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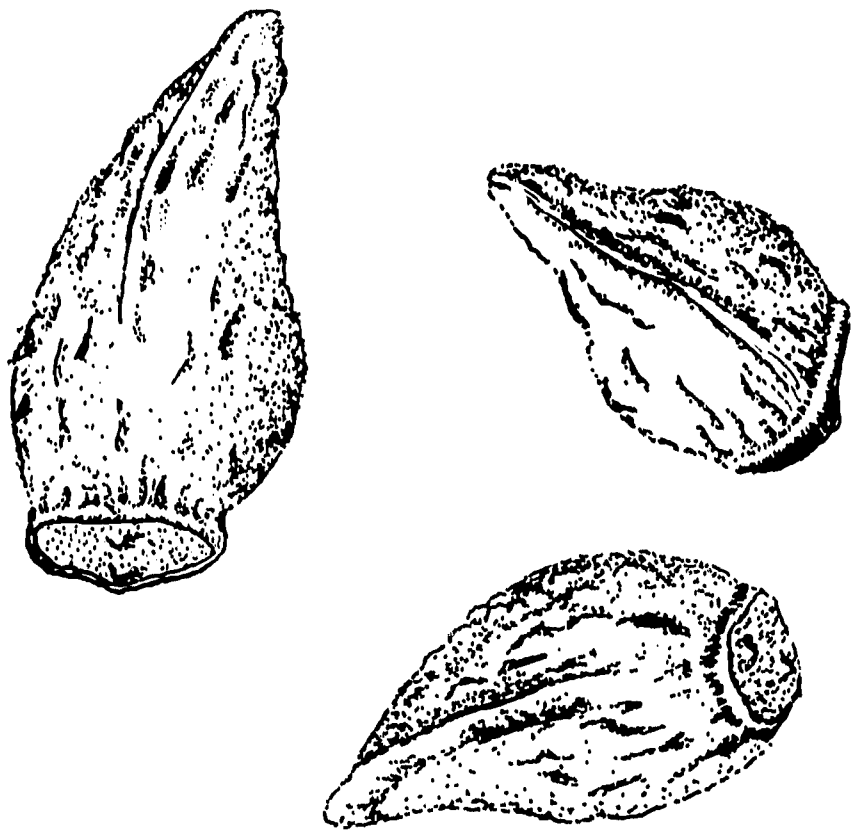
ABSTRACT

Instructional aids produced from these transparency masters and the accompanying narrative may be used by vocational agriculture teachers in presenting courses in plant science. They were developed by subject matter specialists and teacher educators as part of a project designed to test effects of involving vocational agriculture teachers in development and experimental use of instructional materials. Included with the transparencies are introductory material on the project, the method of research, and the results, as well as recommended uses of the masters and teaching suggestions. The transparencies are grouped under five subject areas: (1) General Plant Morphology and Structure, (2) Cereal Crops, (3) Legumes, (4) Grasses, and (5) Weed Identification. Samples of letters and questionnaires used in the research are appended. (AW)

TRANSPARENCY MASTERS

FOR

CROP AND WEED IDENTIFICATION



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1968

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

Transparency masters for teaching plant science.

Final Report
Project No. OE7-0031
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Dwane G. Miller, Agronomy
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ACKNOWLEDGMENTS

Special appreciation is due Ernest G. Kramer, Assistant State Superintendent of Vocational Education, and Bert Brown, State Director of Agricultural Education.

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SUMMARY

The purpose of this project was to test effects of involving vocational agriculture teachers in development and experimental use of instructional materials.

Teachers in the field identified their agronomy curriculum needs. Subject matter specialists cooperated with teacher educators to develop this set of transparencies and accompanying narrative. Returns of questionnaires (Appendix B) indicate that 93 per cent of Washington vocational agriculture teachers have used the previous transparencies during the 1967-68 school year. An additional 2 per cent indicate that they want to use the masters as soon as equipment is available.

INTRODUCTION

Purpose

"Transparency Masters for Teaching Crop Science," is the third study to ascertain the effects of involving teachers in curriculum development. The purpose of this project is to continue to study the effects of involving teachers in development of visual instructional material. This study also explores the value of cooperation between agriculture teacher educators and academic subject matter experts in the development of instructional materials.

Related Research

Vocational teacher supervisors seeking to stimulate curriculum development and use of modernized instructional materials have long recognized the values of involvement. Psychologists and sociologists have researched processes by which involvement increases interest and a sense of identification with new developments and a desire to participate in their use. Curriculum supervisors have explored arrangements and processes designed to enlarge dimensions of participation in developmental processes.

The rationale for this experiment was derived from research indicating the influence of group effort and resultant group relationships on (1) participation, (2) the sense of identification derived from participation, and (3) the effects of participation and personal identification on use of innovations.

The research and observations of Katz and Lazarsfeld[1], Cohen[2], and Sherif and Hovland[3] indicate that cognitive and personal involvement in a process (1) enlarges peoples' sense of identity, (2) increases their comprehension, (3) stimulates purposeful personal effort, and (4) activates a will to pursue purposes derived from consensus of group

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[1]Katz, Elihu, and Paul F. Lazarsfeld, Personal Influence, Free Press, 1955.

[2]Cohen, Arthur R., Attitude Change and Social Influence, Basic Books, 1964.

[3]Sherif, Muzafer, and Carl I. Hovland, Social Judgment, Yale University Press, 1961.

thought. Zander and Medow[4] add evidence that improvements of performance impel individuals and groups to continue sustained efforts to make further improvements.

METHOD

Personal inquiries were made of the state supervisors by the author. Their suggestions were included in the development of the transparencies.

Suggestions from teachers for this third phase of the project were obtained by mail. Fifteen teachers responded to inquiries (See Appendix A). Teacher suggestions as shown in Tables 1 and 2 were used in the development of this series of transparency masters.

TABLE 1

Media Identified as Preferable by
Vocational Agriculture Teachers

Media	Media Preference
Slides	11
Transparencies	10
Workbook	3
Film	2
Chart	1
Film Strip	1
Audio Tape	1

[4]Zander, Alvin and Herman Medow, "Individual and Group Levels of Aspirations," Human Relations, 16:89-104, February, 1963.

TABLE 2

Agronomic Areas of Interest Identified by Vocational Agriculture Teachers

Area	Areas Preferred
Legumes	12
Grasses	7
Weeds	6
Soils	3
Grain Crops	2
Seeds	2
Plant Reproduction	2
Fertilization	1
Root Types	1
Cereals	1

RESULTS

State supervisor and individual teacher reports indicate a strong and increasing interest in specific instructional aids. Workshops, follow-up questionnaires soliciting the teachers' suggestions for refinement of field tested materials, and the continued involvement of teachers in development and testing of new materials have resulted in development of a substantial number of transparency masters.

Returns of questionnaires (see Appendix B) indicate that 93 per cent of Washington state vocational agriculture teachers have used the masters during the 1967-68 school year. An additional 2 per cent indicate that they want to use the masters as soon as equipment is available.

Fifteen teachers indicated their specific interest in transparencies and slides in an agronomic curriculum (See Tables 1 and 2).

DISCUSSION

This project indicates that the effects of involvement hypothesized on the basis of the research and concepts of Katz, Lazarsfeld, Cohen, Sherif, Hovland, and Zander do materialize. Continued involvement of teachers does seem to increase teachers' interest in cooperative work on instructional materials. The vocational agriculture teachers in Washington state are actively using a variety of instructional media. This pursuit and use of the best instructional materials available plus the involvement of large numbers of teachers in workshop meetings offers promise of keeping vocational instruction applicable to current needs.

RECOMMENDED USES OF MASTERS

Suggested Teaching Strategy

Transparencies can be used in many ways by the agriculture teacher. The transparency masters in this unit are designed to enable the teacher to approach a multi-media system of instruction.

The instructional strategy that includes the technqiue most appropriate to commonly held objectives for teaching, identification, and classification of economic crops will in the authors' opinion include colored transparencies. For this reason these transparency masters have been duplicated on tracing paper. Tracing paper enables the production of colored transparencies by the Diazo process.[5]

A colored transparency or slide will most closely approximate the actual conditions necessary for teaching objectives that include discrimination between plant or seed varieties. Living or mounted plant materials would continue to be the primary instructional media and this set of transparency masters would supplement them. These transparencies can be incorporated with slides, programed instruction, discussion, and demonstrations to provide the instructional manager with more media from which to make choices.

The instructor is expected to provide local application of this instructional material. Transparencies lend themselves to editing. The instructional manager should make timely changes in the transparency masters to update and refine them for his teaching objectives.

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[5]Long, Gilbert A., Joel H. Magisos, and Stanford Sleeth, Transparency Masters for Agriculture (Supplement), Department of Education, Vocational-Technical Education Research and Development Project, Washington State University and State Board for Vocational Education, Olympia, May, 1967.

Student Participation

These masters lend themselves well to use by students in classroom reports and speech presentations. They permit individual student review or testing.

The masters are additionally appropriate for Future Farmers of America activities, such as TV shows. They provide good raw material for graphic artists to help demonstrate chapter activities.

Narrative Description

The narrative included with this material, Pages 8-16, can be utilized to prepare audio tapes to supplement the transparency masters, or the teacher can use this narrative as a script accompanying the transparencies.

Presentation

The development of this set of transparencies has been based upon a need for limiting the material presented on each transparency and the realities of cost for preparation of each transparency. Lead lines are on one side of the object projected to enable the instructor to use the step method of revealing each item illustrated in the overhead projection transparency. The teacher is encouraged to modify these masters to fit his particular needs. For a review of overhead transparency duplication and usage see "Transparency Masters for Agriculture (Supplement)"[6] or any of the many current publications available.

The agriculture teacher is encouraged to design a system of instruction that will serve as the best resource for attaining his objectives. Further development of this "instructional system" may well be implemented by the teacher in the field by developing audio tapes of a field man, or a seed grader or similarly employed agronomy service personnel. This could serve to introduce the vocational opportunities available in the agronomy field. Additional interest will result from this interview of a person whose work demonstrates a need for knowledge of agronomy.

In developing this series of transparencies, our objectives were to illustrate the basic plant parts, their shape, structure, and function which would enable the student to better understand the terminology used to describe specific plant parts used in identification of crops and weeds. To become familiar with the general aspects of plant identification, we recommend coverage of Section I first. The remaining sections may be arranged in any logical order according to the desires of the instructor and his respective learning program.

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[6] Ibid.

While these aids demonstrate the basic principles of plant structure, they are designed only to supplement, rather than replace, actual living or mounted plant specimens. Teachers will find these instructional aids most useful to further the interest and understanding of students for crop and weed identification and other basic agronomic principles. These principles can then be applied to field performance. Utilization of these instructional aids conjugated with living material provide a flexible instructional system.

NARRATIVE

SECTION I: GENERAL PLANT MORPHOLOGY AND IDENTIFICATION

PAGE

1. The Seed: 19

Nearly all economic crops grown by the farmer, and the weeds which infest his fields belong to the group of plants called Angiosperms. This group is further subdivided into Monocotyledons, which have one cotyledon or seed leaf per embryo, and Dicotyledons, which have two cotyledons. These two transparencies show vertical cross-section views through a monocot and dicot seed with the important parts of each labeled.

2. Inflorescence Types: 23

The cluster or arrangement of flowers of a plant is known as an inflorescence. Inflorescence type, shape, and structure are often used to separate and identify various crops and weeds. These transparencies present the five basic inflorescence types: spike, panicle, raceme, head, and umbel.

3. Flower Types: 27

Seeds of flowering plants begin their development in a structure known as the flower (floret in grasses). The flower, in addition to other structures, contains the sexual parts of the plant, the stamens, (male structures) in which the pollen develops, and/or the pistle, (female structure) which encloses the ovary or developing egg. These transparencies show typical flowers found in monocots and dicots with the important parts labeled.

4. The Legume Flower: 31

Legumes are dicotyledons and many have a very distinct flower type as shown on this transparency. The five petals (calyx) of this flower are irregular in shape and form the five basic parts.

PAGE

5. The Wheat Spikelet: 33

Grass plants are monocotyledons having a much reduced and modified flower. The sepals and petals have been reduced to papery bracts. This transparency shows the basic parts of a typical grass flower in such a way that they may be put together to form a multiple type transparency.

6. Meristematic Region: 37

Meristematic regions are those areas where cell division occurs and where plant growth is initiated. In woody and herbaceous dicots this region is at the tip of the developing shoot In monocots, growth is initiated in an area just above the last developed node on the stem. These two types are illustrated in this transparency with regions labeled.

7. Sheath and Ligule Types: 39

Most grasses can be identified by basic structural differences. Some vegetative differences are noted in ligule shape and size, and in the type of leaf sheath. These characteristics when coupled with such things as leaf shape, texture, auricle size, pubescence, and other vegetative characteristics can serve to identify many of the grasses. This transparency shows some basic vegetative characteristics found in many of the various grass plants.

8. Specialized Stems: 41

In some plants, stems have been modified to provide for asexual reproduction or propagation. If the stem creeps above the ground, developing roots and shoots at the point (nodes) where it touches the ground, it is known as a stolon. If the stem develops underground, and roots and shoots arise from the nodes, it is known as a rhizome. Many difficult weeds to control, as well as grasses and legumes, spread by rhizomes and stolons. These transparencies show the differences in their formation and are labeled to show the main parts.

PAGE

9. Leaf Types: 45

All plants have characteristic leaf types which aid in their identification. Once a general leaf type has been identified, many other characteristics of the individual leaf are utilized for final identification. Several basic leaf types appear in these transparencies.

10. Legume Leaf: 51

Legumes are important agronomic plants having trifoliolate leaves consisting of three leaflets. This is the primary leaf characteristic of the true clovers, sweetclover, and alfalfa. This transparency shows a typical legume leaf with parts labeled.

11. Grass Leaf: 53

Grasses are the most important agronomic plants belonging to the narrow-leafed group. Most grass leaves have only one blade with the other parts being highly modified from that of a typical broad leaf. A type grass leaf is diagrammed in this transparency.

12. Root Systems: 55

Most plants have either a fibrous root system as found in the grasses, or a tap root system such as that of many legumes. These transparencies describe the principle differences between these two types of root systems.

SECTION II: CEREAL CROP IDENTIFICATION

1. Leaf Vegetable Characteristics of Cereal Grains: 61

This transparency shows several important characteristics which aid in separating the more common cereal plants. These features can be used at a very early growth stage before heading.

2. Morphology of the Wheat Seed: 63

This series of transparencies shows in diagrammatic form the general morphological and structural characteristics of the wheat kernel.

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3. Market Classes of Wheat: 75

Wheats can successfully be identified as to market class by kernel shape and structure, and by brush, check, and crease types. These transparencies illustrate seed characteristics common to the various wheat market classes.

4. Oat Seed: 87

This transparency shows the main identifying characteristics between cultivated and wild oats with parts labeled.

5. Barley: 89

This transparency illustrates the major differences between 2-rowed and 6-rowed barley seed. This difference is difficult to recognize at first but it can be observed with practice.

6. Rye: 91

The factors distinguishing rye from wheat are noted in this transparency.

SECTION III: LEGUME IDENTIFICATION

These transparencies are designed to show the leaf characteristics, stipule shape and size, and other recognizable features of the fully developed legume leaf for several common forage types.

A drawing of the seedling is included to show early structural differences at the first trifoliolate leaf stage. There are no parts labeled in these drawings because labels in Section I for the typical legume leaf are applicable here.

1. Alfalfa: 95

The terminal leaflet of the trifoliolate leaf is supported on an elongated stalk (petiolar branch) and the margin is serrated at the tip.

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[7]The soft red winter overlay can be used for soft white wheat.

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2. Sweetclover: 96

The terminal leaflet of the trifoliolate leaf is supported on an elongated stalk, and the leaflet is serrated along 2/3 of its margin.

3. Red Clover: 97

Leaflets are sessile on the petiole representing a true trifolium leaf. Leaflets are large, pubescent along the margin, and have a light-colored water mark. The tips of the leaflets are usually pointed. Stipules are large and heavily purple veined. Petioles are heavily pubescent.

4. White Clover: 98

Sessile leaflets arise on a long petiole from a prostrate stem (stolon). The leaflet is heart shaped or notched at the tip and has a light-colored water mark. Vegetative parts are not pubescent.

5. Alsike Clover: 99

Sessile leaflets are minutely serrated around the entire margin and are very finely veined. Stipules are long and taper at the tip with light green or white-colored veins. No pubescence is evident on vegetative parts.

6. Strawberry Clover: 100

Sessile leaflets without water marks are borne on long petioles from a creeping stem (stolon). Leaflets have thick parallel veins which are conspicuous at the margin. Pubescence of vegetative parts is usually lacking.

7. Subterranean Clover: 101

Sessile leaflets arise from short petioles from a prostrate stem (stolon). The leaflets are notched at the tip, heart shaped, and pubescent. A water mark is lacking, and the leaves and stems are softly pubescent.

PAGE

8. Crimson Clover: 102

Sessile leaflets arise from an upright stem on long petioles, and they lack a water mark. Both leaflets and petiole are pubescent. Stipules are large, broad, and with distinct purple margins.

9. Hairy Vetch: 103

Leaves are pinnately compound and contain 10 to 20 leaflets alternately arranged on a central axis. Tendrils are present. Petioles, axis, and leaflets hairy or highly pubescent.

10. Birdsfoot Trefoil: 104

In this legume there are actually three leaflets per leaf, however, the stipules resemble leaves presenting the appearance of five leaflets, three apical and two basal. Pubescence of vegetative parts is lacking.

SECTION IV: GRASS IDENTIFICATION

These transparencies show the inflorescence, spikelet, and a dorsal-ventral view of the caryopsis for several grass types. The most easily observed characteristics were drawn as outline sketches with much elimination of detail. The spiklet and seeds illustrated are enlarged to fully demonstrate several minute identifying features. Observation of living material should accompany these transparencies, to gain experience in recognizing the various points as they actually exist. Many of the following features are difficult to see and can be mastered only with considerable practice and observation.

1. Kentucky Bluegrass: 108

Panicle is open with lower branches in whorls of five. The spikelet contains many florets and is much flattened, resulting in compressed seeds. Seeds have a thin hood projecting around the upper half of the seed, and webbing, representing sterile florets, may be present at the base.

PAGE

2. Big Bluegrass: 110

Panicle is much tighter than Kentucky bluegrass but is larger in overall size with the spikelet less compressed and more open. The seed shows a thin hood extending around its upper portion and is toothed along the back rib.

3. Bulbous Bluegrass: 112

Seed is lacking and replaced by bulblets, which are often bluish to purple in color. Matures very early in the spring. Bulbs develop rapidly into new plants, since seed germination is eliminated. Inflorescence is a panicle.

4. Smooth Bromegrass: 113

Panicle is more open with spikelets long, narrow, and tight usually containing 3-6 seeds. The seed is very flat and papery, with a blunt tip, and with a small awn at the appex. The rachilla is large and pubescent.

5. Mountain Bromegrass: 115

The spikelet is large and may be sticky. The seed is long, narrow, and sharp tipped with a long awn. The leaf may be very harsh and prickly to the touch.

6. Tall Fescue: 117

The inflorescence, a panicle, is larger than red fescue with tighter spikelets. The seed is boat shaped with a knobbed rachilla and with spines along the veins of the lemma.

7. Red Fescue: 119

The spikelet is open and rather large. The seed is boat shaped with a short awn. The inner edge of the palea is toothed, and the lemma is smooth. A knobbed rachilla is present.

8. Orchardgrass: 121

The spikelet is small, very dense, and develops in tight clusters within the panicle. The seed is curved with fine hairs along the mid vein of

PAGE

8. Orchardgrass: (Continued) 121

the lemma, terminating in a short curved awn. Rachilla is present, but not knobbed. Stems are much flattened, especially at the base.

9. Intermediate Wheatgrass: 123

The inflorescence is a spike. Spikelets are loosely structured and arranged flatwise to the rachis, that is, the wide side of the spikelet faces the rachis of the spike. The seed has a small awn and a slightly knobbed rachilla. The palea has minute spines around the inner margin.

10. Crested Wheatgrass: 125

The inflorescence is a spike usually in the shape of a pyramid. The seed has a short, broad rachilla, a toothed inner margin on the palea, and a spiny keel with a curved awn.

11. Perennial Ryegrass: 127

The inflorescence is a spike, with spikelets arranged edgewise (in contrast to flatwise) to the rachis. The second glume is absent or compressed into the rachis leaving the appearance of only one glume per spikelet. The seed is boat shaped with a wedge-shaped rachilla and the inner margin of the palea is minutely toothed. Seed is similar to tall fescue in color and size except the rachilla is not knobbed.

12. Tall Oatgrass: 129

The inflorescence is a large open panicle with one spikelet per pedicle. The spikelet contains two florets one of which is usually sterile. The awn is similar to that of wild oats--twisted and bent at the tip.

13. Reed Canarygrass: 131

The inflorescence is quite dense and large with spikelets containing only one seed. The seed is shiny with minute hairs at the tip which may drop off as the seed dries.

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14. Redtop: 133

The inflorescence is a definite pyramidal, open panicle which turns red with maturity. The glumes completely enclose the florets. The seed is small, narrow, pointed, and with no apparent rachilla. A tuft of fine hairs may be present at the base of the seed.

15. Timothy: 135

The inflorescence is a very dense panicle and often resembles a cylindrical spike. The glumes are pronounced, awned and have minute teeth around the outside edge at the tip. Only one seed is contained within each pair of glumes.

SECTION V: WEED IDENTIFICATION

The following transparencies show the identifying plant and seed characteristics of several weeds in diagrammatic form. These drawings are intended only to demonstrate the features of various weeds and should be supplemented by examination of living plant specimens to become competent in weed identification. Specific descriptions related to identification of each weed appears on each of the following transparencies of this series. 138

GENERAL PLANT MORPHOLOGY AND STRUCTURE

SECTION I

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

Dwane G. Miller Gilbert A. Long Clarence E. Manning

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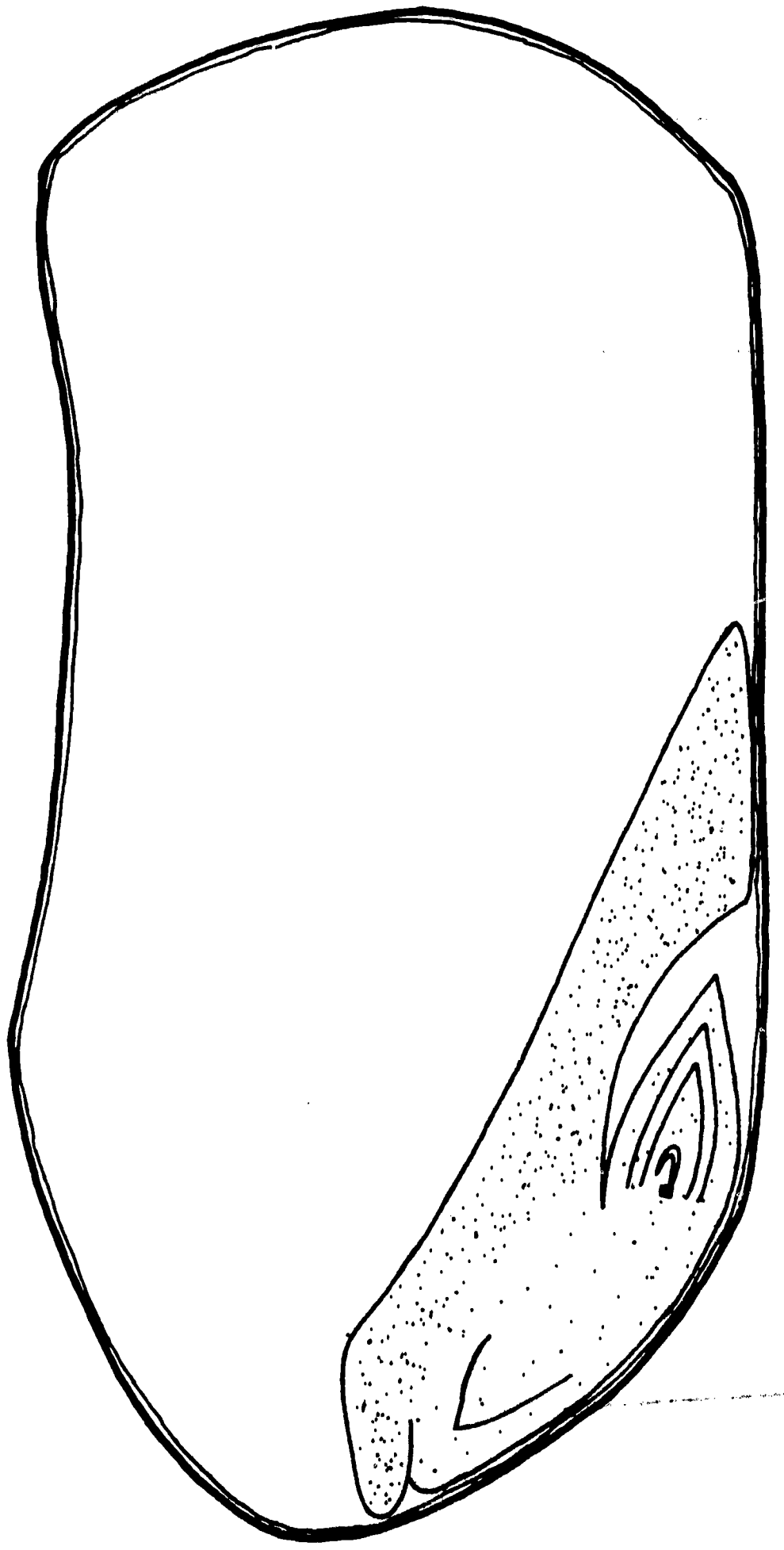
Narrow Grass Leaf 53
Tap Root System 55
Fibrous Root System 57

MONOCOT SEED



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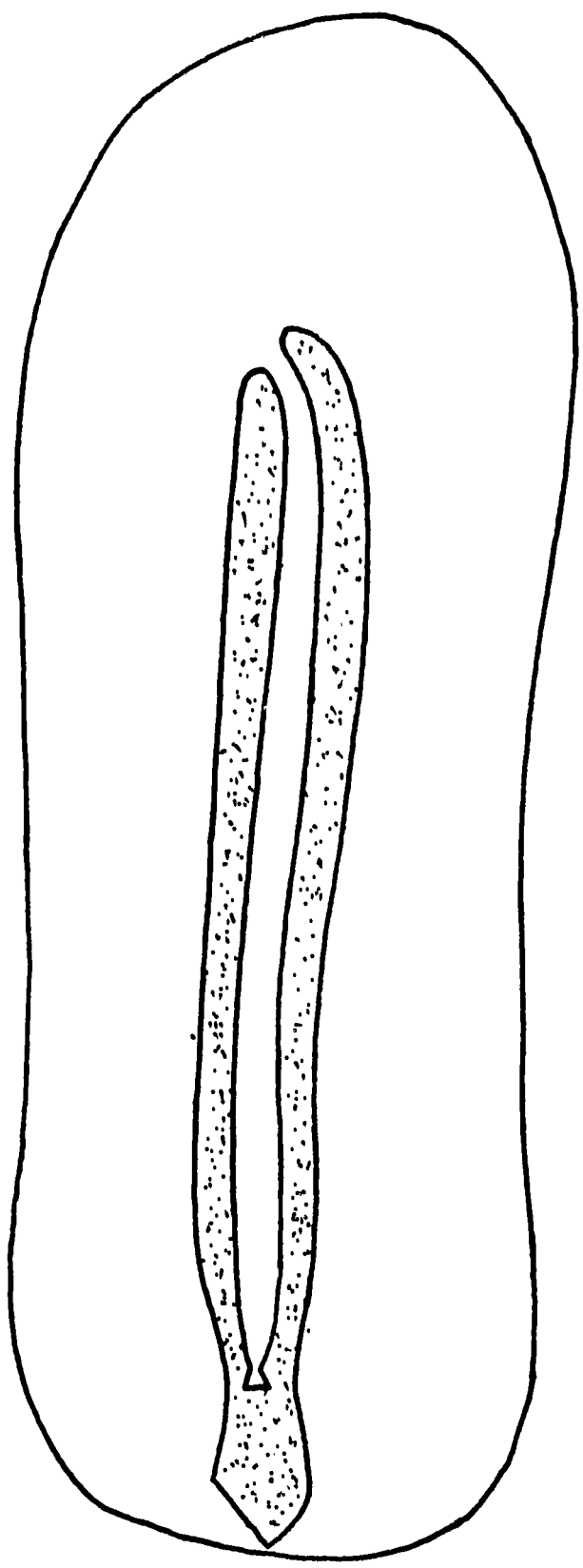
DICOT SEED



