

The Identification of Certain Native and Naturalized Hay and Pasture Grasses by Their Vegetative Characters

MACDONALD COLLEGE

MCGILL UNIVERSITY

Technical Bulletin No. 16

THE IDENTIFICATION OF CERTAIN NATIVE AND NATURALIZED HAY AND PASTURE GRASSES BY THEIR VEGETATIVE CHARACTERS

PASTURE STUDIES IX



BY
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MACDONALD COLLEGE, P. Q., CANADA
JANUARY 1936

Revised and Reprinted March 1938
Reprinted 1942

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ACKNOWLEDGEMENTS

The authors wish to acknowledge the helpful criticisms and suggestions in the preparation of this bulletin made by Fr. Marie-Victorin, M. L. Fernald, J. H. Whyte, J. N. Bird, R. R. McKibbin, H. Groh, O. McConkey and others, and also the continued support of the Department of Agriculture at Quebec.

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PREFACE

The botanical composition of the pasture is one of the best guides to its feeding value and, secondly, botanical analyses are fundamental in the study of grassland.

To recognize grasses at their flowering stage is relatively easy with the many aids that exist, but for their identification at any time throughout the season and in the close-cropped state the investigator in eastern Canada has been compelled, in the past, to rely on keys adapted to other countries with a flora different from his own. The authors of the present bulletin have compiled a key and descriptions which are applicable to Quebec and for the most part to eastern Canada as a whole. They believe, also, that their key is an improvement on existing ones, at least for their type of work. They rest their distinctions upon the morphological features of the parts above the ground, features which are constant and easily observed without disturbing the sod.

The key is the outcome of practice, not theory, and has been well tried by a series of field investigations. Such a work, unlike many scientific papers, is not of merely ephemeral interest; it loses none of its value with the passage of time. Hence, though in any one year the bulletin may be used by relatively few, its cumulative usefulness would seem to justify its publication.

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PREFACE TO SECOND EDITION

The fact that the first edition of this modest bulletin, designed only to meet a local need, has met with a profuse and world wide demand, is evidence of the rising interest in grassland research. Combined, however, with a steady stream of letters of appreciation from pasture workers everywhere and even from leading taxonomists, this unexpected response has led the authors and sponsors of the bulletin to believe that a new and revised edition may prove useful.

The changes which have been made are not extensive. For the most part they are involved in systematization of the nomenclature. In addition, the review of literature is brought up to date and the habitat lists somewhat amended. The key and the descriptions of species, however, remain the same, having stood the test of experience.

G. W. S.

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The Identification of ... Grasses ...

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Abstract:-This bulletin presents a key for the identification of thirty-nine grasses of pastures and meadows of eastern Canada. Characters of the vegetative parts such as sheath, auricles, collar, ligule, and blade are used for their separation. Detailed descriptions of these parts and diagrams illustrating the ligule region are given for each species. The anatomical structure of typical blades is illustrated by camera lucida drawings.

1. INTRODUCTION

Research on methods of improving pastures and meadows is becoming more and more important in eastern Canada, where successive years of grazing and cropping have seriously depleted the soil of the mineral elements required for plant growth. Experiments are being conducted in several parts of Canada and many parts of the United States on the reaction of the pasture flora to soil, grazing, fertilization and management. These experiments necessitate a study of the succession of plant species and the changes in the relative area occupied by each species from year to year. Such changes in the vegetation cannot be satisfactorily followed by general observations but must be calculated by some more specific method, such as the quadrat method. The use of the quadrat in grazed pastures involves the Identification of plant species by their above ground parts in the vegetative stage. The grasses are the most difficult of these species to identify in the flowerless condition.

A practical study of the pasture flora in parts of western Quebec and eastern Ontario revealed the fact that none of the available keys to the grasses in their vegetative condition was satisfactory for use in this district. The several excellent keys published both abroad and in the United States included only a few of the grasses of this region and many not occurring

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within this district at all, so that, while useful, they served the purpose only partially.

Several years of intensive study of the grasses over an area including the lower Ottawa valley, the island of Montreal, parts of the Laurentian and Appalachian highlands, the Laurentian plain and adjoining upland south of the St. Lawrence River bordering Vermont and New York State in the Province of Quebec, and the district surrounding Ottawa in the Province of Ontario, have led to the preparation of this bulletin covering the pasture and meadow grasses of the area.

2. REVIEW OF LITERATURE

A number of keys to the grasses in the vegetative stage have been published since 1863 when, according to Ward (1901), the first systematic study of the non-flowering parts of grasses was made by Jessen in Germany. Twenty-six years later a beautifully illustrated treatise on the vegetative parts of some of the more important grasses of Switzerland was published by Stebler and Schröter (1889).

McAlpine in 1890 wrote a report on the identification of grasses by their leaves and Ward (1901) prepared a classification of the grasses based on vegetative and anatomical characters. Lewton-Brain (1904) followed with an illustrated account of the anatomy of the fifty-one British grasses. In his book on Agricultural Botany, Percival (1916) included a key to seventeen species of English grasses.

Carrier (1917) compiled a key to forty-eight grasses common in eastern United States. This key proved of more practical value for field work in eastern Canada than any other available key.

In 1921 Armstrong published a key to the common British grasses using four main pairs of differentiating characters.

Schindler (1925) of Austria used microscopic features in all extensive key to the grasses based on cross-sections of leaf blades.

Two of the most comprehensive keys to be published on the grasses in the non-flowering condition are by Henning (Sweden 1930) classifying seventy-four species and by Huber (Germany 1931) classifying forty-four species.

Whyte (1930) published a key to nineteen British grasses in which sheath colour and pubescence are used as important distinguishing characters,.

Three important contributions came from the United States within two years. The first by Norton (1930) contains keys to numerous grasses of Maryland in both flowering and non-flowering stages. The second is by Keim, Beadle and Frolik (1932) on the prairie hay grasses of Nebraska. The third is by Copple and Aldous (1932), which, although limited to twenty-six grasses of Kansas, is outstanding in the completeness of its illustrations of the vegetative parts.

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Prat (1932) of France published an exhaustive study of the epidermis of leaf blades, sheaths and glumes of species of the genus *Agropyron*. He studied many species, in addition, in the tribes outside the Hordeae, his findings confirming, for the most part, the already existing grouping of the grasses in keys based on morphology and anatomy. His work has some value in the identification of grasses in their vegetative stage, although primarily intended for use with mature plants.

Burr and Turner (1933) published a work on the identification of British economic grasses in which they present two keys, one based on morphological characters and the other on anatomical characters. The illustrations include camera lucida drawings of cross-sections of grass blades made from free-hand sections.

Vickery (1935) issued the first in a series of papers on the vegetative features, and anatomical characters of the leaves, of grasses indigenous to New South Wales. A discussion of the general vegetative and anatomical characters of the grasses is followed by details of these characters in species of the tribes Andropogoneae, Zoysieae, and Tristegineae. The author plans to conclude her series of papers with an artificial key to the native grasses of New South Wales in their vegetative state.

Hitchcock (1936) prepared a compact key to the almost two hundred species of grasses of Montana. Certain of the species within a genus differed so imperceptibly in their vegetative characters that they were grouped, and the reader was referred to short descriptions, or advised to compare them with authentic herbarium material for certain identification. Each distinctive species was illustrated by drawings grouped on eight plates at the end of the key, and the whole was bound in handy form for use in the field.

Pechanec (1936) studied eighteen grasses belonging to eleven different genera in the semi-arid area of the upper Snake River Plains, Idaho, where, in unusually dry seasons, few or no flowers are produced. This study formed the basis of a key to the vegetative stages of the grasses as well as detailed descriptions of each species. Only two of these species occur in eastern Canada.

Theron (1936) described in detail the leaf anatomy of thirty-eight species and six varieties of the genus *Aristida* indigenous to South Africa. His work, based on herbarium material in the Botanical Museum of Berlin-Dahlem, includes an anatomical key to these African grasses as well as drawings of the lower epidermis and cross-sections of the blades of seventeen species.

3. COMMON GRASS-LIKE PLANTS

There are many common plants occurring in meadows and pastures which might easily be confused with the true grasses (Gramineae) on account of similarities in vegetative structures. These, however, are confined mainly to two families, also monocotyledonous, the Sedge Family

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(Cyperaceae) and the Rush Family (Juncaceae). The first of these families includes six commonly occurring genera (*Carex*, *Scirpus*, *Cyperus*, *Eleocharis*, *Eriophorum* and *Dulichium*), *Carex* and *Scirpus* being the most important as far as prevalence is concerned. The Juncaceae is constituted mainly of one genus, *Juncus*, of which there are several common species, and another rarely occurring genus, *Luzula*. The species of *Carex*, *Scirpus* and *Juncus* are numerous and are adapted to a variety of habitats, from very wet to dry and from exposed to shaded, in which they are invariably associated with each other and with the grasses.

The few diagnostic points presented in the following table will serve to separate these commonly occurring forms from the true grasses.

Differentiation of the grass-like plants of the families Cyperaceae and Juncaceae from the true grasses belonging to the Gramineae.

Character	Gramineae	Cyperaceae	Juncaceae
Culm	Usually hollow; cylindrical or flattened. Nodes conspicuous.	Filled with pith, rarely hollow; generally three- sided. Nodes not conspicuous.	Filled with chambered or open sponge-like pith; cylindrical. Nodes not conspicuous.
Leaf Arrangement.	Two-ranked (Plate I. Figs, 1, 2, 4, 5).	Three-ranked (Plate 1, Fig. 6).	Three-ranked (Plate 1, Fig. 3).
Leaf Sheath	Usually split (Plate I. Figs. 2, 4), occasionally closed (Plate I Fig. 5).	Usually closed (Plate I, Fig. 6).	Open or closed. (Closed in <i>Luzula</i>).
Auricles	Present or absent	Absent.	Absent or present as rounded extensions of the sheath margins
Collar	A distinct band.	Indistinct.	Indistinct.
Ligule	Present, rarely absent.	Absent, or weakly developed.	Absent, or weakly developed.
Leaf Blade	Usually flat, some times closely folded involute or bristle-like; glabrous or pubescent. Margins smooth scabrous or ciliate.	Flat, plicate (Plate II. Fig. 1) or bristle-like: rarely pubescent. Margins usually scabrous.	Channeled (Plate II, Fig. 2) or terete (flat in <i>Luzula</i>); glabrous (hairy on margin and at mouth of sheath in <i>Luzula</i>). Margins smooth on flat or channeled blades.

4. CHARACTERS USED IN THE IDENTIFICATION OF GRAMINEAE

The points of separation used in the included key are based on the characters of the bud-shoot and leaves on the vegetative or lower parts of the flowering shoots of the plant. The leaves high on the flowering culm

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are not considered, because they may have longer ligules, shorter and broader blades than those at the base, and because they are not readily available in closely grazed pastures.

a. The Bud-shoot

The arrangement of the leaves in the bud-shoot, the vernation, is used as the first point in identification. The blades may be either folded (conduplicate) with the margins meeting but not overlapping (Fig. 1A), or rolled lengthwise (convolute) with the margins overlapping (Fig. 1 B).

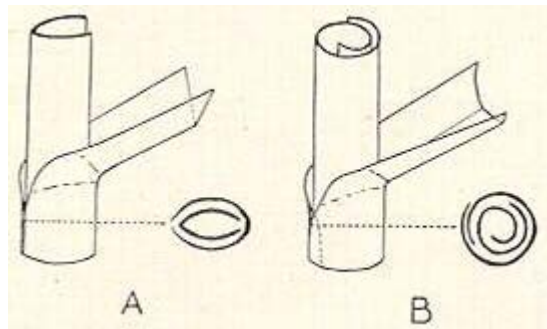


FIGURE 1. Vernation types: A-Leaf folded in the bud-shoot.
B-Leaf rolled in the bud-shoot

The conduplicate type usually forms a laterally compressed shoot, elliptical or lenticular in cross-section (Plate I, Fig. 5). In the convolute type the successive leaves are rolled alternately in clockwise and counter-clockwise manner, forming a cylindrical shoot as a rule (Plate I, Fig. 1). There are, however, a few exceptions in this correlation of the vernation and shape of the bud-shoot; for example, *Setaria lutescens*, *Digitaria sanguinalis* and *Echinochloa crusgalli* (Plate I, Fig. 4) possess rolled blades along with flattened shoots, while *Danthonia spicata* (Plate 1, Fig. 2), *Festuca rubra* and *F. ovina* have folded blades and more or less cylindrical shoots.

The nature of the leaves in the bud-shoot provides a fairly natural basis of separation for the grass species. All the species of the genus *Poa* and the closely related *Glyceria* fall into the "folded" class, while all those of the genera *Igrostis*, *Igropyron*, *Bromus* and the tribe *Paniceae* (*Panicum*, *Setaria*, *Digitaria* and *Echinochloa*) fall into the "rolled" class. Certain exceptions, however, occur in *Lolium* and *Festuca*., which have representatives of both types.

The vernation may be determined easily by cutting the shoot across immediately below the ligule of the outermost leaf and examining the section with a hand lens. It may be determined, however, without sectioning, by an examination of the innermost leaf after stripping off or pulling back the outer leaves from the bud. Neither of these methods may be necessary

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with the larger grass species whose vernation may be determined by examining the terminal blades of the bud-shoot with the unaided eye.

b. The Sheath

The sheath consists of the tubular basal portion of the leaf enveloping the culm or young growing leaves. Sheaths viewed in cross-section may be compressed as in *Dactylis glomerata*, *Setaria lutescens* and *Digitaria sanguinalis*, or rounded as in *Agrostis alba* and *Bromus inermis*. Occasionally they are keeled at the midrib (*Setaria lutescens*, *Dactylis glomerata*).

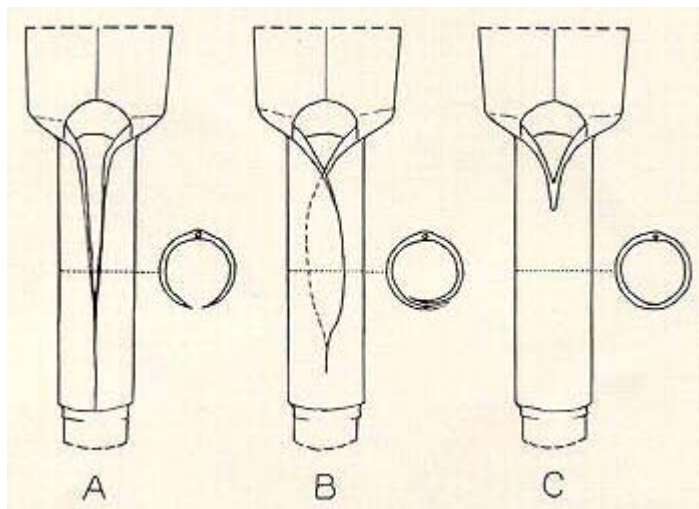


FIGURE 2. *Sheath types: A-Split. B-Split to near base with margins overlapping. C-Closed.*

The colour of sheaths is generally a paler shade of green than the blades, and the inner sheaths of such grasses as *Dactylis glomerata* and *Danthonia spicata* may lack the green pigment altogether. Purple tints on the sheaths of upper leaves, or on the exposed parts of basal ones may be due to bright sunlight and are not constant nor diagnostic. The tender leaves of early spring and in general the foliage of plants growing under unfavourable conditions (drought or cold) often take on a purplish colour which is transient. Bright red or purple tints, however, at the base of unexposed sheaths of lower leaves are constant in *Festuca elatior* and *Alopecurus pratensis* and are of value in identification.

The sheath may be completely split without overlapping edges (Fig. 2A) as in some *Poa* species and *Danthonia spicata*, split with overlapping edges (Fig. 2B) as in *Agropyron cristatum* and *Phalaris arundinacea*, closed (Fig. 2C) as in *Bromus* spp., or closed but easily rupturing as in *Glyceria* spp.

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c. The Auricles

The auricles are appendages projecting from the collar, one from each side, and are characteristic structures of grasses of the tribe *Hordeae*, including *Lolium*, *Agropyron*, *Elymus* and *Hordeum*. When present they may vary in length and shape, from long, terete, firm and clawlike, to short, flat, soft and blunt or so small and rounded as to appear rudimentary.

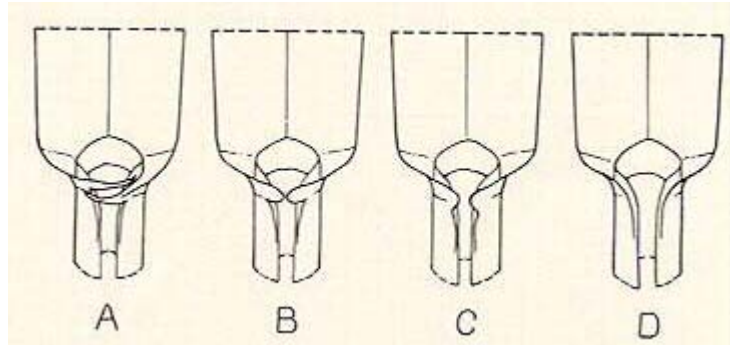


FIGURE 3. *Auricle types: A-Clawlike. B-Rounded. C-Rudimentary. D-Absent.*

(Fig. 3). Their presence and, to some extent, their morphology are valuable diagnostic characters because of constancy within a species.

d. The Collar

The collar is a meristematic band or growth zone marking the division point between the blade and the sheath. This band may be broad (Fig. 4A) or narrow (Fig. 4B), continuous from one margin of the leaf to the other (Fig. 4A, B) or divided by a conspicuous midrib (Fig. 4C). In some cases one side of the collar is higher than the other, giving it an oblique appearance (Fig. 4D) as in *Phalaris arundinacea* and *Agrostis alba*.

The collar is usually glabrous, but may be pubescent over the whole of its surface (Fig. 4E) as in *Agropyron repens*, or bear characteristic hairs or cilia on the margin only (Fig. 4F) as apparently constant in *Phleum pratense*. It may bear a tuft of long hairs at either edge (perhaps analagous to an auricle) as in *Danthonia spicata*, or a fringe of hispid hairs along the base as in *Setaria viridis*.

