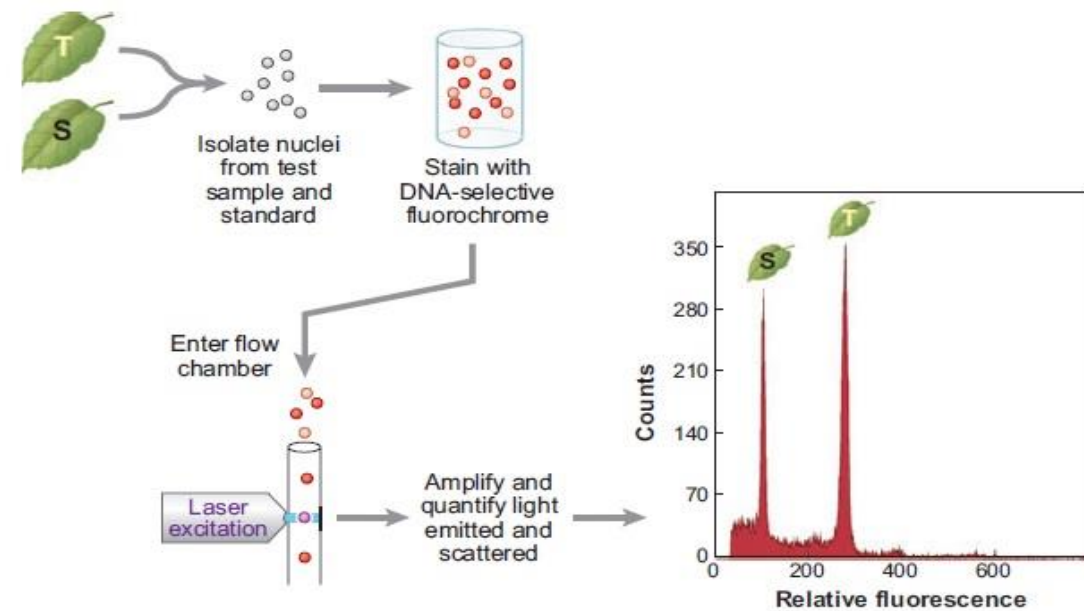
FIGURE 1. Morphological characters of *Festuca rubra* agg. and *F. ovina* agg. A, extravaginal tillers. B, intravaginal tillers. C, fused tiller leaf-sheath as in *F. rubra* agg. D, overlapping tiller leaf-sheath as in *F. ovina* agg. E, vestigial auricles as in *F. rubra* agg. F, distinct auricles as in *F. ovina* agg.

Polyploidy

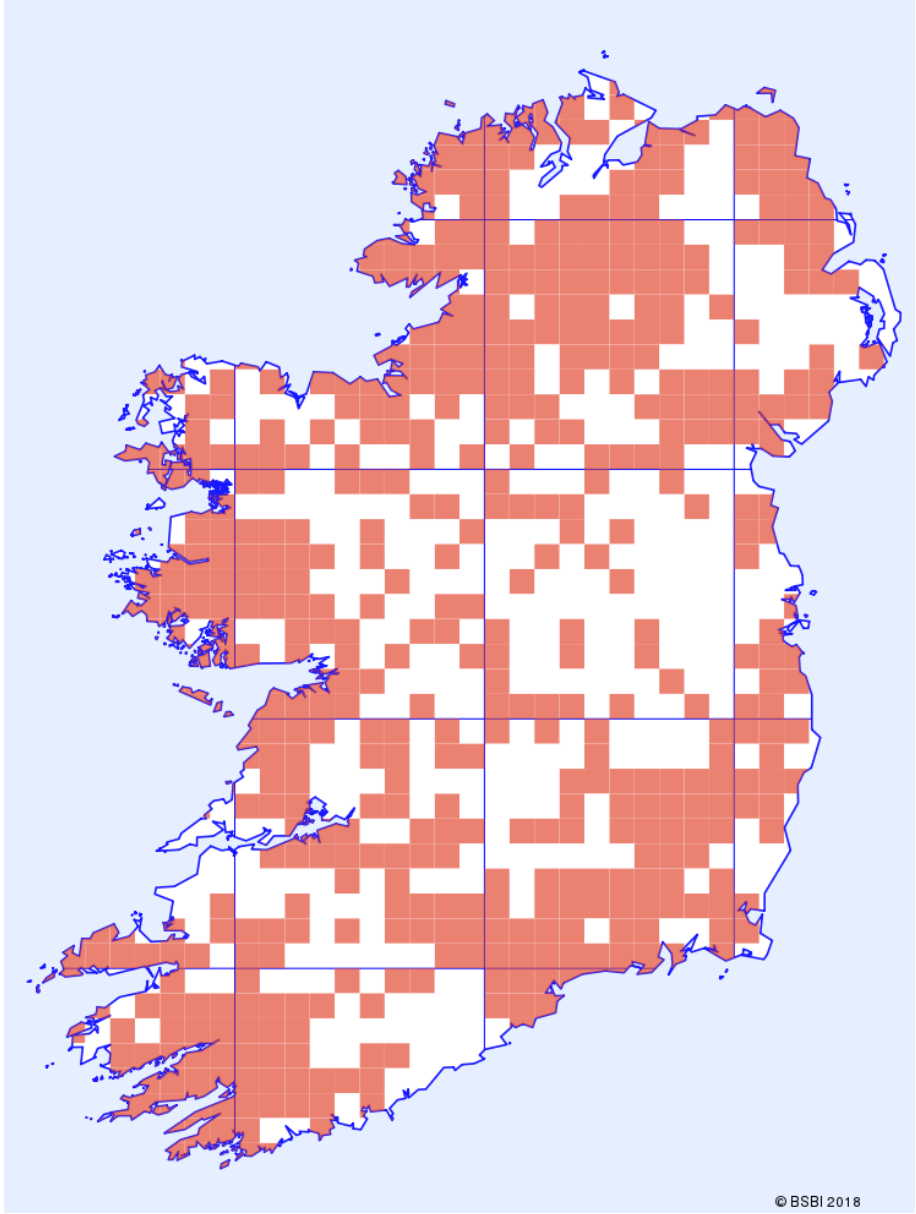
- Polyploid complex group.
- A “*complex of intergrading cytological and ecological races for which suitable discriminating morphological characters are not readily available*” Cope and Gray (2009).
- Base chromosome number = 7
- Wilkinson and Stace (1991) stated that “*about 33% of the species in the aggregate counted are diploid, 38% tetraploid, 25% hexaploid and 4% octoploid*”.
- A decaploid has since been discovered, *Festuca summilusitana* Franco & Rocha Afonso, in the Serra da Estrela in central Portugal and in the northeastern ranges of the Iberian Peninsula (Fuente *et al.* 2001).

THE PROJECT

- Broad-scale collection and screening approach – 40 samples collected across Ireland.
- Followed by morphological and cytological analysis – chromosome counting and flow cytometry.
- DNA barcoding.