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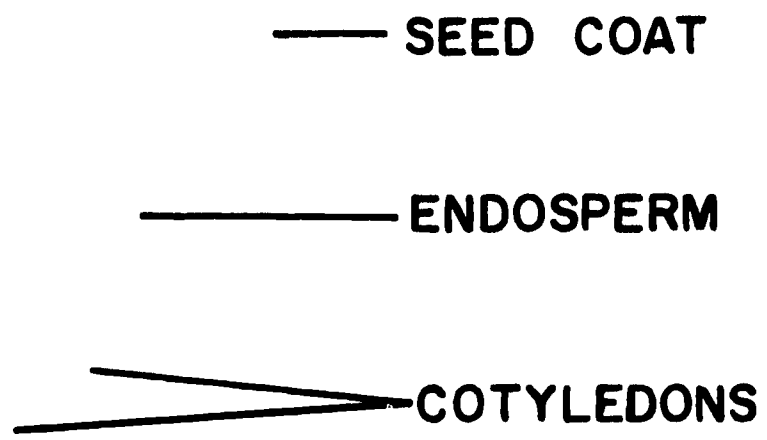
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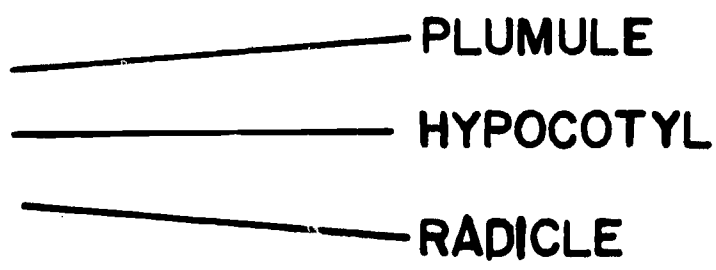
COTYLEDONS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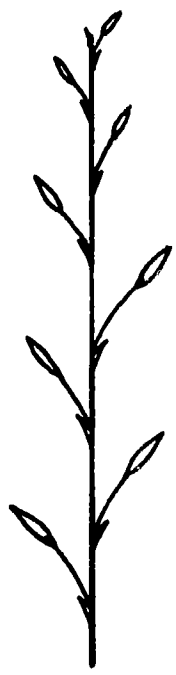
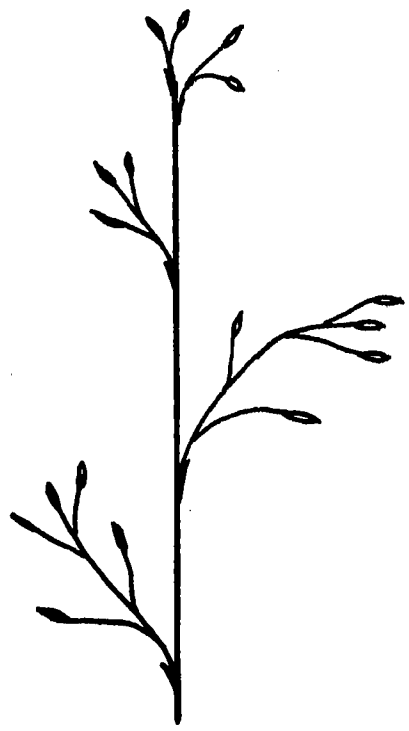
RADICLE