The colour of the collar is usually a paler or more yellowish green than the blade or sheath but may be temporarily tinged with red as in *Setaria lutescens* or *Digitaria Ischaemum*

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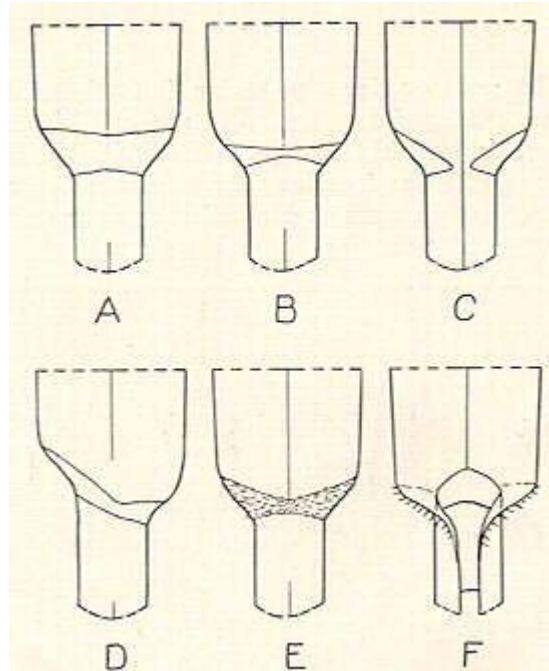


FIGURE 4. Collar types: A-Broad band. B-Narrow band. C-Divided by midrib. D-Oblique. E-Pubescent. F-Ciliate.

e. The Ligule

The ligule is a tongue-like outgrowth at the junction of the blade and sheath clasping the culm or the bud-shoot. It may be simply a fringe of

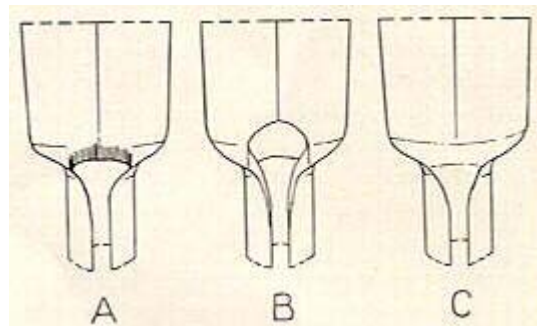


FIGURE 5. Ligule types: A-Fringe of hairs. B-Membranous. C-Absent.

hairs (Fig. 5A) as in species of *Panicum*, *Setaria*, etc., or may be membranous (Fig. 5B) as in many species. Rarely it is absent altogether (Fig. 5C) as in *Echinochloa crusgalli*.

The length of ligule is a useful point in separation and comparison of species. It is very short in *Poa pratensis*, *Festuca rubra*, *Agropyron repens*,

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etc., and long in *Glyceria spp.*, *Dactylis glomerata*, *Phalaris arundinacea*, etc. The length, however, is variable to a certain degree within a species depending on growth conditions, position on the plant and age of the plant.

The membranous types of ligules may be acute (Fig. 6A) as in *Glyceria striata*, acuminate as in *Glyceria grandis* and *Dactylis glomerata*, rounded (Fig. 6B) as in *Agrostis alba*, truncate (Fig. 6C) as in *Agrostis tenuis*, or emarginate (Fig. 6D) as in *Poa compressa*.

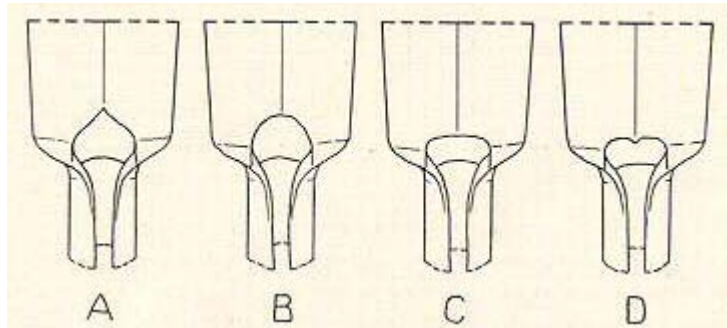


FIGURE 6. *Ligule shapes: A-Acute. B-Rounded. C-Truncate. D-Emarginate*

The margin of the ligule may be entire (Fig. 7A) as in *Poa compressa*, notched (Fig. 7B) as in *Phleum pratense*, toothed as in *Digitaria sanguinalis*, lacerate (Fig. 7C) as in *Agropyron cristatum*, or ciliate (Fig. 7D) as in *Anthoxanthum odoratum*. Margins of ligules often become worn, split or frayed in old leaves, so care should be taken to examine those of young, fresh blades.

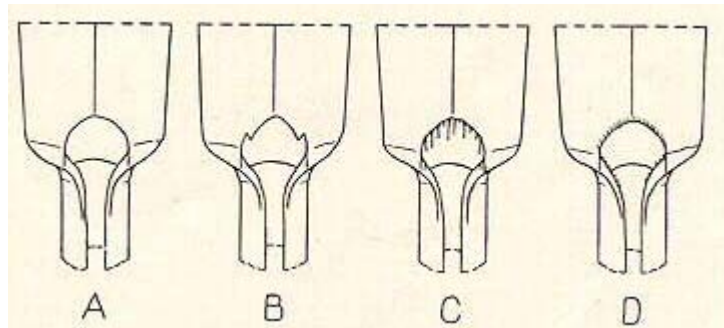


FIGURE 7. *Ligule margins: A-Entire. B-Notched. C-Lacerate. D-Ciliate*

The texture and colour of the ligule varies between species; for example, it is thin and scariosus in *Arrhenatherum elatius*, thin and white in *Poa annua*, and thick and opaque in *Bromus ciliatus*.

The surface of the ligule of the blade is generally glabrous, but may be short-pubescent (Fig. 8) as in all species of *Agrostis*, *Phalaris arundinacea*, etc.

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The presence or absence of ligules, and their nature, if present, are among the most useful characters for the identification of grasses in the flowerless condition.

f. The Blade

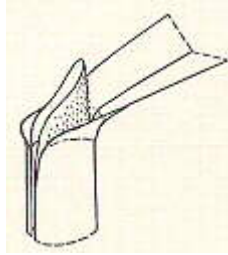


FIGURE 8. *Ligule pubescent on back.*

The blade is the free, or non-clasping, part of the leaf above the collar and ligule. It is usually long, linear and flat but sometimes it is so tightly folded as to appear solid and terete, in which case it may be called "bristle-like" (Fig. 9C). Broad blades may assume a flat (Fig. 9A), partly folded or V-shaped (Fig. 9B), involute (Fig. 9D) or rolled and involute (Fig. 9E) position. The folded and rolled positions are often assumed by flat blades under dry conditions.

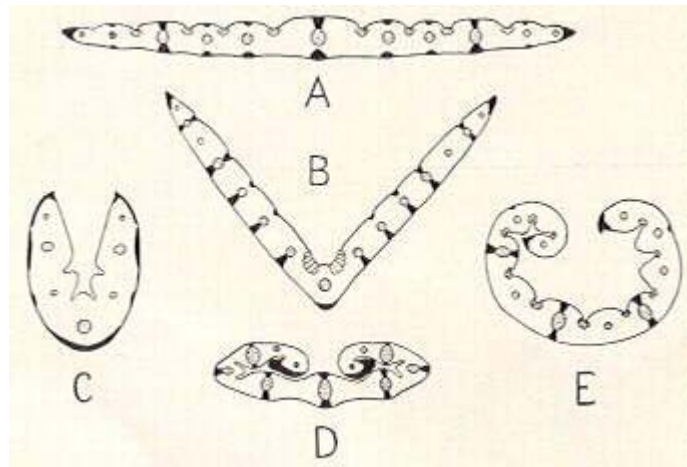


FIGURE 9. *Blade shapes in transverse section: A-Flat (Agropyron repens). B-V-shaped (Poa pratensis). C-Bristle-like (Festuca ovina). D-Involute (Danthonia spicata). E-Rolled with involute margins (Agrostis tenuis).*

The width and length of blades, although variable within a certain limit in a species or on a single plant, are often of considerable value in separating certain grasses. The shape of the blade, whether parallel-sided or tapering gradually from a truncate or broad base to the apex, and the

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shape of the apex, whether sharp, boat-shaped or blunt are also characters of importance. (Fig. 10, A and B).

The blade surfaces may be quite smooth as in *Poa spp.*, *Glyceria spp.* and *Dactylis glomerata* (Plate III). This type is frequently associated with "folded" blades bearing motor cells on either side, or over the midrib.

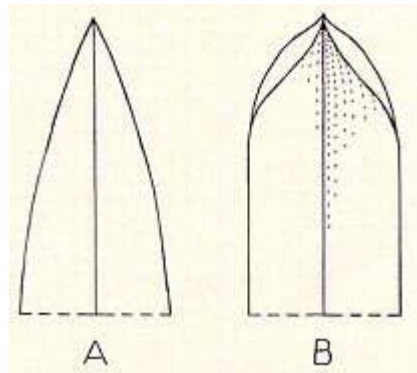


FIGURE 10. *Blade tips: A-Taper-pointed apex. B-Boat-shaped apex.*

Folded blades, however, may be deeply ridged as in *Lolium perenne* (Plate V, Fig. 2), *Festuca rubra* and *F. ovina* (Plate II, Figs. 3, 4) in which the development of motor cells is not marked. Blades rolled in the bud-shoot may be smooth, particularly in annual grasses such as *Setaria viridis*, *S. lutescens* (Plate IV, Figs. 1, 2, 3), *Digitaria* *Ischaemum* and *Echinochloa*

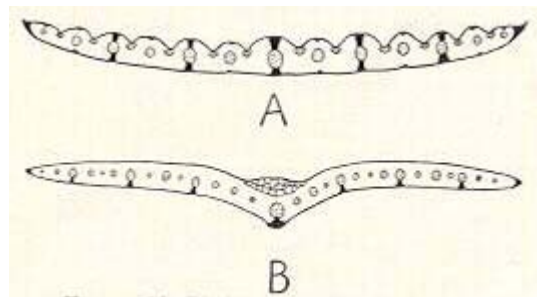


FIGURE 11. *Blade surfaces: A-Ridged and not keeled (Agrostis alba). B-Not ridged and keeled (Echinochloa crusgalli).*

crusgalli (Fig. 11B) or, as is usually the case with perennials, may be ridged, with motor cells in the furrows between each ridge as in *Agrostis alba* (Fig. 11A) and *Alopecurus pratensis* (Plate V, Fig. 1). The midrib is sometimes prominent on the under surface of the blade, forming a keel (Fig. 11B) as in *Dactylis glomerata* (Plate III, Fig. 6) and *Arrhenatherum elatius* (Plate V, Fig. 4).

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The thin-walled motor cells lose and regain water rapidly, becoming limp and flaccid when the leaves fold or roll in dry weather, and turgid when the leaves open in damp weather. Motor cells show up as pale green lines by transmitted light, a valuable diagnostic point for such genera as *Poa* and *Glyceria* in which a distinct line occurs on each side of the midrib. In *Glyceria grandis*, *Phalaris arundinacea*, *Muhlenbergia* spp., and others, transmitted light will show a network formed by tiny cross-veins at right angles to the main veins conspicuous enough to be seen with the naked eye, and therefore useful in the field diagnoses. It should be noted that although the terms "ridges" and "veins" are used interchangeably in some popular descriptions of grass leaves, the two are not necessarily associated. For example, although the vascular bundles or veins of most grasses occur under the ridges, they are between the ridges in *Glyceria striata* and *G. grandis* (Plate III. Figs. 7, 8). Veins may appear as dark green, or as white lines according to the presence or absence of chlorophyll tissue above and below the vascular bundles.

Pubescence is a variable character within a species, and even between leaves, but in some grasses, such as *Panicum* spp. and *Setaria lutescens*, long conspicuous hairs are of great significance.

The colour of the blade varies with the intensity of the light and the soil in which the grass is growing, as well as with the age of the plant. There are, however, distinct pale greens as in *Poa annua*, yellow greens as in *Glyceria grandis*, blue greens as in *Festuca ovina* and *Poa compressa*, and deep greens as in *Poa pratensis*. The surface may be shiny or dull, glaucous or not glaucous, giving a variation in the appearance of the basic colour.

The margins of the blade are usually scabrous (*Setaria viridis*, *Agropyron repens*) but may be smooth (*Agropyron cristatum*, *Digitaria Ischaemum*) or ciliate (*Panicum capillare*).

The Identification of ... Grasses ...

5. KEY FOR IDENTIFICATION

A. Leaf-blade folded in the bud-shoot.

B. Auricles present; lower sheaths reddish at base; glabrous throughout.

1. *Lolium perenne*

BB. Auricles absent.

C. Ligule a fringe of hairs; tuft of long hairs at margins of collar; sheath often pilose; plant tufted.

2. *Danthonia spicata*

CC. Ligule membranous; no long hairs at margins of collar; sheath glabrous or densely puberulent.

D. Blade narrow or bristle-like, prominently ridged on the upper (inner) surface.

E. Ligule less than 0.5 mm. long or obsolete; sheath split; leaves glaucous, blue-green; plant tufted.

3. *Festuca ovina*

EE. Ligule about 0.5 mm. long; sheath closed nearly to top; leaves not glaucous, dark green; plant not tufted.

4. *Festuca rubra*

DD. Blade flat, not bristle-like, not prominently ridged on upper surface.

E. Median lines present; tip of blade boat-shaped, abruptly pointed; blade less than 6 mm. wide (except in 8).

F. Ligule truncate, short (less than 1.0 mm. long).

G. Sheath keeled; ligule short (usually 1 mm. long), emarginate; blade short (2 to 10 cm.), broadest at base, gradually tapering to apex; foliage blue-green, often glaucous; minute hairs on margin of collar absent.

5. *Poa compressa*

Sheath not keeled; ligule shorter than in 5, usually 0.5 mm. long, entire; blade long (5 to 30 cm), parallel-sided; foliage deep-green, not glaucous; minute hairs often present on margin of collar.

6. *Poa pratensis*

FF. Ligule obtuse or acute, long (more than 1.0 mm. long).

G. Sheath with cross-veins joining the main veins.

H. Blade 3 to 5 mm. wide; sheath not keeled.

7. *Glyceria striata*

HH. Blade 6 to 15 mm. wide; sheath keeled.

8. *Glyceria grandis*.

GG. Sheath without evident cross-veins.

H. Blade truncate at base and tapering to a narrow boat-shaped tip; sheath usually scabrous; perennial.

The Identification of ... Grasses ...

- I. Blade glossy on under surface.
9. Poa trivialis
- II. Blade not glossy on under surface.
10. Poa palustris
- HH. Blade not tapering (parallel-sided), often puckered;
tip abruptly pointed and boat-shaped;
sheath smooth; annual.
11. Poa annua
- EE. Median lines absent; tip of blade taper-pointed; blade broad
(more than 6 mm. wide); plant tufted.
12. Dactylis glomerata
- AA. Leaf-blade rolled in the bud-shoot.
- B. Auricles present.
 - C. Blade glossy on under surface; margin of ligule not ciliate; auricles soft, blunt to clawlike.
 - D. Blade scabrous on the margins, ligule generally 0.5 mm. long or less.
13. Festuca elatior
 - DD. Blade smooth on the margins near the base; ligule generally 1.0 mm. long or more.
14. Lolium multiflorum
 - CC. Blade not glossy on under surface; margin of ligule ciliate or lacerate;
auricles stiff, clawlike.
 - D. Blade usually pilose on the upper surface; sheaths, especially the lowest,
with short pubescence.
 - E. Collar minutely pubescent; midrib not pronounced on under surface of blade;
upper surface not prominently ridged; ligule 1.0 mm. long or less.
15. Agropyron repens
 - EE. Collar glabrous; midrib conspicuous on under surface of blade;
upper surface of blade prominently ridged; ligule 0.5 to 1.5 mm. long.
16. Agropyron cristatum
 - DD. Blade glabrous; sheaths glabrous (except sometimes on the margin); collar
glabrous; midrib conspicuous on under side of blade.
 - E. Margin of sheath ciliate; blade almost smooth on the under surface,
about 10 mm. wide; ligule about 1 mm. long.
17. Elymus canadensis
 - EE. Margin of sheath glabrous or scabrous, rarely ciliate;
blade scabrous on both surfaces,
about 8 mm. wide; ligule about 0.5 mm. long.
18. Elymus-virginicus
- BB. Auricles absent or rudimentary.
 - C. Ligule present.

The Identification of ... Grasses ...

D. Ligule a fringe of hairs.

E. Blade densely pubescent on both surfaces.

F. Basal leaves short, ovate and coarse, forming a rosette; ligule 3 to 5 mm. long; a small perennial with short (legs than 5 cm. long) leaves.

19. *Panicum implicatum*.

FF. Basal leaves long, soft and similar to the cauline leaves; ligule 1 to 2 mm. long; a stout annual with large (10 to 20 cm. long) leaves.

20. *Panicum capillare*

EE. Blade glabrous, at least on the under surface.

F. Margins of sheath glabrous; blade sparsely hairy at base on upper surface, the hairs long, twisted and flexuous; collar glabrous.

21. *Setaria lutescens*

FF. Margins of sheath pubescent; blade entirely glabrous; base of collar fringed with hairs.

22. *Setaria viridis*

DD. Ligule membranous.

E. Sheath closed.

F. Sheath and blade pubescent.

G. Ligule short (0.5 to 1 mm. long).

23. *Bromus ciliatus*

GG. Ligule long (1.5 to 2.5 mm. long).

24. *Bromus tectorum*

FF. Sheath and blade glabrous.

25. *Bromus inermis*

EE. Sheath split (margins generally overlapping).

F. Hairs present (on sheath or on blade or on collar).

G. Sheath compressed.

H. Sheath pubescent.

26. *Digitaria sanguinalis*

HH. Sheath glabrous.

27. *Digitaria Ischaemum*

GG. Sheath not compressed.

H. Long hairs on margin of collar; blades bright green; coumarin scented.

28. *Anthoxanthum odoratum*

The Identification of ... Grasses ...

HH. Collar glabrous; blades bluish green; glaucous; not scented.

29. *Hordeum jubatum*

FF. Glabrous throughout (except ciliate collar in 30).

G. broad (more than 1.5 mm. wide).

H. Ligule long (more than 1.5 mm. long).

I. Margin of collar retrorsely ciliate; ligule with prominent notch at either side, glabrous on back

30. *Phleum pratense*

II. Margin of collar glabrous; ligule without a notch at either side, minutely pubescent on back.

J. Sheath keeled.

31. *Arrhenatherum elatius*

JJ. Sheath not keeled.