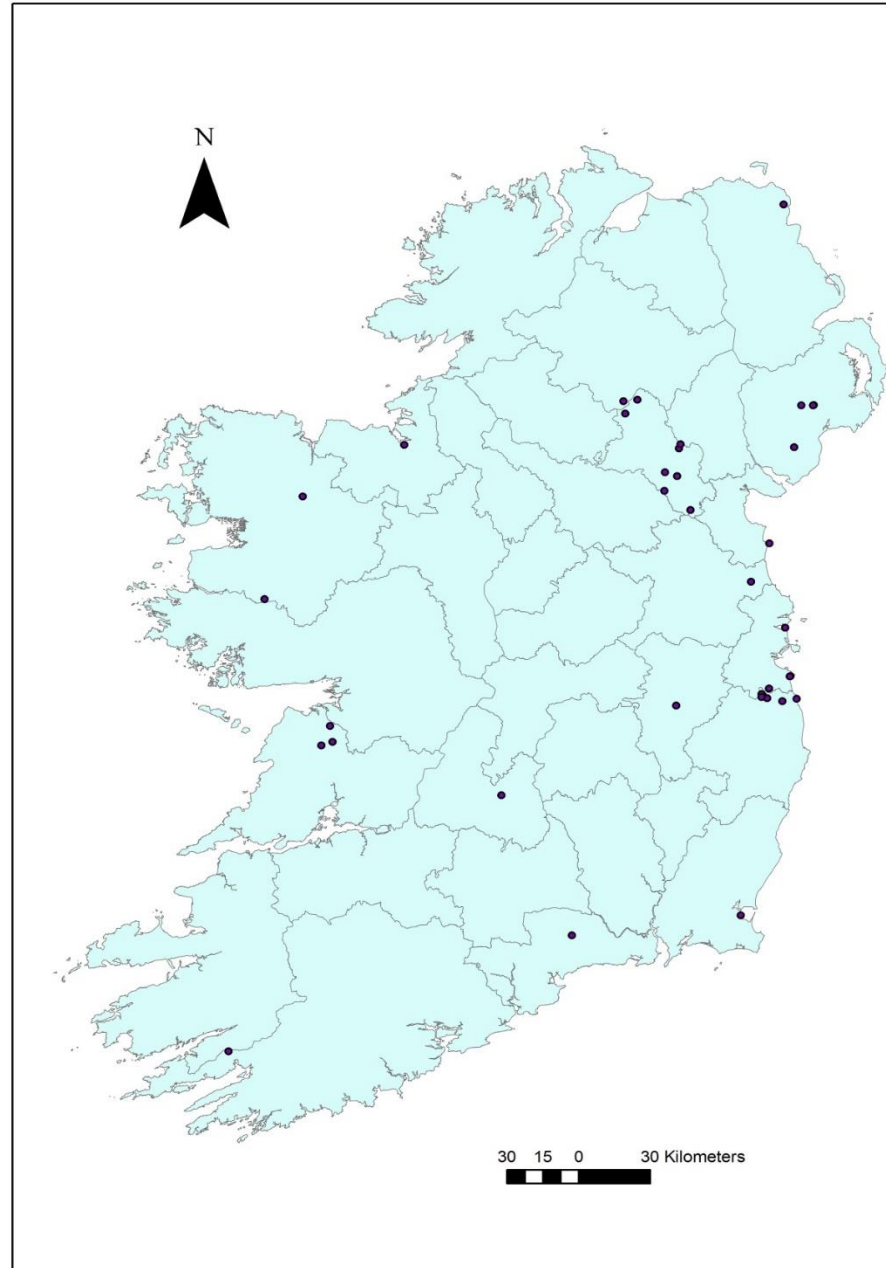


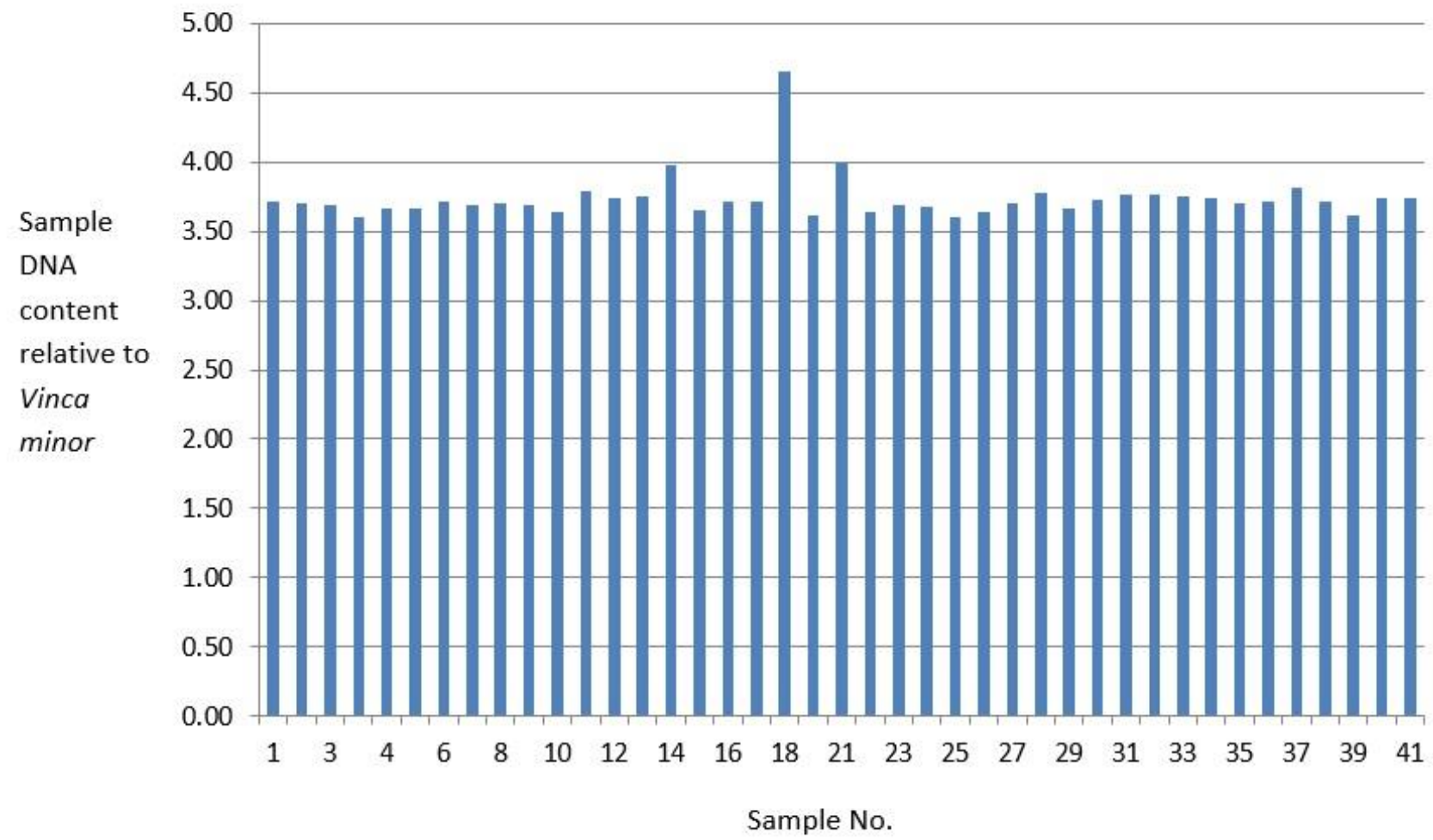
Kron *et al.*
(2007)