INFLORESCENCE TYPES





SPIKELET

BRACT

RACHIS

SPIKE

SPIKELET

PEDICLE

RACHIS

BRACT

SPIKELET

RACEME

CENTRAL AXIS

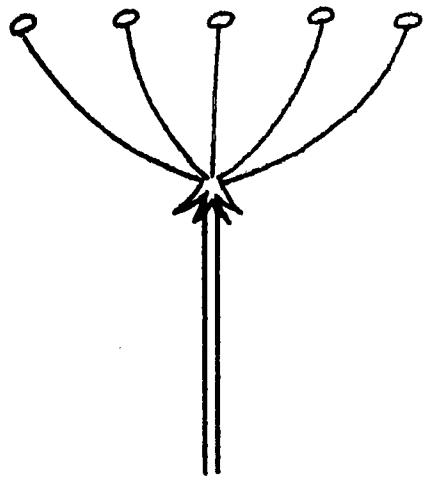
BRANCH

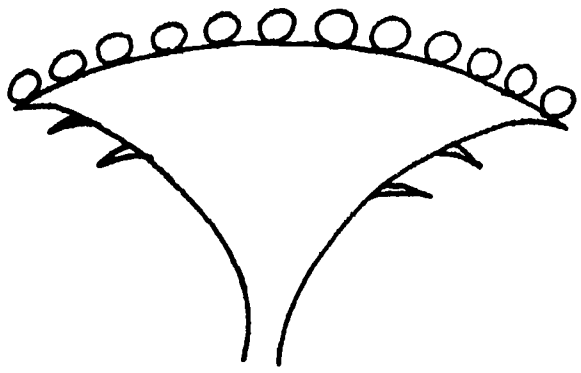
BRACT

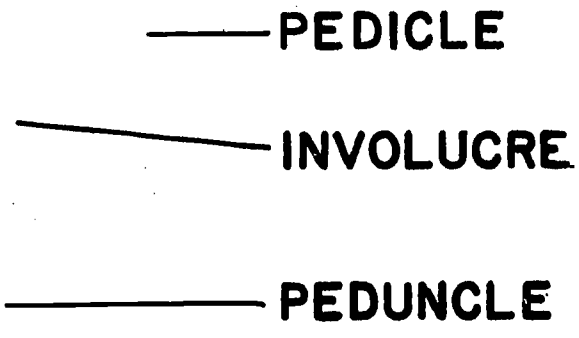
PEDICLE

PANICLE

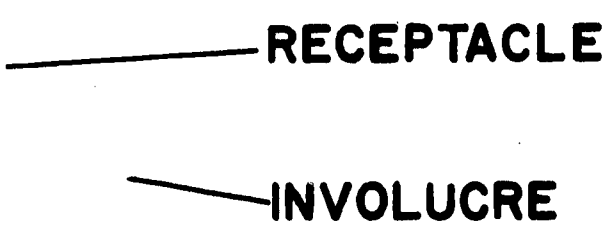
INFLORESCENCE TYPES





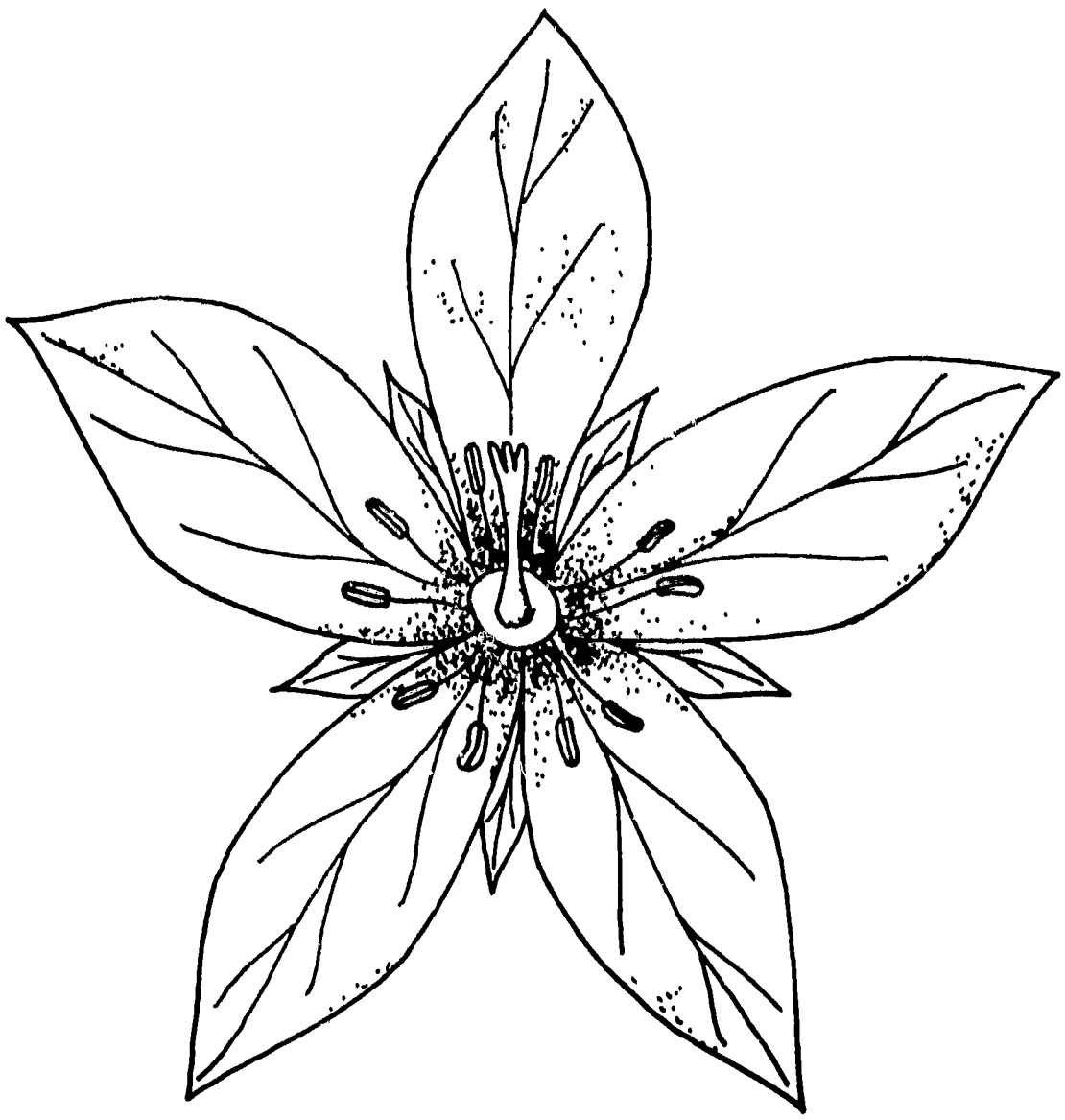


UMBLE



HEAD

TYPICAL DICOT FLOWER



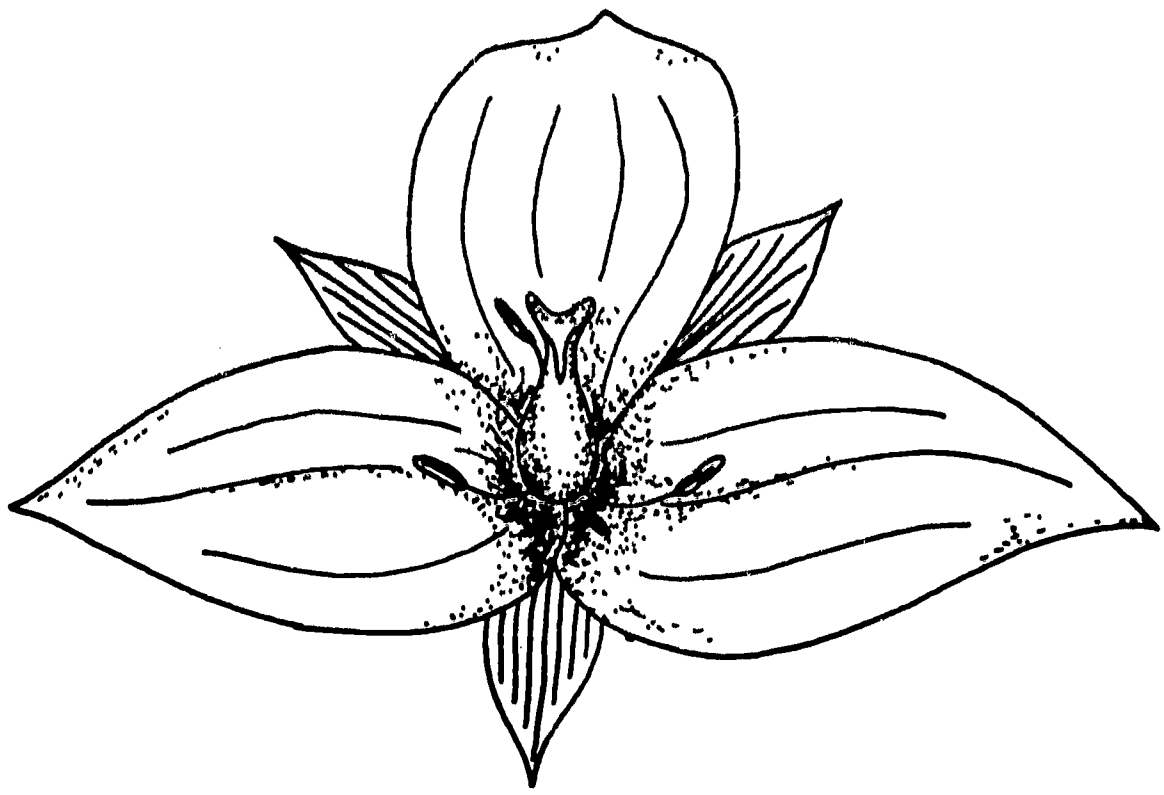
PETAL

SEPAL

PISTLE

STAMEN

TYPICAL MONOCOT FLOWER



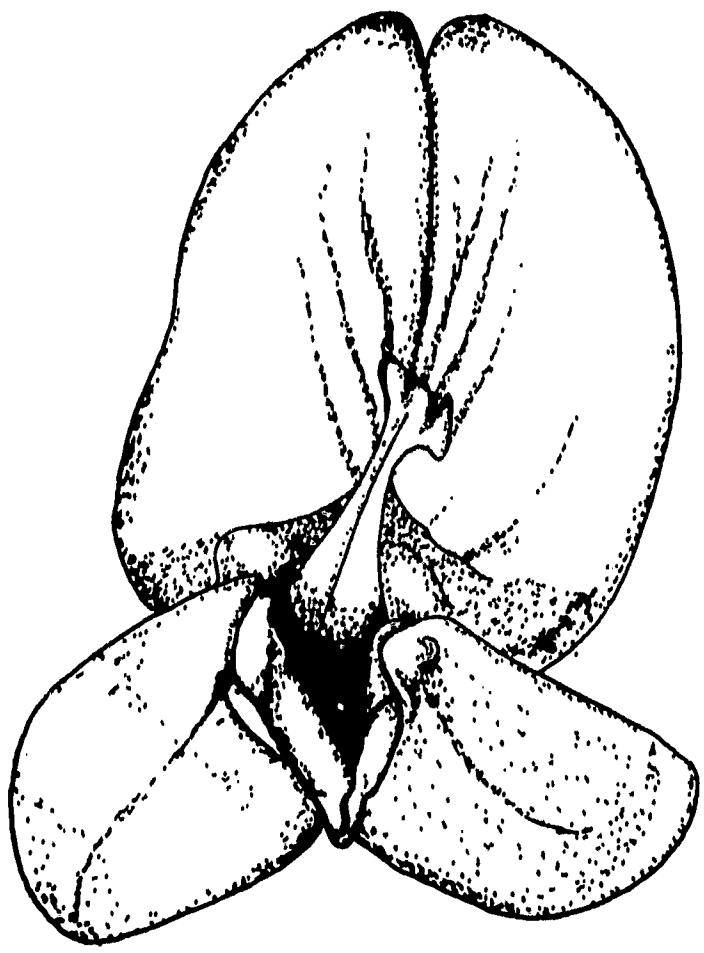
PETAL

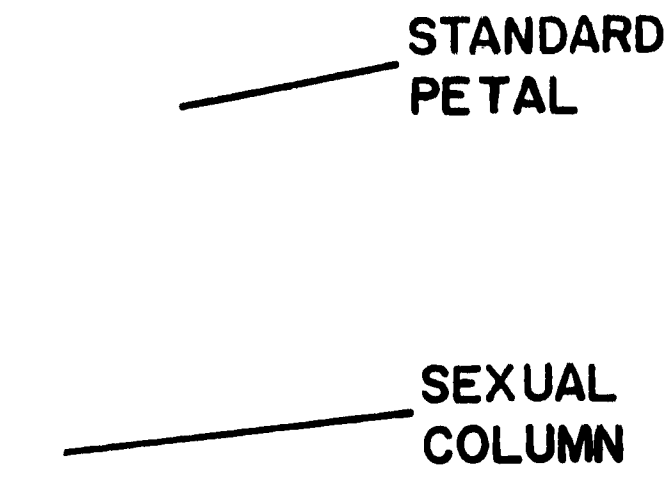
SEPAL

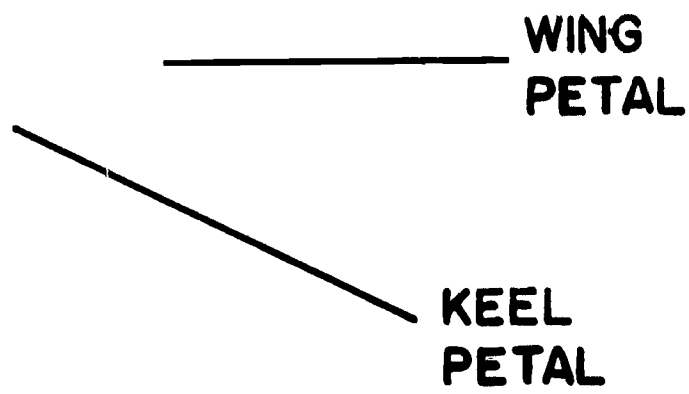
PISTLE

STAMEN

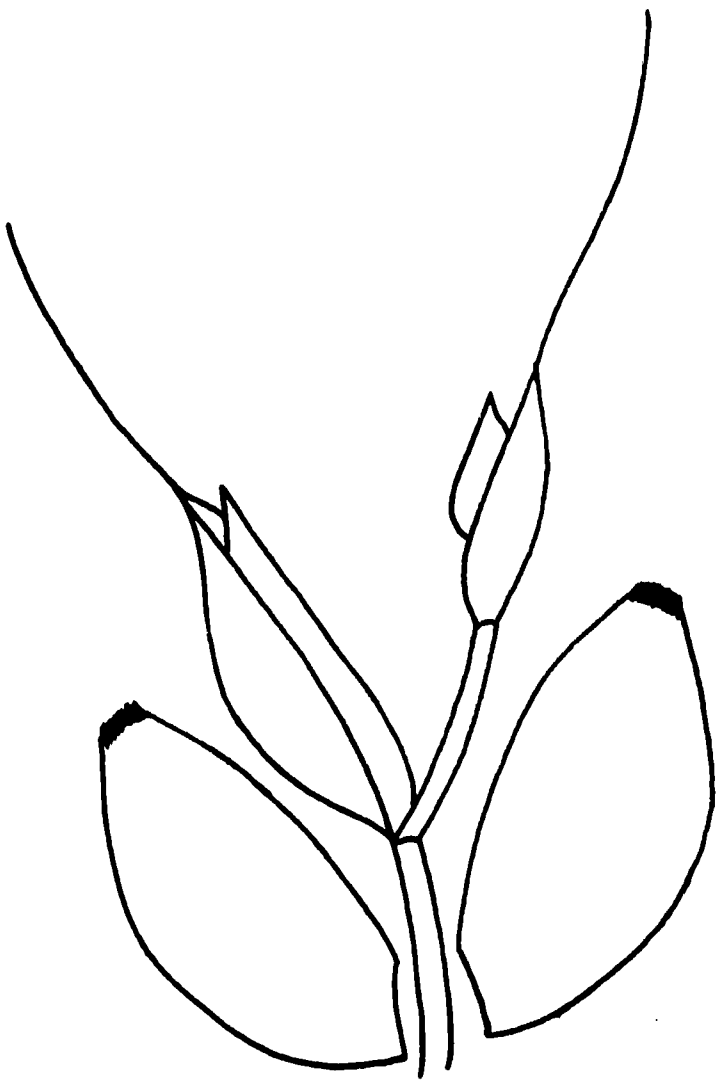
LEGUME FLOWER



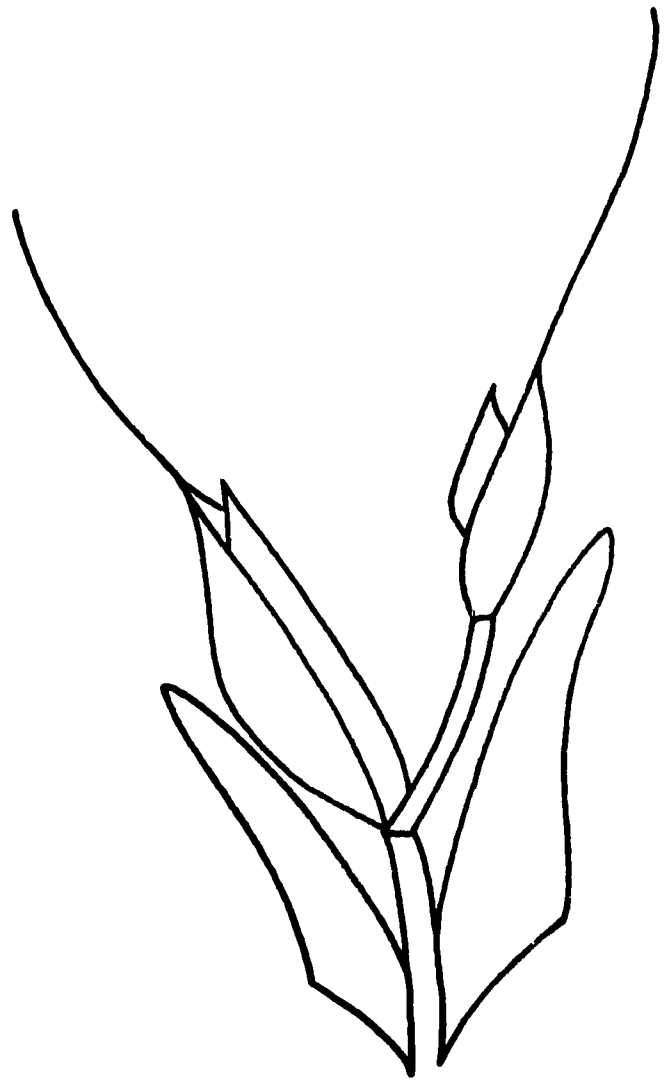

STANDARD
PETAL
SEXUAL
COLUMN


WING
PETAL
KEEL
PETAL

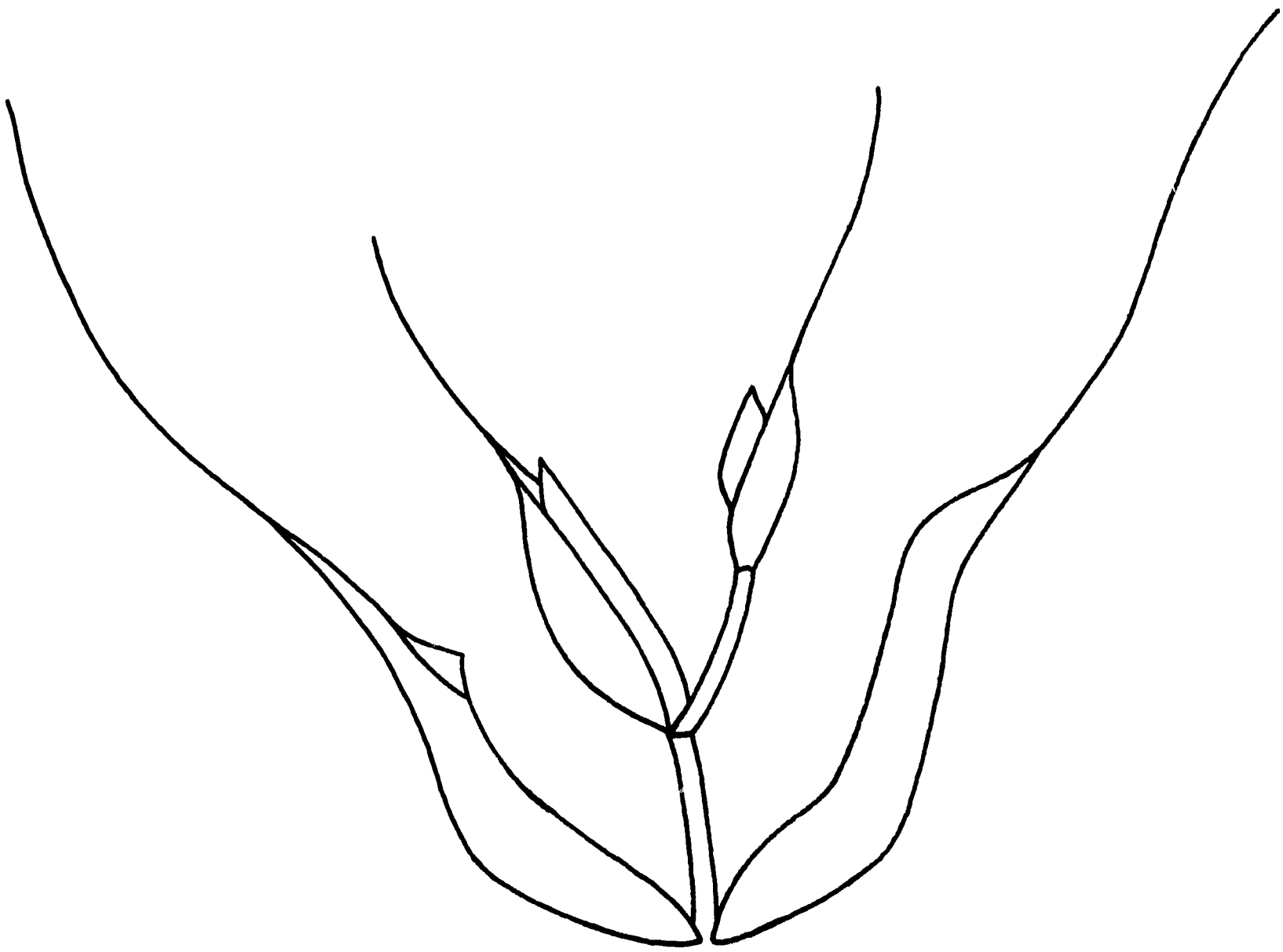
WHEAT SPIKELET



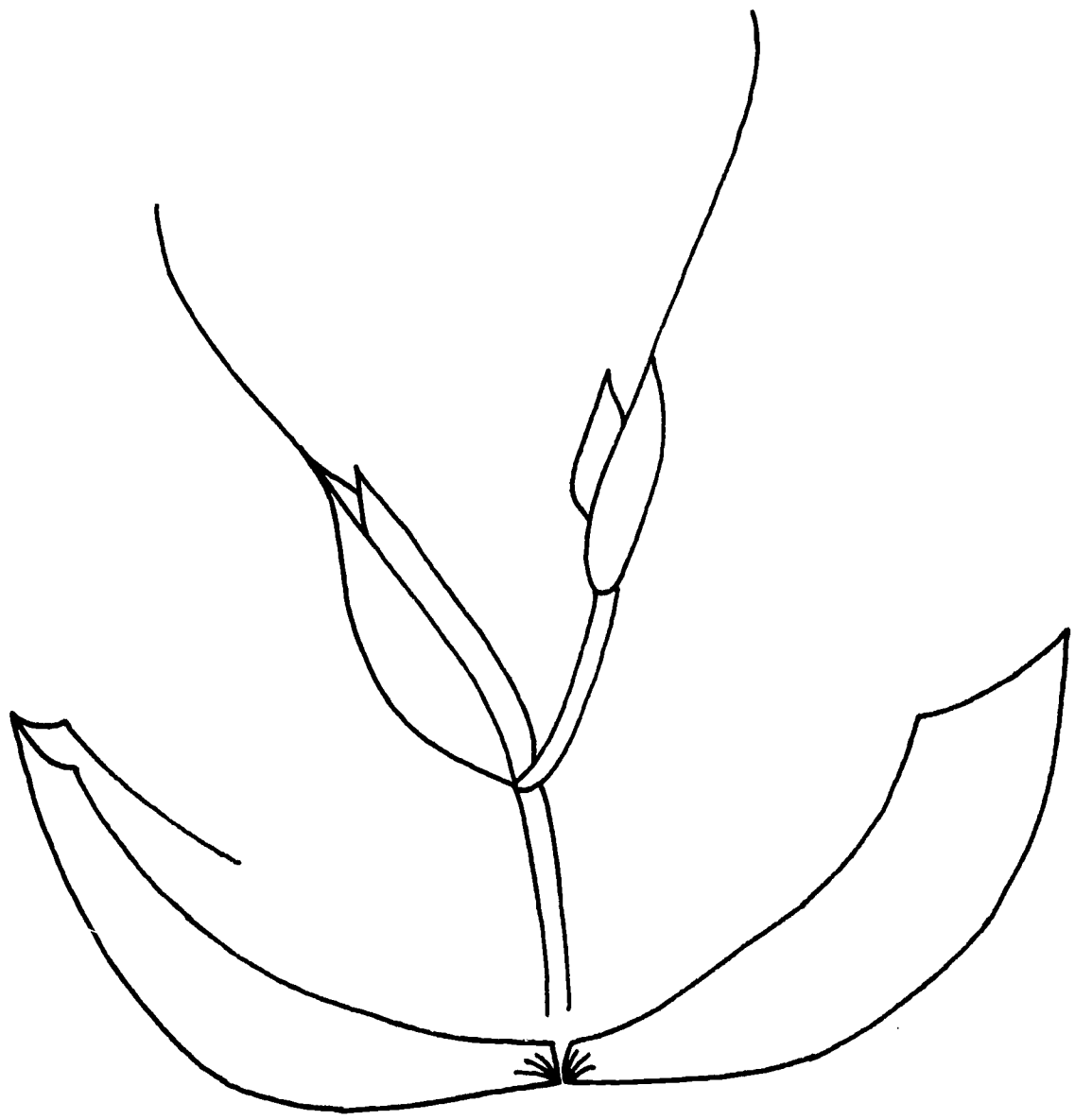
CARYOPSIS



PALEA

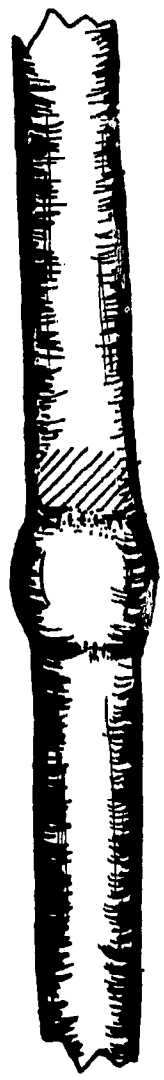


LEMMA

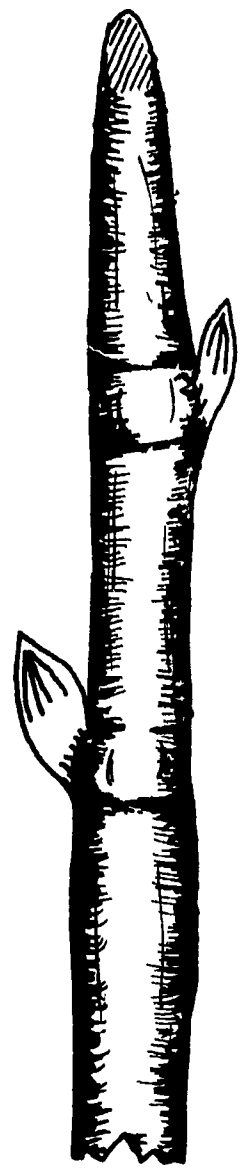


GLUME

MERISTEMATIC REGIONS



GRASS STEM

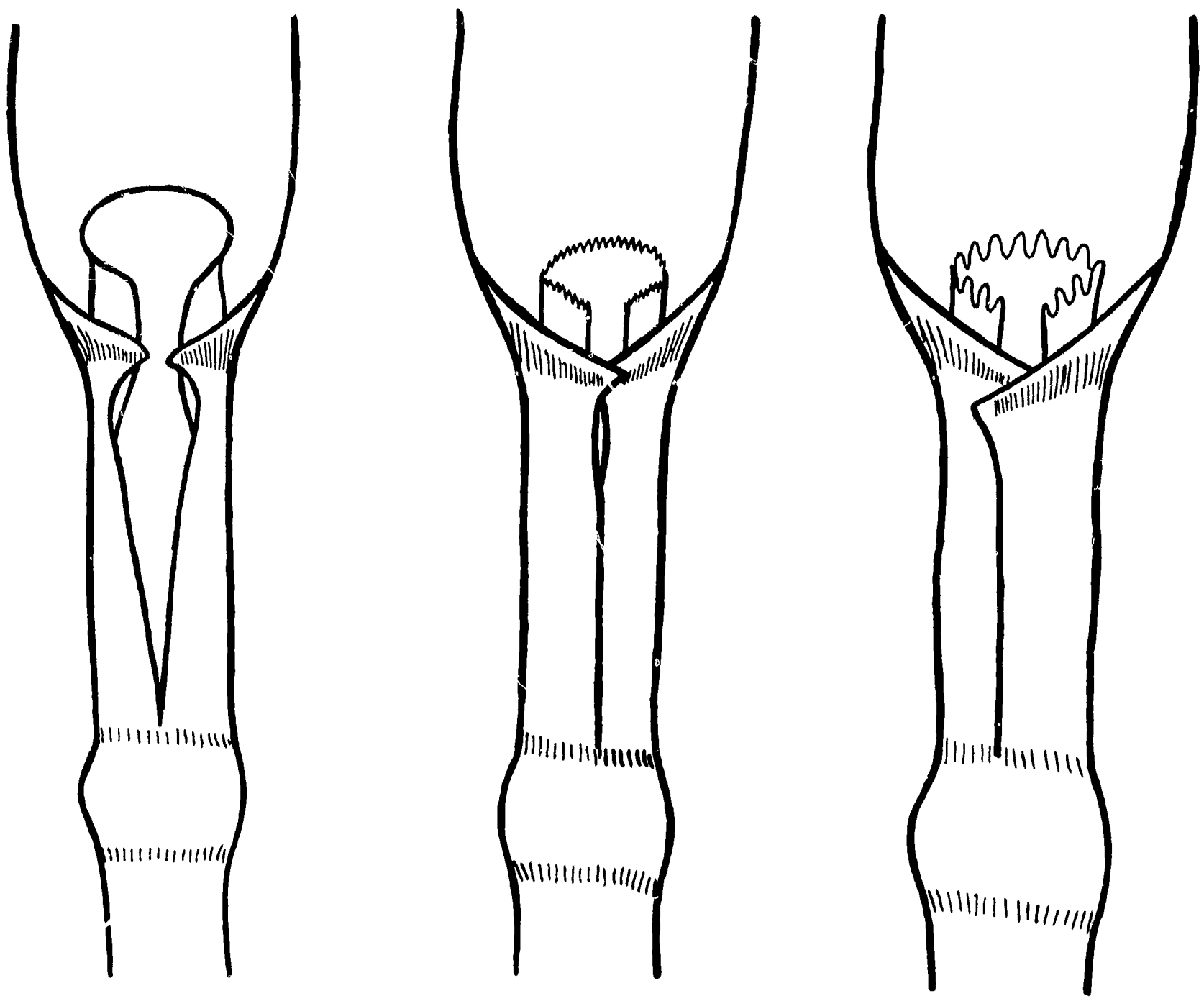


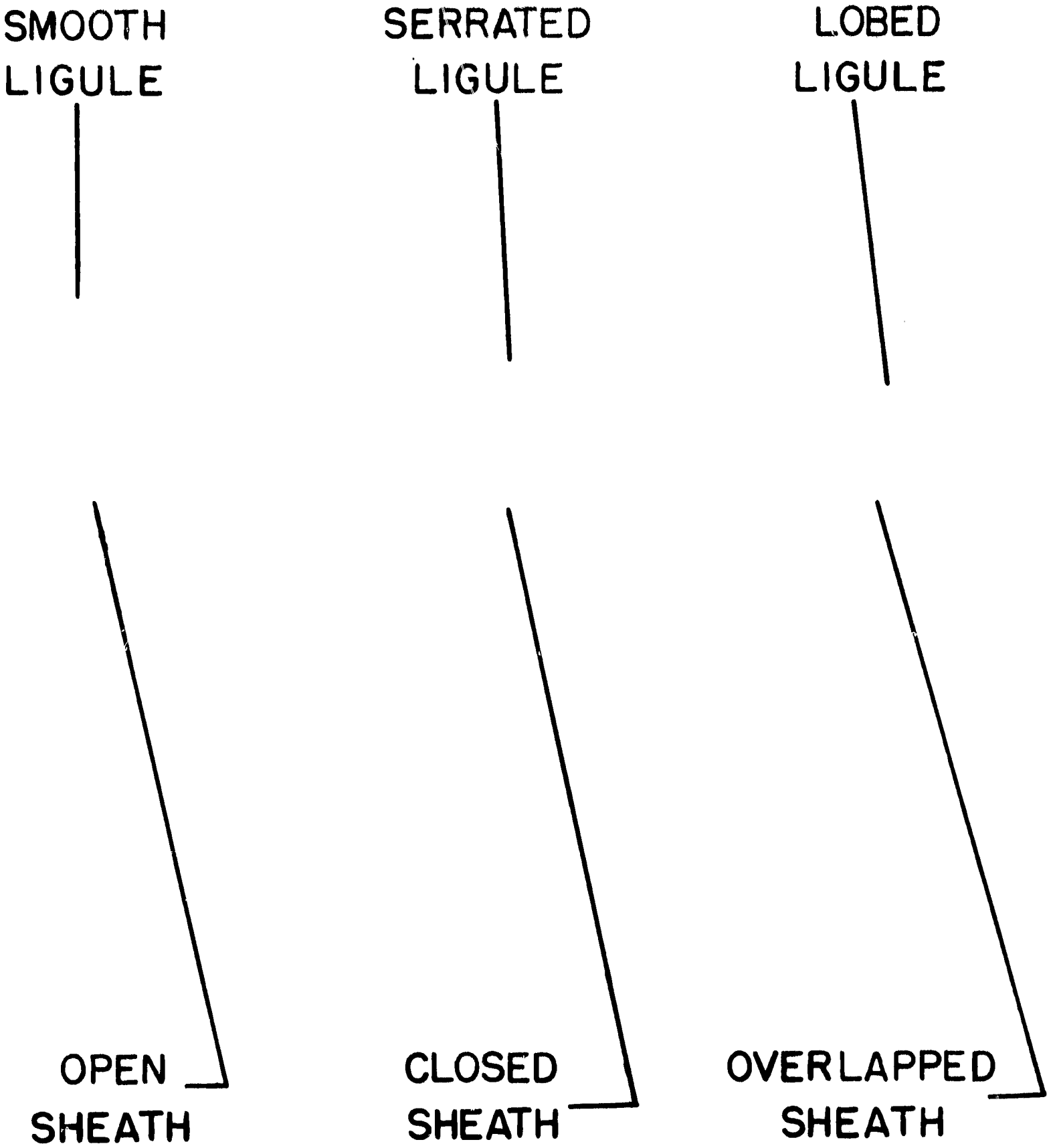
ALFALFA STEM

APICAL
MERISTEM

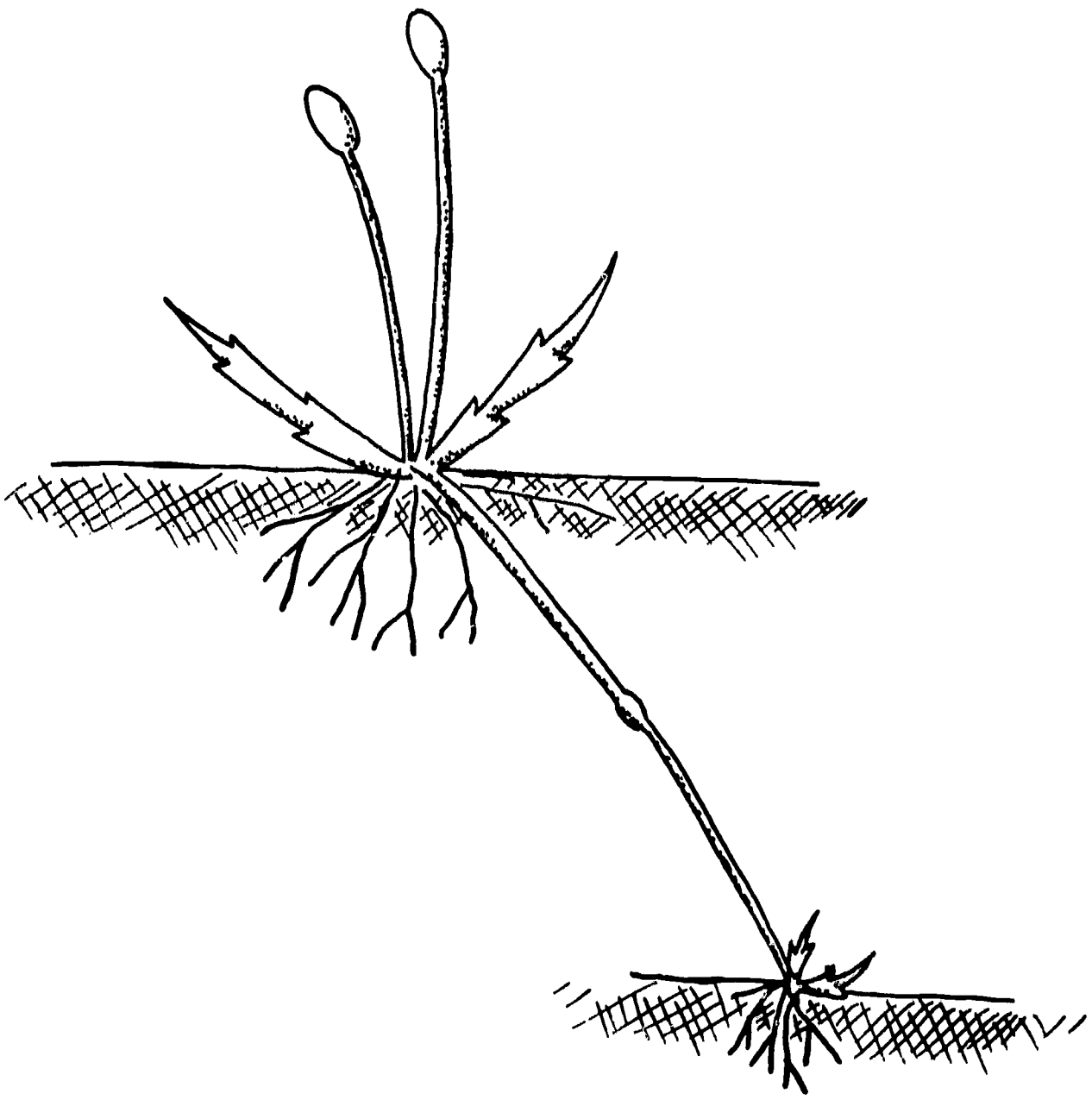
INTERCALARY
MERISTEM

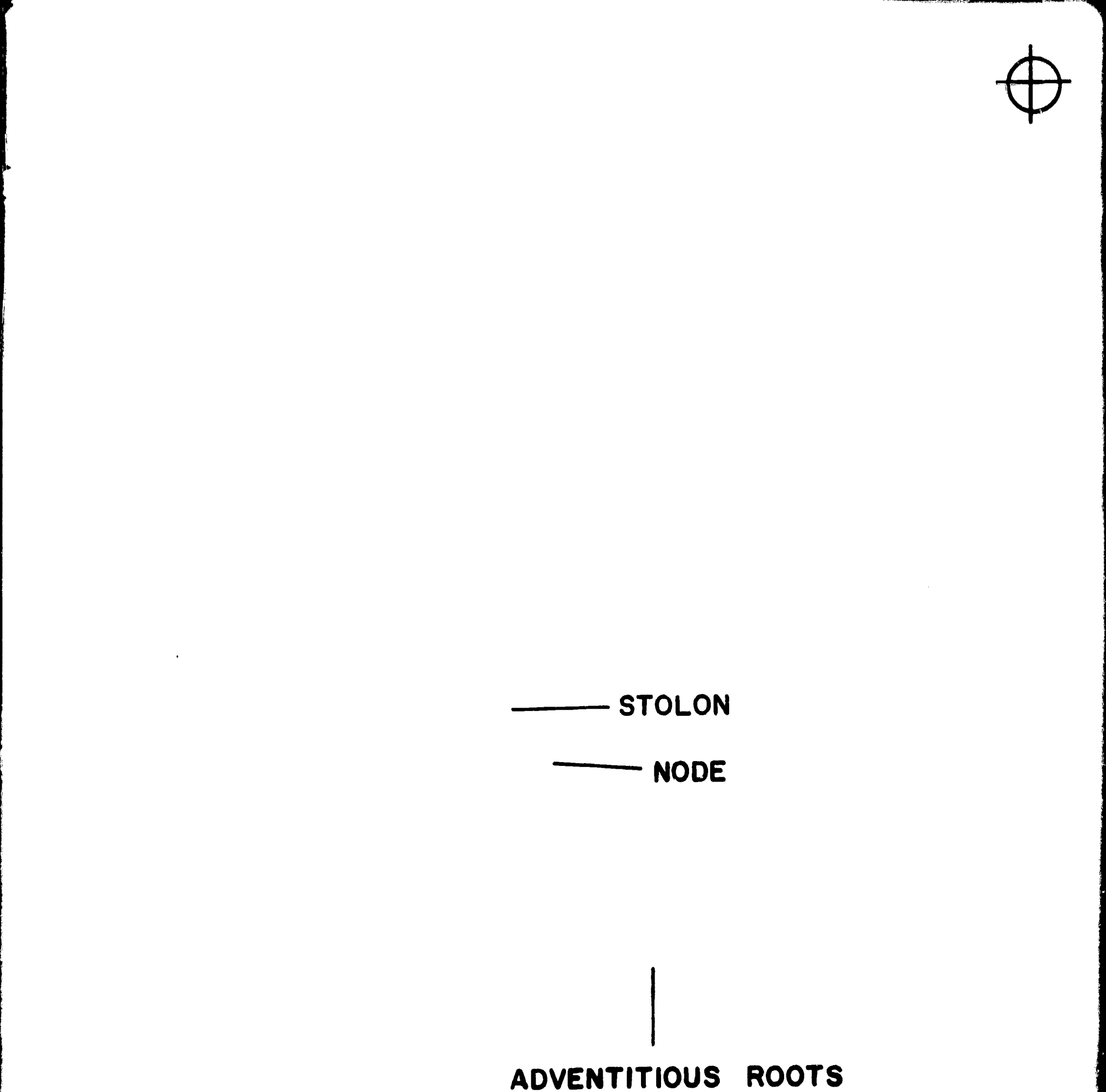
COMMON SHEATH AND LIGULE TYPES



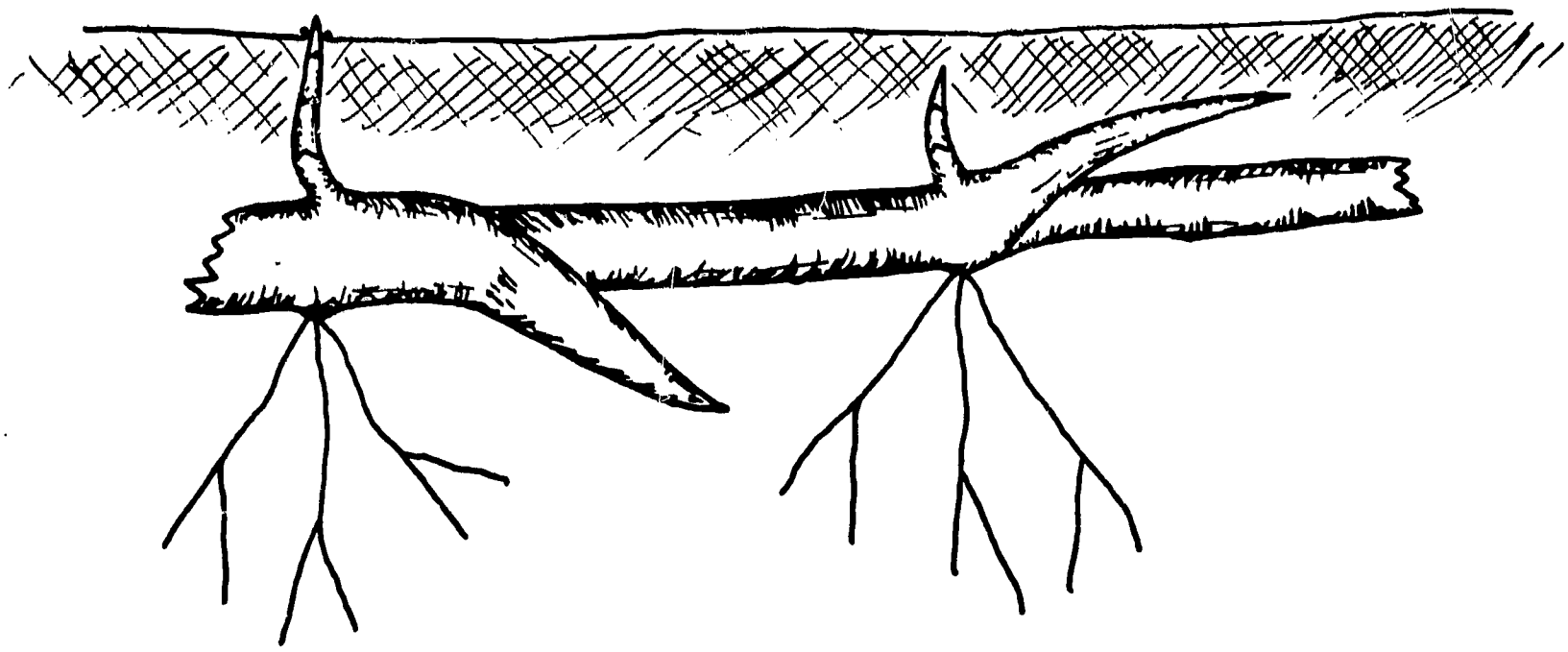

SMOOTH LIGULE
SERRATED LIGULE
LOBED LIGULE
OPEN SHEATH
CLOSED SHEATH
OVERLAPPED SHEATH

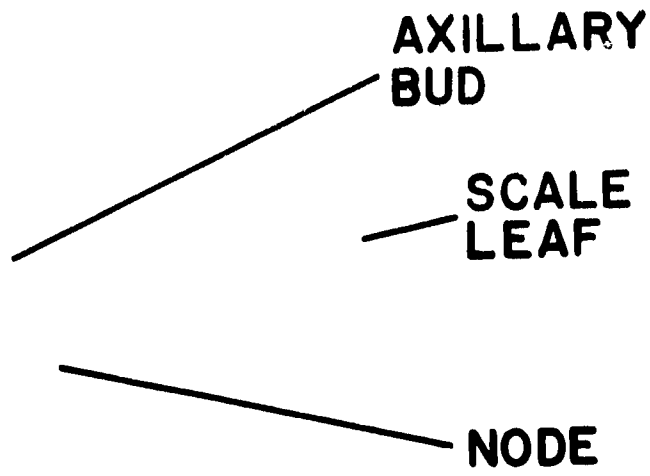
STOLON: A SPECIALIZED STEM




STOLON
NODE
ADVENTITIOUS ROOTS

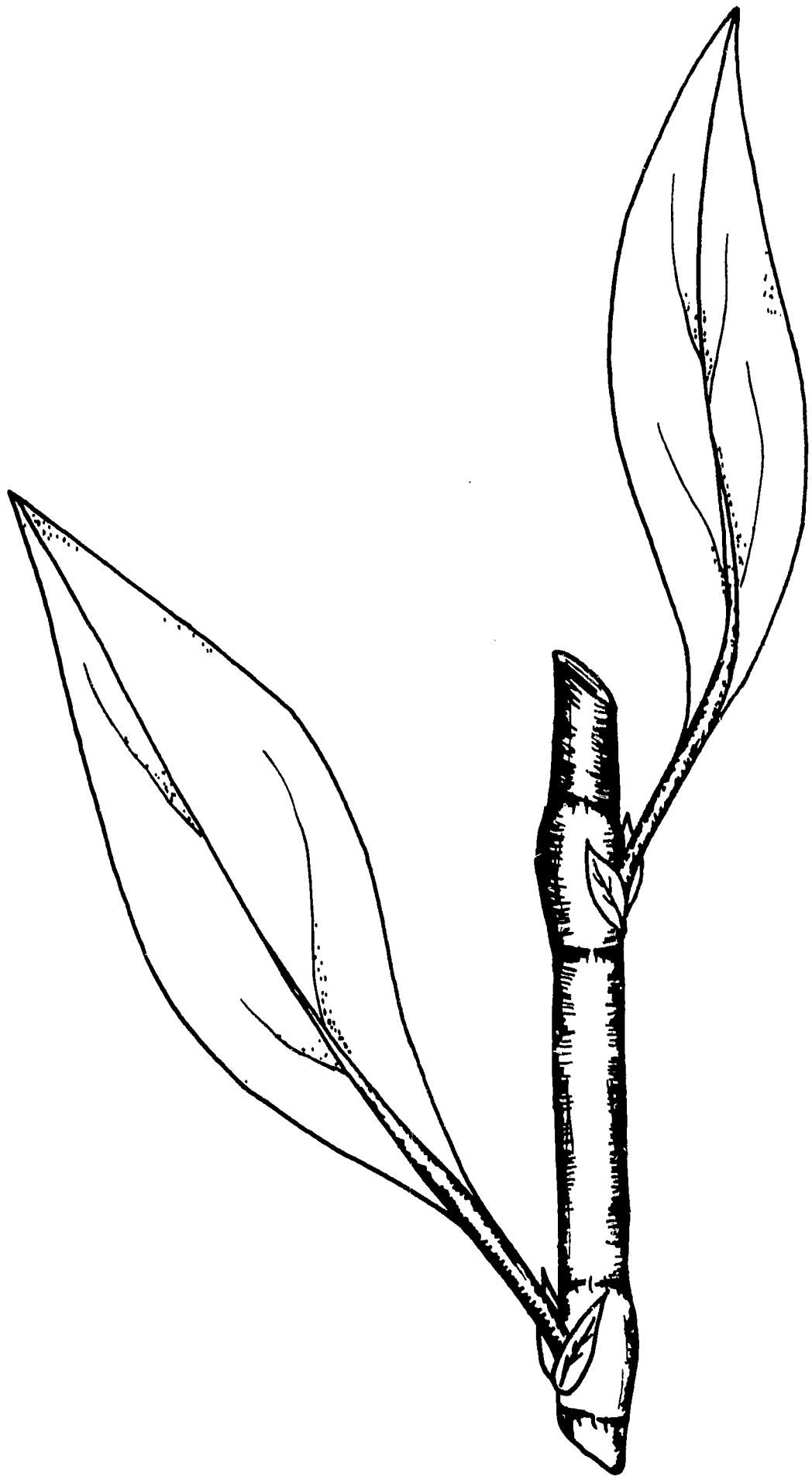
RHIZOME: AN UNDERGROUND STEM