K. Blade 6 to 15 mm. wide; ligule white, papery, 2 to 8 mm. long, acute or obtuse.

32. *Phalaris arundinacea*

KK. Blade 3 to 8 mm. wide; ligule thick-membranous, 1.5 to 2.5 mm. long, truncate.

33. *Alopecurus pratensis*

KKK. Blade 1.5 to 7 mm. wide; ligule thin-membranous, 1.5 to 4 mm. long, rounded or acute.

L. Stolons absent; rhizomes long.

34. *Agrostis alba*

LL. Stolons long leafy, prostrate, rooting at nodes.

35. *Agrostis palustris*

HH. Ligule short (less than 1.5 mm. long), truncate.

I. Blade 1.5 to 3.5 mm. wide; auricles absent; plant with short rootstocks.

36. *Agrostis tenuis*

II. Blade 3 to 6 mm. wide; auricles rudimentary or absent; plant tufted.

37. *Agropyron pauciflorum*

GG. Blade narrow (less than 1.5 mm. wide), soft, generally involute and thread-like especially when dry; plant tufted.

38. *Agrostis hiemalis*

CC. Ligule absent; sheath compressed; plant glabrous.

39. *Echinochloa crusgalli*

The Identification of ... Grasses ...

6. LIST OF LESS COMMON GRASSES (NOT INCLUDED IN THE KEY) CLASSIFIED AS TO THEIR HABITAT

Dry, Sandy or Light Soils

Agropyron subsecundum (Link) Hitchc.
Andropogon jurcatus Muhl.
Danthonia compressa Austin
Panicum boreale Nash
Panicum linearifolium Scribn.
Sporobolus neglectus Nash
Sporobolus vaginiflorus (Torr.) Wood
Trisetum spicatum (L.) Richt.

Moist to Wet Soils

Agrostis perennans (Walt.) Tuckerm.
Alopecurus aequalis Sobol.
Calamagrostis canadensis (Michx.) Beauv.
Deschampsia caespitosa (L.) Beauv.
Elymus riparius Wieg.
Glyceria canadensis (Michx.) Trin.
Muhlenbergia sylvatica Torr.
Panicum clandestinum L.
Poa saltuensis Fern. & Wieg.

Semi-aquatic to Aquatic Habitat

Glyceria borealis (Nash) Botch.
Leersia oryzoides (L.) Swartz
Phragmites communis Trin.
Spartina pectinata Link
Zizania aquatica L.

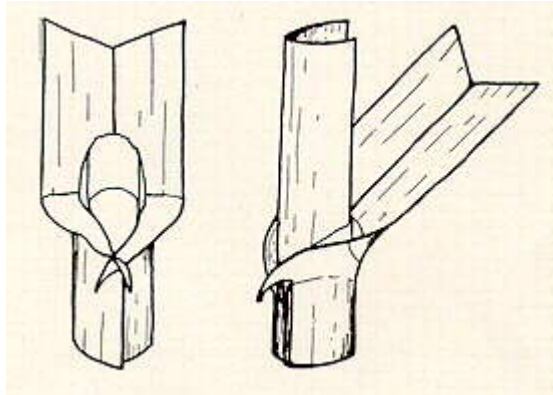
Shaded or Wooded Habitat

Brachyelytrum erectum (Schreb.) Beauv.
Cinna arundinacea L.
Hystrix patula Moench.
Leersia virginica Willd.
Milium effusum L.
Oryzopsis asperifolia Michx.
Oryzopsis racemosa (J. E. Smith) Ricker
Poa nemoralis L.
Schizachne purpurascens (Torr.) Swaller

The Identification of ... Grasses ...

7. DESCRIPTION OF GRASSES

LOLIUM PERENNE



1. *Lolium perenne* L. PERENNIAL RYE-GRASS) COMMON DARNEL.

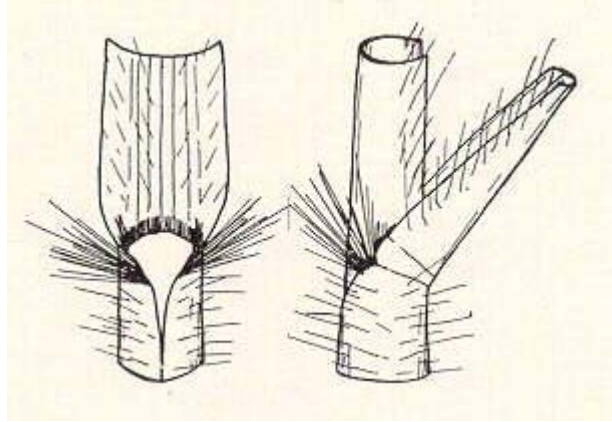
A fibrous-rooted, entirely glabrous, tufted perennial occurring almost exclusively in periodically reseeded meadows and pastures.

Leaves folded in the bud-shoot. **Sheath** usually compressed but sometimes almost cylindrical, not keeled, glabrous, pale green, reddish at base, closed or split. **Auricles** small, soft, clawlike. **Collar** narrow, distinct, glabrous, yellowish to whitish green. **Ligule** thin-membranous, 0.5 to 2 mm. long, obtuse, toothed near the apex. **Blade** 2 to 6 mm. wide, 5 to 15 cm. long, sharply taper-pointed, keeled, prominently ridged on upper surface, smooth and glossy on lower surface, bright green; margins slightly scabrous.

This grass closely resembles *L. multiflorum* and *Festuca elatior*, from which it is distinguished by the folded leaves in the bud-shoot.

The Identification of ... Grasses ...

DANTHONIA SPICATA



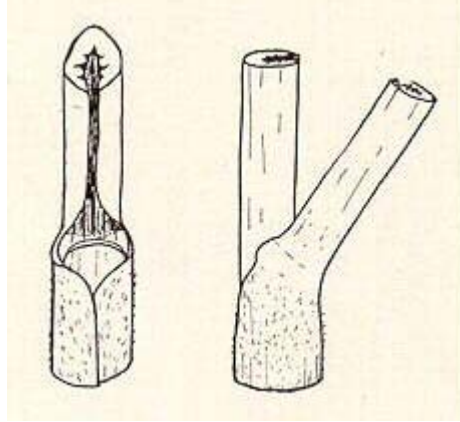
2. *Danthonia spicata* (L.) Beauv. POVERTY GRASS) WILD OAT-GRASS, POVERTY OAT-GRASS.

A short-leaved, light green, tufted perennial found on dry and poor sandy or gravelly soils, often predominating in depleted natural pastures where, although grazed by cattle when young, it soon becomes wiry, tough and unpalatable.

Leaves folded in the bud-shoot. **Sheath** not compressed, not keeled, usually pilose-pubescent, pale green to white, split to base. **Auricles** absent. **Collar** narrow, continuous, with long hairs on margins, lighter in colour than the blade. **Ligule** a fringe of hairs 0.2 to 1.2 mm. long. **Blade** 2 to 3 mm. wide, basal leaves 5 to 15 cm. long, not keeled, very sharply pointed, flat with margins becoming involute in dry weather, twisted and curled when dead, generally sparsely pilose but often glabrous; upper surface dull green or glaucous, ridged near midrib; under surface bright green, sometimes glossy, not ridged; margins slightly scabrous.

The Identification of ... Grasses ...

FESTUCA OVINA



3. *Festuca ovina* L. SHEEP FESCUE, SHEEP'S FESCUE.

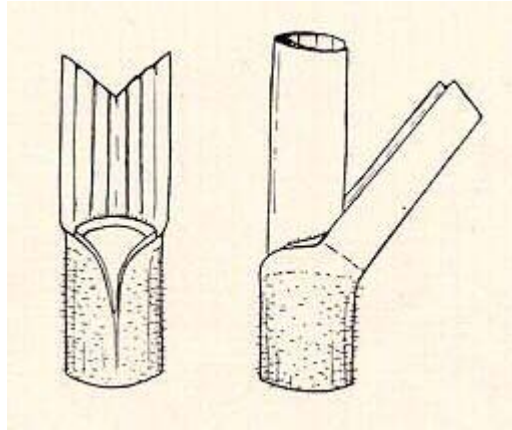
A fibrous-rooted, densely-tufted, narrow-leaved perennial growing on poor dry soils, on top of knolls and, in general, in exposed situations; sometimes occurring in pastures and lawns.

Leaves folded in the bud-shoot. **Sheath** not compressed, not keeled, finely and densely pubescent, bluish green (lower ones sometimes pinkish at base), glaucous, split with margins generally overlapping; dead sheaths pale brown. **Auricles** absent, or present as rounded cartilaginous thickenings of the margins of the collar. **Collar** indistinct, narrow, glabrous. **Ligule** membranous, very short (less than 0.5 mm. long) or obsolete, truncate, ciliate. **Blade** closely and permanently folded, bristle-like, about 1 mm. in diameter, 5 to 15 cm. long, pale, bluish green, glaucous, deeply ridged on upper (inner) surface, glabrous or finely pubescent at base, usually scabrous; margins smooth.

This species can be distinguished from *F. rubra* by being glaucous, densely tufted, and having blades folded, even under moist conditions.

The Identification of ... Grasses ...

FESTUCA RUBRA



4. *Festuca rubra*. L. RED FESCUE.

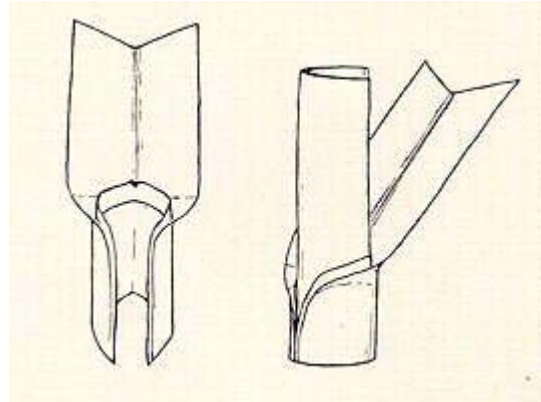
A narrow-leaved perennial, with short running rootstocks (except in *F. Rubra* var. *fallax*. Chewing's Fescue) but frequently showing tufted growth; occurring throughout the greater part of southern Quebec in meadows and pastures on moister and better soils than *F. ovina*.

Leaves folded in the bud-shoot. **Sheath** not compressed, not keeled, finely pubescent, split part way only; dead basal sheaths reddish brown, becoming fibrillose. **Auricles** absent or present as rounded extensions of the margins of the collar. **Collar** indistinct, narrow, continuous, glabrous, pale green. **Ligule** membranous, about 0.5 mm. long, truncate, entire or ciliate. **Blade** 1.5 to 3 mm. wide, 5 to 15 cm. long, thick, V-shaped to closely folded and bristle-like, dark green, deeply ridged on upper surface, smooth and slightly shiny on under surface; margins smooth.

Festuca rubra can be distinguished from *F. ovina* by its dark green colour, its habit of spreading, forming an even or somewhat tufted turf, and by its leaves, which are usually open but may close, depending on moisture conditions.

The Identification of ... Grasses ...

POA COMPRESSA



5. *Poa compressa* L. CANADA BLUE-GRASS, WIRE-GRASS, FLAT-STEMMED MEADOW-GRASS.

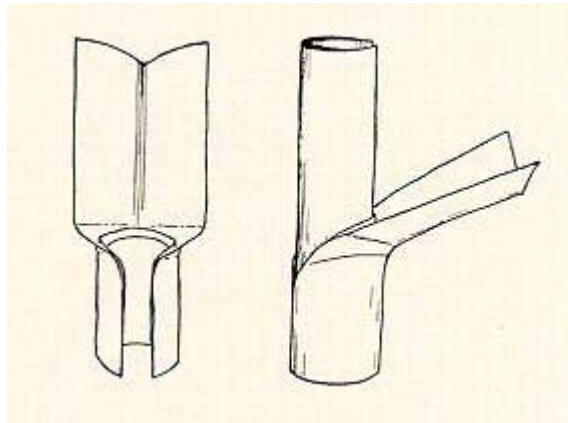
A bluish green, flat-stemmed perennial with creeping rootstocks and forming a loose turf; frequent on dry usually sterile soil in meadows, pastures and waste places; sometimes used in mixtures for seeding pastures and lawns.

Leaves folded in the bud-shoot. **Sheath** strongly compressed and sharply keeled, glabrous, green or purple-tinged, usually split to base, the margins being hyaline and not overlapping. **Auricles** absent. **Collar** narrow, glabrous, light green, divided by the midrib. **Ligule** membranous, white, short (0.2 to 1.2 mm. long), truncate or emarginate, entire. **Blade** 2 to 5 mm. wide, 2 to 10 cm. long, flat to slightly V-shaped, sharply keeled below, broadest at base, tapering throughout its length to a boat-shaped tip, glabrous, not ridged, bluish green, somewhat glaucous; margins slightly scabrous; the row of motor cells on each side of the midrib show as two light lines by transmitted light; the short, firm blades make broad angles with the axis of the shoot.

The leaves of this grass, in contrast to those of *P. pratensis* are a pale bluish or glaucous green, rather than a deep green colour, and are never shiny and always glabrous. The ligule is longer, paler and more conspicuous.

The Identification of ... Grasses ...

POA PRATENSIS



6. *Poa pratensis* L. KENTUCKY BLUE-GRASS, JUNE GRASS.

A dark green leafy perennial with creeping rootstocks, forming a dense sod; common in pastures, meadows, roadsides and lawns, thriving best in good soils with a moderate amount of moisture.

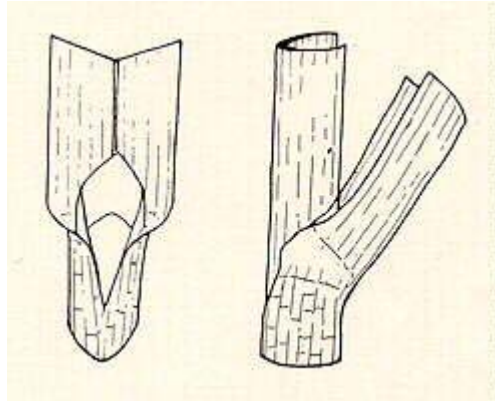
Leaves folded in the bud-shoot. **Sheath** compressed but not sharply keeled, glabrous, green, closed when young but later split with margins sometimes overlapping. **Auricles** absent. **Collar** medium broad, usually ciliate, yellowish green, slightly divided by the midrib. **Ligule** membranous, very short (0.2 to 0.6 mm. long), truncate, entire to finely ciliate, puberulent on back. **Blade** 2 to 5 mm. wide, 5 to 40 cm. long, usually V-shaped, tightly folded in dry weather, keeled below, parallel-sided and abruptly narrowed to a boat-shaped tip, sometimes minutely pubescent, not ridged, deep green, sometimes shiny on under surface, not glaucous; margins scabrous; the row of motor cells on each side of the midrib shows as two light lines by transmitted light; the long blades forming almost right angles with the axis of the shoot.

Poa pratensis is distinguished from *P. compressa* by the deeper green colour of its foliage, by the longer, parallel-sided blades, which are sometimes puberulent towards the base, and by the shorter ligule.

This grass, when growing in dry situations, has its narrow blades closely folded and might easily be confused with *Festuca rubra*. The absence of ridges on the inner surface when the blade is unfolded will distinguish it.

The Identification of ... Grasses ...

GLYCERIA STRIATA



7. *Glyceria striata* (Lam.) Hitchc. NERVED MANNA-GRASS, FOWL MANNAGRASS, FOWL MEADOW-GRASS.

Glyceria nervata (Willd.) Trin.

Panicularia nervato (Willd.) Kuntze

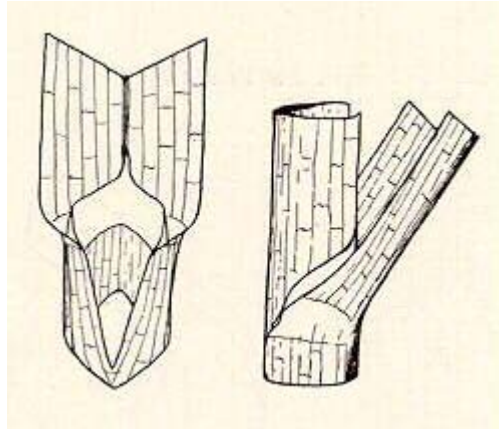
A native perennial with short rootstocks giving rise to erect leafy shoots in a loose tuft; found in moist meadows, pastures and ditches.

Leaves folded in the bud-shoot. **Sheath** flattened or elliptical but not prominently keeled, slightly scabrous pale green to purple or at least tinged with purple, prominently cross-nerved, closed almost to the summit but splitting easily due to its membranous nature. **Auricles** absent. **Collar** not conspicuous, glabrous, pale, divided by midrib. **Ligule** thin-membranous, 2 to 4 mm. long, acute, entire. **Blade** 2.5 to 5 mm. wide, 5 to 25 cm. long, flat or V-shaped, abruptly acute and boat-shaped at tip, glabrous, faintly ridged, pale green, not glossy, with the two median lines conspicuous; the younger blades remain folded for some time and arise at a sharp angle from the shoot; margins scabrous, especially towards the apex.

This species is distinguished from *G. grandis* by its narrower leaves, its purple-tinted sheaths, absence of conspicuous cross-nerves in the blades and its lower soil moisture requirement.

The Identification of ... Grasses ...

GLYCERIA GRANDIS



8. *Glyceria grandis* Wats. REED MANNA-GRASS, AMERICAN MANNAGRASS, REED MEADOW-GRASS, TALL GLYCERIA.

Panicularia americana (Torr.) MacM.

Panicularia grandis Nash

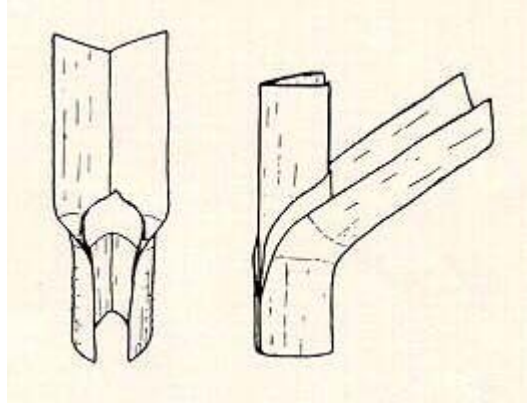
A tall, erect, stout, glabrous perennial growing in wet soils, on banks of streams, in moist meadows and in ditches.