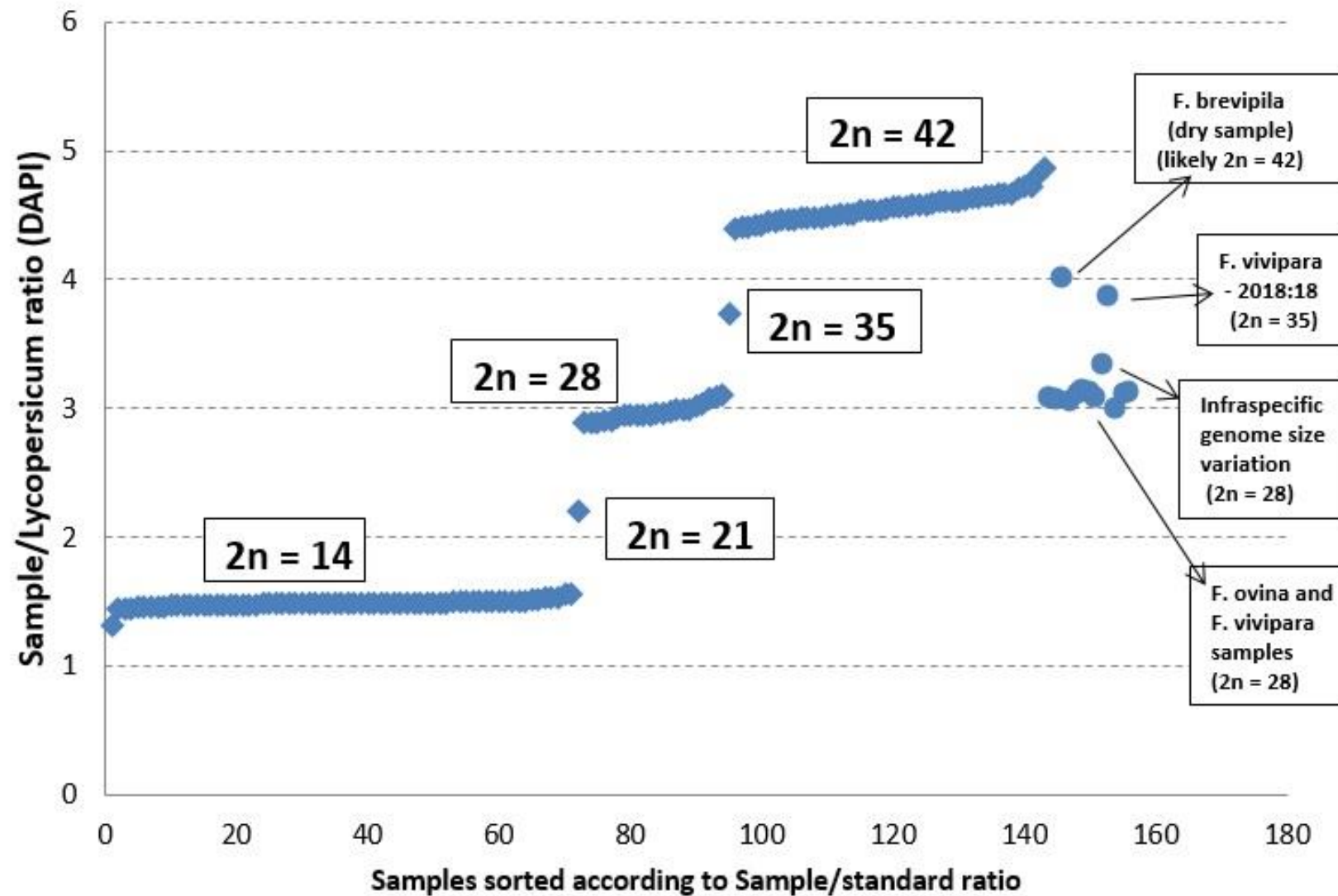


RESULTS

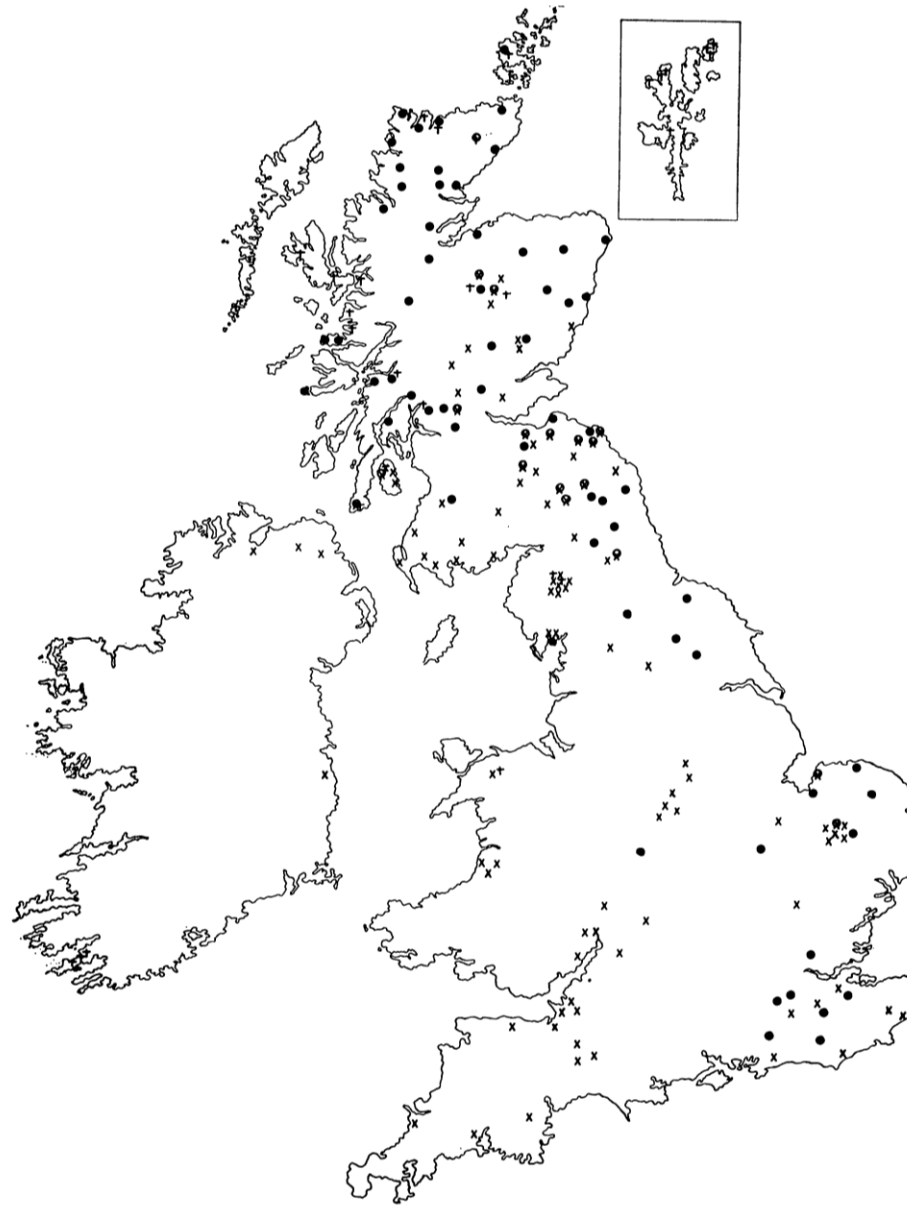
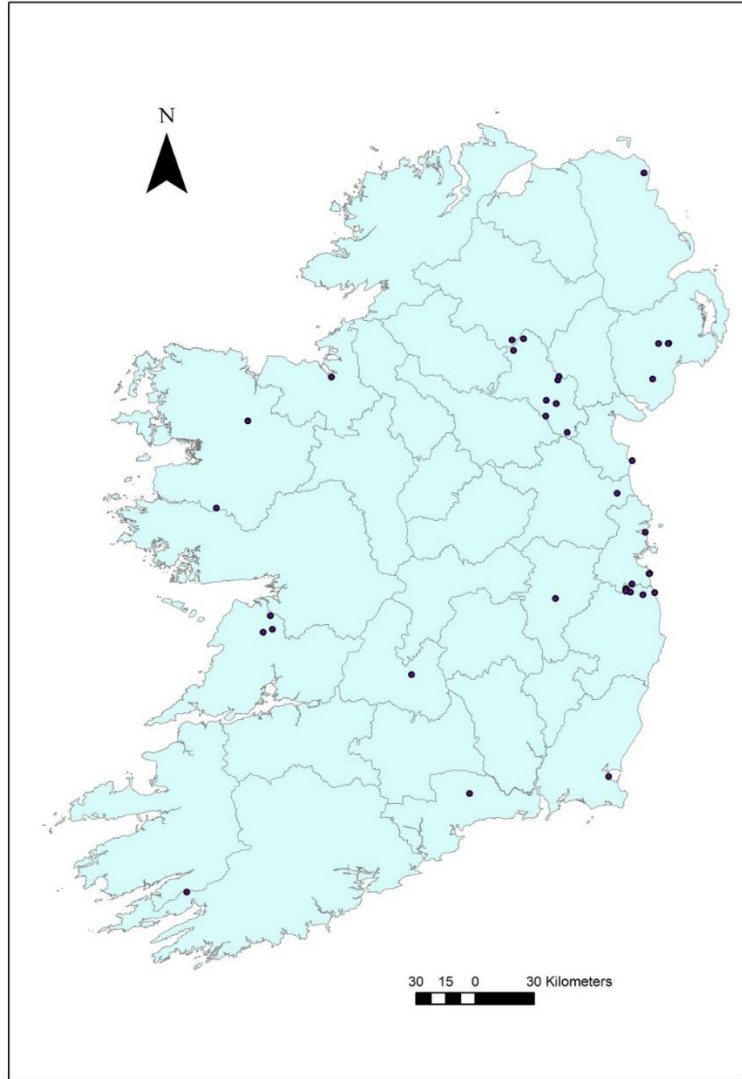
Thanks in particular go to Ralph Sheppard, Stephen Ward, David McNeill, Clare Heardman, Declan Doogue and David Nash, for collecting fresh material for me from across the island.