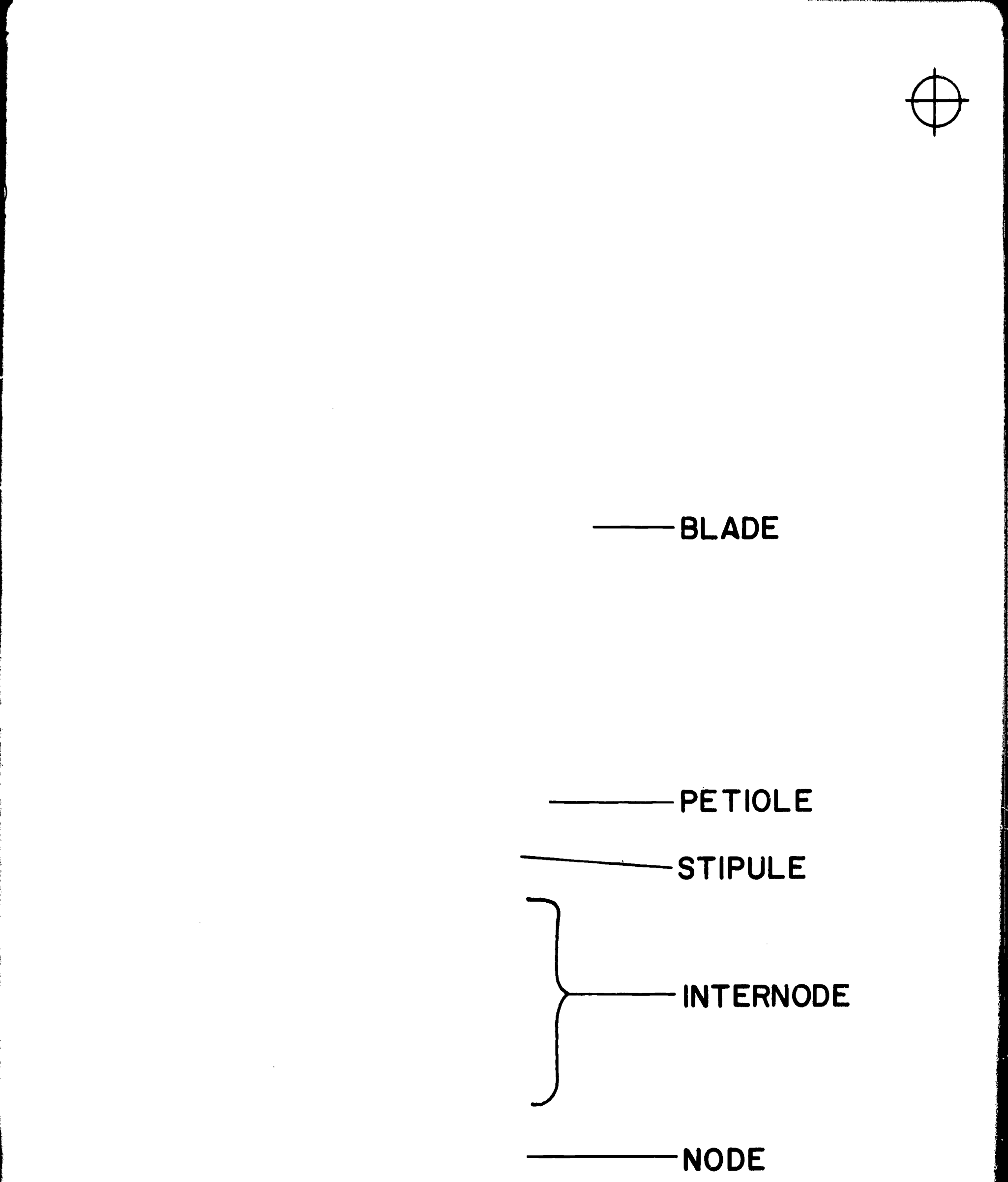




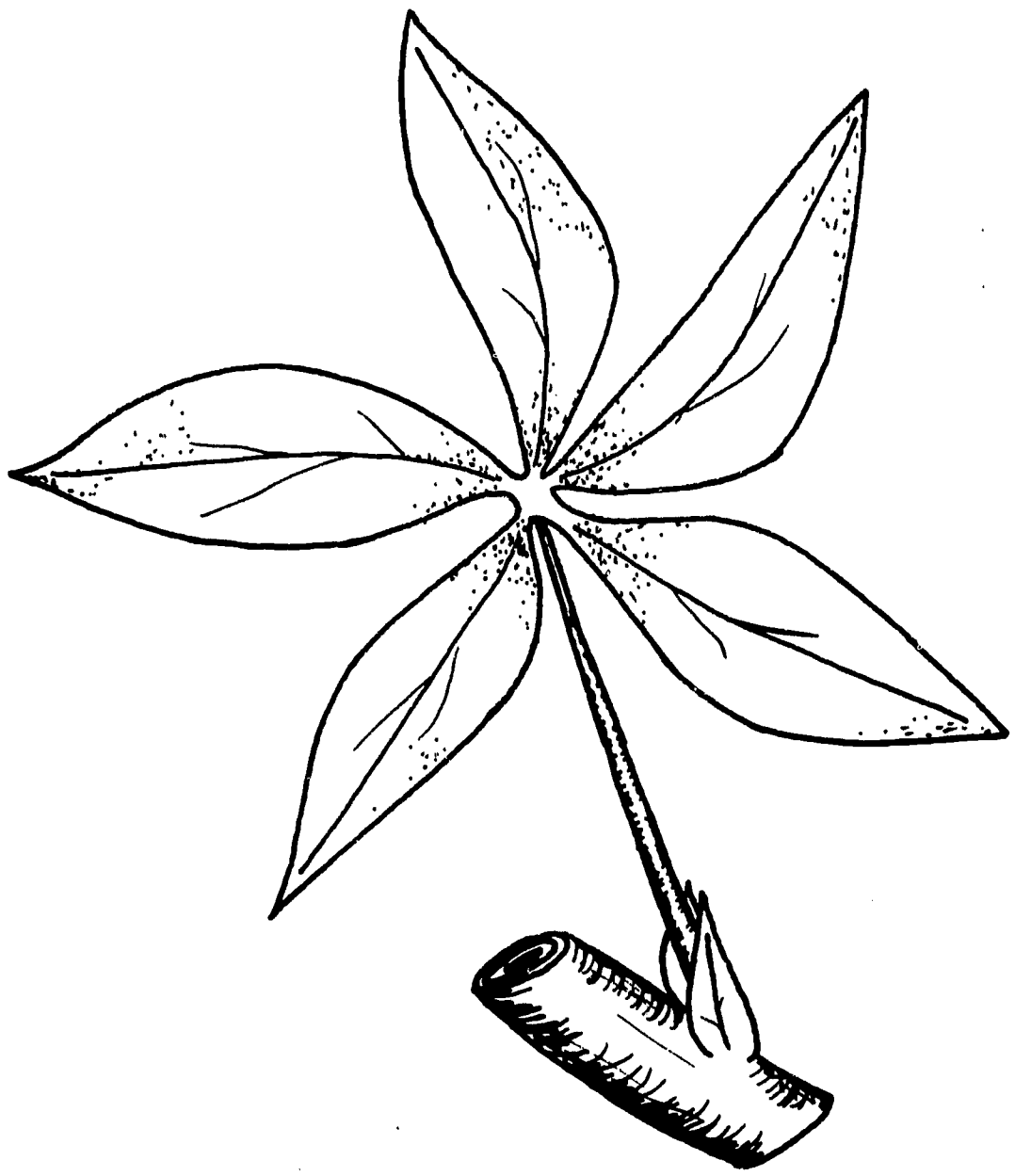
ADVENTITIOUS ROOTS

SIMPLE BROAD LEAF




BLADE
PETIOLE
STIPULE
INTERNODE
NODE

SIMPLE PALMATELY COMPOUND LEAF

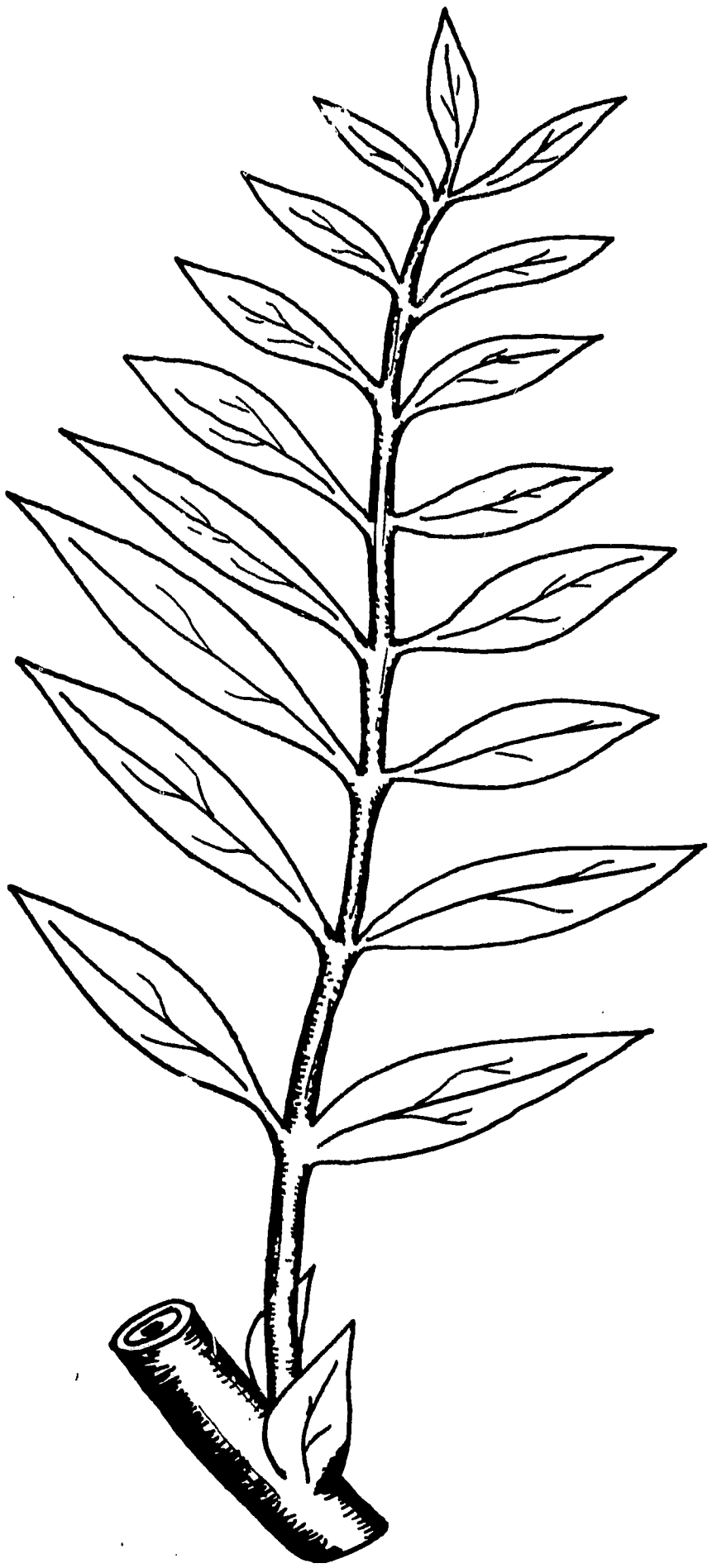


LEAFLET

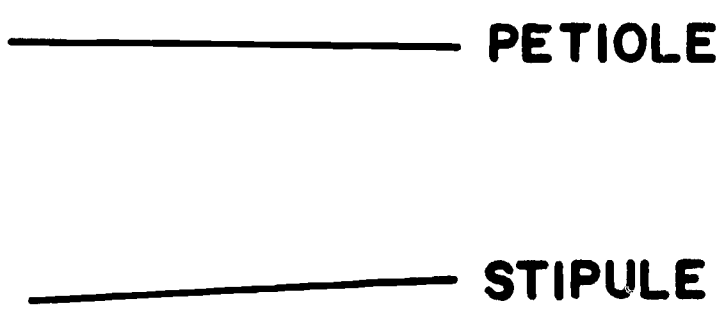
PETIOLE

STIPULE

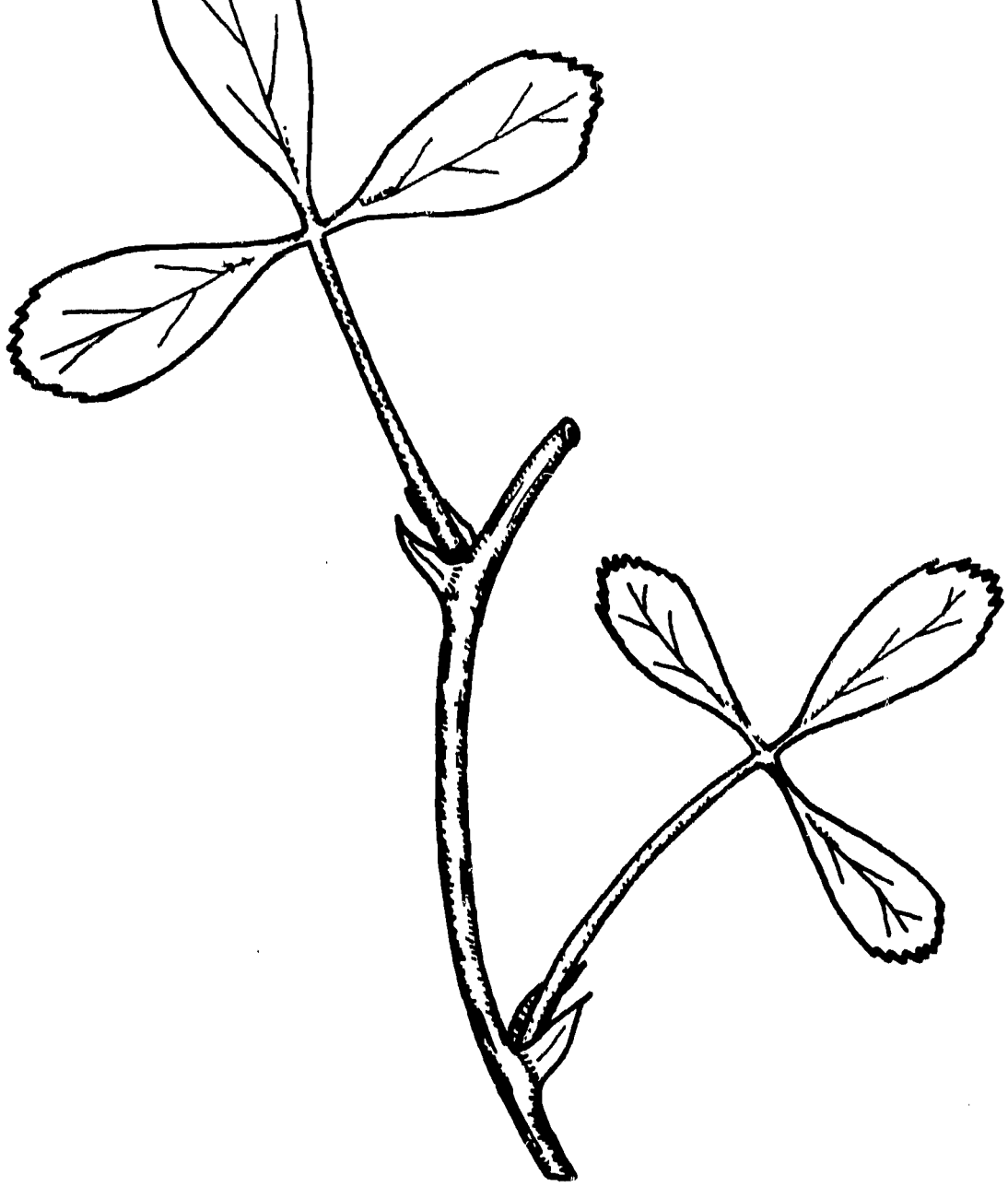
SIMPLE PINNATELY COMPOUND LEAF




LEAFLETS


PETIOLE
STIPULE

TYPICAL TRIFOLIOLATE LEGUME LEAF



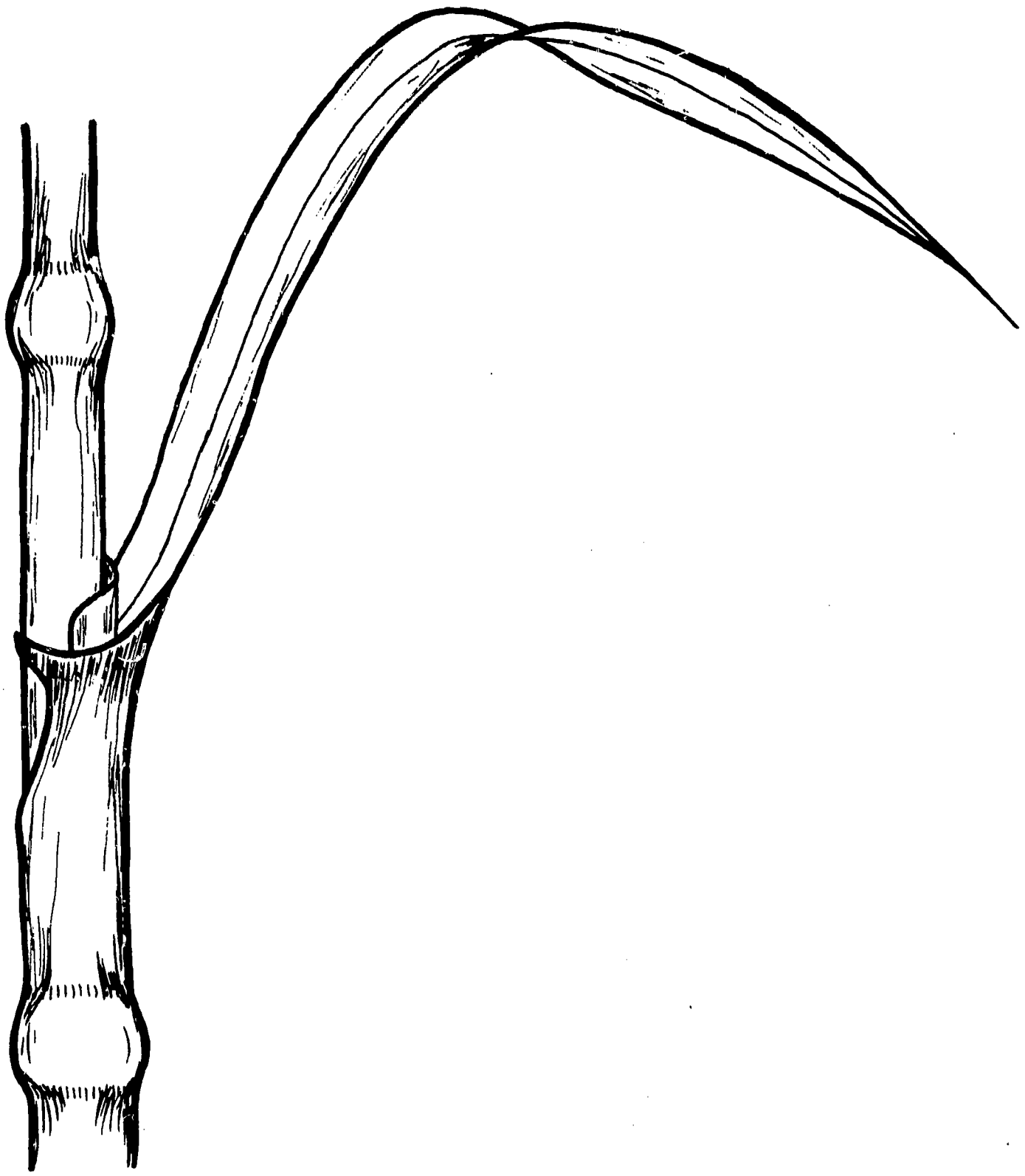
LEAFLET

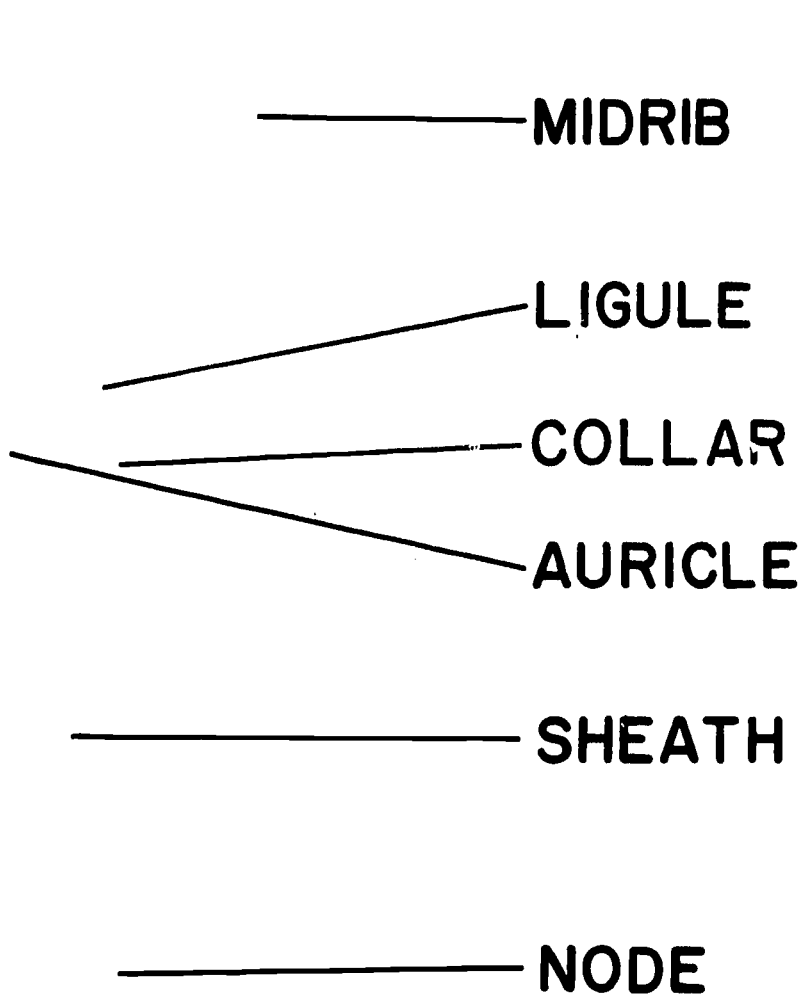
PETIOLE

PETIOLAR BRANCH

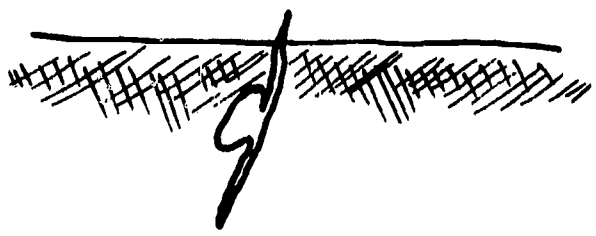
STIPULE

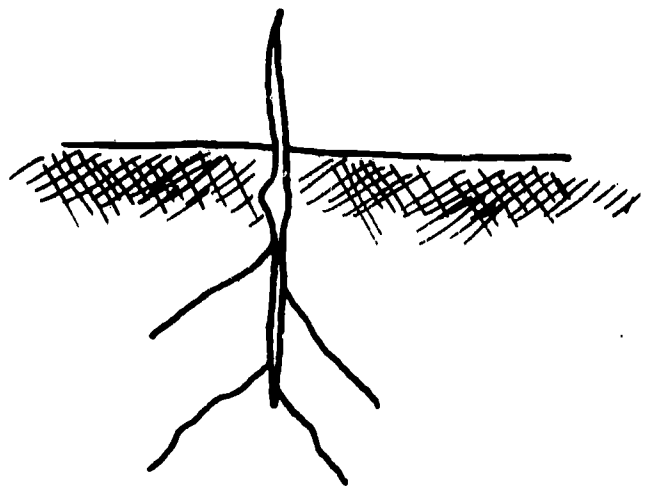
NARROW GRASS LEAF

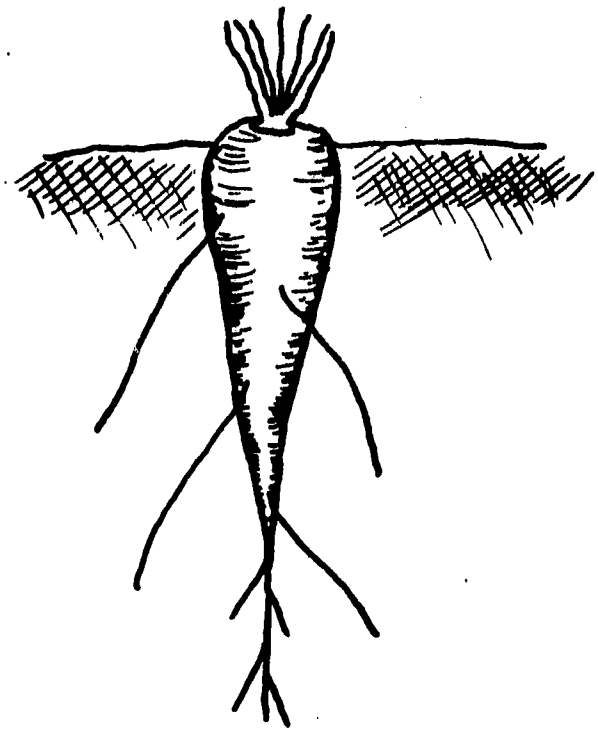



BLADE
MIDRIB
LIGULE
COLLAR
AURICLE
SHEATH
NODE

TAP ROOT SYSTEM







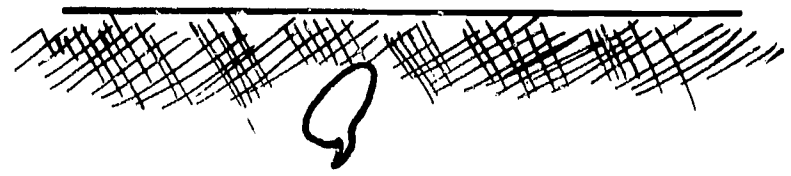
RADICLE

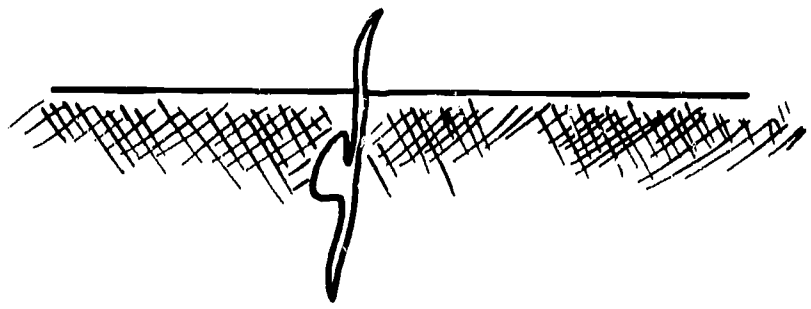
PRIMARY ROOT

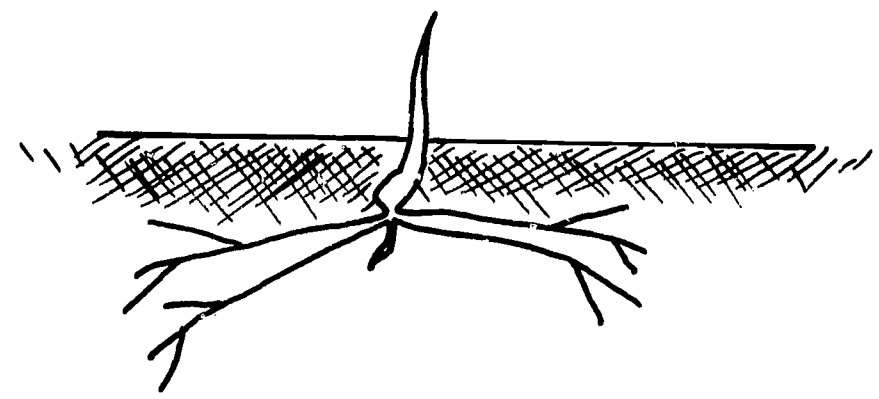
SECONDARY ROOTS

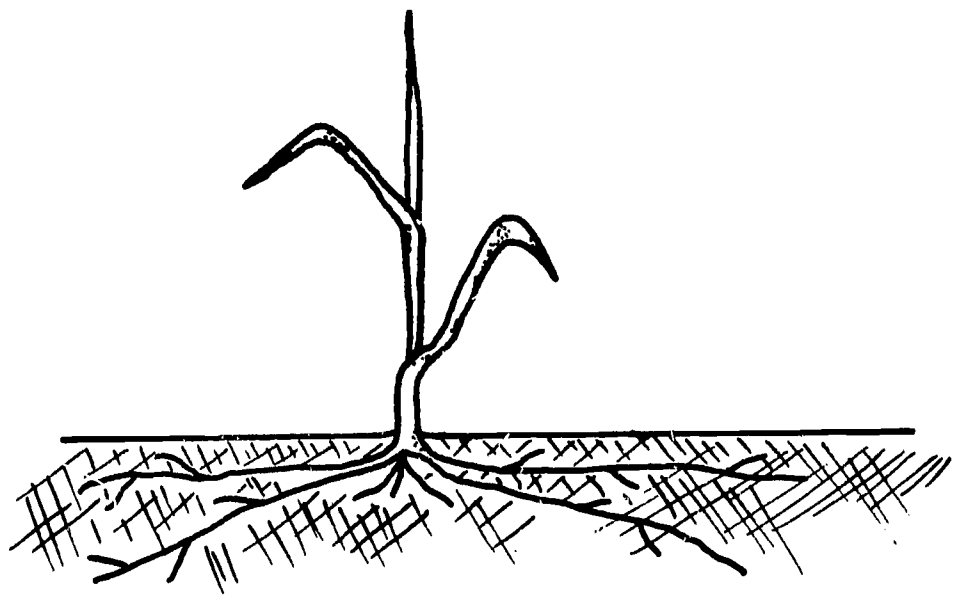
DEEP, PENETRATING ROOT SYSTEM

FIBROUS ROOT SYSTEM









RADICLE

PRIMARY ROOT

SECONDARY ROOTS

SHALLOW, SPREADING ROOT SYSTEM

CEREAL CROPS

SECTION II

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

Dwane G. Miller Gilbert A. Long Clarence E. Manning

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Amber Durum Wheat 83
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Oat Seed 87
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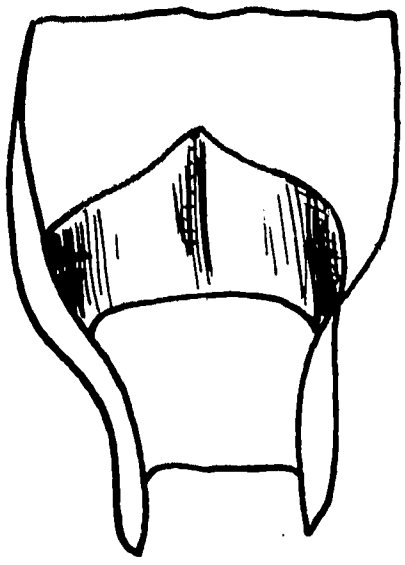
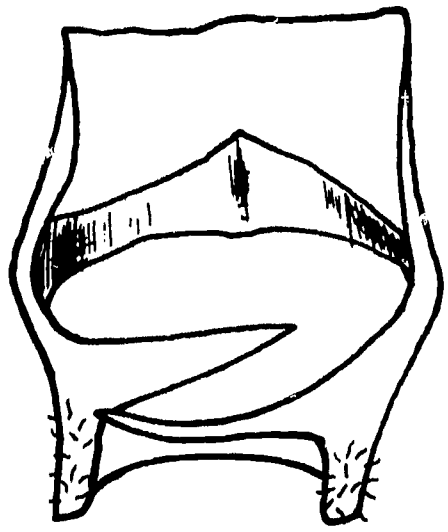
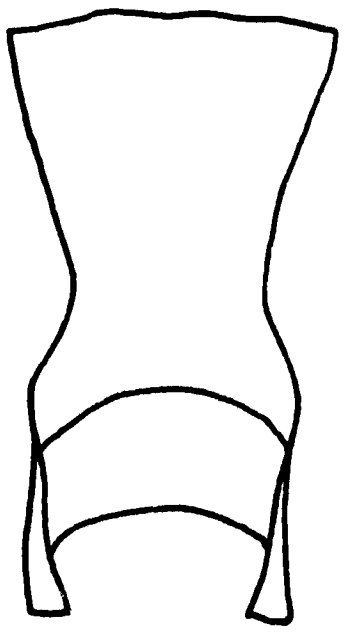
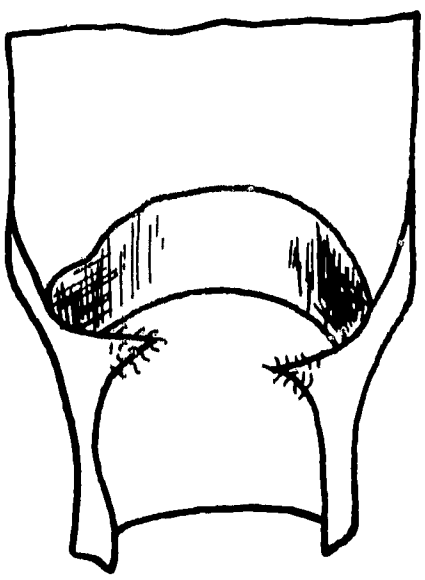
Rye 91

