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# New combinations in *Hookerochloa* and *Poa* (Gramineae)

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**Abstract**

The genus *Austrofestuca* is a synonym of *Poa* with its type species, *A.littoralis* - now a synonym of *Poa billardierei.* The combination ***P. pubinervis*** is made to place this closely related species with *P. billardierei.* The other two species, *A. eriopoda* and *A. hookeriana* belong together in the genus *Hookerochloa* and a new combination is provided for ***Hookerochloa eriopoda***.

## Introduction

Alexeev (1976) established *Austrofestuca* (Tzvelev) E.B.Alexeev from *Festuca* subgenus *Austrofestuca*, based on *A. littoralis* (Labill.) Alexeev. Clayton and Renvoize (1986) accepted *Austrofestuca* but stated that the characters used to delimit it required the inclusion of three more Australasian species. Simon (1986) provided the combination for *A. pubinervis* (Vickery) B.K.Simon, and Jacobs (1990) provided combinations for the remaining two, *A. eriopoda* (Vickery) S.W.L.Jacobs and *A. hookeriana* (F.Muell.) S.W.L.Jacobs.

*Austrofestuca*, *Festucella* E.B.Alexeev, *Hookerochloa* E.B.Alexeev, and *Poa* L. all belong to tribe Poeae subtribe Poinae which includes 15–21 genera as outlined by Soreng et al. (2007). While there had always been some thought that *Austrofestuca littoralis* may have been a species of *Poa* (see Edgar and Connor 2000 for a summary of the synonymy), it was not thought to be a good fit in that genus (Edgar and Connor 2000); the base of the lemma lacks a web and has a dense crown of short hairs to 0.5–0.8 mm long, and the apex said to be muticous or mucronate. Recent DNA studies (Hunter et al. 2004; Gillespie & Soreng 2005; Gillespie et al. 2007, Soreng et al. 2007) have made it clear that *A. littoralis* and *A. pubinervis* are species of *Poa.* Gillespie and Soreng (2005) suggest that *Poa billardierei* (Spreng.) St.-Yves is the appropriate combination in *Poa* to use for *A. littoralis*; the epithet is probably sufficiently distinct from the Australian *P. labillardierei* Steud. (also naturalised in New Zealand) to prevent confusion. Gillespie and Soreng (2005) also point out that most of the characters of *Poa billardierei* (*A. littoralis s.lat.*, including *A. pubinervis*) thought to exclude it from *Poa* occur elsewhere in that genus.

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Hunter et al. (2004) also suggest that both the genera *Festucella* and *Hookerochloa* should be recognised as '…the taxa differ in a wide range of quantitative and qualitative vegetative and reproductive characters…'. They list 14 characters; three of these as discontinuous, viz., (i) leaf blade inrolled vs folded, (ii) glumes smooth vs scabrous, and (iii) caryopsis 3.8–4.5 mm vs 2.6–3.4 mm long. They have two other characters whose character states are worded differently but actually do not differ significantly, viz., (i) abaxial palea surface glabrous to hairy vs glabrous or scabrous, and (ii) habitat descriptions of 'open montane to subalpine forest and grassland' versus 'swampy subalpine to alpine forest and grassland'. We maintain there are two further distinguishing characters that they omitted: leaf width, and a few characters related to this (Jacobs 1990); and epidermal features, where *Festucella* has a coarsely scabrous adaxial epidermis and *Hookerochloa* has a smooth to scabrid adaxial epidermis (Soreng & Gillespie 2007).

As a new edition of Wheeler et al. (2002) is about to be prepared, it has become necessary to clarify the situation and provide any necessary new combinations.

## Methods

A total of 39 specimens of each species of *Festucella* and *Hookerochloa* were examined. The specimens (all held at NSW) covered the full geographic range and variation observed in these taxa. The following characters were investigated:

(i) leaf blade inrolled vs folded,

(ii) glumes smooth vs scabrous, and

(iii) caryopsis length.

Cladograms from Hunter et al. (2004), Gillespie and Soreng (2005) and Gillespie et al. (2007) and analyses from Gillespie and Soreng (unpublished data) were used to decide on the generic placement of the species.

The situation with *Austrofestuca pubinervis* was assessed from the literature and specimens.