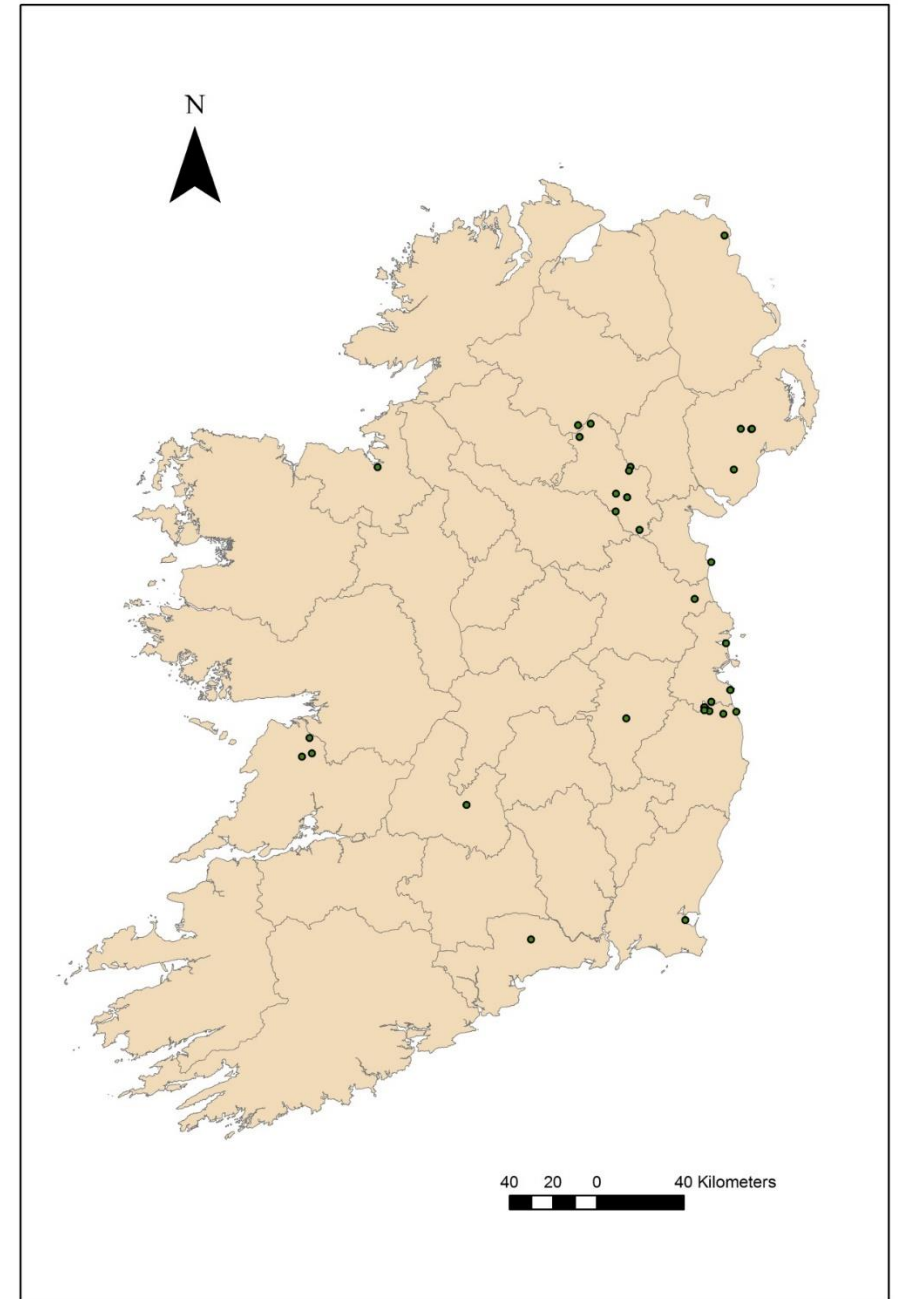
Ratios of different ploidy levels of *Festuca valesiaca* s.l. (blue squares) compared with a subset (13 samples) of Irish *Festuca ovina* agg. samples (blue circles), relative to the internal standard *Lycopersicum esculentum*. *Festuca valesiaca* s.l. and *Festuca ovina* s.l. are very closely related and have more or less identical genetic content, so they can be compared with one another in terms of ploidy evaluation. *Festuca valesiaca* s.l. counts were analysed by Petr Šmarda for a study of the *Festuca ovina* agg. as part of an upcoming Flora of Ukraine. data from Bednarska & Šmarda, unpublished; figure and data reproduced with permission of Petr Šmarda.