Leaves folded in the bud-shoot. **Sheath** compressed and keeled, glabrous, smooth or slightly scabrous, closed almost to the top but rupturing easily, pale yellowish green, with conspicuous cross-nerves connecting main veins. **Auricles** absent. **Collar** prominent, glabrous, pale green or yellowish brown, divided by the midrib. **Ligule** membranous, 2.0 to 5.0 mm. long, truncate to acute, abruptly sharp acuminate, entire or slightly undulate. **Blade** 6 to 15 mm. wide 10 to 40 cm. long, V-shaped or flat with boat-shaped apex, glabrous, pale green, quite scabrous and faintly ridged on the upper surface, smooth or slightly scabrous on the keeled underside; transverse veins numerous and distinct forming a network with longitudinal veins; margins scabrous; the row of motor cells on each side of midrib showing as two light lines by transmitted light.

This grass is distinctly yellowish green in colour and the leaves are firm, erect and not conspicuously ridged. The cross-nerves joining the veins, interrupting the air-filled lacunae, are distinct in both sheaths and blades of this species.

The Identification of ... Grasses ...

POA TRIVIALIS



9. *Poa trivialis* L. ROUGH BLUE-GRASS, ROUGH-STALKED MEADOW-GRASS.

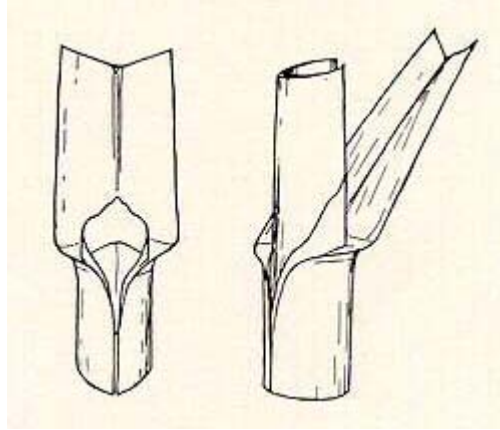
A bright green perennial spreading by stolons and growing in rich soil in wet meadows, ditches and cultivated fields; not very common except where recently seeded.

Leaves folded in the bud-shoot. Sheath compressed and sharply keeled, generally scabrous, green or purple tinted, split part way only. **Auricles** absent. **Collar** broad, distinct, glabrous, divided by the midrib. **Ligule** membranous, 2 to 3 mm. long, acute, entire or ciliate. **Blade** 2 to 4.5 mm. wide, 7 to 15 cm. long, flat, tapering from the base to the tip which is narrowly boat-shaped, yellowish green, slightly retrorsely scabrous on upper surface, glossy and keeled on lower surface; median lines not prominent; margins scabrous.

This grass resembles a few other species of *Poa* but may be distinguished by its scabrous sheath and the glossy under-surface of the blade.

The Identification of ... Grasses ...

POA PALUSTRIS



10. *Poa palustris* L. FOWL BLUE-GRASS, FOWL MEADOW-GRASS, SWAMP MEADOW-GRASS.

Poa triflora Gilib.

Poa, serotina Ehrh.

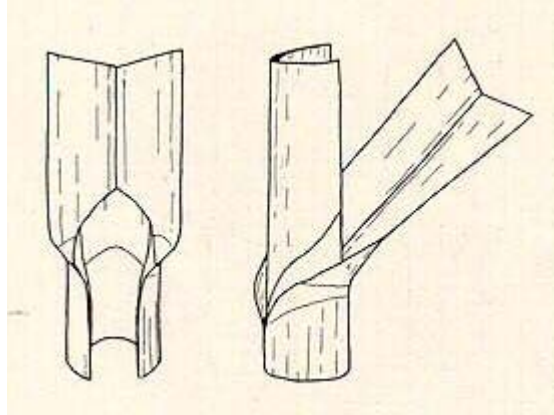
A perennial with short rootstocks which produce a few leafy shoots forming loose tufts; thrives best in moist meadows and pastures, in ditches and along streams.

Leaves folded in the bud-shoot. **Sheath** compressed and keeled, glabrous, slightly scabrous, green, split nearly to base with margins overlapping part of the way; margins scarious. **Auricles** absent. **Collar** distinct, glabrous, pale green, V-shaped. **Ligule** membranous, 1.5 to 3.5 mm. long, acute, entire or often toothed. **Blade** 2 to 4 mm. wide, 7 to 15 cm. long, flat or slightly V-shaped, keeled, broad at base, tapering to tip, slightly scabrous, pale green, not ridged but showing two light lines along midrib which are more distinct near the tip than at the base of blade; margins minutely hairy, retrorsely so at base.

Its distinguishing characters are its long acute ligule, compressed and keeled sheaths, and broad truncate-based blades which stand erect or ascending on the shoots.

The Identification of ... Grasses ...

POA ANNUA



11. *Poa annua* L. ANNUAL BLUE-GRASS, LOW SPEAR-GRASS, ANNUAL MEADOW-GRASS.

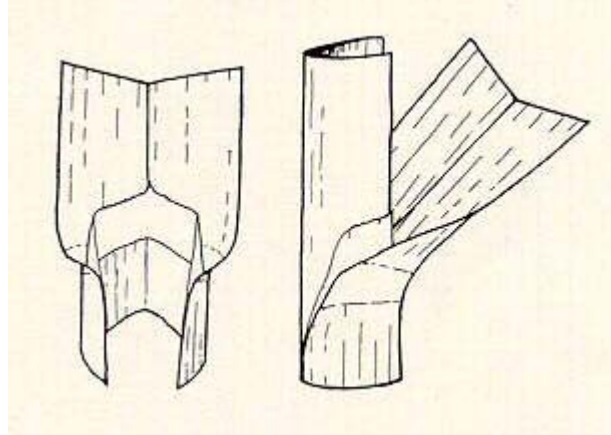
A low-growing, glabrous, tufted annual of cultivated and waste ground, paths, lawns and barnyards; widely distributed in the regions studied; flowering and fruiting readily even when severely tramped and frequently clipped.

Leaves folded in the bud-shoot. **Sheath** compressed and slightly keeled, glabrous, light green, split part way only; margins membranous and usually overlapping. **Auricles** absent. **Collar** distinct, glabrous, pale green, V-shaped. **Ligule** membranous, white, 1.0 to 3.0 mm. (usually 1.2 to 1.8 mm.) long, acute, entire. **Blade** 1.5 to 4 mm. wide, 2 to 8 cm. long, flat or V-shaped in section at base with sub-acute tip, light green, not glossy, thin, soft, often cross-wrinkled; two distinct light lines may be seen along the midvein by transmitted light; margins glabrous, slightly scabrous towards tip; the blades are widely spreading from the axis of the shoot.

Its non-stoloniferous habit, its soft, pale green and generally puckered blades, and its white, fairly conspicuous ligules are diagnostic.

The Identification of ... Grasses ...

DACTYLIS GLOMERATA



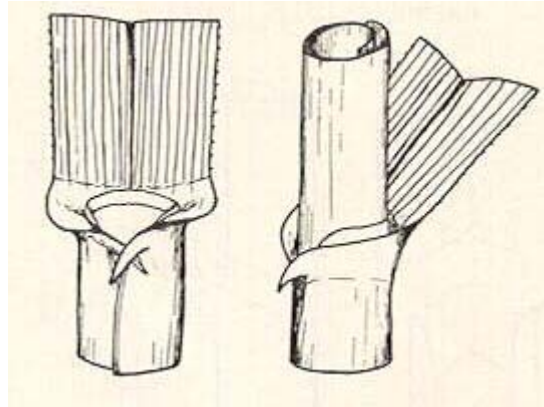
12. *Dactylis glomerata* L. ORCHARD GRASS, COCKSFOOT.

A coarse, tufted, glabrous perennial, of meadows, waste places and roadsides.

Leaves folded in the bud-shoot. **Sheath** much compressed, keeled, glabrous, green on upper part but very pale green or white on lower part, split part way, closed below. **Auricles** absent. **Collar** broad, distinct, glabrous, yellowish green, divided by the midrib. **Ligule** membranous, white, 2 to 8 mm. long, truncate, usually with awn-like point at apex, ciliolate, sometimes split to base. **Blade** 5 to 12 mm. wide, 8 to 40 cm. long, flat, V-shaped in cross-section near base, sharply keeled below, gradually tapering to an acute point, not ridged but with a deep furrow over the midrib, pale green, sometimes glaucous; margins almost smooth or scabrous.

The Identification of ... Grasses ...

FESTUCA ELATIOR



13. *Festuca elatior* L. MEADOW FESCUE.

F. pratensis Huds.

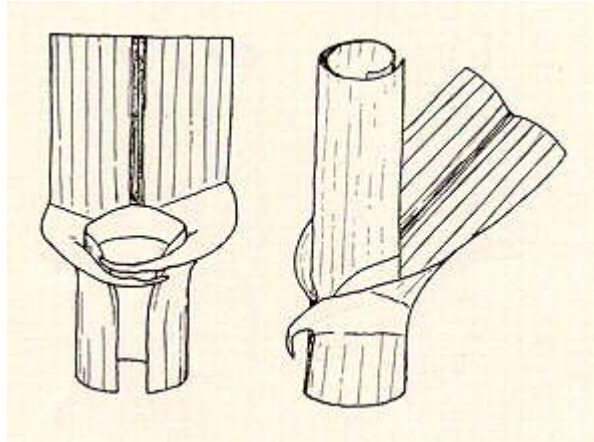
A tufted, deep-rooted perennial growing commonly on good soil in meadows but occurring also in pastures, along roadsides, river banks and in waste places.

Leaves rolled in the bud-shoot. **Sheath** not keeled, glabrous, pale green, reddish to purple at base, split to very near the base with the hyaline margins overlapping. **Auricles** present, 0.5 to 1.5 mm. long, soft, clawlike or blunt, yellow-green to creamy-white. **Collar** broad, distinct, glabrous, yellow-green to cream colour; margins thin, dilated and often wavy. **Ligule** membranous, greenish, short (0.2 to 0.5 mm. long), truncate to obtuse, entire. **Blade** 3 to 8 mm. wide, 10 to 50 cm. long, bright green; upper surface dull, scabrous and prominently ridged; lower surface glossy, smooth and slightly keeled; margins scabrous.

This grass is distinguished from *Lolium perenne* by rolled bud-leaves and from *Lolium multiflorum* by the rough leaf-margins and very short truncate ligule.

The Identification of ... Grasses ...

LOLIUM MULTIFLORUM



14. *Lolium multiflorum* Lam. ITALIAN RYE-GRASS.

L. italicum A. Br.

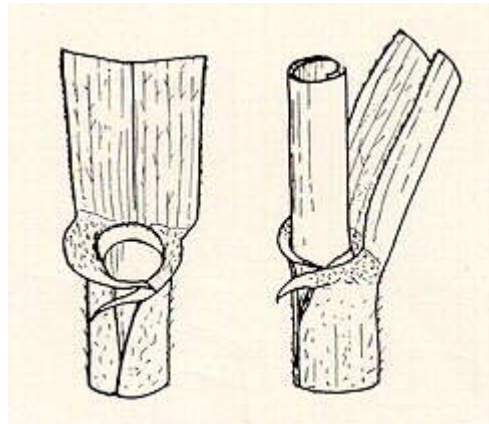
A glabrous, tufted, short-lived, perennial, very similar to *L. perenne* and *Festuca elatior* in general appearance; sometimes seeded in meadow and pasture mixtures but seldom persisting for more than one season.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, glabrous, green, pinkish at base, split; margins hyaline and overlapping. **Auricles** present, 1 to 3 mm. long, soft, flat and pointed or sometimes blunt or clawlike. **Collar** broad, distinct, continuous, glabrous, pale to yellowish green; margins thin and dilated. **Ligule** membranous, 0.5 to 2.0 mm. long, obtuse, entire. **Blade** 4 to 7 mm. wide, 10 to 40 cm. long, soft, bright green; upper surface dull, prominently ridged; lower surface smooth, glossy and slightly keeled; margins smooth at base.

This species is distinguished from *L. perenne* by its rolled bud-leaves, and from *Festuca elatior* by its smooth leaf-margins, narrower auricles and longer ligule.

The Identification of ... Grasses ...

AGROPYRON REPENS



15. *Agropyron repens* (L.) Beauv. COUCH GRASS, QUACK GRASS.

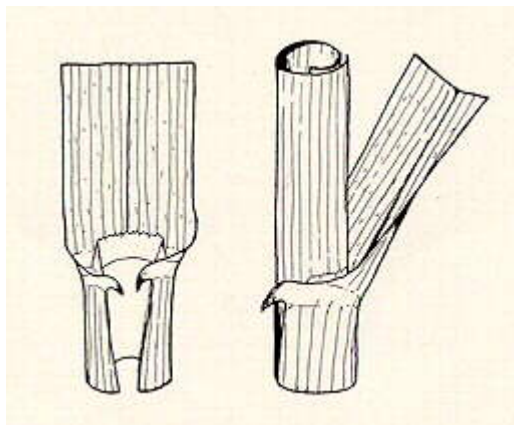
A perennial with long running rootstocks which ramify through the soil and send up numerous shoots, forming a loose but tough sod; a grass of wide distribution and one of the weeds most difficult to eradicate from cultivated fields.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, pubescent with soft, short, erect or retrorse hairs especially on lower leaves, rarely glabrous, green, split, with hyaline margins overlapping. **Auricles** present, 1 to 3 mm. long, slender, terete, clawlike, clasping. **Collar** distinct, puberulent both inside and outside, whitish, yellowish or sometimes purplish tinged, broad, V-shaped, divided by midrib, oblique. **Ligule** membranous, 0.5 to 1.0 mm. long, obtuse, finely tooth-fringed, ciliolate or entire. **Blade** 3 to 10 mm. wide, 8 to 20 cm. long, flat, slightly keeled at base, sharp-pointed, green sometimes slightly glaucous; upper surface generally sparsely pilose-pubescent, slightly ridged but midrib not conspicuous; margins and upper surface harsh-scabrous.

This grass is extremely variable in the degree of hairiness of the blades and sheaths. The hairs are more noticeable on the young leaves in the spring than on those formed later in the season. *Agropyron repens* may be distinguished from *A. cristatum* by its puberulent collar and less conspicuously ridged blade.

The Identification of ... Grasses ...

AGROPYRON CRISTATUM



16. *Agropyron cristatum* (L.) Gaertn. CRESTED WHEAT-GRASS.

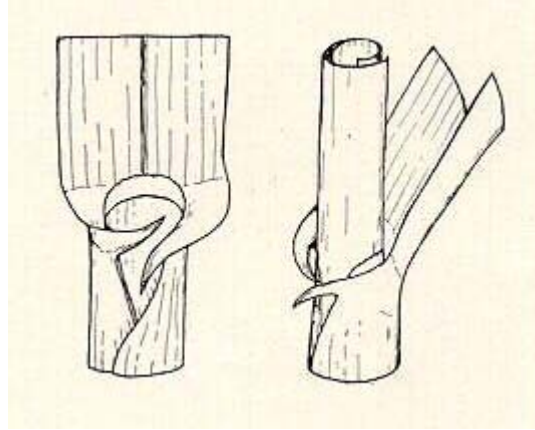
A light bluish green perennial, with fibrous rootstocks occurring in reseeded hay-meadows or pastures, growing equally well on both heavy and light soil; in western Canada some strains are used extensively for fairways and lawns.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, glabrous or the lowest usually soft pubescent, slightly scabrous, dark green, split with margins overlapping. **Auricles** present, 1.0 to 1.5 mm. long, clawlike, not clasping. **Collar** distinct, glabrous or ciliate, light green or yellow, V-shaped, divided. **Ligule** membranous, 0.5 to 1.5 mm. long, truncate, lacerate. **Blade** 2 to 6 mm. wide, 5 to 20 cm. long, flat, tapering to a sharp point, pale bluish green; upper surface scabrous, conspicuously ridged and usually soft pubescent; lower surface smooth; margins scabrous.

This species is distinguished from *A. repens* by its glabrous collar and its conspicuously ridged blades.

The Identification of ... Grasses ...

ELYMUS CANADENSIS



17. *Elymus canadensis* L. CANADA WILD RYE, NODDING WILD RYE, LYME GRASS.

E. robustus Scribn. & J. G. Smith, var. *vestitus* Wieg.

E. Wiegandii. Fern.

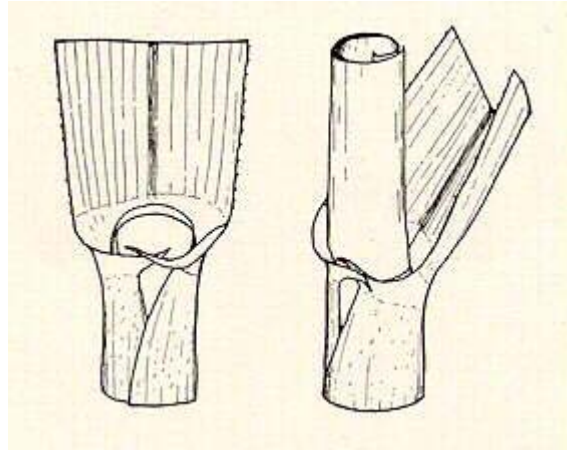
A tall, erect, dark green or glaucous perennial, with short rhizomes, thriving on moist soils and forming a loose sod; found in natural meadows, along stream banks and in damp open woods.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, green or glaucous, sometimes pinkish at base, glabrous, smooth, split with edges overlapping, the innermost margin broadly hyaline, the outermost ciliate with hairs to 1.5 mm. long. **Auricles** present, narrow, 1.0 to 2.5 mm. long, claw-like, clasping. **Collar** distinct, broad, continuous, glabrous, yellowish green, often oblique. **Ligule** coarse-membranous, greenish, 0.5 to 1.5 mm. long, truncate, finely notched and short-ciliate. **Blade** 8 to 20 mm. wide, 10 to 30 cm. long, dark green, sometimes glaucous, flat, tapering, sharp-pointed, dull, prominently ridged and slightly scabrous on the upper surface, almost smooth on the under surface, the midrib forming a keel toward the base; margins scabrous.

Elymus canadensis generally has broader and smoother blades and longer ligule than *E. virginicus*. Both species have broader and coarser blades than *Agropyron cristatum*.

The Identification of ... Grasses ...

ELYMUS VIRGINICUS



18. *Elymus virginicus* L. VIRGINIA WILD RYE, LYME GRASS) TERRELL GRASS.