## Results

*Hookerochloa/Festucella*

(i) *Leaf blade inrolled vs folded*: the leaves are folded or flat in both species; Alexeev (1987) illustrated a folded transection of *Festucella eriopoda* while describing the blade as inrolled. As indicated in Jacobs (1990), the character distinguishing the two is basically leaf width. The leaves of *F. eriopoda* can be very narrow and the folded portion in some cases very small, giving the appearance of rolling. The situation is clearer on specimens with larger leaves.

(ii) *Glumes smooth vs scabrous*: the glumes of both species can be smooth or scabrous. From the specimens held at NSW, smooth glumes are more common in *H. hookeriana* than in *F. eriopoda*, opposite to the situation suggested in Hunter et al. (2004). We conclude that this character does not significantly differ between the species.

(iii) *Caryopsis length*: caryopses were difficult to find in any specimen, but enough were found to indicate that the stated difference does not hold. The figures supplied here would be slightly less than the full potential size, though it is not clear by how much. *F. eriopoda* had seed 3.0–4.1 mm long (mean = 3.6, n = 5) and *H. hookeriana* seeds 3.0–4.2 mm long (mean = 3.6, n = 8). Clearly, in our sample, there were no differences in the seeds lengths between the species.

(iv) *Other characters*: there is a difference in leaf blade width and some associated characters such as number of lateral veins in the blade (Jacobs 1990). There may be a tendency for the degree of hairiness of the abaxial palea surface to differ, but not in any disjunct way. There is a difference in the degree of scabridity of the adaxial leaf surface (Soreng & Gillespie 2007). The important difference in the habitat differentiators suggested by Hunter et al. (2004) is that *H. hookeriana* tends to grow at higher altitudes than *F. eriopoda*.

These are certainly useful characters to discriminate species but are inadequate to use to separate the species into two genera.

The ITS sequences in Hunter et al. (2004) and plastid sequences in Soreng et al. (2007) show good support for a clade containing both species, with *Arctagrostis latifolia* as sister to that clade. While there is good support for several of the final groupings in the cladograms, there is little resolution of the relationships between the groups, a common occurrence with grass gene sequences.

Gillespie and Soreng (2005) did not include either *Festucella* or *Hookerochloa* in their published cladograms, though they did point out that both genera shared slender awned lemmas and a few other characteristics with *Poa* subgen. *Andinae,* now proposed as a new genus *Nicoraepoa* (Soreng & Gillespie 2007). Gillespie and Soreng (unpublished data) also ran analyses with both *Festucella* and *Hookerochloa*; they found that:

(i) in cpDNA *trn*T–*trn*F analyses *Festucella* resolves in a clade with *Arctagrostis* (but this is not well supported being based on a single shared character), and this pair unites in a polytomy with *Hookerochloa* and species of *Nicoraepoa* (with relationships in this clade poorly resolved); and

(ii) in ITS analyses *Festucella* and *Hookerochloa* are sister taxa, *Arctagrostis* forms a clade with *Nicoraepoa,* and these four taxa are united in a strongly supported clade.

In a separate analysis using three independent chloroplast gene sequences (Soreng et al. 2007) *Festucella* and *Hookerochloa* are sisters in a polytomy with *Arctagrostis* and *Nicoraepoa,* without any other taxa, and *Poa billardierei* (actually *P. pubinervis*) is resolved with *Poa*.

These results are similar to those of Hunter et al. (2004).

*Austrofestuca pubinervis/Austrofestuca littoralis*

The lemma apex in both species is entire or occasionally minutely notched with the stout keel extending at the apex as a minute but firm nub <0.1 mm long behind the marginal dents (in side view). An apex with a stout short awn (rarely up to 3 mm long) develops occasionally in *Poa* sect. *Parodiochloa* (C.E. Hubb.) Soreng. These mucros or awns are thicker than the more delicate awns that extend from the lemma apices in the two *Hookerochloa* species.

While the ITS sequences in Hunter et al. (2004) show *A. littoralis* as a clade within *Poa,* few *Poa* species and no other Australian species were included in the analysis. Gillespie and Soreng (2005) included six other Australian species in their cpDNA analysis of relationships in *Poa* and *A. pubinervis* aligns well with the other Australian species in the same major clade in *Poa*. Similar results were obtained with plastid sequence data by Gillespie et al. (2007).