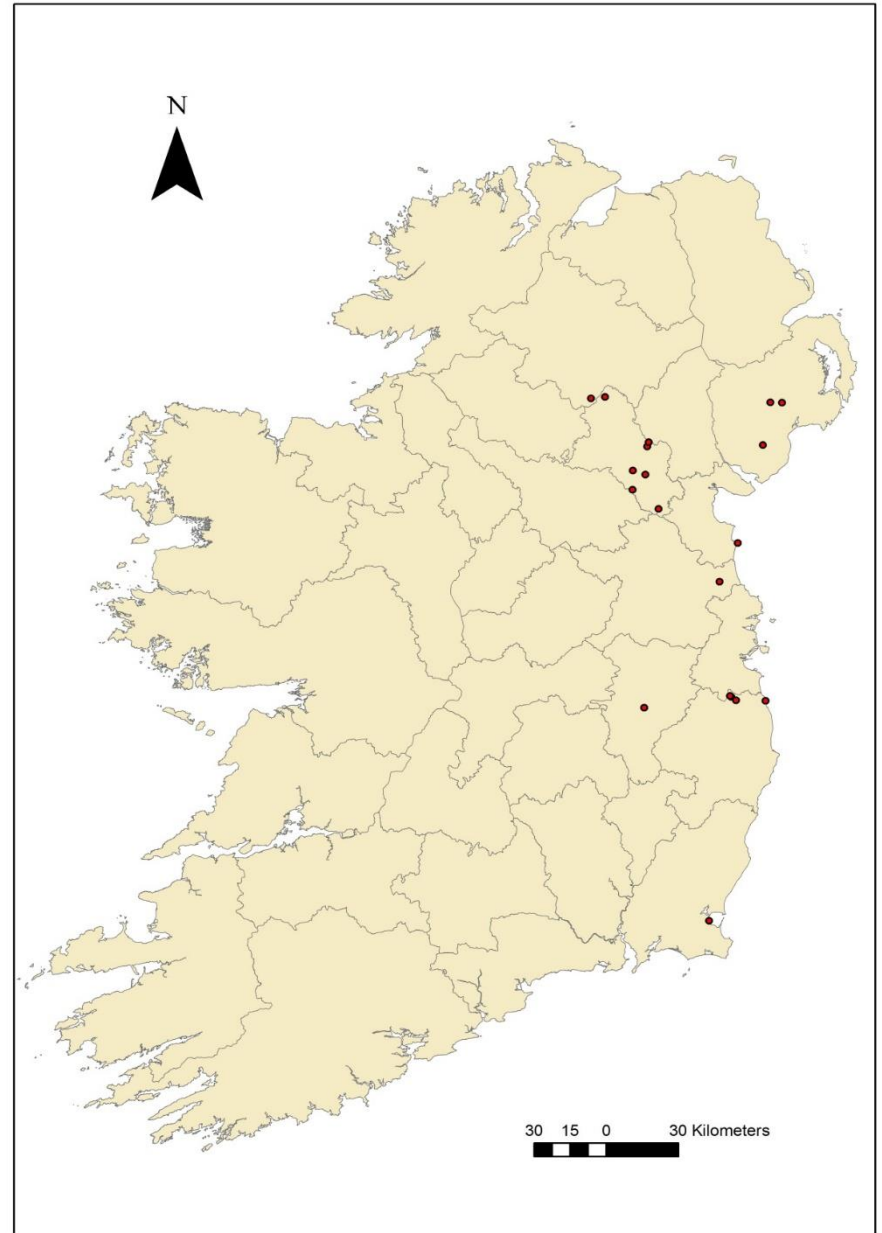
Watson (1958) –
black circles are
diploids, x symbols
are tetraploids, +
symbols are
viviparous, circles
with an arrow at
base are mixed
diploids and
tetraploids

Irish Taxa

- *Festuca ovina* s.s. – tetraploid ($2n = 28$).
- 2 or 3 subspecies known in Ireland,
- subsp. *hirtula* and subsp. *ophiolicola*.
- The diploid ($2n = 14$) subsp. *ovina* remains enigma – likely rare.