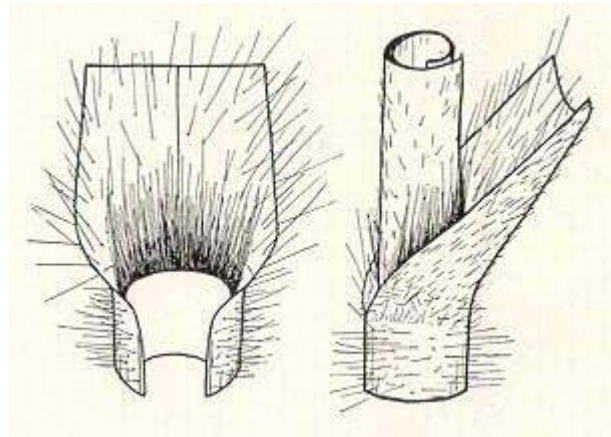
A tall, loosely tufted perennial of natural meadows, stream banks, thin woodlands or open soil.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, glabrous or rarely sparsely retrorse-hairy on the veins, smooth or sometimes slightly scabrous, green or the outer sheaths sometimes reddish at the base, split to the base, the edges overlapping, the margin of the outer one being scabrous, glabrous, or rarely sparsely ciliate, the margin of the inner hyaline, smooth and glabrous. **Auricles** present, 0.5 to 1.5 mm. long, sharp and clawlike, or rounded. **Collar** broad, continuous glabrous, yellow-green, often oblique. **Ligule** thick-membranous, greenish, about 0.5 mm. long, truncate, undulate, ciliolate. **Blade** 4 to 12 mm. wide, 10 to 30 cm. long, flat, tapering to a sharp point; upper surface dull and sometimes slightly glaucous, distinctly nerved with small and close ridges; lower surface bright green with the distinct midrib forming a keel; scabrous on both surfaces; margins scabrous.

This species may be distinguished from *E. canadensis* by having narrower blades, shorter ligule and more scabrous surfaces of blades. Both species of *Elymus* have broader and coarser blades than *Agropyron Cristatum*.

The Identification of ... Grasses ...

PANICUM IMPLICATUM



19. *Panicum implicatum* Scribn. WOOLLY PANIC-GRASS.

P. Lindheimeri Nash, var. *implicatum* (Scribn.) Fern.

P. lanuginasum Ell., var. *implicatum* (Scribn.) Fern.

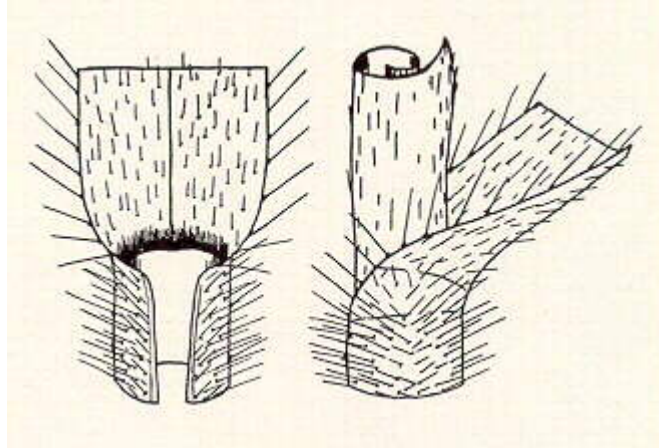
A lowgrowing, tufted, perennial panic-grass with soft-hairy blades and sheaths commonly growing in sandy, dry and sterile pastures and meadows or rarely in moister soils.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, densely papillose-pilose with erect hairs 1 to 2 mm. long, split to base, loose; margins not as broadly hyaline as in *P. capillare*. **Auricles** absent. **Collar** broad, distinct, pubescent, yellowish or light green, **Ligule** a fringe of long (3 to 5 mm.) and short (0.5 to 1 mm.) hairs. **Blade** 3 to 7 mm. wide, 3 to 5 cm. long, flat, cordate at base and tapering to the pointed tip, long, firm, erect or ascending, pilose on the upper surface with erect, whitish hairs 2 to 4 mm. long, densely appressed-pubescent on the lower surface, green, not ridged, not keeled; midrib not conspicuous; margins often involute towards the apex, scabrous. The basal leaves forming the winter rosette are 4 to 5 mm. wide, 1 to 2 cm. long, lanceolate-ovate, acuminate, coriaceous, green in the autumn, becoming brown and persisting in the following summer, glabrous on the surfaces but long-ciliate on the margins, finely ridged.

This grass is distinguished from *P. capillare* by its longer ligule and long-hairy upper surface of blade, and by its smaller but coarser foliage. Other species of *Panicum* (*P. tennesseense* Ashe, *P. boreale* Nash and *P. huachucae* Ashe) of similar growth habits are often found in pastures and meadows. The first two may be distinguished from *P. implicatum* by their relatively glabrous blades and the latter by its short appressed pubescence.

The Identification of ... Grasses ...

PANICUM CAPILLARE



20. *Panicum capillare* L. OLD WITCH GRASS, CAPILLARY PANIC-GRASS.

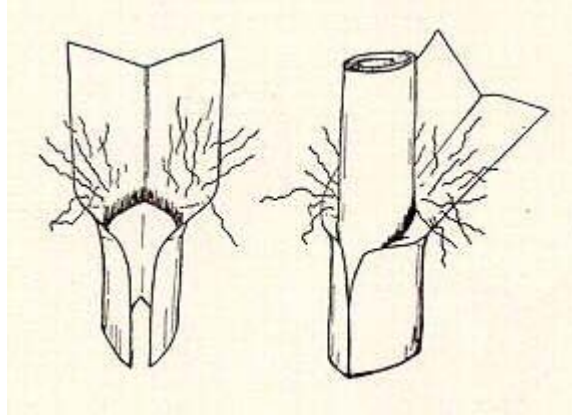
A stout, branching annual with very hairy sheaths and blades, occurring in dry soil; common as a weed in cultivated fields and meadows.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, conspicuously papillose-hispid between the veins, dull green, split; margins overlapping and hyaline. **Auricles** absent. **Collar** broad, distinct, pubescent, yellowish green. **Ligule** a dense fringe of hairs fused at base, 1.0 to 2.0 mm. long. **Blade** 8 to 15 mm. wide, 8 to 20 cm. long, soft, cordate and keeled at base, sharply taper-pointed at apex, densely short-pubescent on both surfaces with silky hairs; midrib prominent; margins scabrous, papilloseciliate towards base of blade.

This species is distinguished from *P. implicatum* by its shorter ligule, broader and longer blades and annual habit.

The Identification of ... Grasses ...

SETARIA LUTESCENS



21. *Setaria lutescens* (Weigel) Hubb. YELLOW BRISTLE-GRASS, YELLOW FOXTAIL, PIGEON GRASS.

Choetochloa glauca (L.) Scribn.

Setaria glauca (L.) Beauv.

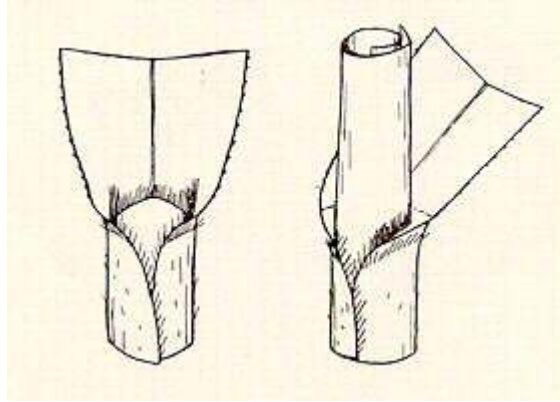
A semi-erect, fibrous-rooted annual of waste places, cultivated ground or over-grazed pastures.

Leaves rolled in the bud-shoot. **Sheath** much compressed, sharply keeled, glabrous, pale green or frequently tinged with purple and red towards base or on the veins, split, loose; hyaline margins sometimes overlapping. **Auricles** absent. **Collar** narrow, distinct, continuous, glabrous, pale green, purplish or reddish. **Ligule** a fringe of short hairs 1 mm. long or less, fused at base. **Blade** 4 to 10 mm. wide, 5 to 30 cm. long, flat, V-shaped towards base, keeled, soft drooping, taper-pointed, not ridged but midrib prominent, slightly scabrous, light green; upper surface slightly glaucous and bearing long, twisted and flexuous hairs near base; margins smooth or slightly scabrous.

This species is distinguished from *S. viridis* by the flexuous, twisted and hygroscopic hairs at the base of the blade and by the absence of cilia on the flattened sheath.

The Identification of ... Grasses ...

SETARIA VIRIDIS



22. *Setaria viridis* (L.) Beauv. GREEN BRISTLE-GRASS, GREEN FOXTAIL, BOTTLE GRASS.

Chaetochloa viridis (L.) Scribn.

Panicum viride L.

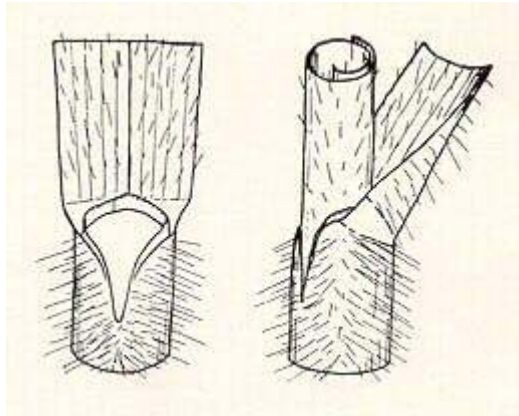
A coarse annual, semi-erect and branching from the base; common weed of waste places, cultivated fields and gardens.

Leaves rolled in the bud-shoot. **Sheath** cylindrical or slightly compressed, not keeled, glabrous but sometimes sparse-appressed pubescent, light green or tinged with purple towards base, split; margins pubescent with hairs about 1 mm. long (where the margins overlap the inner one is glabrous). **Auricles** absent. **Collar** broad, distinct, continuous, yellowish green or tinged with red, pubescent along base. **Ligule** a fringe of hairs 1 to 2 mm. long, fused at base, with the longer hairs towards the edges. **Blade** 4 to 10 mm. wide, 5 to 20 cm. long, flat, not keeled, gradually tapering to a sharp tip, not ridged but midvein prominent, glabrous, green, scabrous; margins serrulate-scabrous.

S. viridis is readily distinguishable from *S. lutescens* by the ciliate margins of the sheath and absence of twisted hairs at the base of the blade. The ligule is longer, the sheath is not compressed and is of firmer texture than in *S. lutescens*.

The Identification of ... Grasses ...

BROMUS CILIATUS



23. *Bromus ciliatus* L. FRINGED BROME-GRASS.

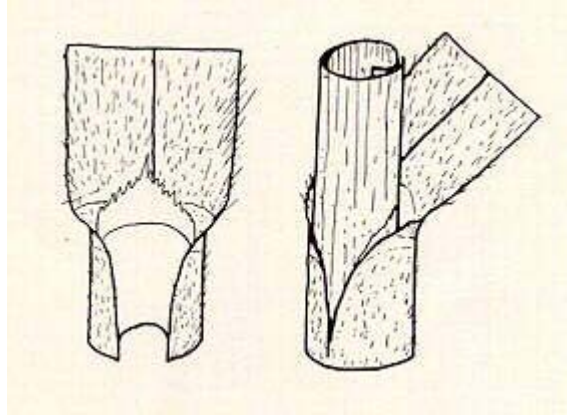
A tall perennial grass of moist soils; often occurring in natural meadows or in open woods.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, retrorsely pilose, closed to within 1 cm. of summit. **Auricles** absent. **Collar** narrow, distinct, glabrous, pale green, divided by midrib; margins sometimes constricted. **Ligule** coarse-membranous, short (0.5 to 1 mm. long), truncate, entire or slightly lacerate. **Blade** 4 to 10 mm. wide, 8 to 20 cm. long, flat, tapering to a sharp point, soft-pubescent, dark green, slightly ridged on upper surface; midrib distinct on under surface; margins scabrous.

This species is distinguished from *B. tectorum* by its shorter ligule, and from *B. inermis* by its longer pubescent sheath and blade.

The Identification of ... Grasses ...

BROMUS TECTORUM



24. *Bromus tectorum* L. DOWNY BROME-GRASS, DOWNY CHESS.

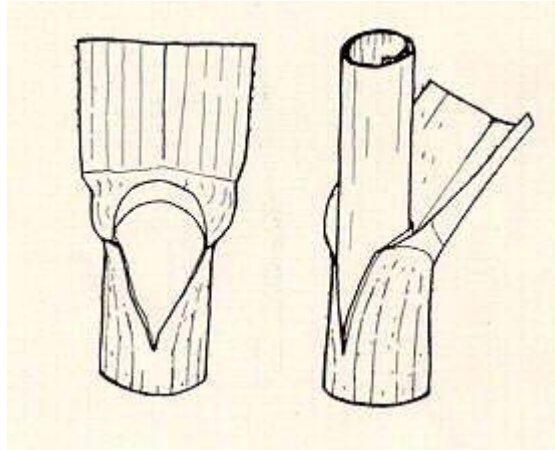
A slender tufted annual, rarely occurring in pastures which have been seeded at some time.

Leaves rolled in the bud-shoot. **Sheath** not compressed, keeled, softly pubescent, pale green, often pink or purple tinged, split part way only. **Auricles** absent. **Collar** pubescent, pale, narrow, distinct, usually divided. **Ligule** membranous, 1.5 to 2.5 mm. long, truncate, lacerate or coarsely ciliate near apex. **Blade** 4 to 8 mm. wide, 5 to 12 cm. long, flat, softly pubescent, sharp pointed, pale green; margins pilose.

This species is distinguished from *B. ciliatus* by its longer ligule and from *B. inermis* by its pubescence.

The Identification of ... Grasses ...

BROMUS INERMIS



25. *Bromus inermis* Leyss. AWNLESS BROME-GRASS, SMOOTH BROMEGRASS, HUNGARIAN BROME-GRASS.

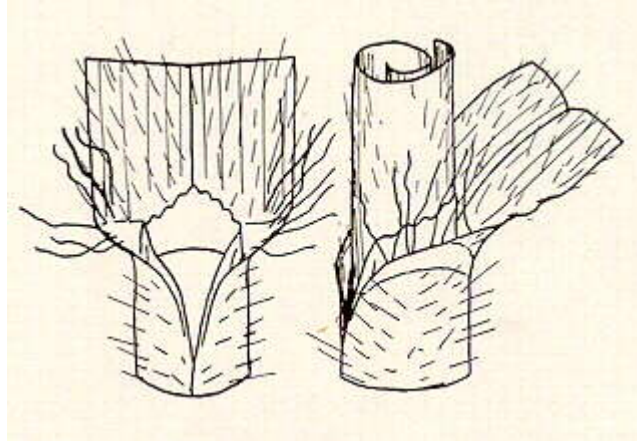
A strong perennial with creeping scaly rootstocks, growing well in the various soil types, thriving best, however, in loose sandy loam; used as a pasture and meadow plant but escaping to fence rows and roadsides where it becomes so persistent as to be a weed.

Leaves rolled in the bud-shoot. **Sheath** not compressed, slightly or not at all keeled, glabrous or the lower rarely sparse-pubescent, scabrous, closed to near the summit. **Auricles** absent or rarely rudimentary. **Collar** narrow, glabrous, light green, divided. **Ligule** membranous, short (about 0.5 mm. long), obtuse, entire or slightly lacerate. **Blade** 4 to 12 mm. wide, 15 to 40 cm. long, flat, tapering to a sharp point, glabrous but sometimes minutely pubescent on both surfaces, dark green, almost ridgeless above, slightly keeled below; margins scabrous.

This grass is distinguished from the other species of *Bromus* by its glabrous, or nearly glabrous, sheaths and blades.

The Identification of ... Grasses ...

DIGITARIA SANGUINALIS



26. *Digitaria sanguinalis* (L.) SCOP. LARGE CRAB-GRASS) FINGER-GRASS.

Syntherisma sanguinalis (L.) Dulac

Panicum sanguinale L.

Digitaria fimbriata Link

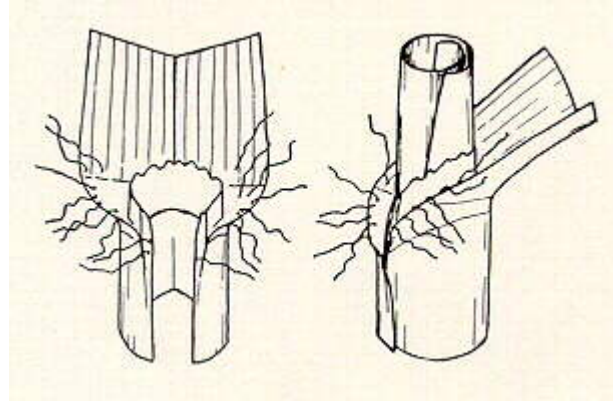
A low-growing spreading, hairy and pale green annual, bent and often rooting at the nodes; frequently occurring along roadsides, in over-grazed pastures, lawns and gardens.

Leaves rolled in the bud-shoot. **Sheath** compressed, pilose, green but sometimes purplish-veined, split with margins hyaline. **Auricles** absent. **Collar** broad, distinct, sparsely hairy, divided by midrib. **Ligule** membranous, 0.5 to 2.0 mm. long, acute, undulate or toothed, often reddish. **Blade** 4 to 10 mm. wide, 5 to 15 cm. long, flat, soft, drooping, often puckered, sharp-pointed, green, not ridged, pilose on both surfaces with a few longer hairs at base on upper surface; midrib prominent on lower surface; margins scabrous.

D. sanguinalis is a stouter-growing grass than *D. Ischaemum*, is pubescent on the sheaths and blades and generally lacks the purple coloring.

The Identification of ... Grasses ...

DIGITARIA ISCHAEMUM



27. *Digitaria Ischaemum* (Schreb.) Muhl. SMALL CRAB-GRASS, SMOOTH CRAB-GRASS.

Digitaria humifusa Pers.

Syntherisma Ischaemum (Schreb.) Nash

Panicum glabrum Gaud.