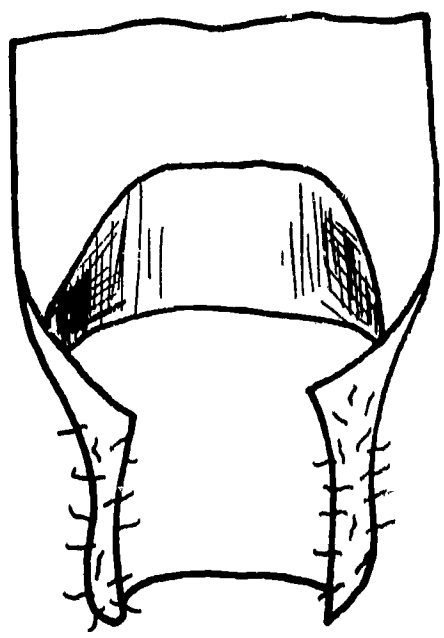
VEGETATIVE CHARACTERISTICS OF CEREALS











OATS
AURICLE LACKING
PUBESCENCE
LACKING

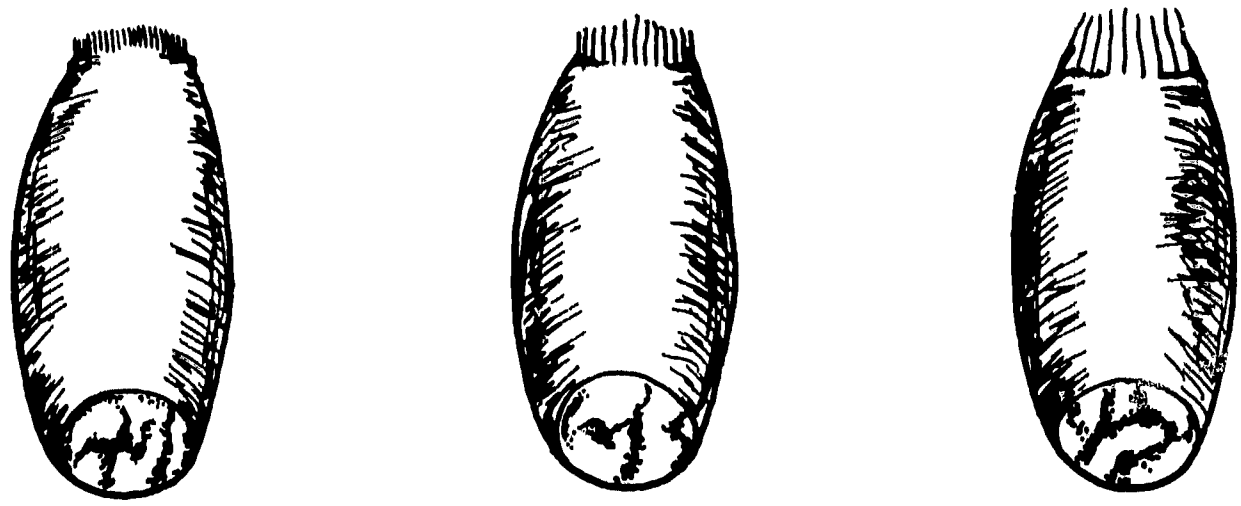
BARLEY
LONG AURICLE
PUBESCENCE
ON COLLAR

CORN
AURICLE LACKING
LIGULE MINUTE

WHEAT
MEDIUM AURICLE
PUBESCENCE ON
AURICLE

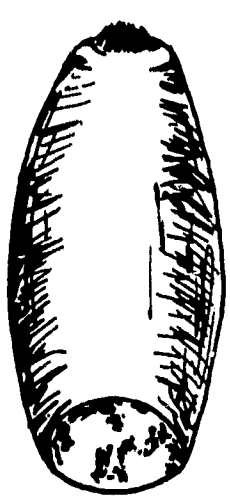
RYE
SHORT AURICLE
PUBESCENCE ON
COLLAR

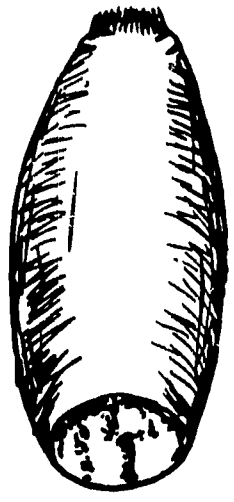
BRUSH LENGTHS

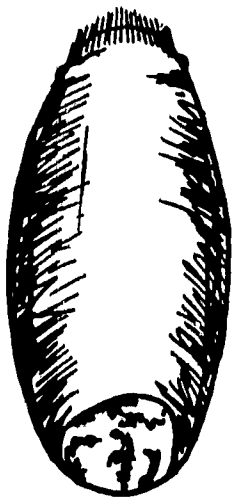


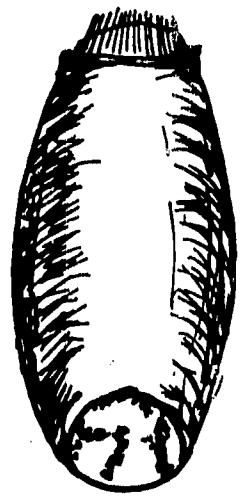
SHORT MIDLONG LONG

BRUSH SIZES









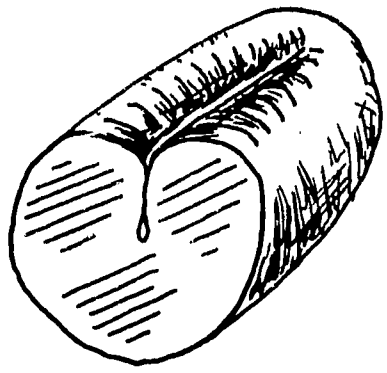
SMALL

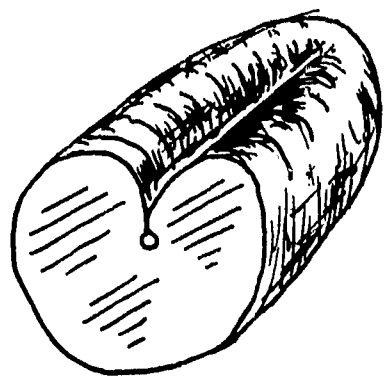
MIDSIZE

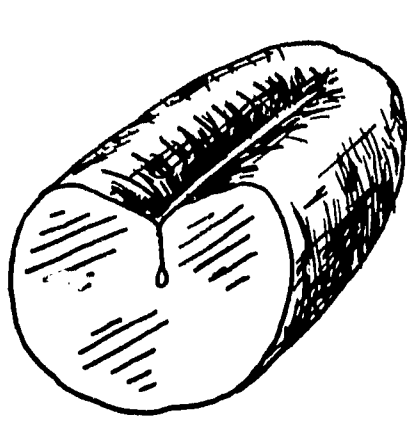
LARGE

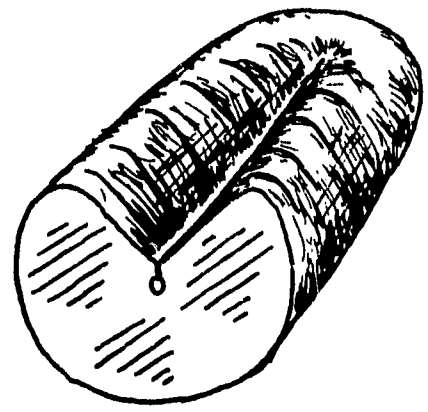
COLLARED

CHEEK SHAPES





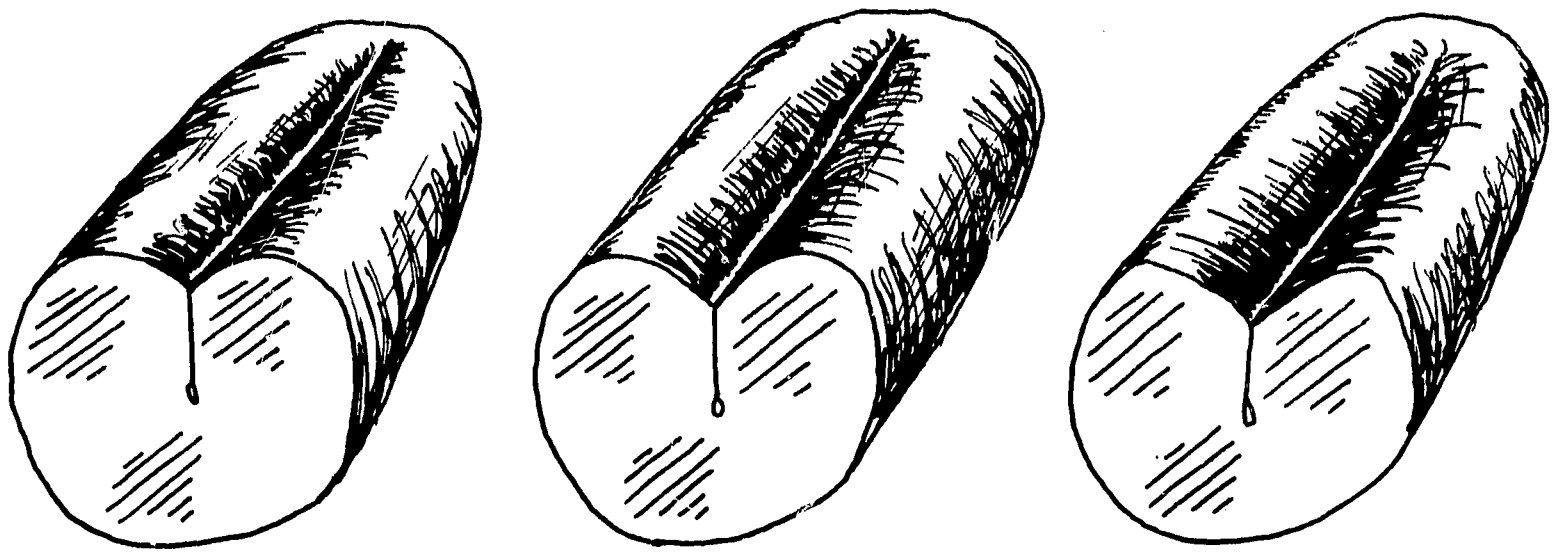




ROUNDED

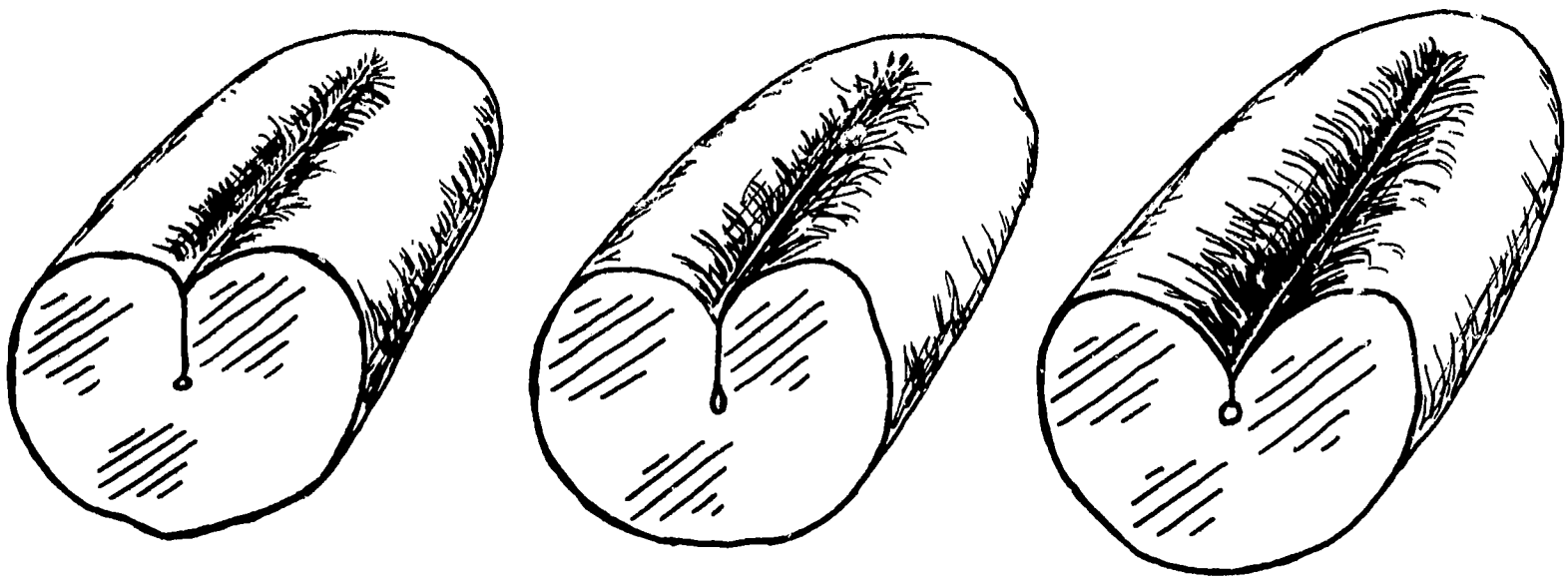
ANGULAR

CREASE WIDTHS



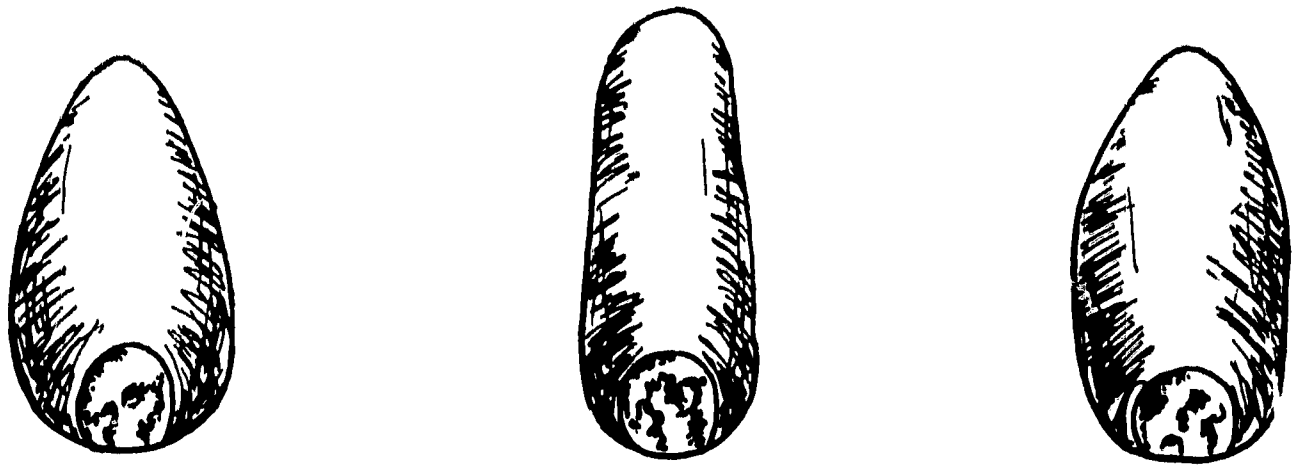
NARROW MIDWIDE WIDE

CREASE DEPTHS



SHALLOW MIDDEEP DEEP

KERNEL SHAPES

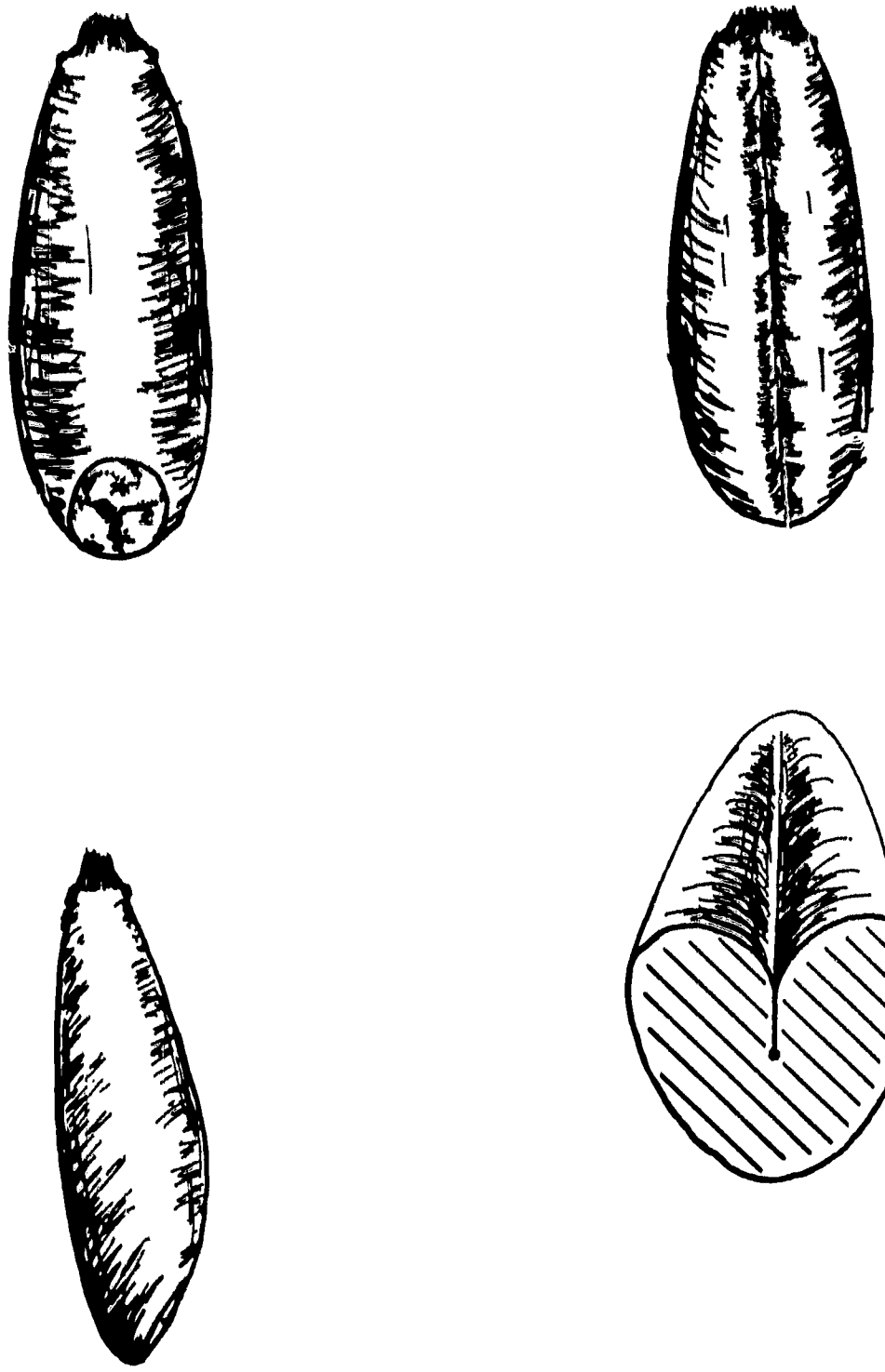


OVAL

ELLIPTICAL

OVATE

HARD RED WINTER WHEAT



BRUSH
MIDLONG

LONG, SLENDER
KERNEL

ROUNDED
CREASE

SMALL
GERM

WIDEST NEAR
GERM END

ROUNDED
CHEEKS

SMOOTH
BACK

HARD RED SPRING WHEAT

LONG, POINTED
BRUSH WITH A
DEFINATE RING

SHORT, PLUMP
KERNEL

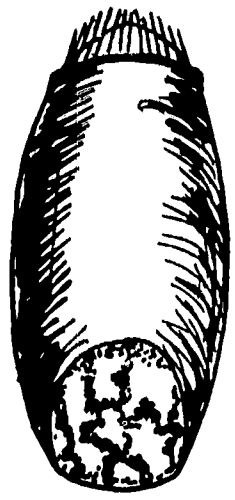
MIDDEEP
CREASE

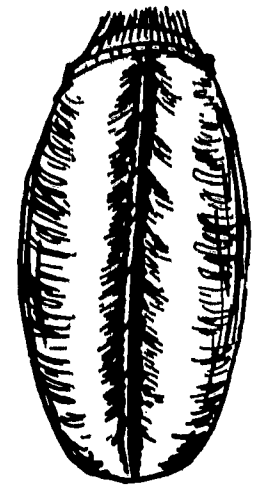
LARGE
GERM

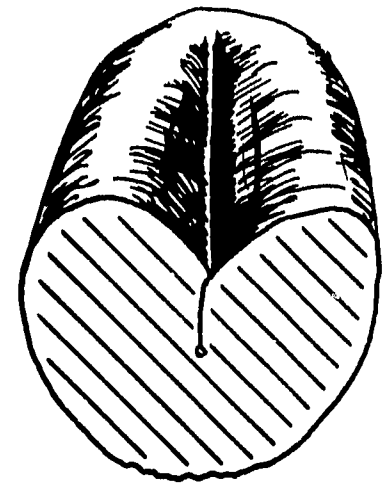
ANGULAR
CHEEKS

BACK RIDGE
OFFSET WITH
DIMPLE

SOFT RED WINTER WHEAT







BRUSH MIDLONG
DEFINATE RING

BARREL
SHAPED
KERNEL

OPEN
CREASE

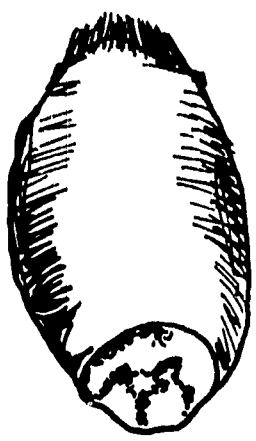
LARGE
GERM

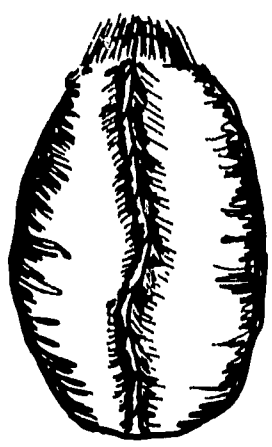
WIDEST
AT
MIDDLE

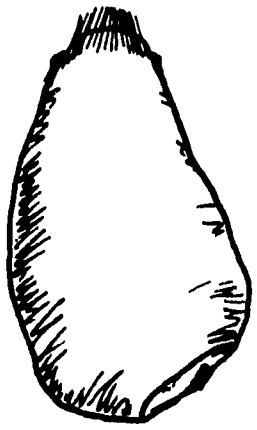
ROUNDED
CHEEKS

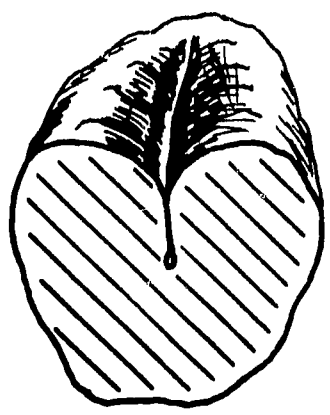
ROUND, SOMETIMES
WRINKLED BACK

WHITE CLUB WHEAT









BRUSH MIDLONG
SOMETIMES
POINTED

VERY IRREGULAR
SHAPED KERNEL

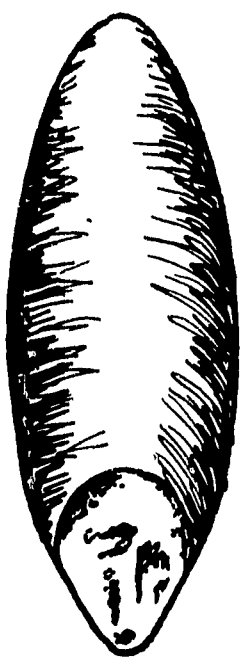
MIDDEEP
CREASE

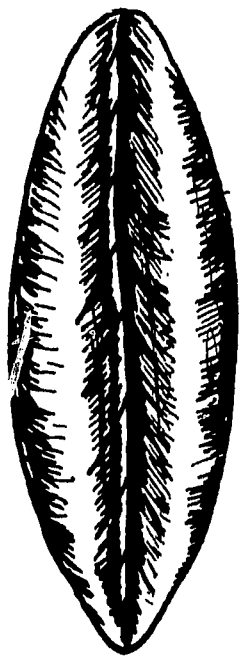
MIDSIZE
GERM

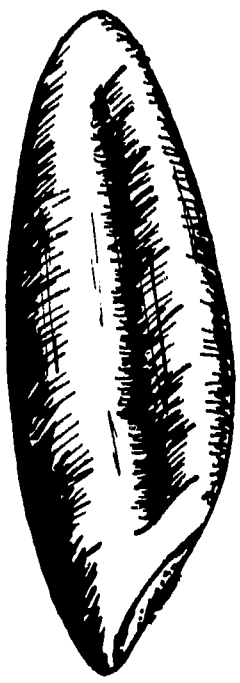
ROUNDED
CHEEKS

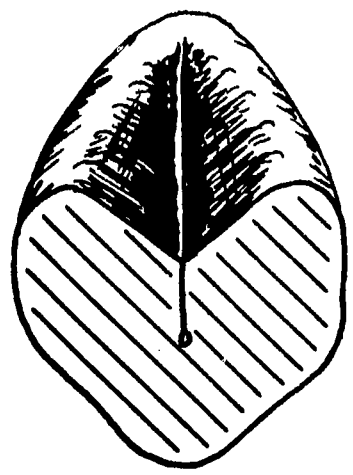
HUMP BACK
NEAR GERM

AMBER DURUM WHEAT









BRUSH VERY
SHORT OR
LACKING

LONG KERNEL

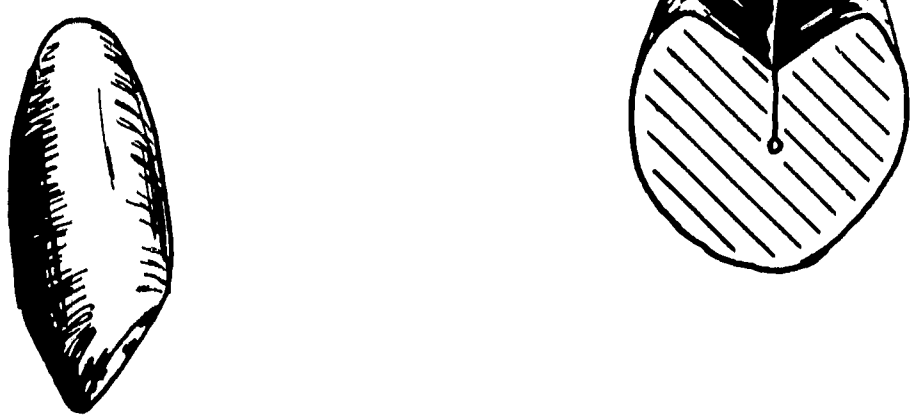
DEEP
CREASE

LONG POINTED
GERM

ANGULAR
CHEEKS

HIGH RIDGE
DOWN BACK

RED DURUM WHEAT



BRUSH
LACKING

WIDEST NEAR
TIP END

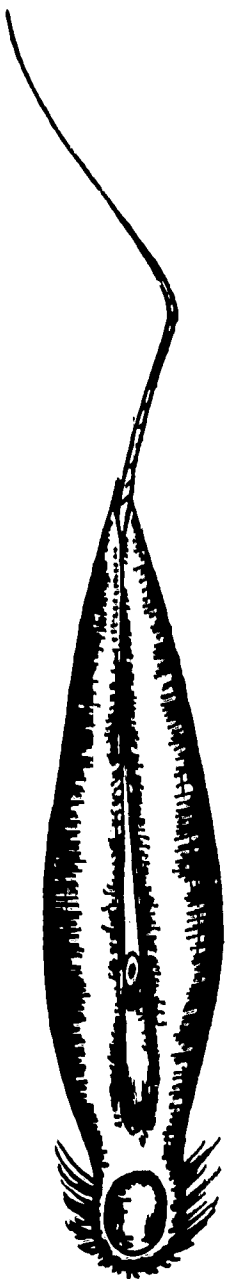
MIDDEEP
CREASE

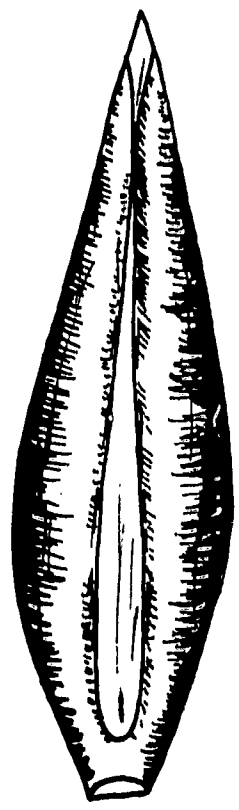
SHARP
POINTED
GERM

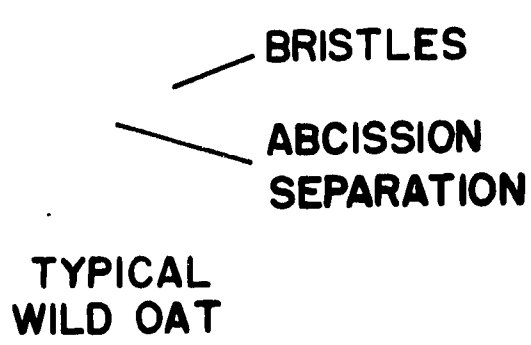
ANGULAR
CHEEKS

ROUNDED
BACK

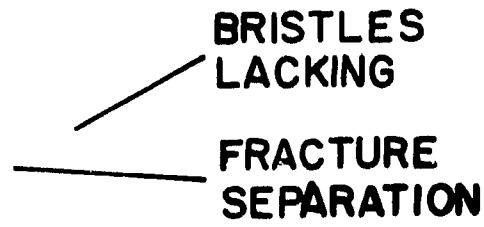