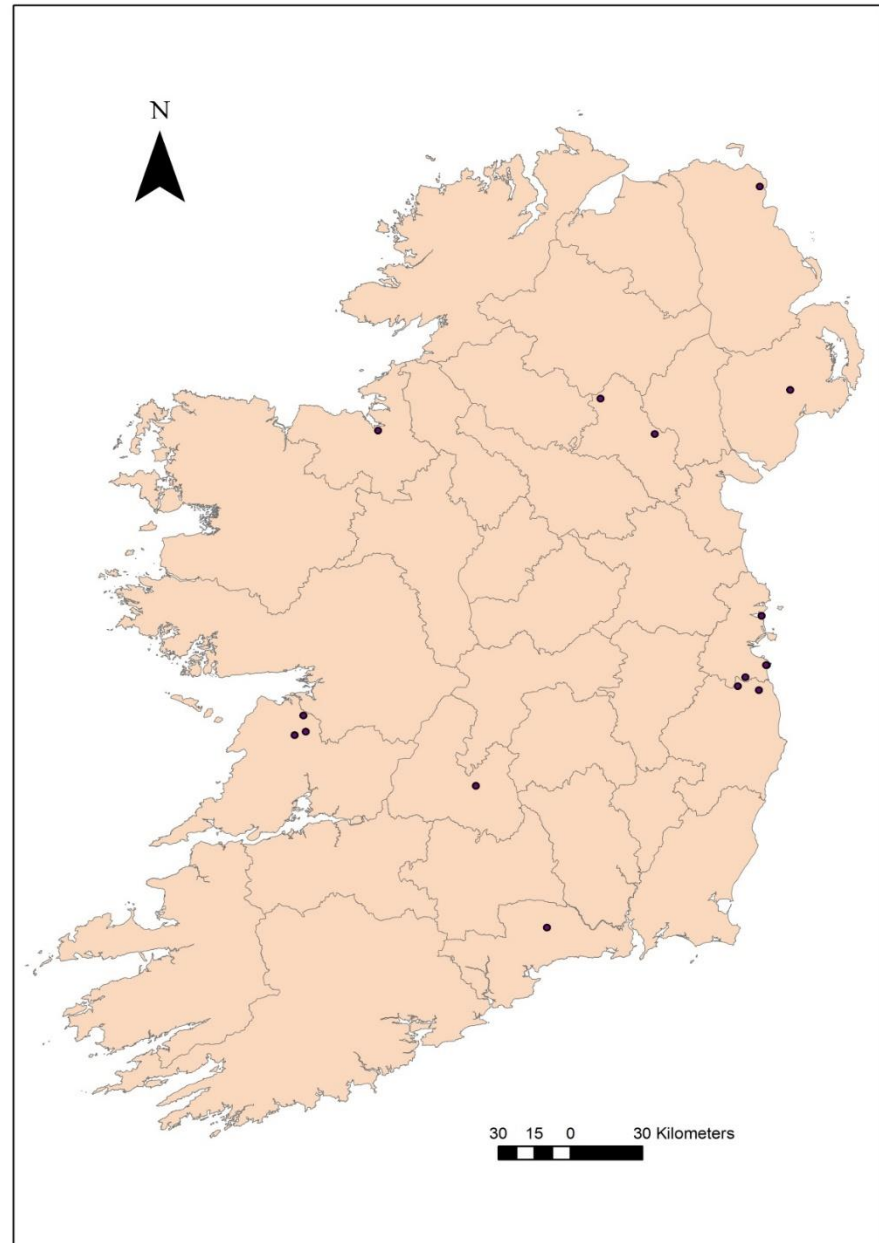
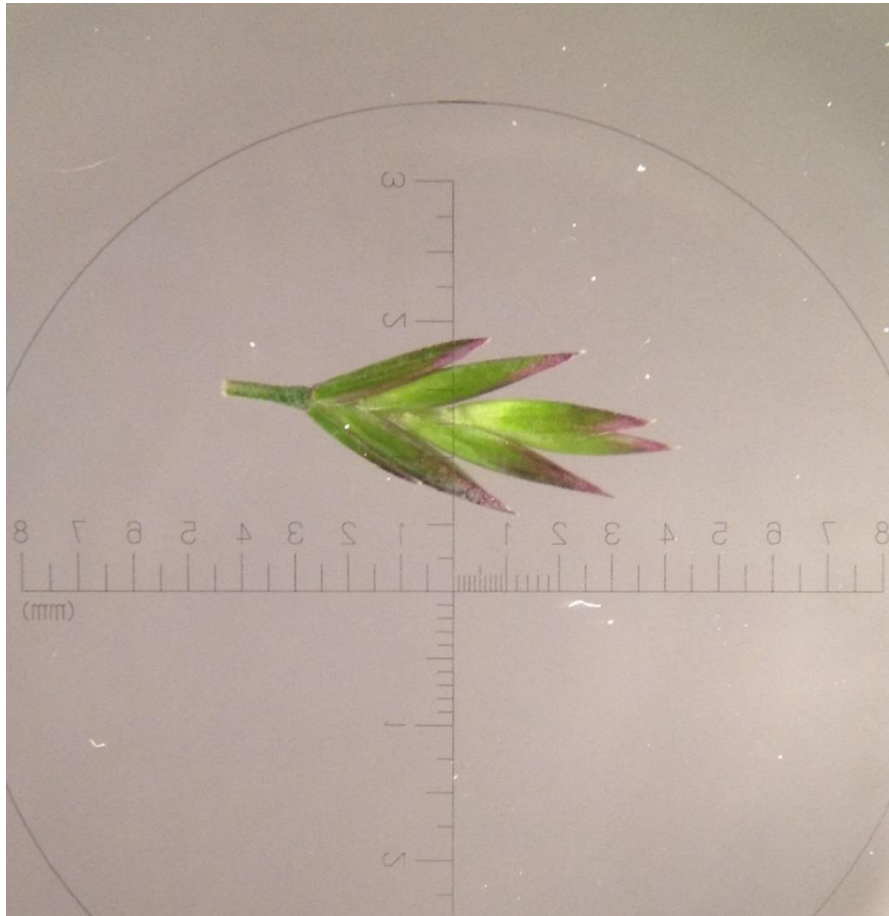