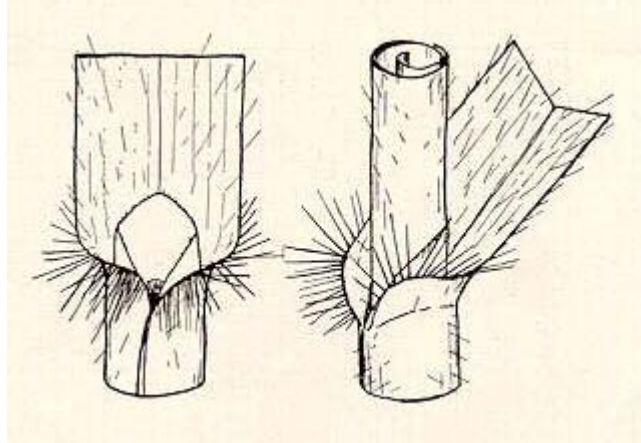
A low, branching, ascending or nearly prostrate annual growing as a weed in lawns, pastures, meadows and waste places.

Leaves rolled in the bud-shoot. **Sheath** compressed, glabrous or the basal ones sometimes sparsely hairy, pale green, tinted pink or purple, split, with margins hyaline and overlapping. **Auricles** absent. **Collar** broad, distinct, with a few flexuous hairs at the margin, pale, often divided. **Ligule** membranous, 2 to 3 mm. long, obtuse to truncate, slightly undulate, thickened and often tinted at the edges. **Blade** 2 to 6 mm. wide, 2 to 10 long, flat, cordate at base, sharp-pointed, not ridged, dull green or tinged with purple, sparsely hairy with twisted hairs at base on upper surface; margins glabrous or sparsely ciliate, smooth or scabrous.

D. Ischaemum is distinguished from *D. sanguinalis* by its smaller size and glabrous and usually purplish sheaths.

The Identification of ... Grasses ...

ANTHOXANTHUM ODORATUM



28. *Anthoxanthum odoratum* L. SWEET VERNAL GRASS.

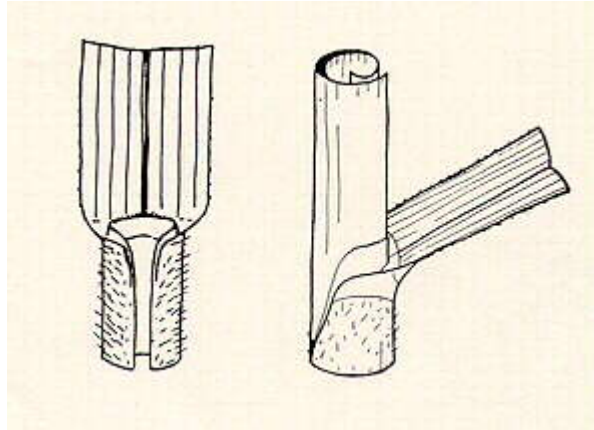
A bright green perennial with short rootstocks and tufted stems in meadows, open woods and pastures; widely distributed in the part of our range, thriving best in moist sandy loam.

Leaves rolled in the bud-shoot. **Sheath** not compressed, slightly glabrous or sometimes pubescent; margins hyaline, overlapping when young. **Auricles** absent or reduced. **Collar** broad, pale green, divided, often dilated and frilled with long dense hairs on the margins. **Ligule** membranous, about 2 mm. long, obtuse to truncate, ciliate. **Blade** 3 to 8 mm. wide 4 to 20 cm. long; flat, bright green, hairy especially near base; upper surface ridged; margins scabrous, sparsely hairy at base.

This grass has a distinctive sweet odour which becomes more pronounced as the plant dries.

The Identification of ... Grasses ...

HORDEUM JUBATUM



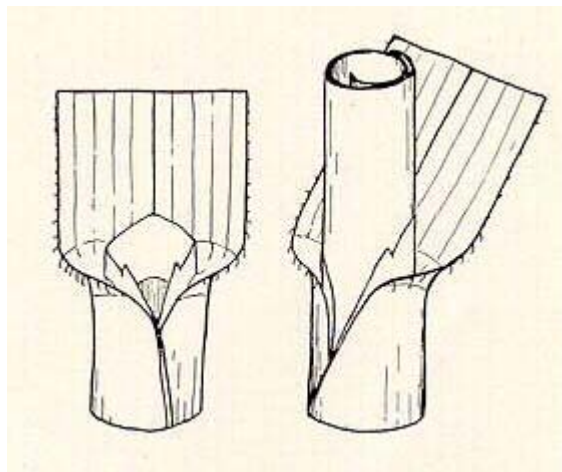
29. *Hordeum jubatum* L. WILD BARLEY, SQUIRREL-TAIL GRASS, FOX TAIL BARLEY.

A fine-leaved, erect perennial with inconspicuous rhizomes, sometimes found along roadsides and in fields on moderately moist silty or sandy loam soils.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, pale green or pink-tinted at base, glaucous, glabrous, the lower generally pubescent, split with hyaline margins overlapping. **Auricles** absent or reduced. **Collar** broad, glabrous, pale green, continuous. **Ligule** membranous, 0.5 to 1 mm. long, obtuse to truncate ciliate. **Blade** 2 to 6 mm. wide, 5 to 12 cm. long, erect, tapering gradually to a sharp point, glabrous, light bluish green; upper surface pubescent and prominently ridged; margins slightly scabrous.

The Identification of ... Grasses ...

PHLEUM PRATENSE



30. *Phleum pratense* L. TIMOTHY, HERD'S GRASS.

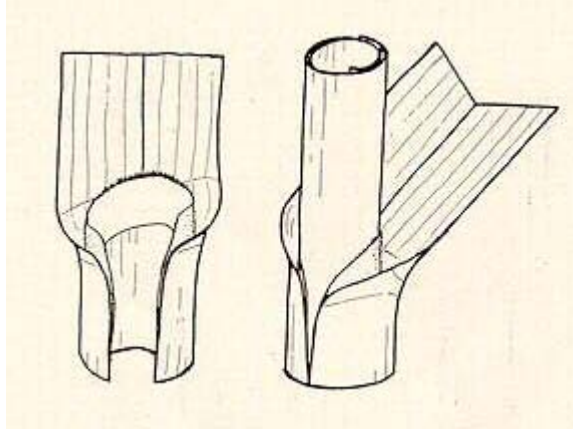
A glabrous perennial with bulbous base, growing in more or less compact tufts; the most extensively cultivated of meadow grasses, escaping freely and becoming established in natural meadows and pastures, roadsides and waste places.

Leaves rolled in the bud-shoot. **Sheath** not compressed, glabrous, light green, sometimes purplish at base in young plants, split almost to base; margins hyaline and edges overlapping to near base. **Auricles** absent. **Collar** broad, distinct, glabrous, light green, continuous; margins sparsely retrorse-ciliate. **Ligule** membranous, white, 1.0 to 2.5 mm. long, obtuse to acute, with distinct notch at either side, otherwise entire or minutely toothed. **Blade** 4 to 12 mm. wide, 7 to 25 cm. long, flat, sharp-pointed, light green, glabrous; ridges on the upper surface low and rounded; under surface smooth, slightly keeled at base; margins scabrous, retrorsely so at the base.

Phleum pratense is sometimes confused with *Agrostis alba* but can be distinguished by its white and more opaque ligule with a notch at either side and without hairs on the back. The presence of cilia on the shoulder and less conspicuous ridging of the upper surface of the blade are also diagnostic.

The Identification of ... Grasses ...

ARRHENATHERUM ELATIUS



31. *Arrhenatherum elatius* (L.) Beauv. TALL OAT-GRASS.

A. avenaceum Beauv.

Avena elatior L.

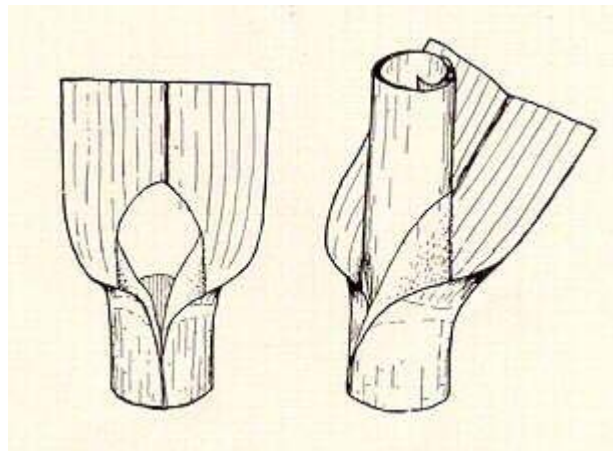
A tall, loosely tufted perennial introduced into meadows or pastures through seeding, very seldom occurring naturally.

Leaves rolled in the bud-shoot. **Sheath** not compressed, keeled, glabrous or very sparsely hairy, green, split with overlapping margins. **Auricles** absent. **Collar** broad, glabrous, pale green or yellow, divided, generally oblique. **Ligule** membranous, white, 1.5 to 2.5 mm. long, truncate to obtuse, generally finely toothed or entire, minutely hairy on back. **Blade** 3 to 10 mm. wide, 10 to 50 cm. long, flat, soft, sharp-pointed, glabrous, ridged on upper surface, smooth on under surface, keeled at midrib; margins slightly scabrous.

Arrhenatherum elatius is distinguished from *Phleum pratense* by its truncate, puberulent, ciliate-toothed ligule and absence of retrorse cilia on the collar. It is distinguished from *Alopecurus pratensis* by its less scabrous blade margins, more truncate ligule and thinner sheaths which are keeled but never reddish at the base.

The Identification of ... Grasses ...

PHALARIS ARUNDINACEA



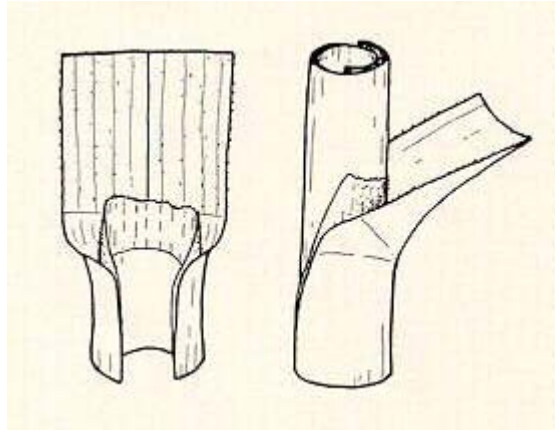
32. *Phalaris arundinacea* L. REED CANARY-GRASS.

A stout, erect perennial with long, scaly rootstocks; particularly adapted to mucky, sandy loam or silty loam soils high in moisture content, though fairly resistant to drought under cultural conditions; a valuable meadow grass.

Leaves rolled in the bud-shoot. **Sheath** not compressed, glabrous, smooth, light green or yellow-green; margins membranous and overlapping below; veins distinct and joined by numerous cross-nerves. **Auricles** absent. **Collar** distinct, glabrous, pale green or yellow, continuous, oblique. **Ligule** membranous, white, 2 to 5 mm. long, acute to obtuse, entire, erose, lacerate or split, minutely hairy on back. **Blade** 6 to 15 mm. wide, 10 to 30 cm. long, flat, sharp-pointed, glabrous or rarely very sparsely hairy at base, light green, glaucous, indistinctly ridged on upper surface; midrib prominent below; margins scabrous, slightly ciliate at base.

The Identification of ... Grasses ...

ALOPECURUS PRATENSIS



33. *Alopecurus pratensis* L. MEADOW FOXTAIL.

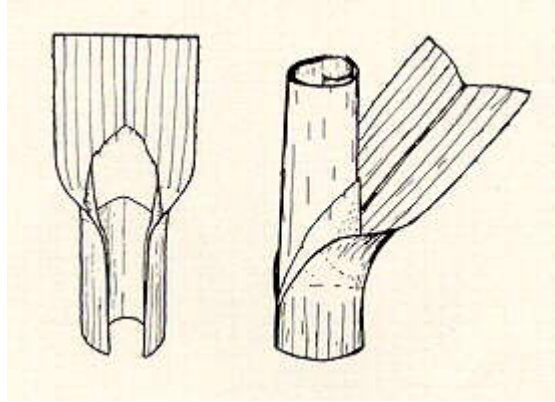
A slightly stoloniferous, glabrous perennial forming loose tufts of shoots with abundant dark green foliage; thriving best in low-lying clays and loams or soils subject to temporary flooding; often seeded in meadows and pastures.

Leaves rolled in the bud-shoot. **Sheath** not compressed, glabrous, green, sometimes purplish at base, split with the broad-hyaline margins overlapping. **Auricles** absent. **Collar** medium broad, glabrous, light green or yellow, divided, oblique. **Ligule** coarse-membranous, faintly striate, 1.0 to 2.5 mm. long, truncate to obtuse, entire, ciliate, undulate or oblique, puberulent on back, variable in shape and margin. **Blade** 3 to 8 mm. wide, 10 to 15 cm. long, flat, taper-pointed, dull; upper surface scabrous and prominently ridged; midrib forming a slight keel on under surface; margins quite scabrous.

Alopecurus pratensis may be distinguished from *Phleum pratense* by its more scabrous blade margins, absence of cilia on collar and absence of notches on the ligule.

The Identification of ... Grasses ...

AGROSTIS ALBA



34. *Agrostis alba* L. RED-TOP.

A. stolonifera L., var., *major* (Gaud.) Farw.

A. Palustris Huds.

A. stolonifera L., var. *gigantea* Koch

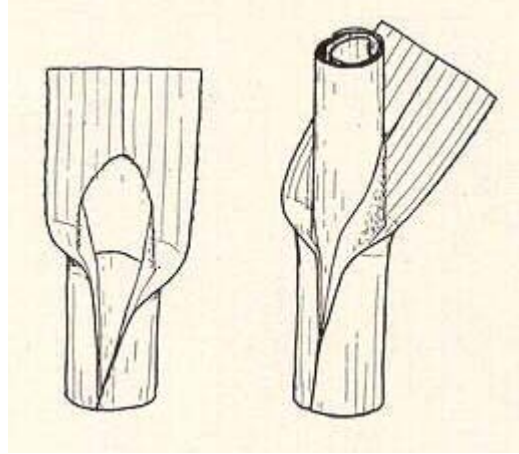
A dark green, glabrous perennial with erect or geniculate culms and long, vigorous, creeping rootstocks forming a thick sod; widely distributed on moderately moist soils; a common grass of pastures, meadows, fields and roadsides.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, glabrous, smooth, green, longer than the internode on the basal shoots, split with margins overlapping. **Auricles** absent. **Collar** prominent, glabrous, pale green, V-shaped, usually oblique. **Ligule** membranous, thin, 1.5 to 4.0 mm. long, rounded to acute, lacerate, erose, or split, minutely retrorse hairy on back. **Blade** 2 to 7 mm. wide, 5 to 20 cm. long, flat, tapering to a sharp point, prominently ridged on upper surface; midrib distinct below; surfaces scabrous or smooth; margins scabrous.

A. alba is distinguished from *Phleum pratense* by the glabrous margins of collar, the absence of a notch at either side of ligule and by the prominently ridged upper surface of blade. It is distinguished from *A. palustris* by the absence of long surface stolons and non-creeping habit. It has a longer ligule and broader blades in comparison to *A. tenuis* and *A. hiemalis*, respectively.

The Identification of ... Grasses ...

AGROSTIS PALUSTRIS



35. *Agrostis palustris* Huds. CREEPING BENT-GRASS, CARPET BENTGRASS.

A. stolonifera L.. var. *compacta* Hartm.

A. alba L., var., *maritima* (Lam.) G. Meyer.

A. maritima Lam.

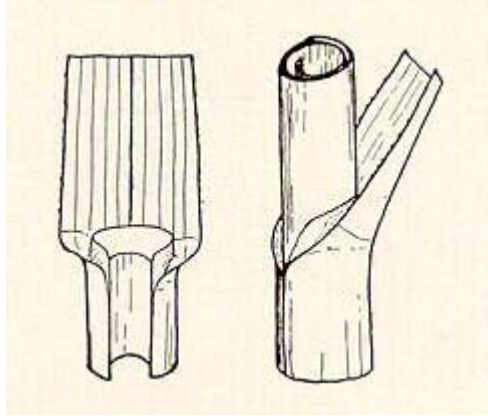
A prostrate and low-growing, glabrous perennial with numerous long stolons spreading along the surface of the ground, branching and rooting at the nodes; forming mats of foliage in moist situations in pastures and ditches, generally on sandy soils.

Leaves rolled in the bud-shoot. **Sheath** not compressed, not keeled, glabrous, smooth, pale green or purplish, shorter than or equaling the internode in length on the vegetative shoots, split with hyaline margins. **Auricles** absent. **Collar** distinct, glabrous, pale green, usually oblique. **Ligule** membranous, thin, 1.5 to 3 mm. long, rounded or obtuse, finely lacerate-toothed or entire, minutely hairy on the back. **Blade** 1.5 to 4 mm. wide, 3 to 10 cm. long, erect, flat, tapering, distinctly ridged on upper surface, slightly keeled on lower surface, scabrous on the surfaces and margins.

Creeping bent-grass and red top are often considered as varieties of *A. stolonifera* being very similar to red-top in leaves and ligule and differing from it in habit of growth, the former producing long surface stolons and the latter rootstocks.

The Identification of ... Grasses ...

AGROSTIS TENUIS



36. *Agrostis tenuis* Sibth. BROWN-TOP, COLONIAL BENT-GRASS, RHODE ISLAND BENT-GRASS.

A. alba L., var. *vulgaris* (With.) Thurb.

A. capillaris L.

A. vulgaris Thurb.

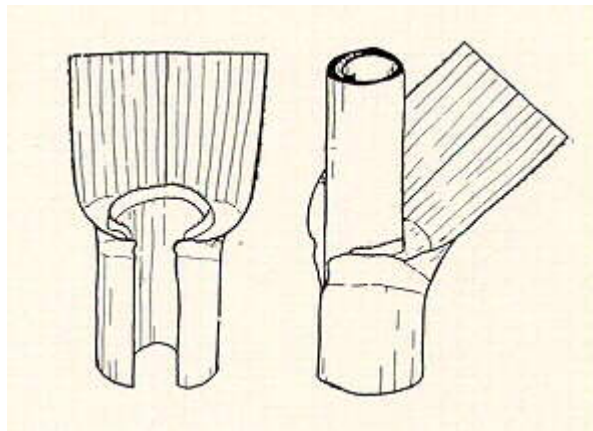
A dark green, glabrous perennial spreading by short rootstocks, forming a compact sod or appearing slightly tufted; found in meadows and permanent pastures in the southern and eastern parts of our range on poor soils of moderate or small amount of moisture.