OAT SEED





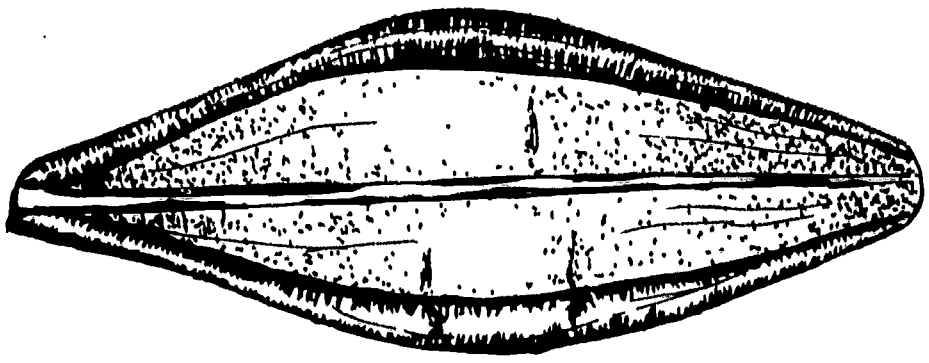


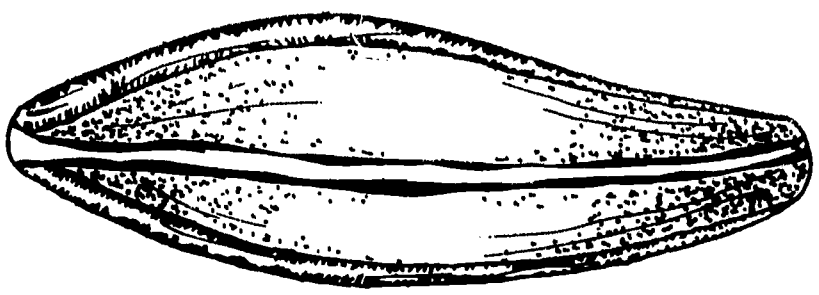
TYPICAL
WILD OAT



TYPICAL
CULTIVATED OAT

BARLEY





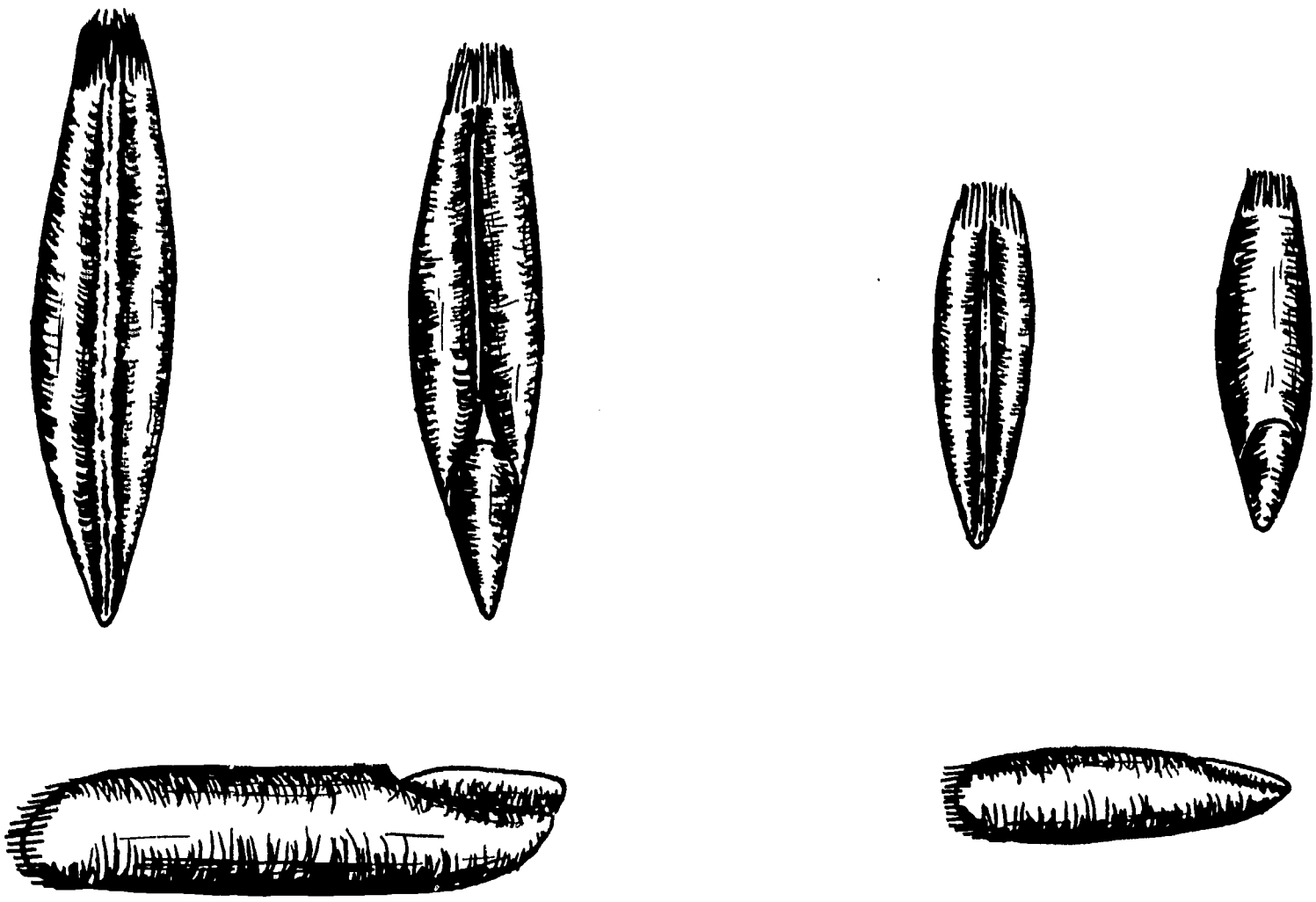
2-ROW

ALL KERNELS ARE STRAIGHT

6-ROW

2/3 OF THE KERNELS ARE
BENT DUE TO CROWDING
AT RACHIS JOINT

RYE



TETRA PETCUS

DEEP, OPEN CREASE
LARGE, POINTED GERM
RIDGE ON BACK
SHORT BRUSH

BALBOA

SHALLOW, TIGHT CREASE
LARGE, POINTED GERM
SMOOTH BACK
SHORT BRUSH

LEGUMES

SECTION III

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

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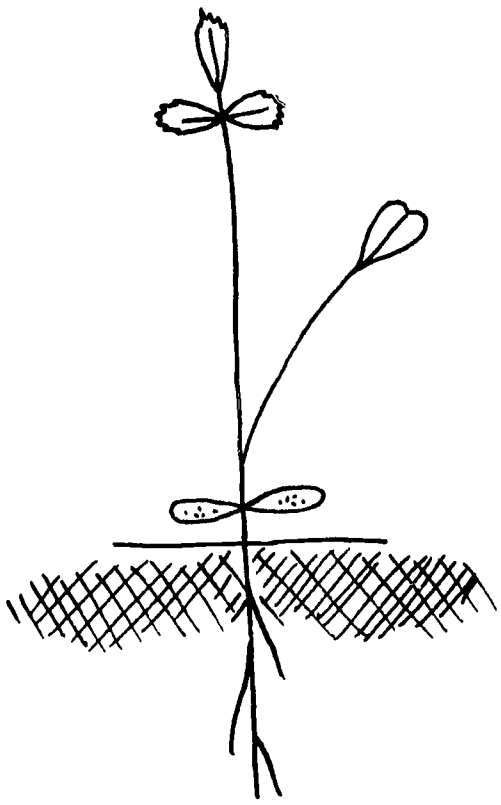

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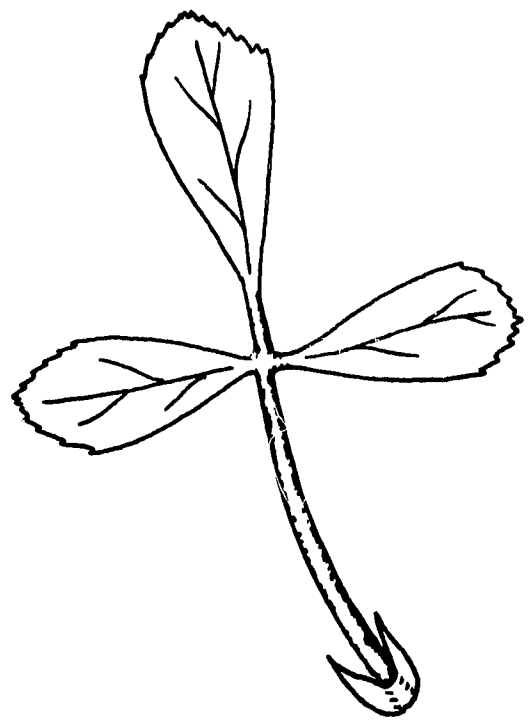
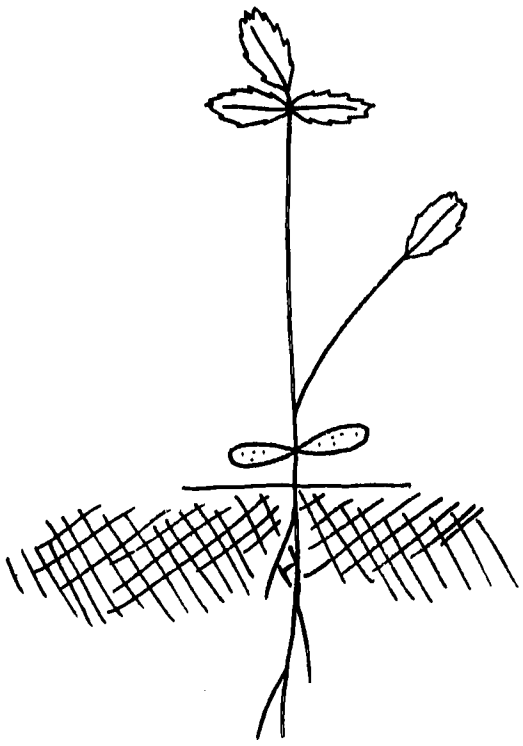


MATURE LEAF

SWEETCLOVER



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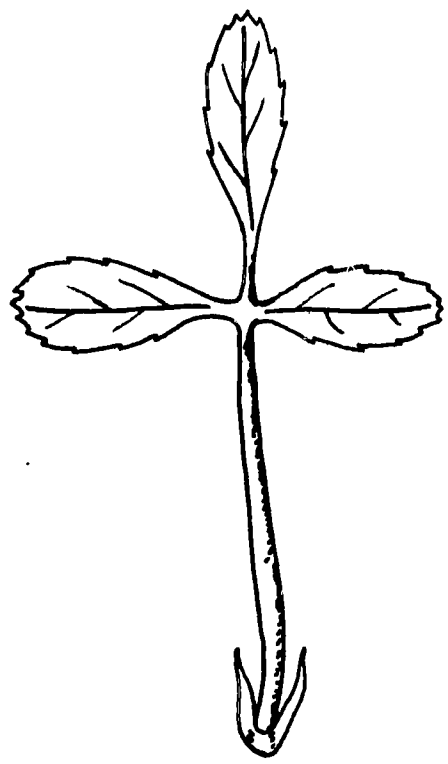
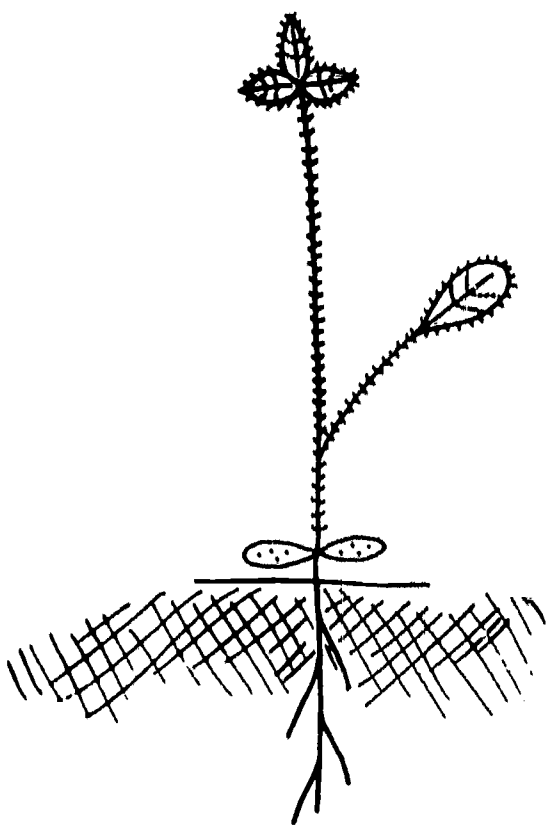


MATURE LEAF

RED CLOVER



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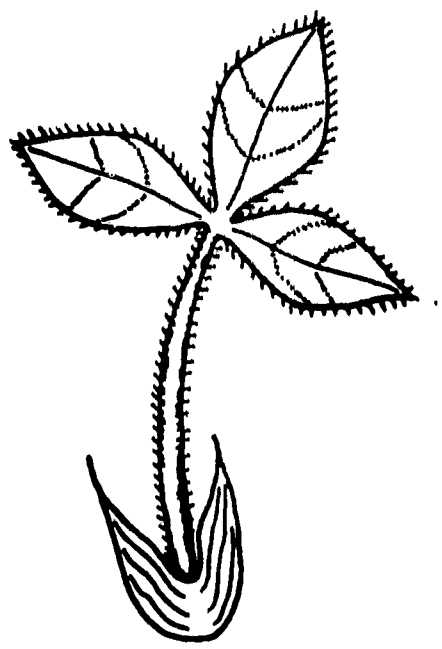
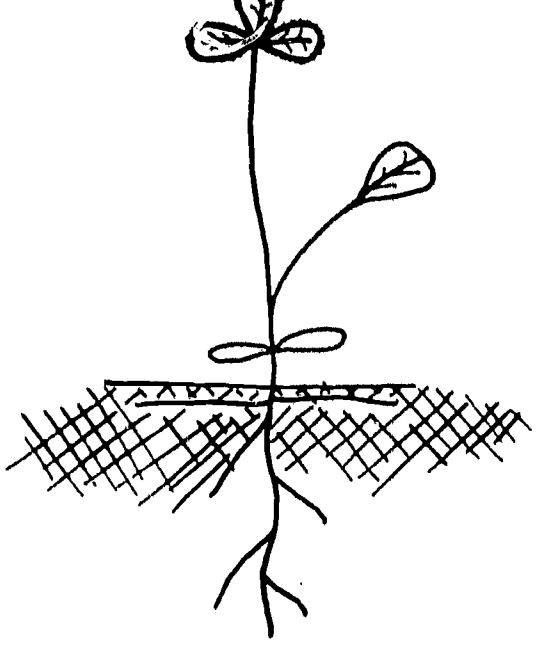


MATURE LEAF

WHITE CLOVER



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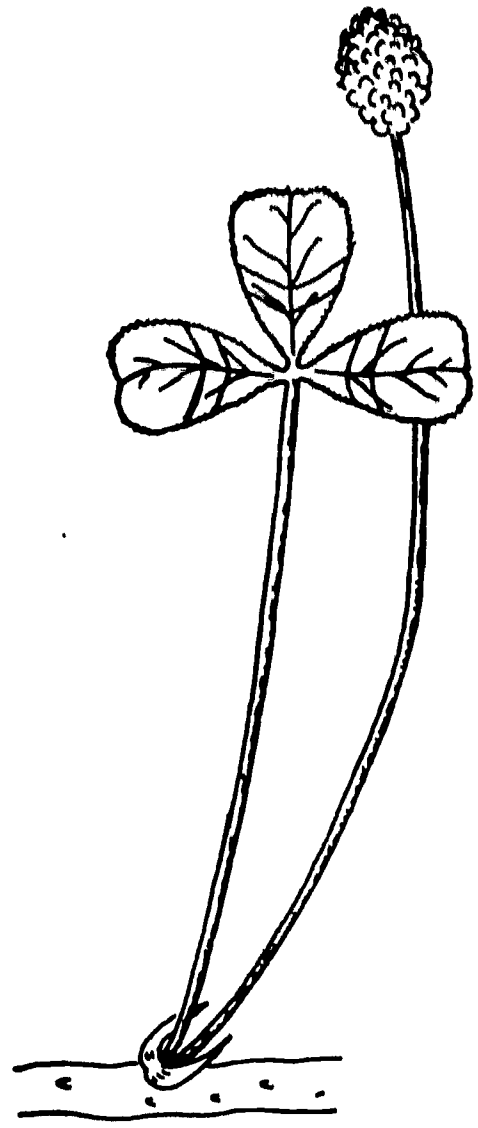
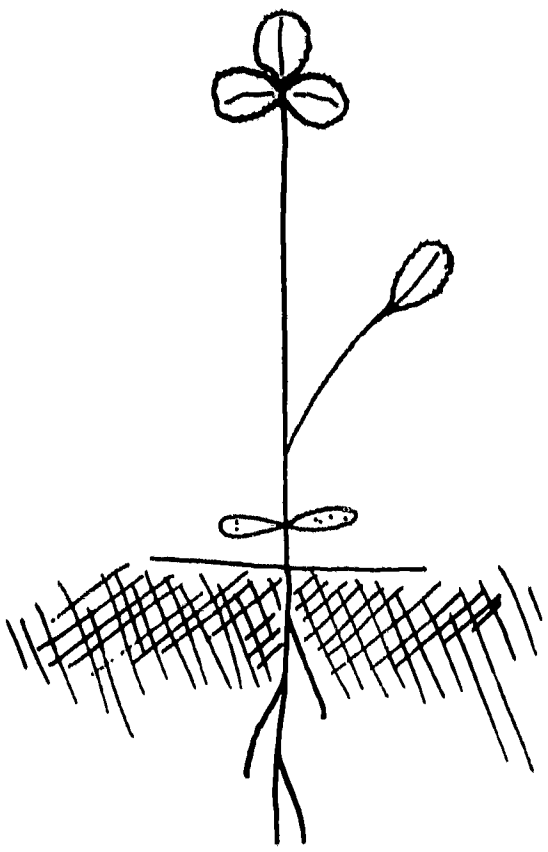


MATURE LEAF

ALSIKE CLOVER



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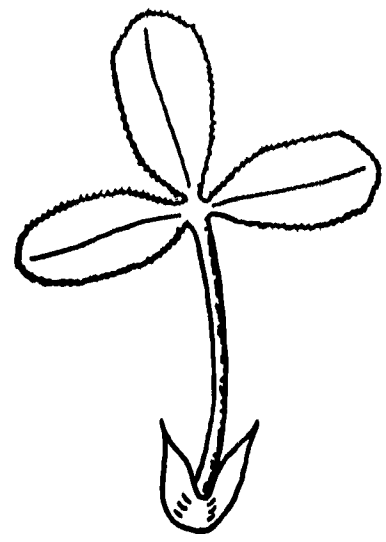
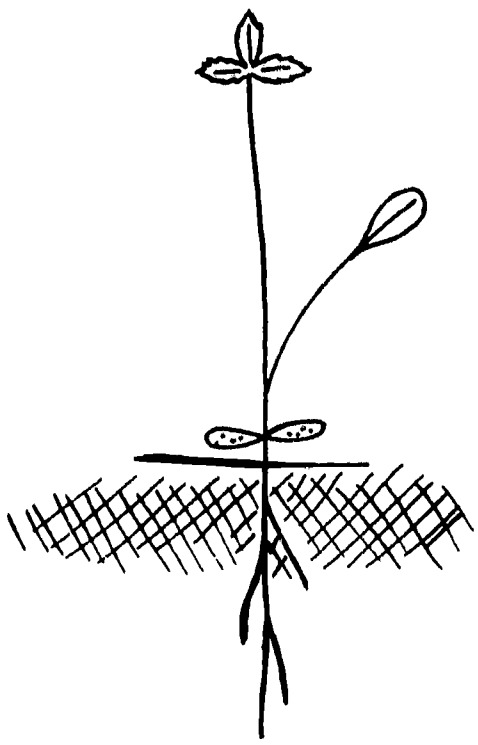


MATURE LEAF

STRAWBERRY CLOVER



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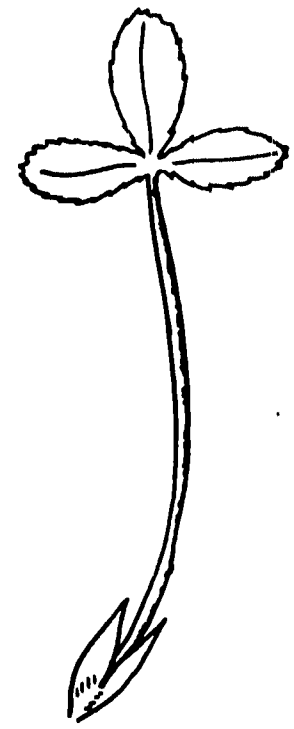
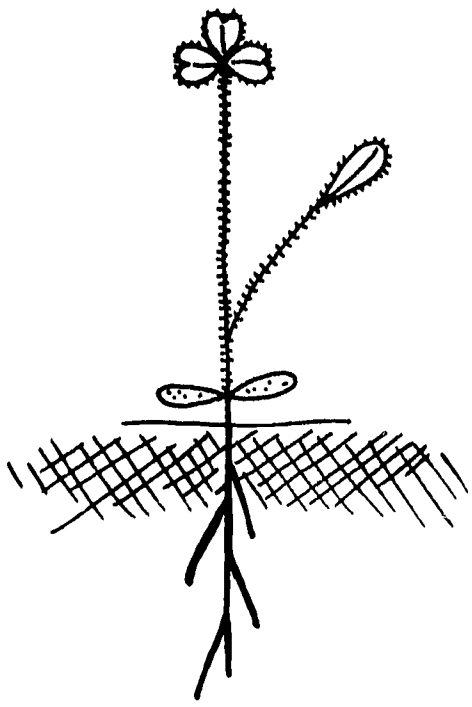


MATURE LEAF

SUBTERRANEAN CLOVER



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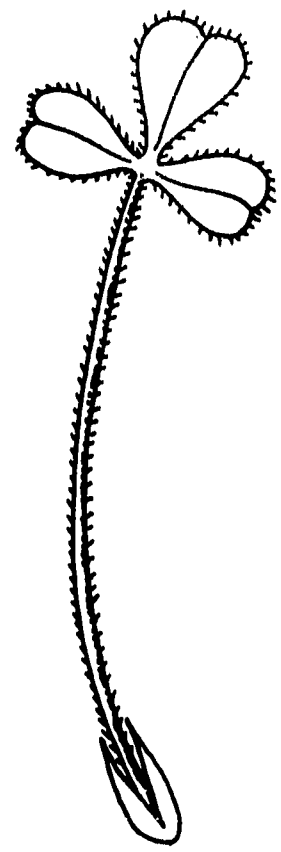
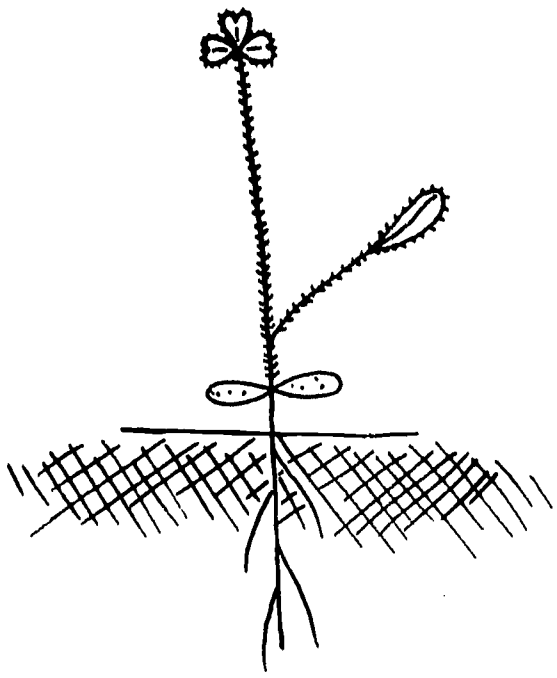


MATURE LEAF

CRIMSON CLOVER



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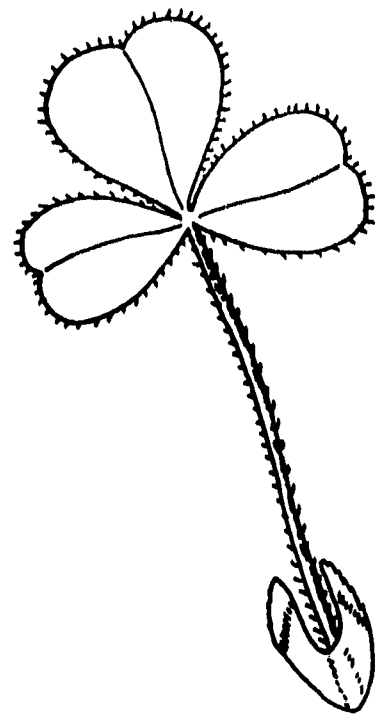
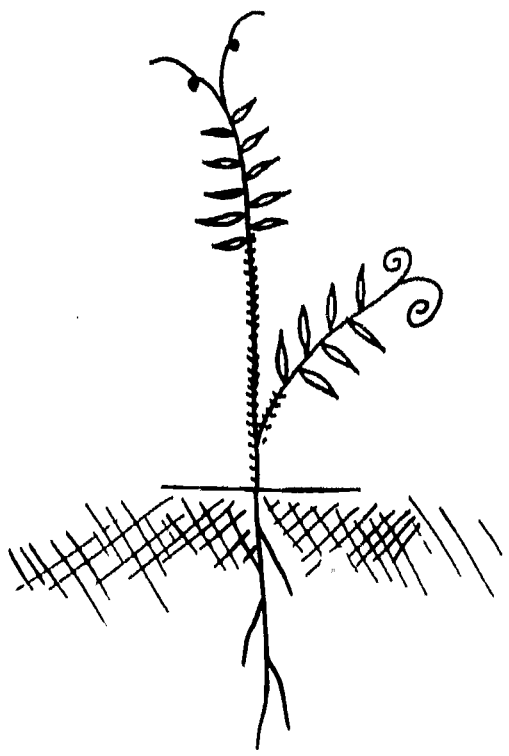


MATURE LEAF

HAIRY VETCH



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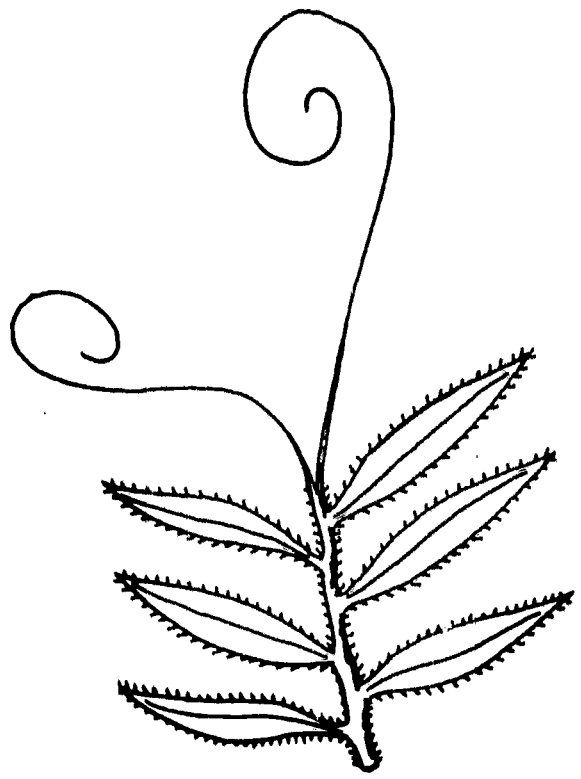
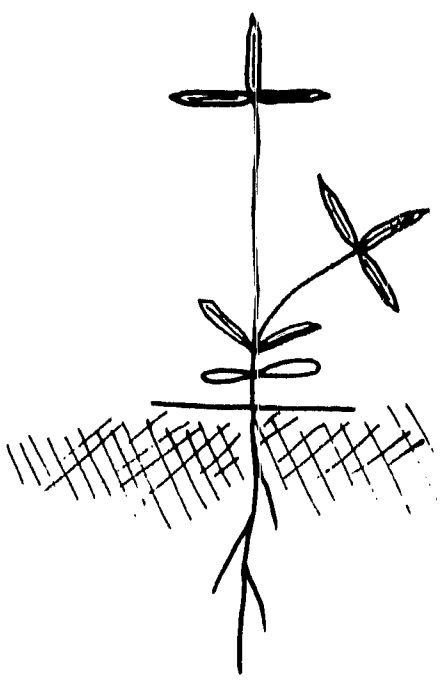


MATURE LEAF

BIRDSFOOT TREFOIL



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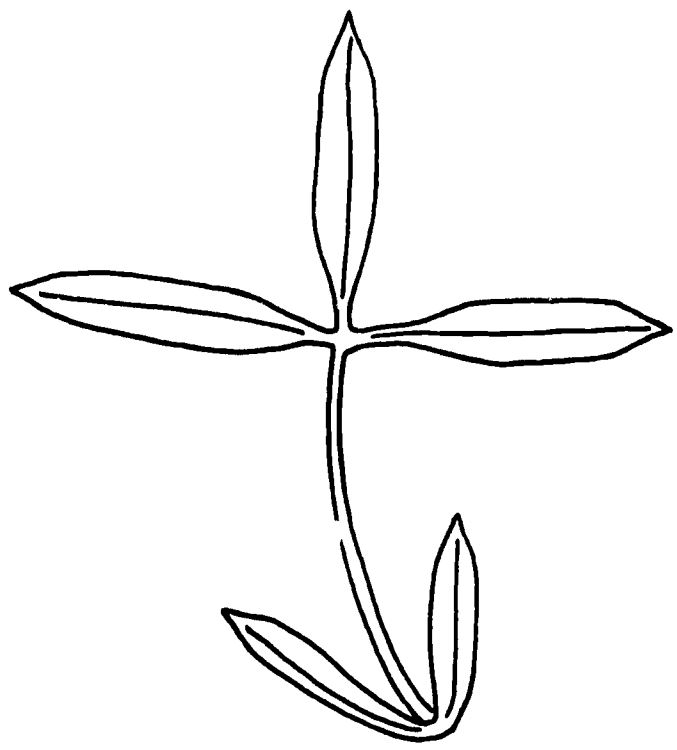

MATURE LEAF

GRASSES

SECTION IV

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

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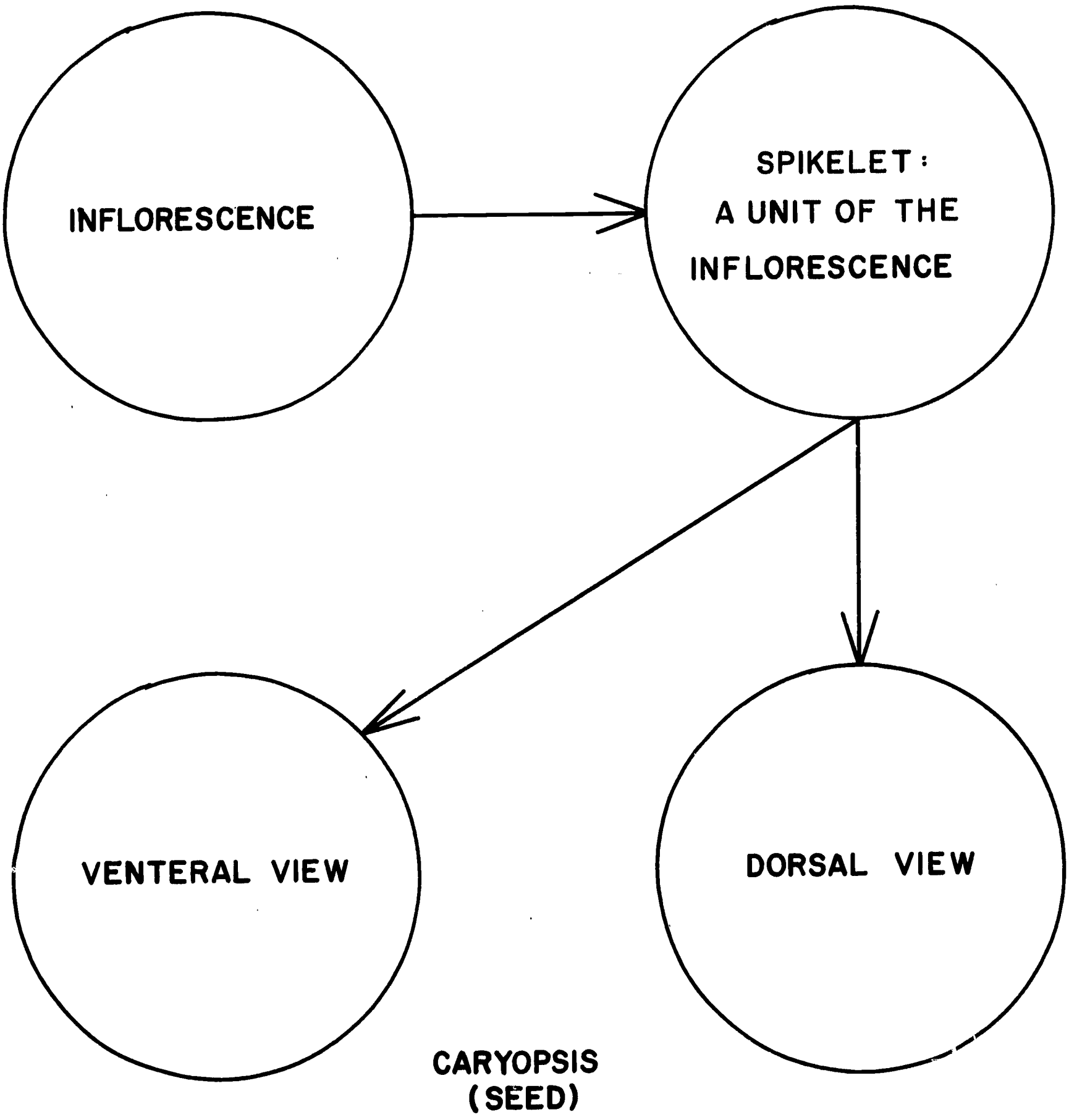
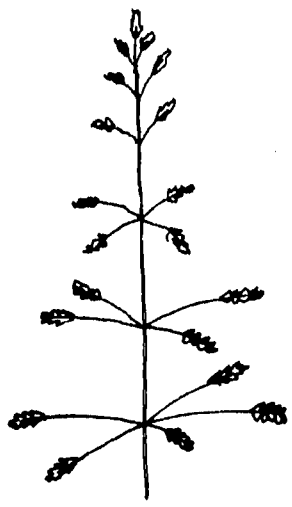
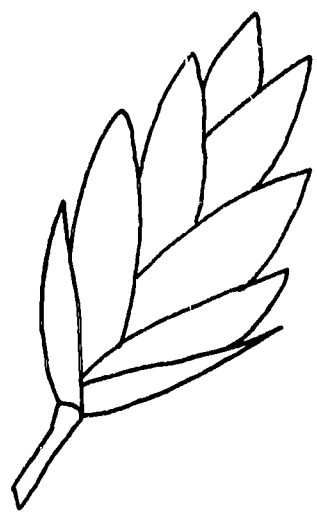
PROSPECTIVE VIEW OF THE VARIOUS PARTS OF THE GRASS INFLORESCENCE SHOWING LEVELS OF DEVELOPMENT.