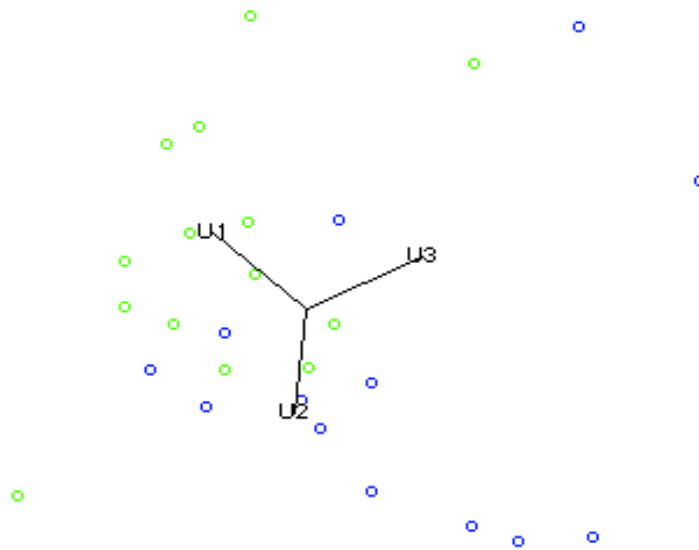
Festuca ovina subsp. *hirtula*



Festuca ovina subsp. *ophiolitica*

var. *ophiolitica* and var. *hibernica*

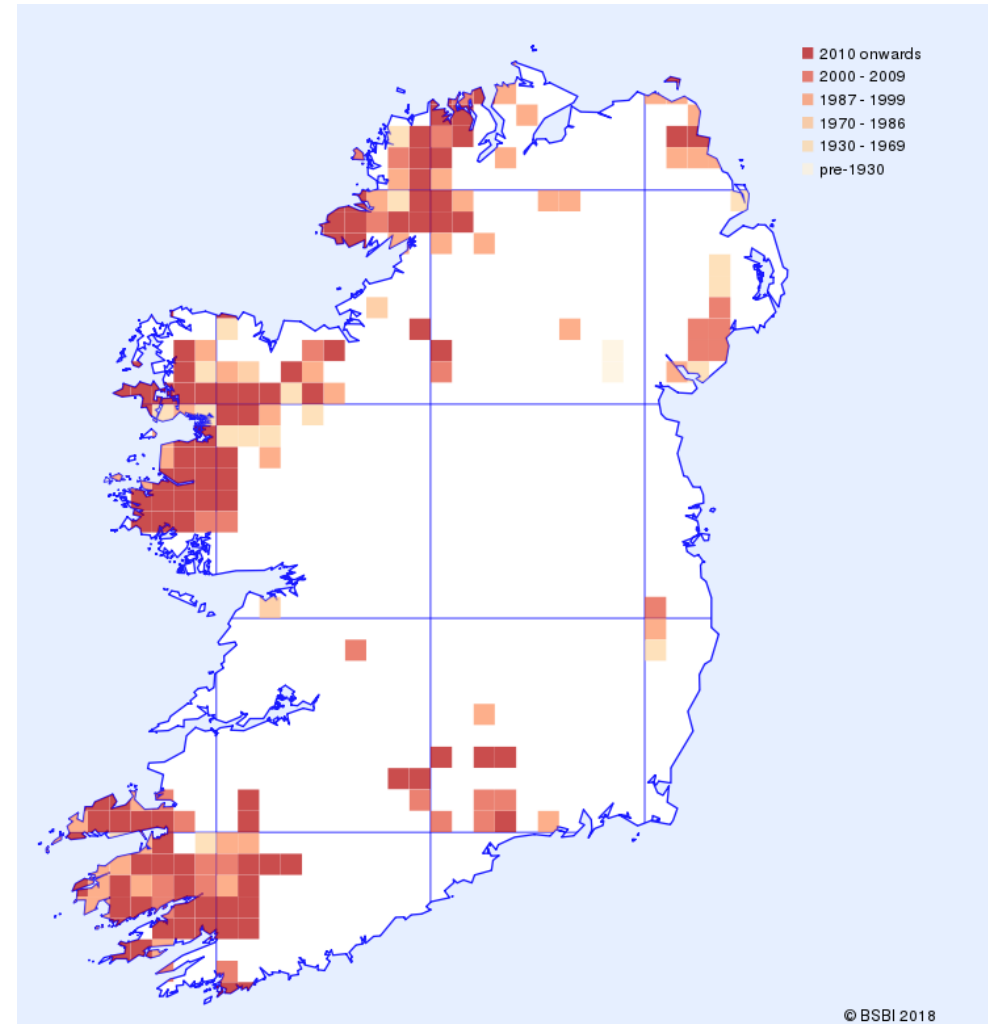




Rotating plot of the 3 most significant axes of variance in the *Festuca ovina* s.s. morphological data. Blue dots indicate those samples which were determined morphologically as *Festuca ovina* subsp. *ophiolithicola* and green for subsp. *hirtula*. There is clearly some overlap between the two subspp.

Irish Taxa

- *Festuca vivipara*
- Strongly favours areas of high rainfall and low sunshine – Atlantic & Arctic coast of Europe, and mountainous areas, e.g. the Alps (Wilkinson & Stace 1991).
- Triploid ($2n = 21$) and tetraploid ($2n = 28$).
- New pentaploid ($2n = 35$) population discovered in Mayo – only otherwise known in Tatra Mountains of Poland/Slovakia!

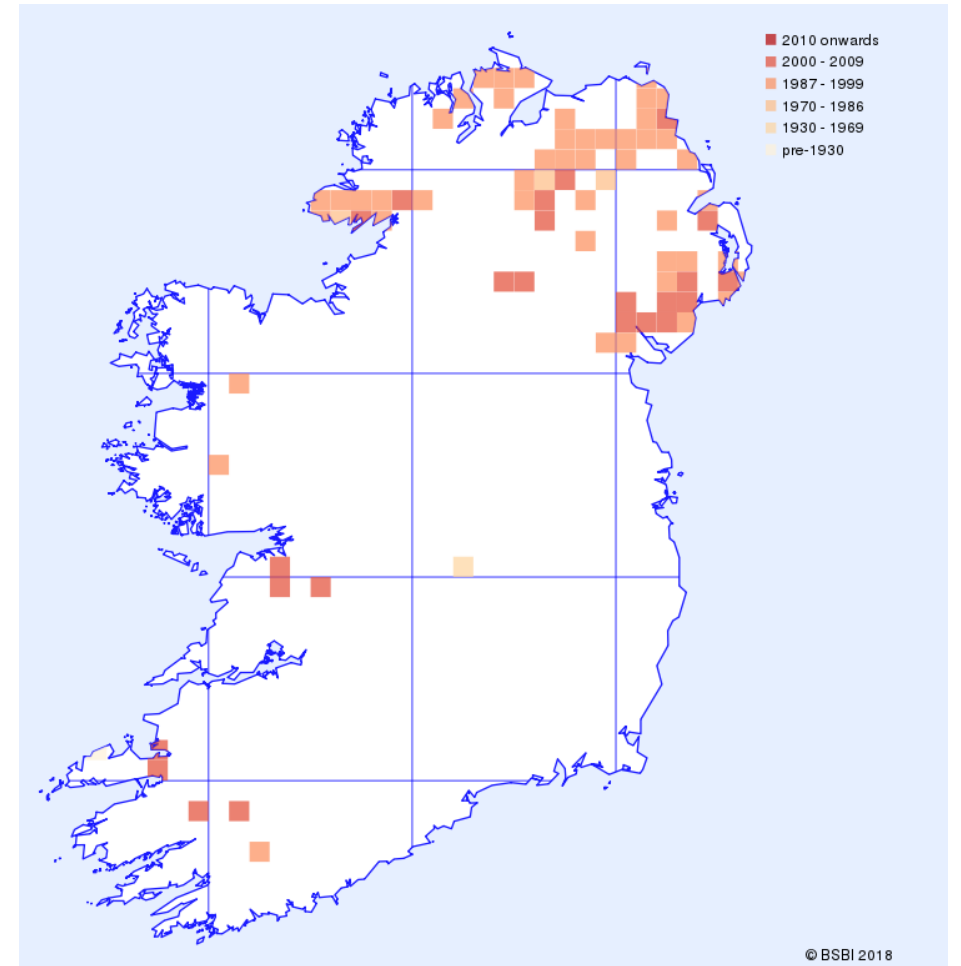




Pontoon, W
Mayo (H27)

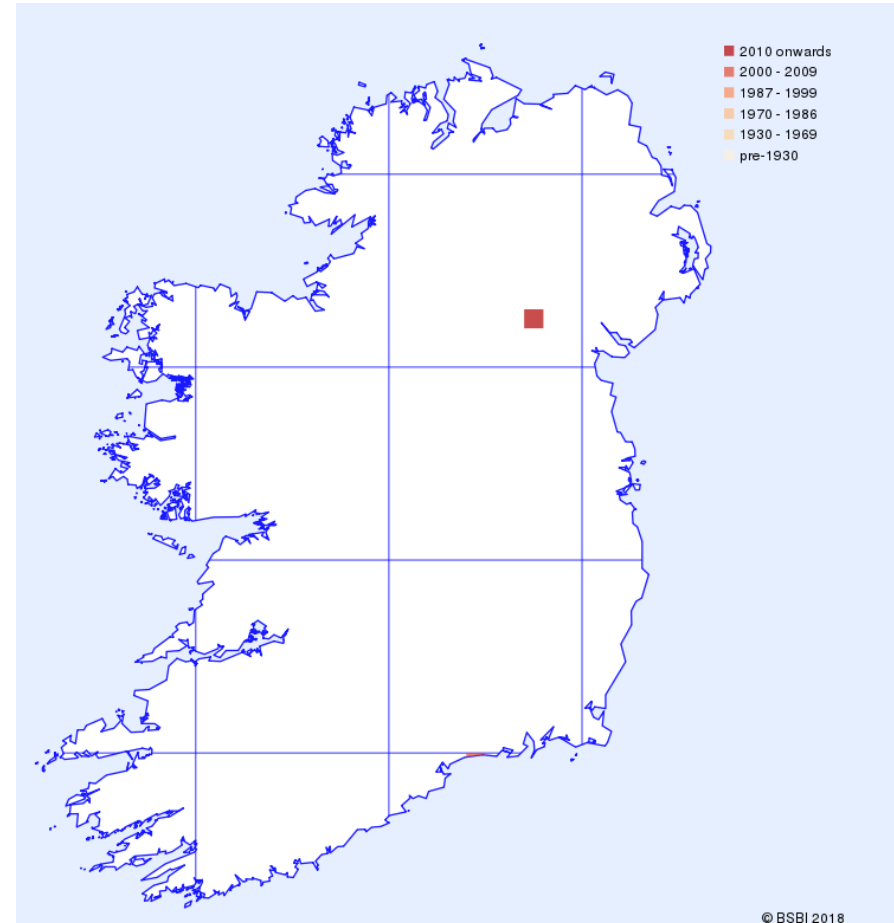
Irish Taxa

- *Festuca filiformis*
- Diploid ($2n = 14$).
- Largely distributed in the north and west of Ireland – very likely over-recorded for *Festuca ovina* subsp. *hirtula* and perhaps also subsp. *ovina*.



