The grass spikelet formula: an aid in teaching and identification

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Abstract

The structure and arrangement of the grass spikelet may be summarized by use of a spikelet formula. The parts of the formula are stacked vertically to correspond to the parts of the grass spikelet. Nerves and numbers of parts are indicated by super- and subscripts. Spikelet formulae may be a useful teaching tool, as well as a convenient field notation.

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As one learns about flowering plants and then begins to identify them, there is a need to summarize the structure and arrangement of the flower parts used in identification. For most plant families, this need may be met by a long-used system of notation termed the floral formula. In such a formula, the arrangement, number, and position of flower parts (sepals, petals, stamens, carpels) are represented by abbreviations and superscripts. For example, the floral formula for Chenopodiaceae reads $K^5\ C^0\ A^5\ G^{(2)}$, indicating flowers with 5 sepals, no petals, 5 stamens, and a superior ovary with 2 united carpels. In studying and teaching about grasses, we have seen a similar need to summarize in a clear and concise manner the structure and arrangement of a grass spikelet. We have found that the distinguishing features of most genera of Gramineae may be accurately described by a spikelet formula.

Components of the Spikelet Formula

Each spikelet formula conveys information about the *glumes, fertile florets, reduced florets, disarticulation,* and *inflorescence.* The components are abbreviated by **G** (glumes), **F** (fertile florets or lemmas), **R** (reduced florets), a **line** (point of disarticulation), and an abbreviation for the inflorescence. The 5 components are then placed in the same sequence or position that occurs in the spikelet they represent. For example, a hypothetical formula might be

R
F
———
G
pan

This explains that the grass spikelet disarticulates above the glumes, has reduced florets above the fertile florets, and is arranged in a paniculate inflorescence.

More information may be indicated by superscripts or subscripts. Superscripts would always refer to the number of the part in the spikelet, i.e., F^2 denotes 2 fertile florets. Subscripts would refer to the number of nerves of that part, i.e., F_3 means that the fertile florets (lemmas) are 3-nerved. Normally, superscripts and subscripts are used together, as both number of spikelet parts and nerves are usually important. Thus, the formula for a spikelet of *Aristida* (threeawn) reads

R^0
$^3F_3^1$
———
G^2
pan

This explains that *Aristida* spikelets are borne in a panicle, have 2 glumes, disarticulate above the glumes, have a single fertile floret with 3 nerves, and have no reduced florets.

Notice in the *Aristida* example that we have added a further refinement. Awn development is indicated with superscripts to the left of the spikelet part that bears the awn. Thus, the notation explains that the fertile florets (lemmas) of *Aristida* are 3-awned. Awns on the glumes or reduced florets may be indicated in the same way. It would be possible to add more super- or subscripts for additional information, but we have found that it soon becomes too confusing in practice.

Occasionally, additional features need to be added below the inflorescence notation. For instance, in the Paniceae tribe where the spikelets are remarkably uniform and spikelet formulae are similar among genera, we need to add a notation about the bristles for *Setaria* or about the cup-shaped glume for *Eriochloa.* Also, plants with unisexual spikelets such as burrograss, *Scleropogon,* often need a separate formula for each sex.

The following list summarizes some of the common uses of the notation system. The super- or subscript may be used with any spikelet part, and not just with the one illustrated.

G^1 = one glume present (first glume absent)
G^0 = no glumes
$\underline{G}$ = disarticulation below the glumes
F^{2+} = fertile florets 2 to several
$F_{7\text{-}9}$ = fertile florets 7- to 9-nerved
(R) = reduced florets occasionally developed
$F^{1(2)}$ = fertile florets one, occasionally two
$F_?$ = nerves of fertile florets obscure
pan = panicle
rac = raceme
spk = spike

Examples of Spikelete Formulae

Kentucky bluegrass (*Poa pratensis,* Poeae tribe)

(R)	reduced florets occasionally developed
$F_5^{3\text{-}5}$	3-5 florets with 5 nerves
———	disarticulation above the glumes
G^2	2 glumes
pan	inflorescence a panicle

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Wild oat (*Avena fatua,* Aveneae tribe)

R^{1-2}	1-2 reduced florets above the fertile ones
${}^{1}F^{2-3}_{5-7}$	2-3 fertile florets, awned, 5-7 nerves
——	disarticulation above the glumes
G^2	2 glumes
pan	inflorescence a panicle

Switchgrass, (*Panicum virgatum,* Paniceae tribe)

$F^1_?$	1 fertile floret above, the nerves obscure
R^1_{5-7}	1 reduced floret with 5-7 nerves on lemma
G^2	2 glumes
——	disarticulation below the glumes
pan	inflorescence a panicle

Big bluestem (*Andropogon gerardii,* Andropogoneae tribe): sessile spikelet

${}^{1}F^1_1$	1 fertile floret, 1-awned and 1-nerved
R^1	1 reduced floret below the fertile
G^2	2 glumes
——	disarticulation below the glumes
pan/rames	inflorescence a panicle of rames

Big bluestem (*Andropogon gerardii,* Andropogoneae tribe): pedicelled spikelet

F^0	no fertile florets
R^1_1	1 reduced floret, 1-nerved
G^2_{1-7}	2 glumes, 1-7 nerves
——	disarticulation below glumes
pan/rames	inflorescence a panicle of rames

Burrograss, *(Scleropogon brevifolius,* Eragrosteae tribe): male spikelets

${}^{0}R^{6-15}_3$	6-15 male florets, 3-nerved, awnless
G^2	2 glumes
(——)	disarticulation below the glumes or not at all
rac	inflorescence a raceme

Burrograss (*Scleropogon brevifolius,* Eragrosteae tribe): female spikelets

${}^{3}R^{4+}_3$	4 to several female florets, 3-nerved, 3-awned
——	disarticulation above the glumes
G^2	2 glumes
rac	inflorescence a raceme

Conclusions

The spikelet formula summarizes easily the structure and numerical parts of a grass spikelet. We have found it especially useful in the classroom, and we suggest that when keying grasses students be required to first determine the spikelet formula for their specimens and then proceed to the actual keying process. This requires they understand fully he composition of the spikelet. Spikelet formulae may also be used in the field when quick notations are necessary to describe unusual forms or unknown species.