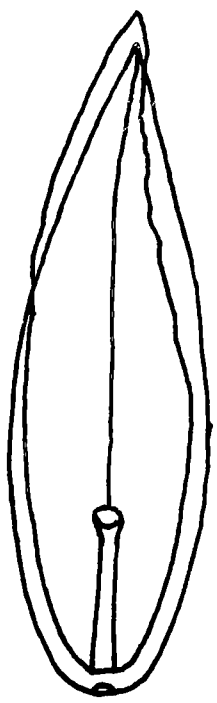
KENTUCKY BLUEGRASS

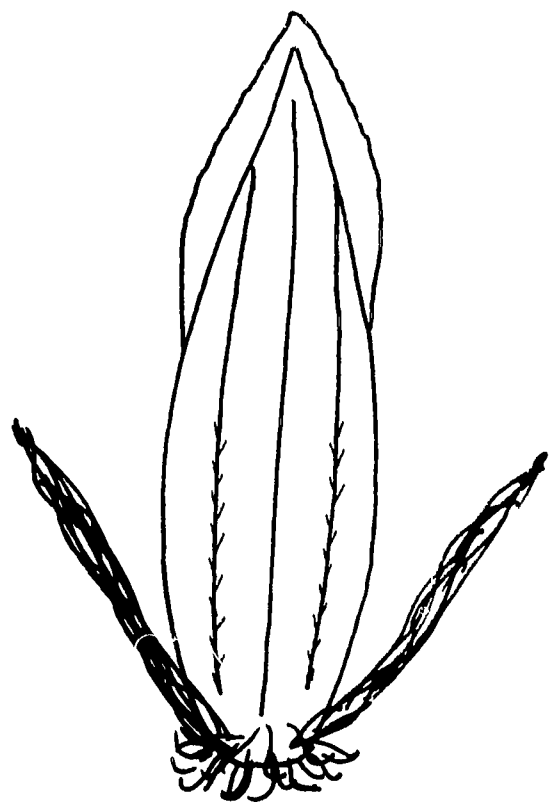


INFLORESCENCE



SPIKELET





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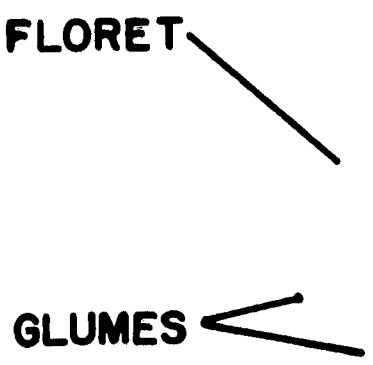


PALEA

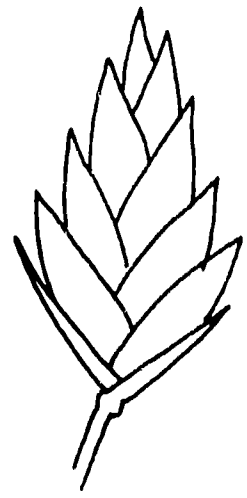
LEMMA

RACHILLA

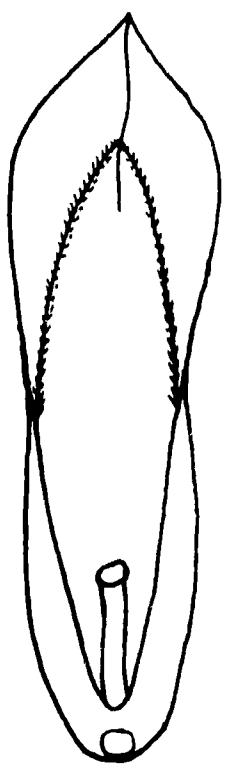
STERILE FLORETS

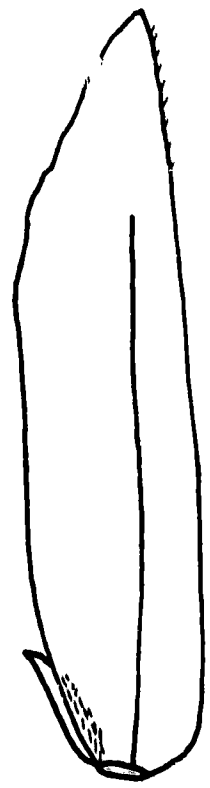
BIG BLUEGRASS

INFLORESCENCE



SPIKELET

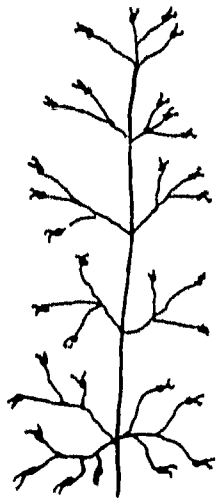




SEED

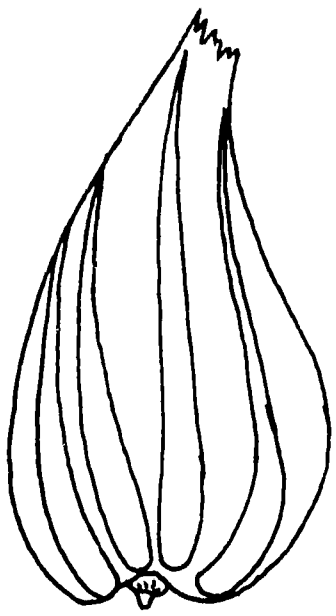

FLORET
GLUMES
LEMMA
PALEA
RACHILLA

BULBOUS BLUEGRASS



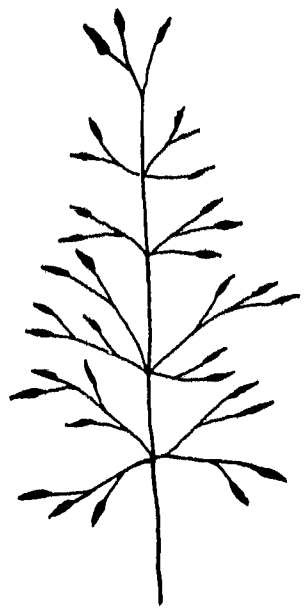
INFLORESCENCE

BULBLET



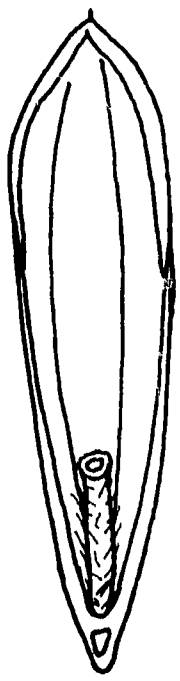
BULB

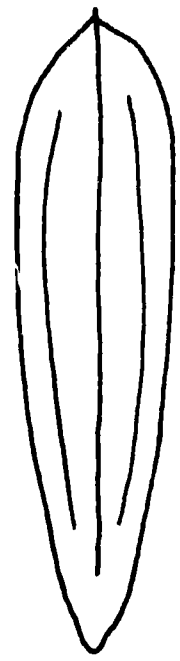
SMOOTH BROMEGRASS



INFLORESCENCE

SPIKELET





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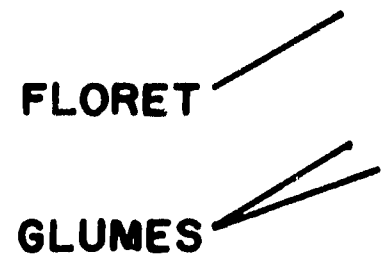

FLORET
GLUMES

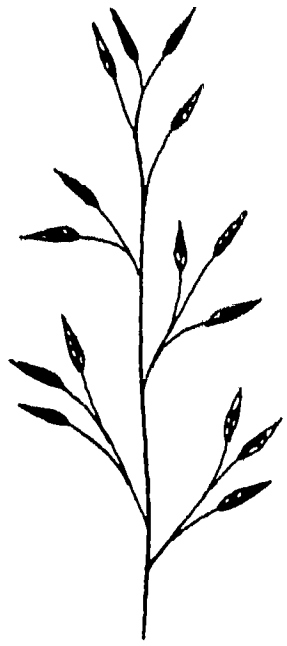

AWNLET


PALEA


LEMMA

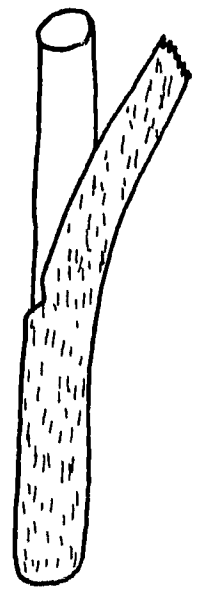

RACHILLA

MOUNTAIN BROMEGRASS



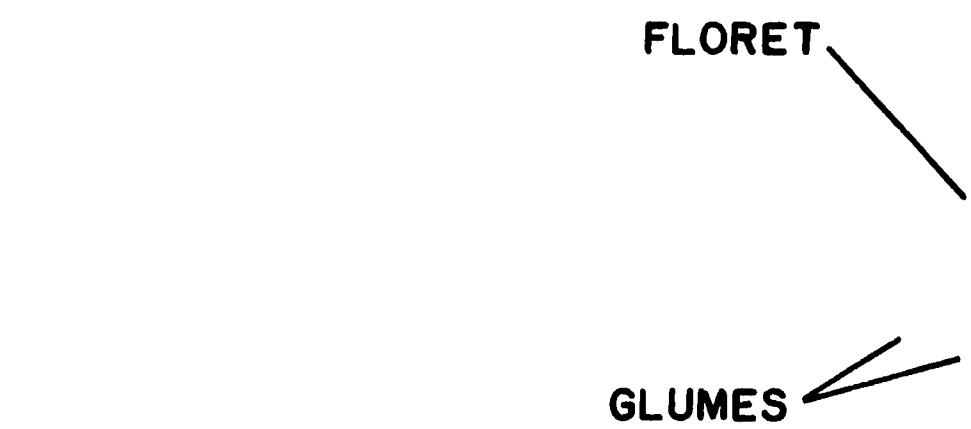
INFLORESCENCE

SPIKELET



STEM

SEED



PUBESCENT
LEAF AND
SHEATH

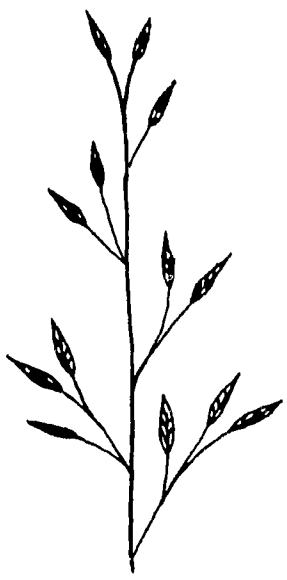
AWN

LEMMA

PALEA

RACHILLA

TALL FESCUE



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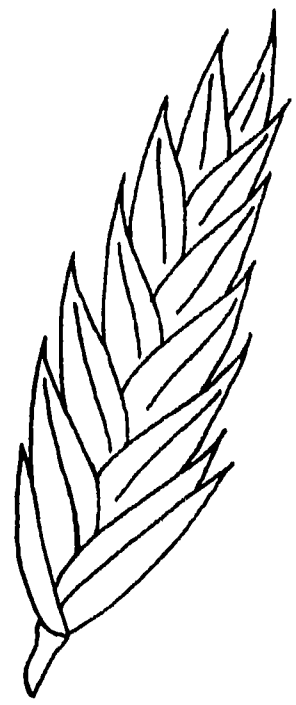

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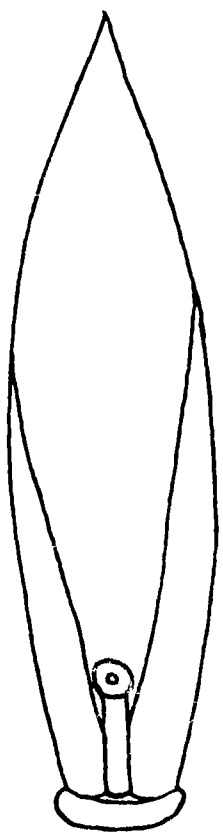

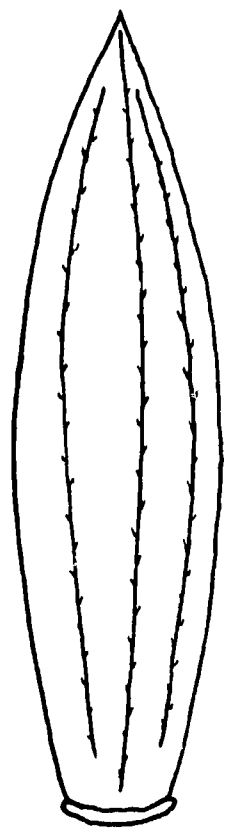

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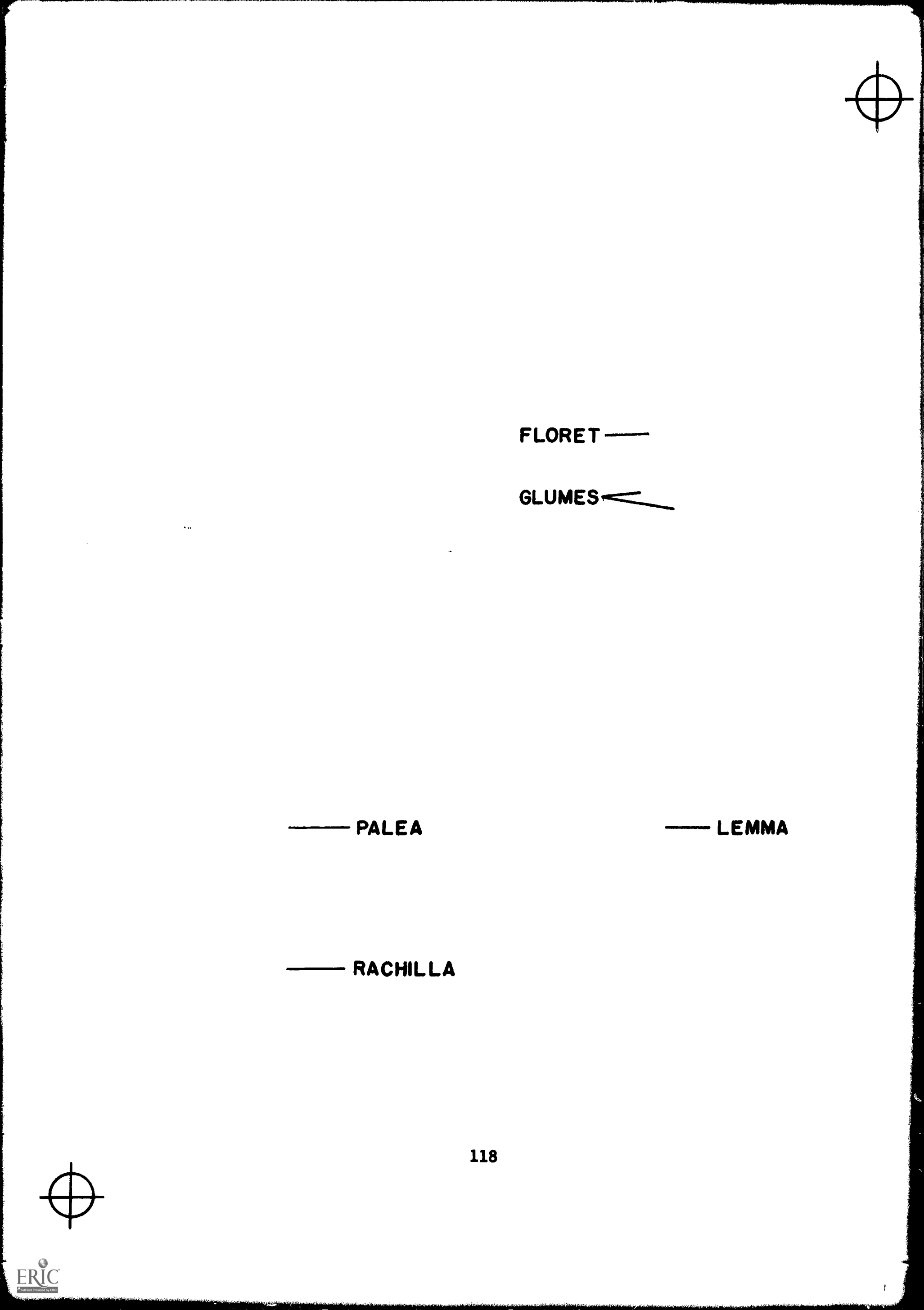
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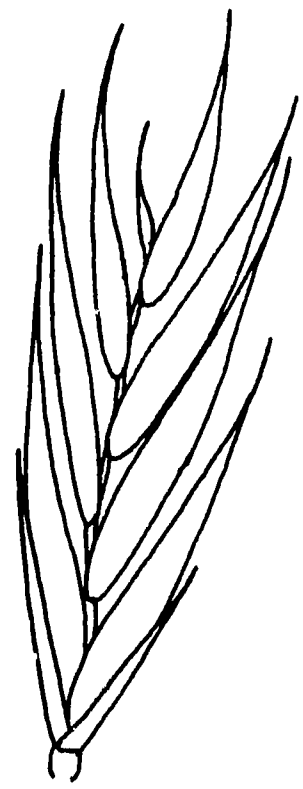
GLUMES
PALEA
LEMMA
RACHILLA

RED FESCUE

INFLORESCENCE



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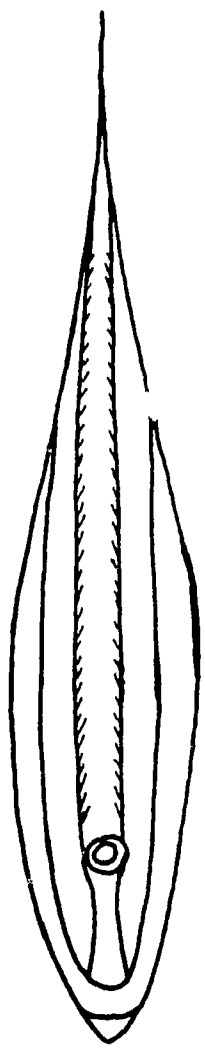

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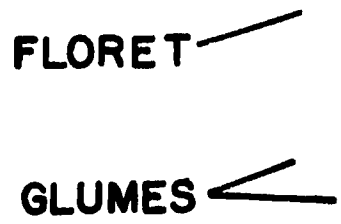
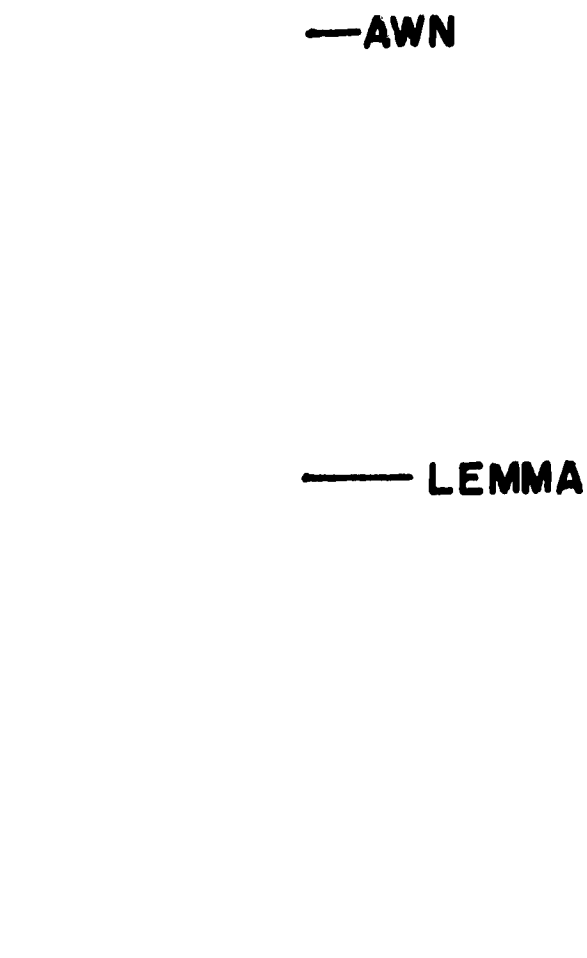
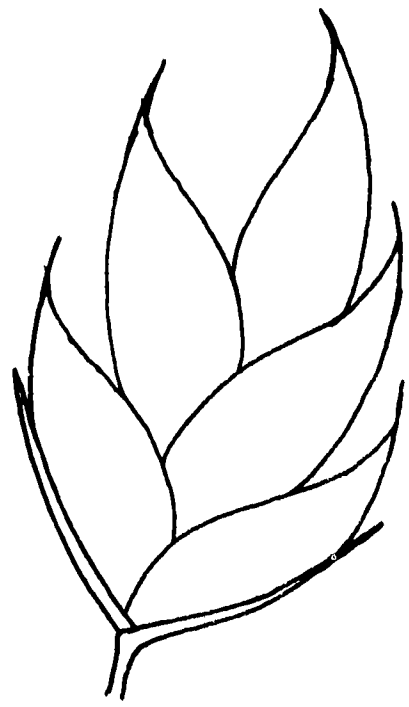

FLORET
GLUMES


AWN
LEMMA
PALEA
RACHILLA

ORCHARDGRASS

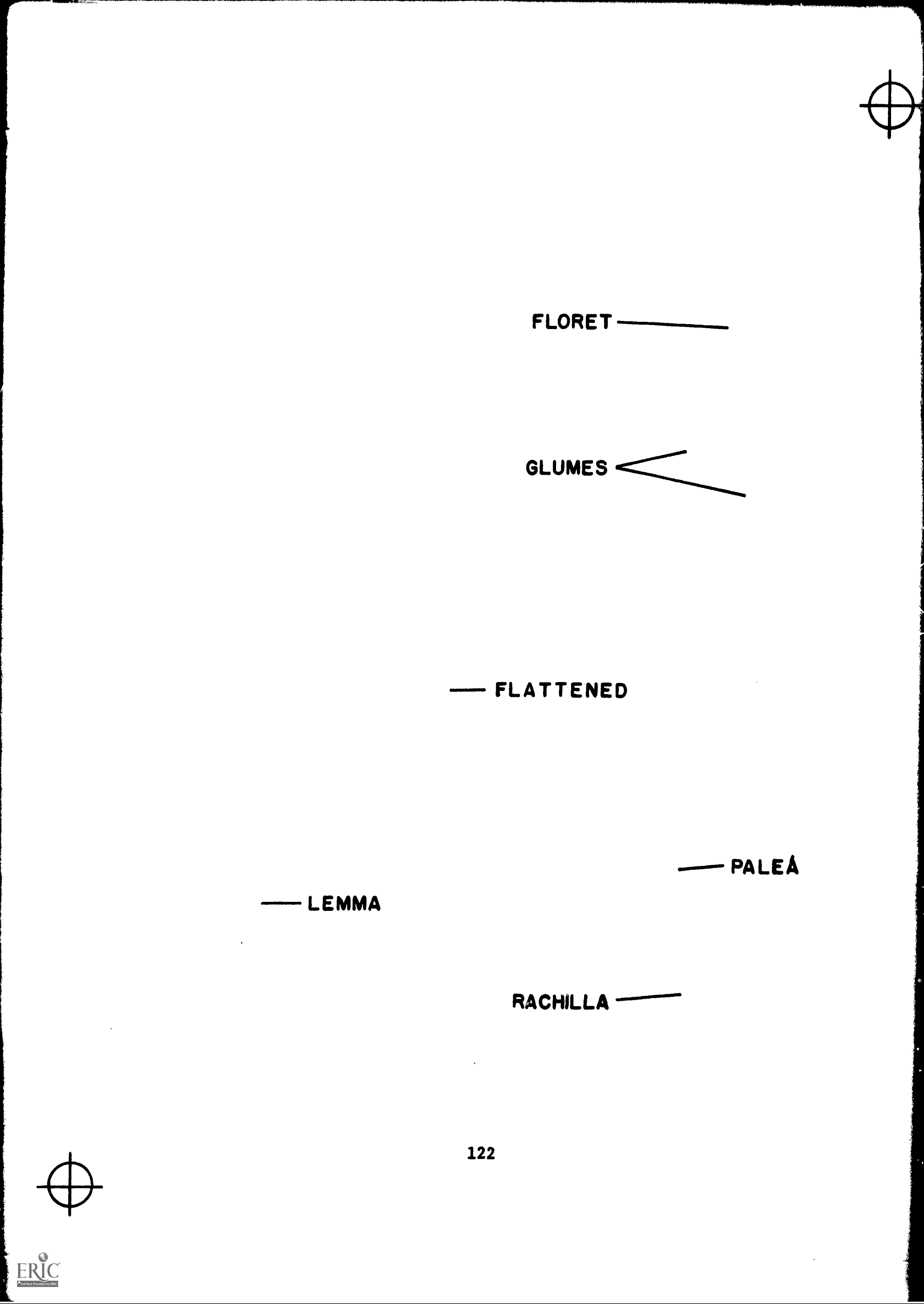
INFLORESCENCE

STEM

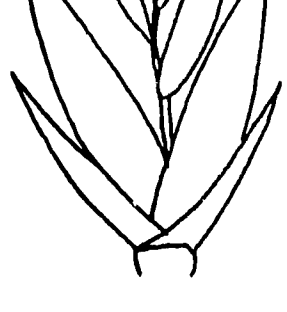


SPIKELET

SEED


FLORET
GLUMES
FLATTENED
PALEA
LEMMA
RACHILLA

INTERMEDIATE WHEATGRASS



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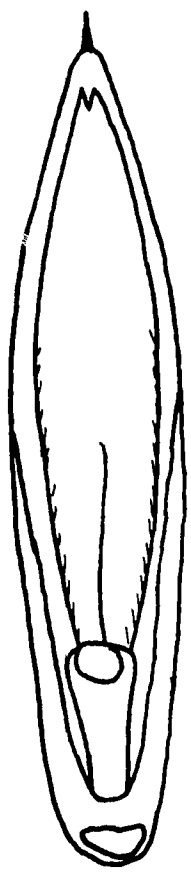

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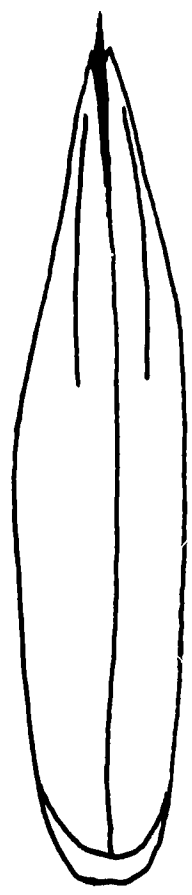