Irish Taxa

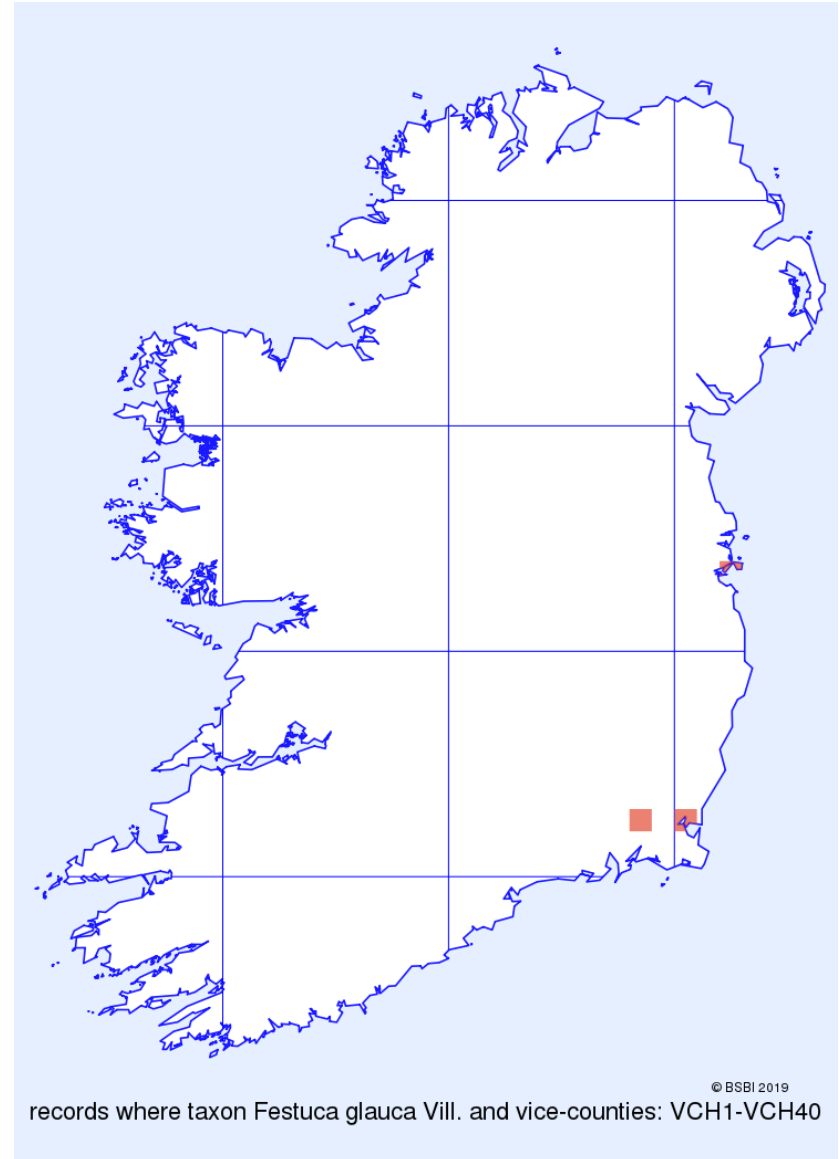
- *Festuca brevipila*
- Hexaploid ($2n = 42$)
- Neophyte
- Currently very rare in Ireland –
Monaghan (H32) and Waterford (H6)
- May well be under-recorded





Irish Taxa

- *Festuca glauca*
- Hexaploid ($2n = 42$)
- Neophyte
- Currently very rare in Ireland
- Possibly under-recorded



- DNA barcoding still ongoing...

1. Awns usually more than 1.2 mm and often more than 1.6 mm; leaves sometimes strongly pruinose, with 5-9(10) veins, with 4(-6) grooves on adaxial surface, usually with bulliform cells; up to 84% of stomata and prickles with accompanying silica cells.....2
1. Awns usually less than 1.2 mm and rarely more than 1.6 mm; leaves subpruinose or not pruinose, with 5-7 veins, with 2(-4) grooves on adaxial surface, rarely with bulliform cells; less than 30% of stomata and prickles with accompanying silica cells.....3
2. Pedicels 1.2-2.8mm; spikelets 6.1-8.5mm; lemmas with awns 1.2-2.6mm; leaves not or slightly glaucous, with abaxial sclerenchyma in 3 main islets; 2n = 42.....***F. brevipila***
2. Pedicels 0.3-0.5(0.8)mm; spikelets 5.4-7mm; lemmas with awns 0.5-1.5mm; leaves usually very glaucous, with abaxial sclerenchyma ± continuous; 2n = 42.....***F. glauca***
3. Spikelets proliferating; sexual florets usually absent but if present with lemmas 3.4-4.2 mm and lacking awns or with awns up to 0.2 mm; 2n = 21,28,35.....***F. vivipara***
3. Spikelets not proliferating, only rarely containing some pseudoviviparous bulbils; sexual florets with lemmas 2.5-4.9 mm and with awns 0-1 mm.....4
4. Spikelets up to 5.2(5.5) mm; lemmas up to 3.2(3.5) mm; awns 0-0.3(0.6) mm; leaves glabrous; 2n = 14.....***F. filiformis***
4. Spikelets more than 5.2 mm; lemmas more than 3.2 mm; awns (0)0.2-1(1.6) mm; leaves hairy at base or glabrous (*F. ovina* s.s.).....5
5. Spikelets 5.3-6(6.3) mm; lemmas 3.3-3.9 mm; 5-7 veins in leafblades; principally of acidic substrates.....6
5. Spikelets (5.5)5.9-7(7.5) mm; lemmas (3.6)3.8-4.6(4.9) mm; (5-) 7 veins in leaf-blades; principally of calcareous substrates.....7
6. Awns (0)0.2-0.6(0.8) mm; leaf-blades usually hairy at base; lemmas usually hairy; stomata (30)31.5-34(37) µm; 2n = 28.....***F. ovina* subsp. *hirtula***
6. Awns (0)0.4-1(1.2) mm; leaf-blades and lemmas usually glabrous or scabrid; stomata (25)27.5-31.5(35) µm; 2n = 14.....***F. ovina* subsp. *ovina***
7. Awns (0)0.5-1(1.6) mm; leaf-blade diameter (0.45)0.5-0.7; 2n = 28.....***F. ovina* subsp. *ophiolicola* var. *ophiolicola***
7. Awns 0-0.3(0.4) mm; leaf-blade diameter 0.39-0.59 mm; 2n = 28.....***F. ovina* subsp. *ophiolicola* var. *hibernica***

Key to Irish
Taxa –
adapted from
the keys in
Stace (2019)
and Wilkinson
& Stace
(1991)

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