Leaves rolled in the bud-shoot. **Sheath** not compressed, glabrous, green or purplish, longer than internode on vegetative shoots, split with the hyaline margins overlapping. **Auricles** absent. **Collar** distinct, narrow, glabrous, light green, continuous or divided by the midrib, oblique. **Ligule** membranous, short (0.3 to 1.2 mm. long), truncate, entire or finely toothed, sparsely and minutely hairy on back. **Blade** 1.5 to 3.5 mm. wide, 2 to 10 cm. long, truncate at base, sharp-pointed, flat with margins rolling in towards the apex, involute in dry weather, dark green, dull or sometimes shiny on the under surface, distinctly ridged on the upper surface, slightly keeled on under surface; margins and upper surface scabrous.

A. tenuis can be distinguished from *A. alba* by its short, truncate ligule, smaller size and darker and more delicate foliage.

The Identification of ... Grasses ...

AGROPYRON PAUCIFLORUM



37. *Agropyron pauciflorum* (Schwein.) Hitchc. SLENDER WHEAT-GRASS DOG COUCH GRASS, WESTERN RYE-GRASS.

A. trochycalum (Link) Malte

A. tenerum Vasey

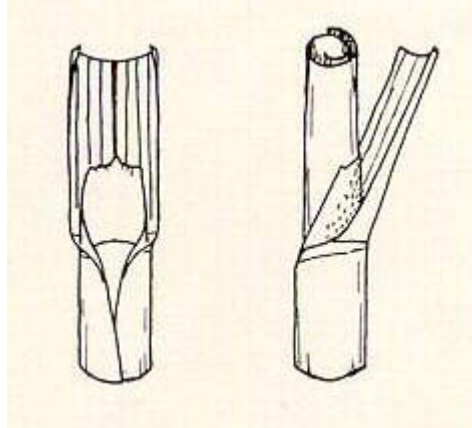
An erect perennial with very short rootstocks, growing in dense tufts and branches; sometimes found in seeded pastures.

Leaves rolled in the bud-shoot. **Sheath** not compressed, glabrous, light green, split; margins hyaline. **Auricles** rudimentary or absent. **Collar** distinct, glabrous, pale green, continuous, often oblique. **Ligule** membranous, 0.5 to 1.0 mm. long, truncate, finely ciliate. **Blade** 3 to 6 mm. wide, 5 to 25 cm. long, flat, narrow at base, tapering to a sharp point, medium green, glaucous, scabrous and distinctly ridged on upper surface, keeled on under side; margins scabrous.

Agropyron pauciflorum is distinguished from *Agrostis tenuis* by its broader blades, rudimentary auricles and its tufted habit.

The Identification of ... Grasses ...

AGROSTIS HIEMALIS



38. *Agrostis hiemalis* (Walt.) B.S.P. HAIR GRASS, TICKLE GRASS, FLY-AWAY GRASS.

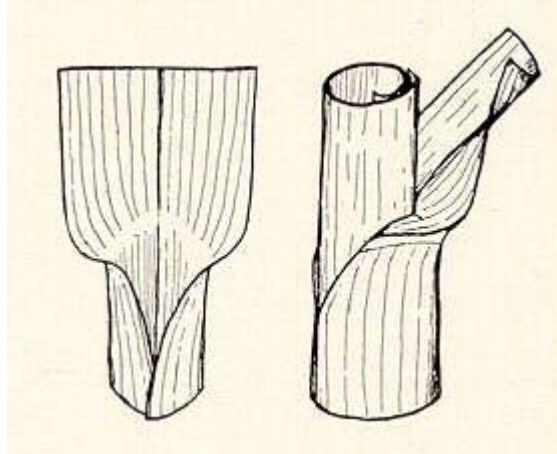
A. scabra Willd.

A small, tufted grass with the very narrow, soft leaves clustered in a basal rosette; growing commonly on dry, sandy soil in old meadows and pastures where the sod is open.

Leaves rolled in the bud-shoot. **Sheath** not compressed, slightly keeled, glabrous, smooth, pale green to white or purplish, split. **Auricles** absent. **Collar** narrow, inconspicuous, pale green. **Ligule** membranous, 1 to 2.5 mm. long, truncate or three-pointed, entire or finely lacerate, hairy on the back. **Blade** 0.5 to 2 mm. wide, 2 to 8 cm. long, soft, very sharp taper-pointed, often inrolled or involute and hair-like when dry, glabrous, distinctly ridged and scabrous on upper surface, smooth and distinctly keeled on under surface; margins scabrous.

The Identification of ... Grasses ...

ECHINOCHLOA CRUSGALLI



39. *Echinochloa crusgalli* (L.) Beauv. BARNYARD GRASS.

Panicum crusgalli L.

A coarse annual with broad leaves; a weed in open meadows, cultivated fields and especially in waste land about buildings.

Leaves rolled in the bud-shoot. **Sheath** compressed, keeled, glabrous, smooth, pale green, split. **Auricles** absent. **Collar** conspicuous, broad, glabrous, light yellowish green. **Ligule** absent. **Blade** 8 to 15 mm. wide, 10 to 30 cm. long, glabrous, pale or yellowish green, keeled, not ridged; margins smooth or scabrous.

The Identification of ... Grasses ...

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Names in *italics* are synonyms.

* Nomenclature according to "The Manual of the Grasses of the United States" by A. S. Hitchcock, U.S.D.A. Misc., Pub., 200, 1935.

NOTE - These pages have been corrected as per the ERRATA listed below.

ERRATA

On pages 62 and 63 the pages referred to in the index of Botanical and Common names are in error. In each case subtract two to find the correct page.

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The Identification of ... Grasses ...

In the publication, *The Identification of Certain Native and Naturalized Hay and Pasture Grasses by Their Vegetative Characters*, page 64 is blank. We have therefore removed it from the regular links of this web site.

If you have accidentally arrived at this page, please use the links provided to continue your Internet journey.

Thank you

The Identification of ... Grasses ...

APPENDIX PLATES

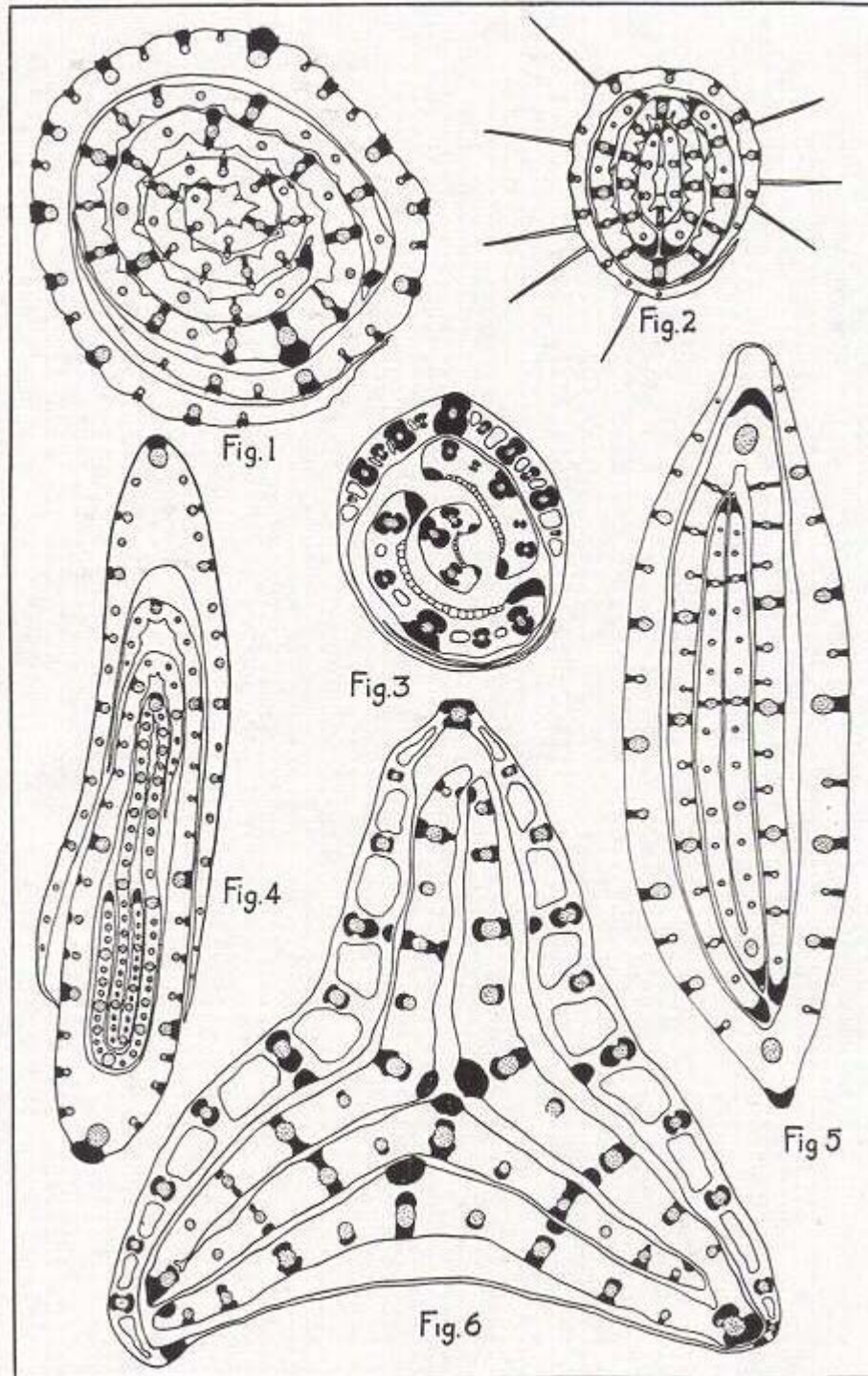
EXPLANATION: In the following figures the stippled areas indicate vascular bundles, the blackened areas, sclerenchymatous tissue, and the outlined areas in the mesophyll, air-lacunae. The term *asperity* means "rough excrescence" and refers to outgrowing epidermal cells which project beyond the epidermis, giving the grass a scabrous surface.

The Identification of ... Grasses ...

- PLATE I. *Transverse sections of bud-shoots showing sheath and enclosed leaf-blades (Magnification about 20 times).*
- FIGURE 1. A typical cylindrical shoot with rolled blades and sheath with overlapping and membranous margins (*Phleum pratense*).
- FIGURE 2. Cylindrical shoot with folded blades (*Danthonia spicata*).
- FIGURE 3. A typical cylindrical shoot of *Juncus* with the three-ranked arrangements of leaves and thin, membranous overlapping margins of the sheath (*J. macer*).
- FIGURE 4. Compressed shoot with rolled blades. The single blade is shown enveloped by two sheaths (*Echinochloa crusgalli*).
- FIGURE 5. A typical compressed shoot with folded blades and closed sheath (*Dactylis glomerata*).
- FIGURE 6. A typical triangular shoot of *Carex*-showing the three-ranked arrangement of leaves and sheath closed by a thin membrane (*C. stipita*).

The Identification of ... Grasses ...

PLATE I



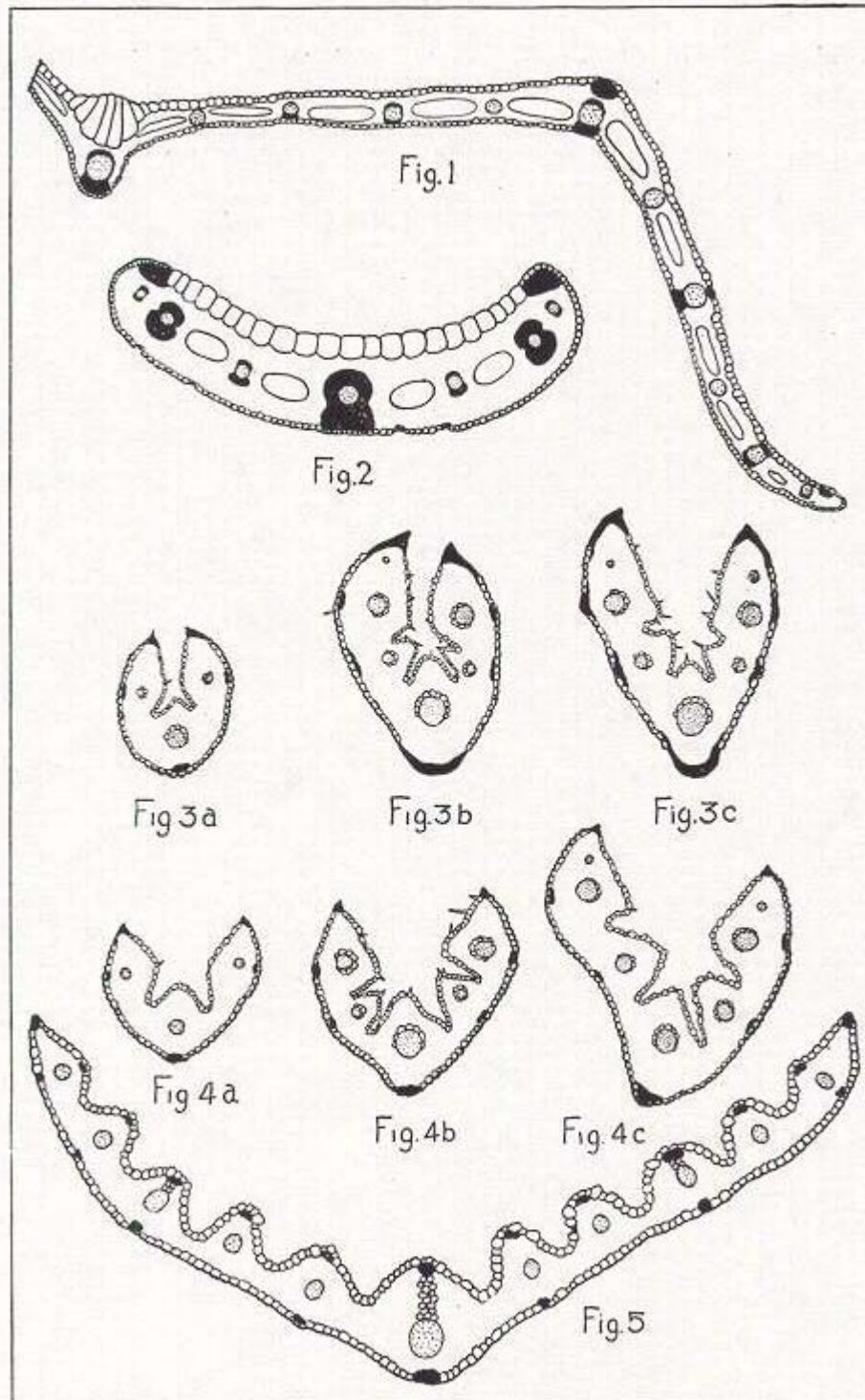
The Identification of ... Grasses ...

- PLATE II . *Transverse sections of leaf-blades. (Magnification about 60 times).*
- FIGURE 1. *Carex stipita*. Plicate blade showing deeply penetrating motor cells, midrib and air-lacunae.
- FIGURE 2. *Juncus macer*. Flat or slightly channeled blade showing upper epidermis of large thin-walled motor cell, air-lacunae, stomata in lower epidermis only.
- FIGURE 3. *Festuca ovina*. Bristle-like blade closely folded with prominent ridge over midrib and less prominent ones over the two adjacent vascular bundles, upper epidermis harsh with asperities, lower epidermis thickened with sub-epidermal sclerenchymatous tissue in elongated patches below the bundles and conspicuous at the margins.* (a) Section at tip of blade-, (b) middle of blade, (c) base of blade.
- FIGURE 4. *Festuca rubra*. Bristle-like blade when folded but often open and flat, more prominently ridged than in above with five to seven ridges, upper surface with asperities, lower surface bordered with small patches of sclerenchyma beneath the bundles. (a) Section at tip of blade, (b) middle of blade, (3) base of blade.
- FIGURE 5. *Festuca elatior*. Broad, flat blade prominently ridged with the ridges slightly flattened over large bundles, motor cells not well developed in furrows, clear cells over midrib and main bundles, sclerenchyma in apex of each ridge, at margins, and below some bundles, bundles never girdered.

*Howarth says that although an *Festuca ovina sens. strict.* the sub-epidermal schlerenchymatous layer is usually broken between the vascular bundles, or may be almost absent, it is continuous in certain glaucous green forms.

The Identification of ... Grasses ...

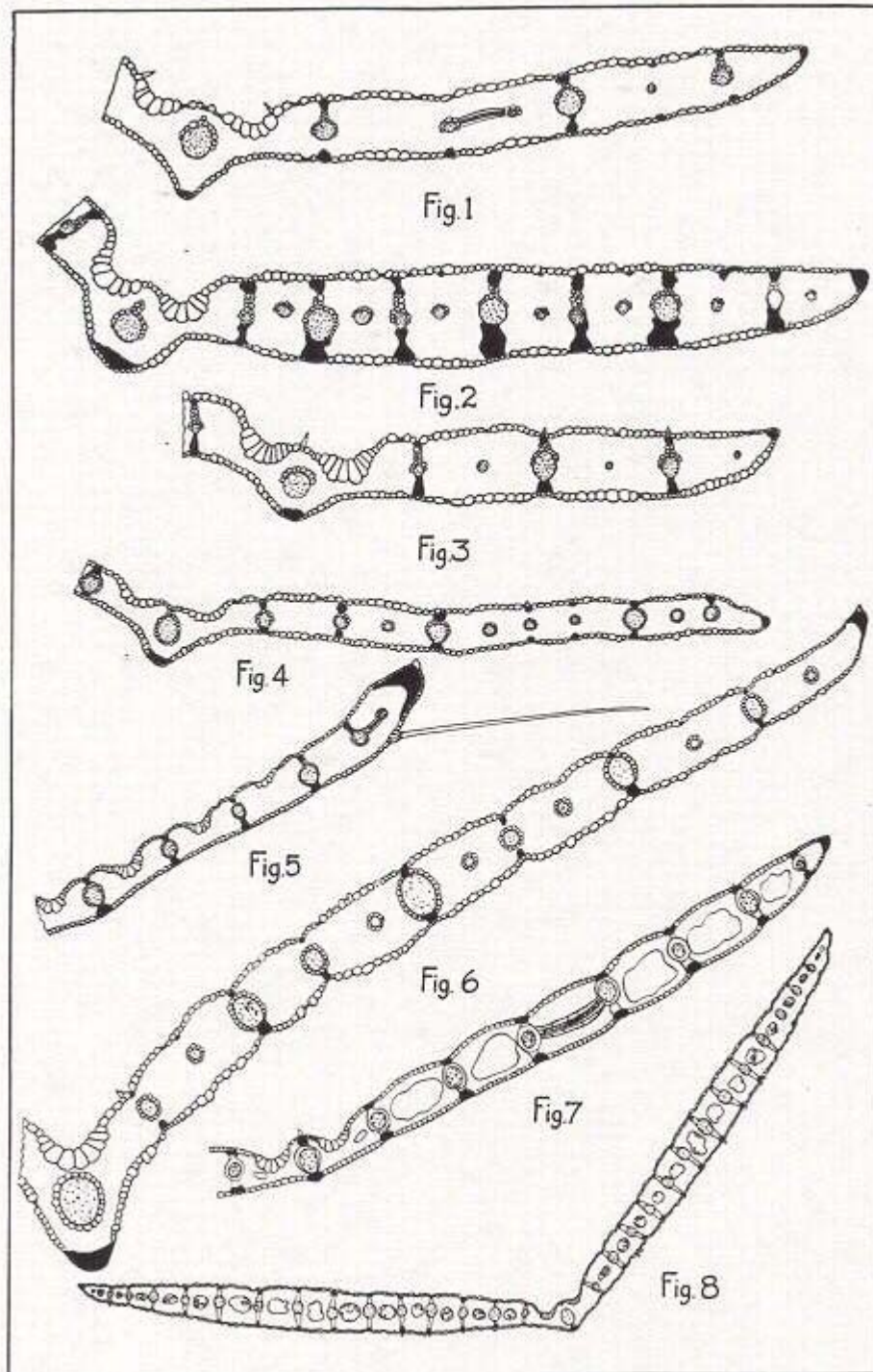
PLATE II



The Identification of ... Grasses ...