Plastid and ITS data for '*Austrofestuca pubinervis*' or '*Poa billardierei*' s.l., generated by Gillespie and Soreng (2005) and Gillespie et al. (2007: unpublished data) and discussed by Soreng et al. (2007) are all derived from collections of *A. pubinervis* from Western Australia (*Peterson et al. 14510*). When *A. pubinervis* is included in ITS and cpDNA analyses (Gillespie et al. 2007, unpublished data) with sequences of *P. billardierei* s.str. from New Zealand (from Hunter et al. 2004), they come out together with other Australian *Poa* species within *Poa*.

Hunter et al. (2004), quoting Weiller et al. (1995 et seq.), suggest that *A. pubinervis* is doubtfully distinct from *Poa billardierei* [as *A. littoralis*]. The url of Weiller et al. that is quoted no longer appears active but, presuming it is the same text that appears in another url suggesting the same citation, then Weiller et al. do say there is some doubt as to the distinctness of *A. pubinervis* but still treat it as a distinct species and do not synonymise the name. The situation is still as suggested by Simon (1986) viz., the name was provided by Vickery (1939) to replace an earlier invalid name (*Festuca triticoides* Steud.), and the species is maintained as separate in NSW and BRI. There is variation in the hairiness of the lower lemma, as stated by Weiller et al. (1995 et seq.): the Western Australian specimens have lemmas that are hairy below (i.e., *P. pubinervis s.str.*); the specimens from New South Wales have a lemma that is glabrous below (i.e., *P. billardierei s. str.*). Both forms (species) grow in Victoria, Tasmania and New Zealand. The only South Australian specimens seen were too mature to characterise lemma vestiture. It is clear that these two species would benefit from further study. Synonymising the two names is only one option and there are insufficient data to support this option over any other at this stage.

## Discussion

*Hookerochloa/Festucella*

The characters that Hunter et al. (2004) put forward for maintaining *Festucella* and *Hookerochloa* as separate genera are either erroneous or not discontinuous. The situation has not changed since Jacobs (1990) noted that the two species were only reliably separated by leaf blade width or associated characters. There are no good characters to separate the two into different genera.

The sequence data do not support either combining the two into one genus or recognising two genera, but do provide support for treating them as sister taxa. The data do suggest that consideration needs to be given to the relationships with *Arctagrostis* and *Poa* subgen. *Andinae* (for discussion of the latter see Soreng and Gillespie (2007) where this section is elevated to the rank of genus as *Nicoraepoa*). *Arctagrostis* is variously treated as having 1–4 species but all have a single floret per spikelet, acute to mucronate lemmas and a glabrous callus, quite distinct from the floral morphology of both *Festucella* and *Hookerochloa*, which have long-acute awned lemmas and a hairy

callus. *Nicoraepoa* is sister to the three genera above and is probably most similar morphologically to *Festucella* and *Hookerochloa* but the sequence data do not support treating all three in one genus. To do so would require including *Arctagrostis* and, if equivalence was to be even vaguely maintained, would require the amalgamation of several morphologically diverse genera from the subtribe Poinae. Both *Festucella* and *Hookerochloa* were published at the same time and have equal priority. We have chosen to combine both under *Hookerochloa.*

*Austrofestuca pubinervis*

This species undoubtedly belongs in *Poa.* Its status with respect to *Poa billardierei* would certainly benefit from further investigation, but the evidence thus far suggests it is worth maintaining until more complete studies are available. Consequently a new combination is provided in *Poa.*

## New Combinations

***Hookerochloa eriopoda*** (Vickery) S.W.L.Jacobs, ***comb. nov.***

Basionym: *Festuca eriopoda* Vickery (1939: 10–11).

Synonyms: *Festucella eriopoda* (Vickery) E.B.Alexeev (1985: 104); *Austrofestuca eriopoda* (Vickery) S.W.L.Jacobs (1990: 602).

Type: Blue Mountains, Kanimbla Valley (Mt Victoria) *J.J. Fletcher* 24.12.1892 (K).

***Poa pubinervis*** (Vickery) S.W.L.Jacobs, ***comb. nov.***

Basionym: *Festuca pubinervis* Vickery (1939: 7), nom. nov. for *Festuca triticoides* Steudel (1855 [1854]: 315) non Lamarck (1791).

Synonyms: *Austrofestuca pubinervis* (Vickery) B.K.Simon (1986: 241); *Austrofestuca triticoides* (Benth.) E.B.Alexeev (1987: 15); *Schedonorus littoralis* var. *triticoides* Bentham (1878: 656).

Type: South-west Australia, *Drummond* 150, (K) n.v.

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