- PLATE III. *Transverse sections of blades of species with blades folded in the bud-shoot. (Figures 1 to 7 magnified about 60 times, figure 8 about 20 times).*
- FIGURE 1. *Poa compressa*. Broad, smooth, slightly folded blade with motor cells flanking midrib, sharply keeled beneath, sclerenchyma not strongly developed but girdering some bundles below, upper epidermis with rare asperities, clear cells distinct above main bundles, transverse vein shown joining second and third bundle.
- FIGURE 2. *Poa pratensis* (a broad-leaved specimen from field). Broad, thick, smooth blade folded to a V-shape, motor cells flanking the midrib, upper epidermis with occasional asperities, lower surface less sharply keeled than in *P. compressa*, sclerenchyma girdering main bundles, clear cells over main veins.
- FIGURE 3. *Poa pratensis* (a narrow-leaved specimen from field). The same as Fig. 2 except for reduction in the amount of sclerenchyma. Figures 2 and 3 show the variation that may be expected within a species.
- FIGURE 4. *Poa palustris*. Similar to *P. compressa* except for its thinner blade, absence of clear cells over main bundles, and usually less sclerenchyma.
- FIGURE 5. *Danthonia spicata*. Narrow blade, tending to become involute, not keeled, ridged with motor cells in furrows towards midrib, smooth, thicker and without well-defined motor cells towards margin, upper epidermis thin-walled, lower epidermis thick-walled on outer side, sclerenchyma heavy at margins and girdering main bundles, rows of long hairs are frequently present towards edges of the blade.
- FIGURE 6. *Dactylis glomerata*. Broad, smooth blade folded to V-shape with motor cells as a band over midrib, keeled, sclerenchyma fairly well developed, girdering the main bundles.
- FIGURE 7. *Glyceria striata*. Relatively narrow blade with motor cells flanking midrib, faintly ridged, the vascular bundles, except the midvein, lying between the arches rather than beneath, sclerenchyma above and below all bundles.
- FIGURE 8. *Glyceria grandis*. Broad blade, often completely folded with motor cells flanking midrib, ridges and keel slightly more apparent than in *G. striata*, lacunae usually more prominent (the size of lacunae varies with age of the leaf and habitat of particular plant), clear cells more conspicuous and sclerenchyma less than in *G. striata*.

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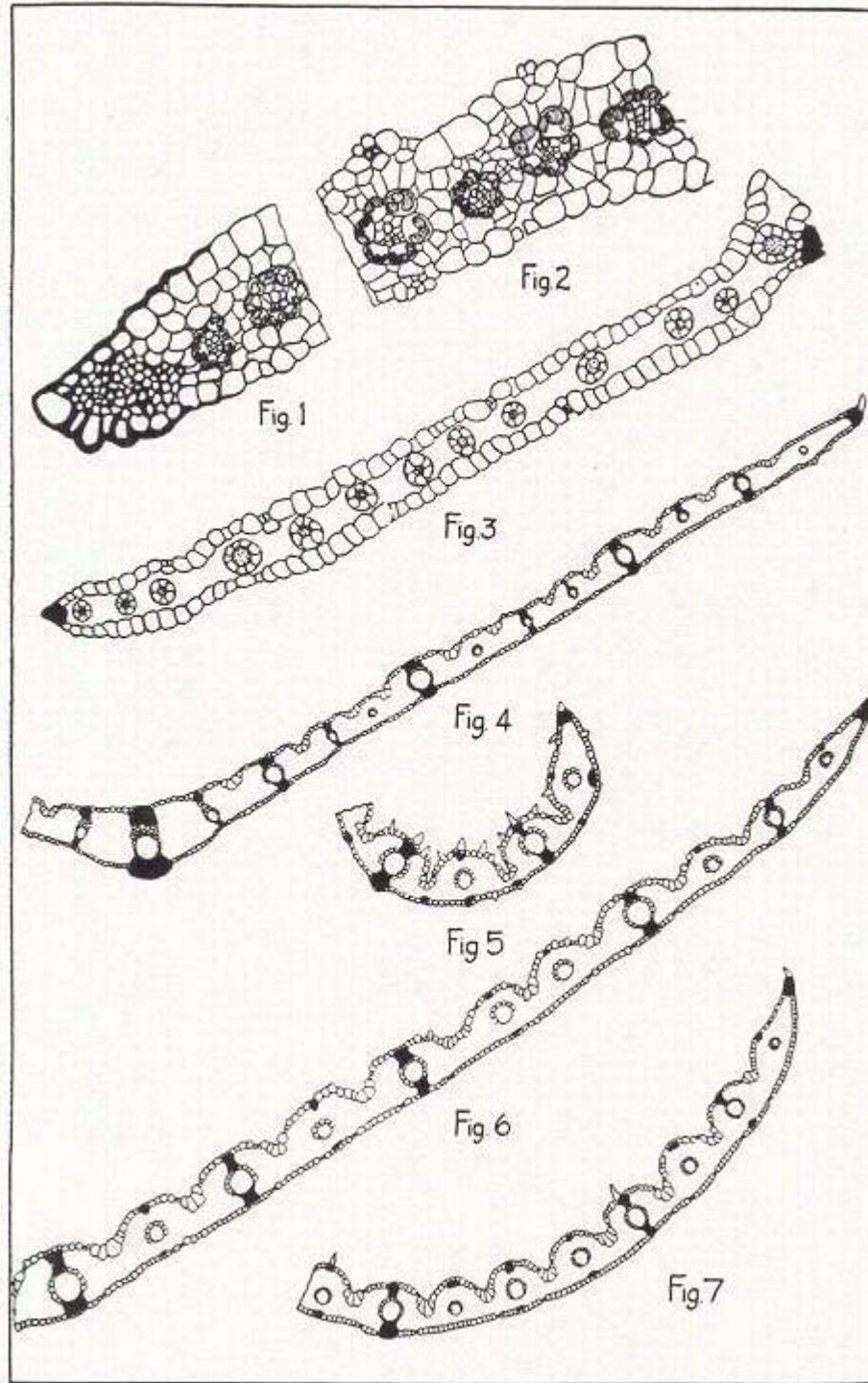


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- PLATE IV. *Transverse sections of blades of species with leaves rolled in the bud-shoot. (Figures 1 and 2 magnified about 180 times; figure 3 about 75 times; figures 4 to 7 about 60 times.*
- FIGURE 1. *Setaria viridis*. Details of sclerenchyma and blade margin.
- FIGURE 2. *Setaria viridis*. Details of epidermis and mesophyll; epidermis composed of large, cells, irregular in- size (a common type in annual grasses with leaves rolled in bud-shoot, such as *Echinochloa* and *Digitaria*) ; *asperities* occasional; vascular bundles small with conspicuous bundle sheaths packed with chloroplasts aggregated in a peculiar crescent shape in this specimen collected in late autumn; sclerenchyma absent, except at margins and midrib.
- FIGURE 3. *Setaria lutescens*. Smooth, broad blade, keeled on lower surface due to prominent patch of sclerenchyma beneath midrib; very little sclerenchyma elsewhere; structure of bundles as in above.
- FIGURE 4. *Phleum pratense*. Broad blade, ridged with low rounded ridges; motor cells in furrows; slightly keeled on lower surface; principal bundles girdered.
- FIGURE 5. *Agrostis hiemalis*. Very narrow blade, generally involute deeply ridged with motor cells in furrows; upper epidermis with numerous *asperities*; lower epidermis fairly smooth, distinctly keeled at midrib; main bundles girdered.
- FIGURE 6. *Agrostis alba*. Broad blade, deeply ridged with rounded to acute ribs; motor cells in furrows; upper and lower epidermis smooth, or with some *asperities*.
- FIGURE 7. *Agrostis tenuis*. Blade with motor cells, in furrows, narrower and more conspicuously ridged than *A. alba*; lower epidermis usually smooth; upper epidermis bearing *asperities*, main bundles girdered; midrib more prominent than in *A. alba*.

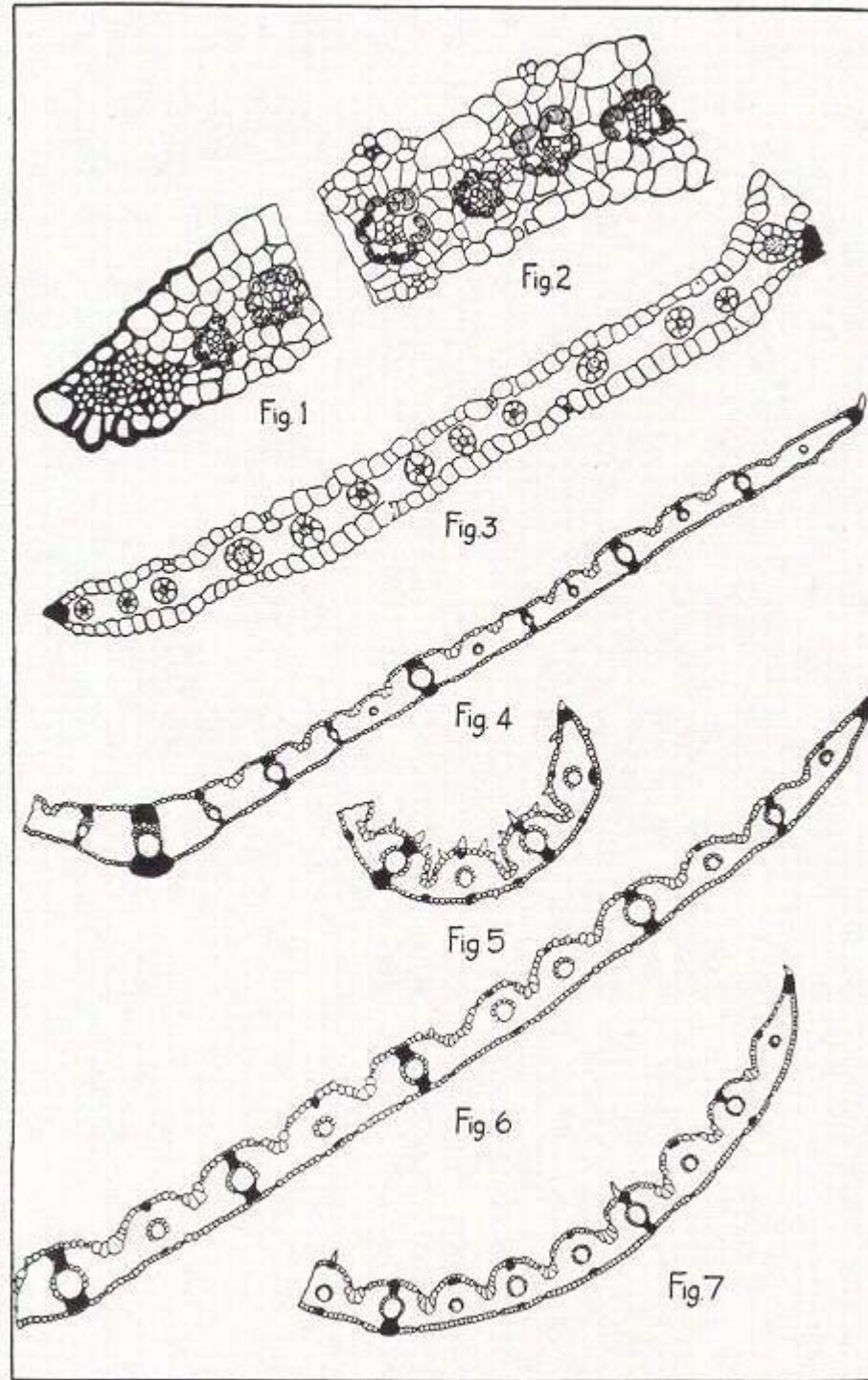
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PLATE IV



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PLATE IV

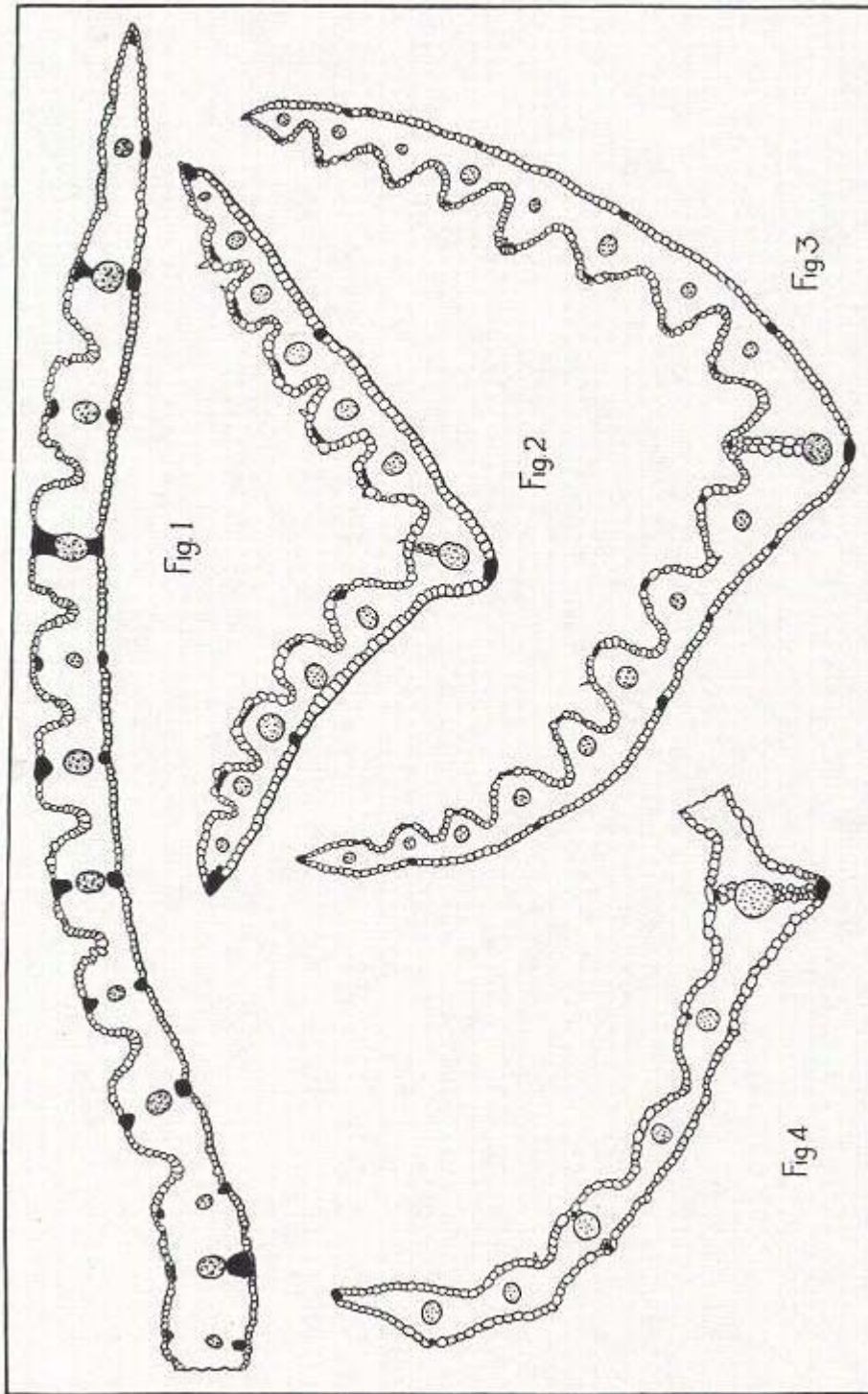


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- PLATE V. *Transverse sections of blades. (Magnification about 60 times).*
- FIGURE 1. *Alopecurus pratensis*. Broad: flat blade: upper surface deeply ridged with flattened ribs; motor cells in furrows; lower surface smooth: not keeled; bundles occasionally girdered in older leaves; very little sclerenchyma. at margins.
- FIGURE 2. *Lolium perenne*. Slightly folded blade: deeply ridged with flattened or rounded ribs: without well developed motor cells in furrows; upper epidermis with asperities; lower epidermis smooth and keeled; sclerenchyma sparse at apex of each rib: at margins and below main bundles; bundles never girdered.
- FIGURE 3. *Lolium multiflorum*. Broad blade: deeply ridged: with more acute ribs than in *L. perenne*, without well developed motor cells in furrows; upper and lower epidermis smooth: or with occasional asperities; lower surface slightly keeled; sclerenchyma sparse: in apex of each rib and below main bundles; bundles never girdered.
- FIGURE 4. *Arrhenatherum elatius*. Broad: flat blade: ridged: with low: rounded ridges: without well developed motor cells in furrows; upper epidermis with rare asperities; lower epidermis rough with projecting: rounded epidermal cells: keeled: slightly ridged over main veins.

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PLATE V



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