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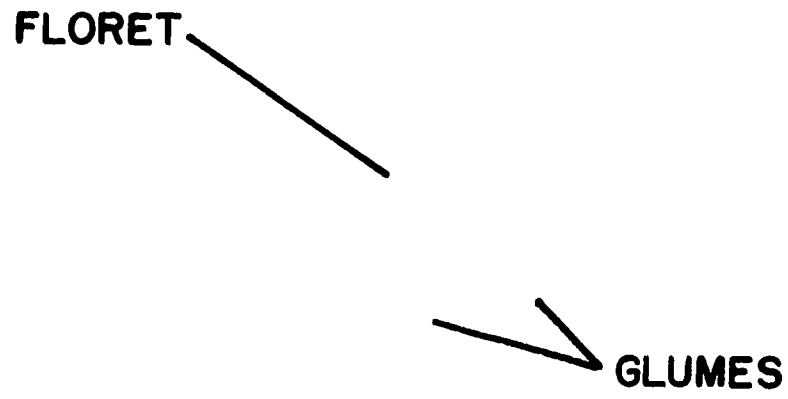
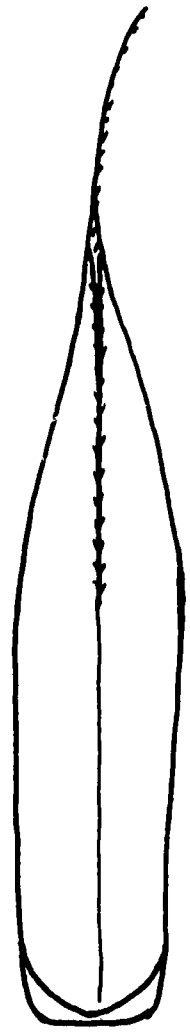

FLORET
GLUMES
PALEA
LEMMA
RACHILLA

CRESTED WHEATGRASS

INFLORESCENCE

SPIKELET



SEED

FLORET

GLUMES

AWN

LEMMA

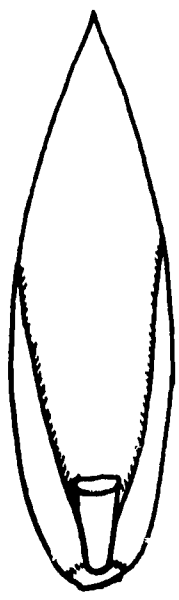
PALEA

RACHILLA

PERENNIAL RYEGRASS

INFLORESCENCE

SPIKELET



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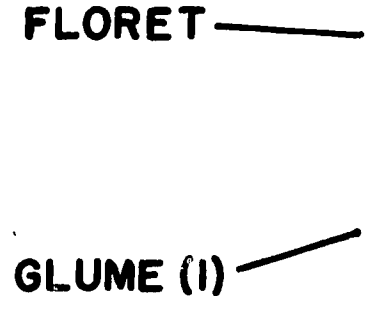
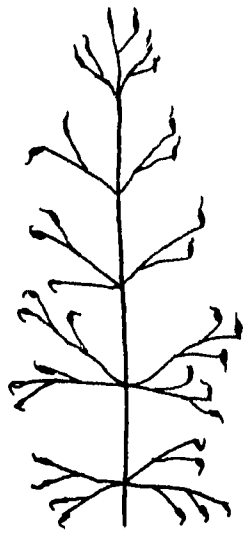
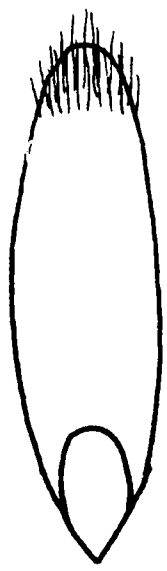

FLORET
GLUME (1)
PALEA
LEMMA
RACHILLA

TALL OATGRASS



INFLORESCENCE

SPIKELET



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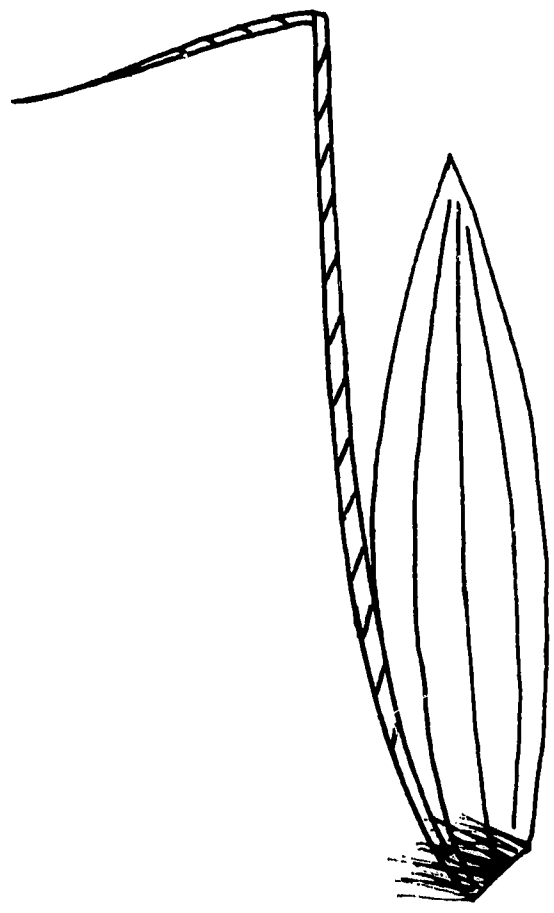

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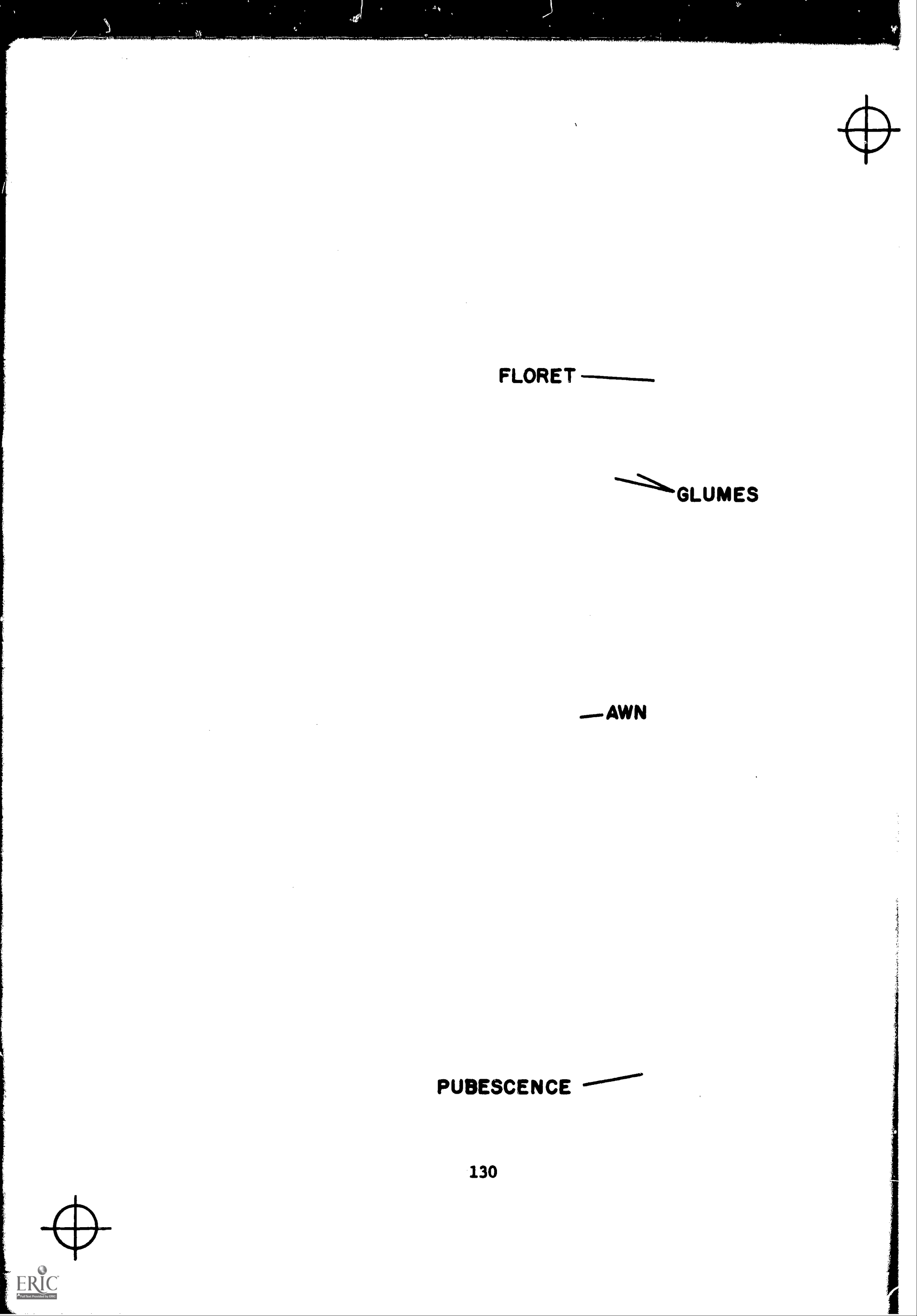
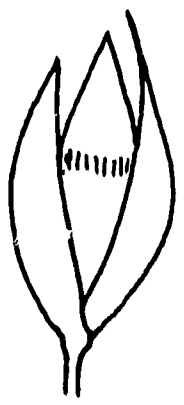

FLORET
GLUMES
AWN
PUBESCENCE

REED CANARYGRASS

INFLORESCENCE



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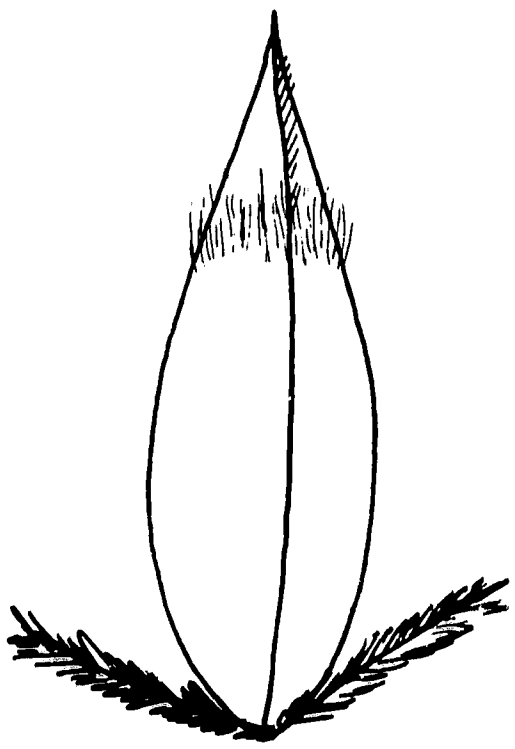

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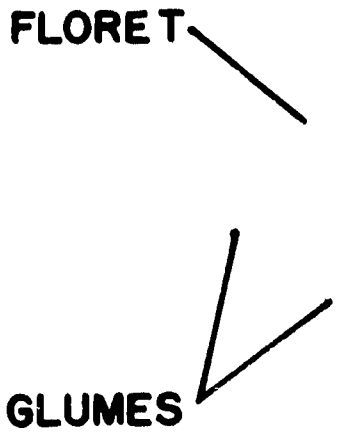
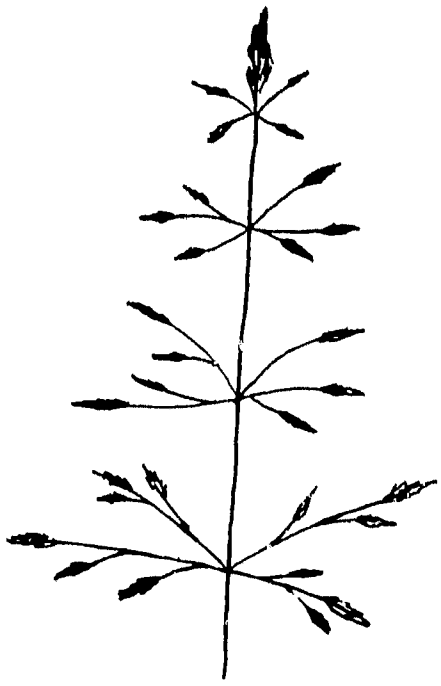


STERILE FLORETS

RED TOP



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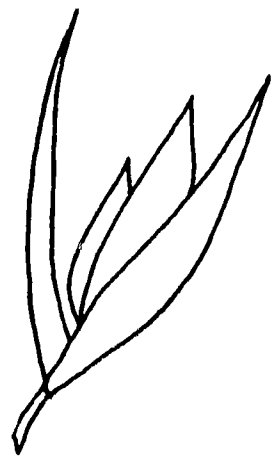

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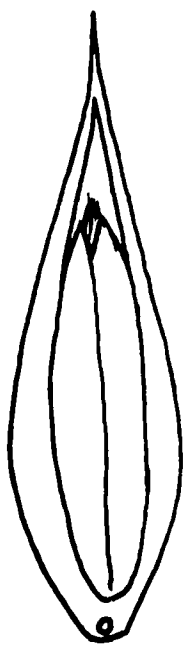

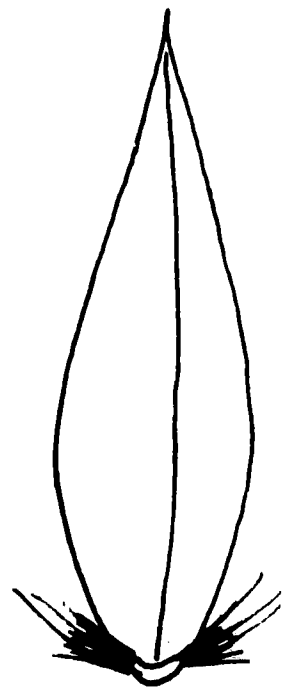

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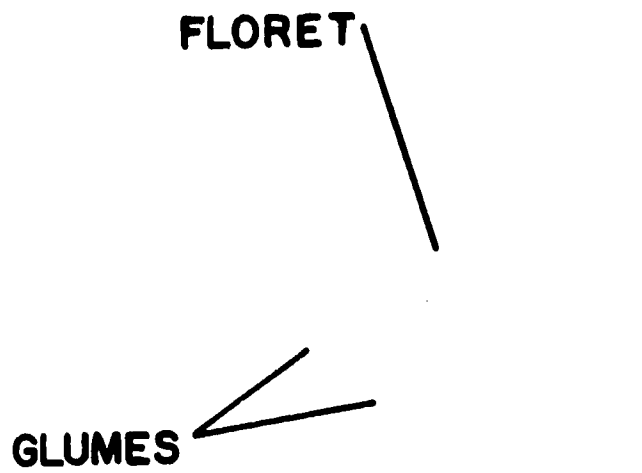
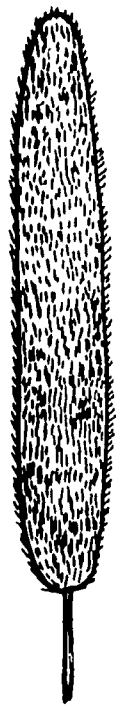

FLORET
GLUMES
LEMMA
PALEA
PUBESCENCE

TIMOTHY



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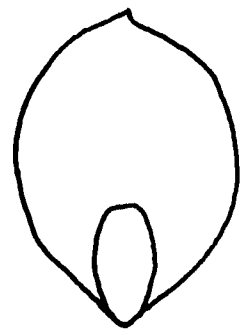

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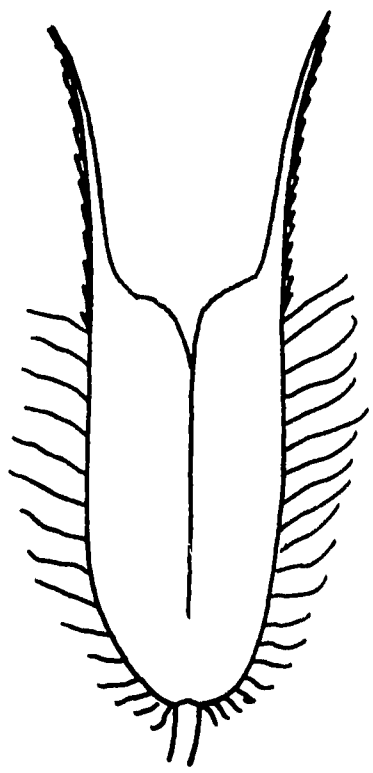
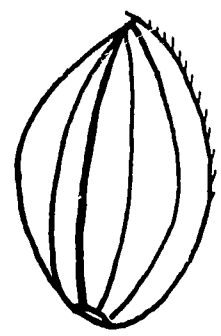


GLUMES



FLORET

WEEDS

SECTION V

TRANSPARENCY MASTERS FOR CROP AND WEED IDENTIFICATION

Dwane G. Miller Gilbert A. Long Clarence E. Manning

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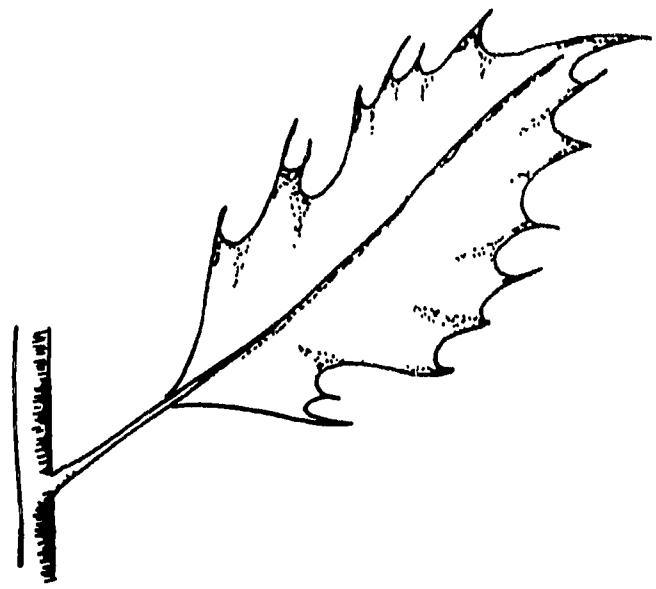
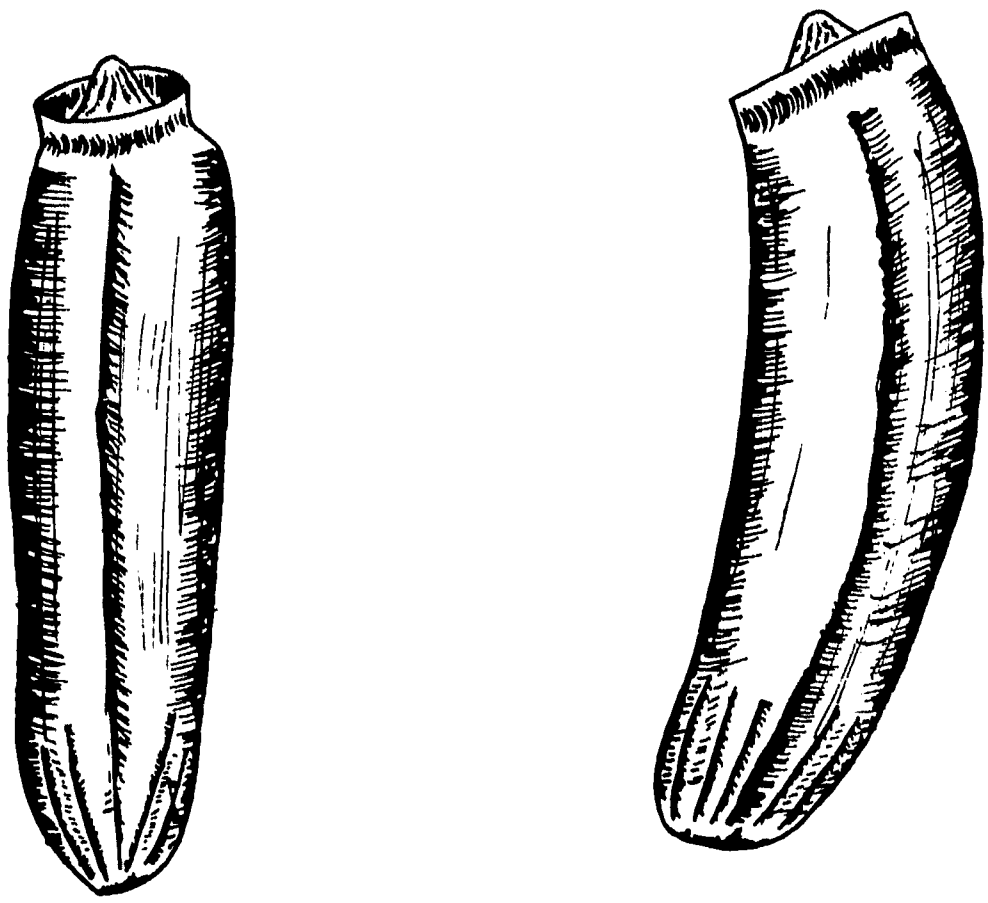
CANADA THISTLE



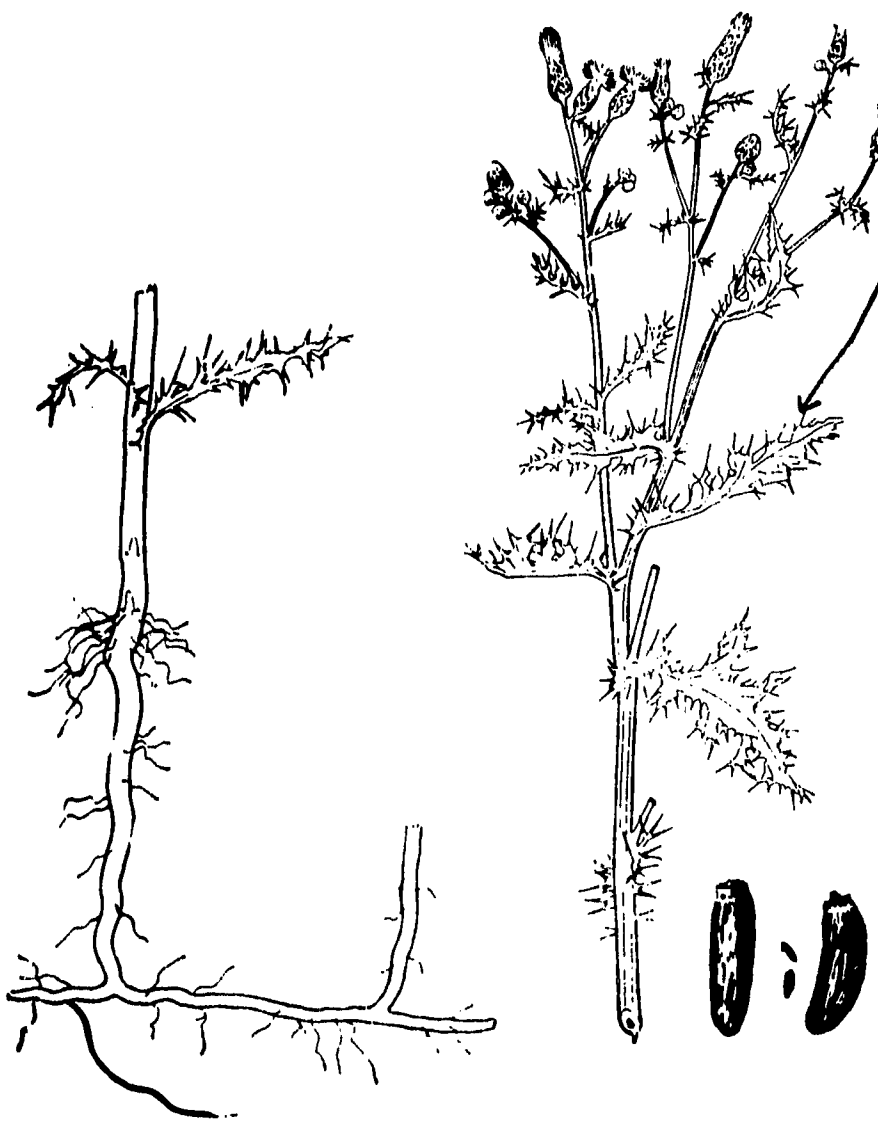
LEAF



SEED

CANADA THISTLE

(Cirsium arvense (L.) Scop)
Cursed thistle, Devil's thistle



Rose-purple flowers

Leaves irregular, deeply cut relatively smooth to spiny margins

Both male and female flowers

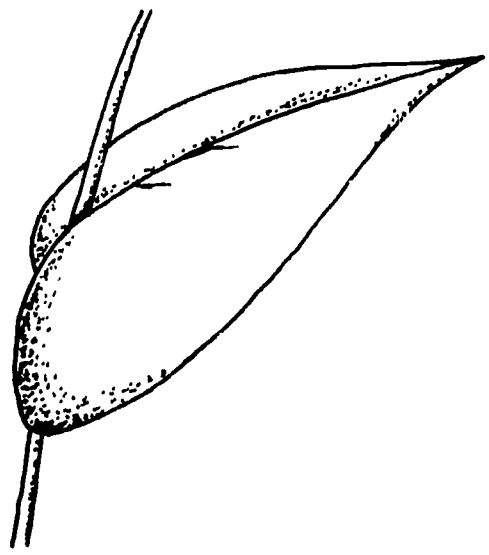
Plant erect branching near the top

Grows 2 to 7 feet high

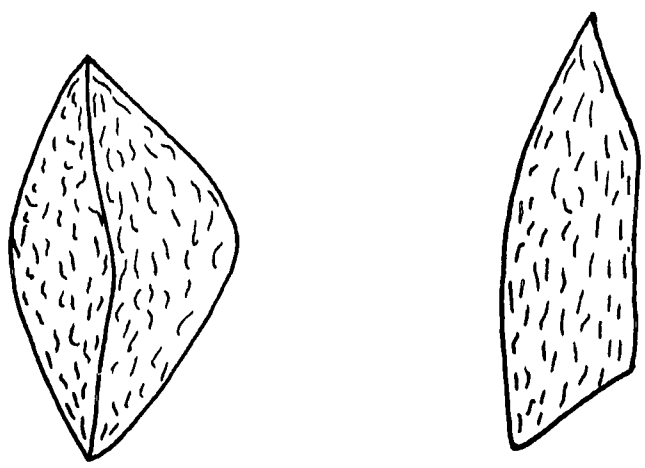
Reproduces by seed and by underground rootstocks

Perennial

DALMATIAN TOADFLAX



LEAF



SEED

DALMATIAN TOADFLAX

(Linaria Dalmantica)

Bright yellow flowers tinged with orange

Flowers look like those of cultivated snapdragons

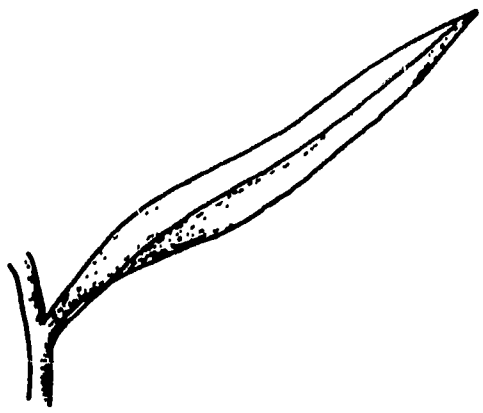
Upper leaves more heart shaped and clasp the stem

Grows 1 to 4 feet high

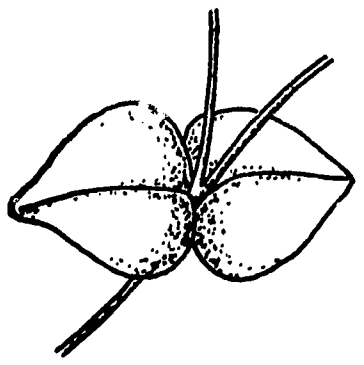
Reproduces by seed and underground rootstocks

Perennial

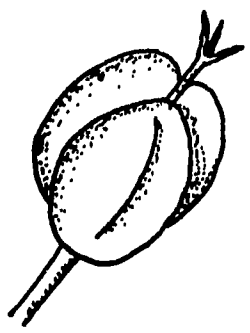
LEAFY SPURGE



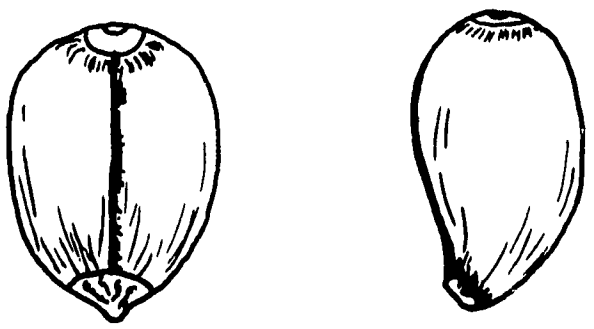
LOWER LEAF



UPPER LEAF



CAPSULE



SEED

LEAFY SPURGE

(Euphorbia esula (L.) Hill)

Entire top portion of plant may appear yellowish green at this stage

Leaves, alternate, narrow and lace-like

Seeds borne in a three-lobed capsule

Entire plant has a milky juice

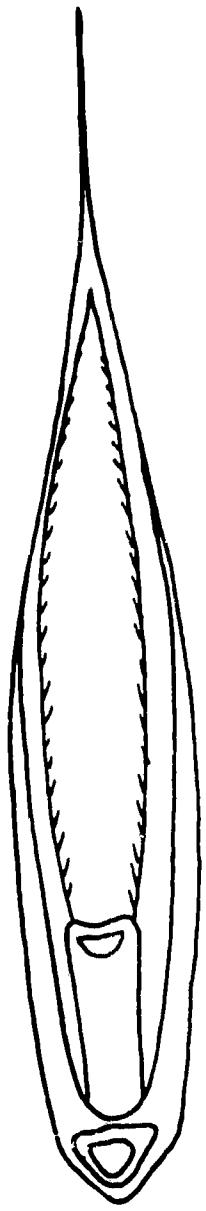
Reproduces by seed and underground rootstalks

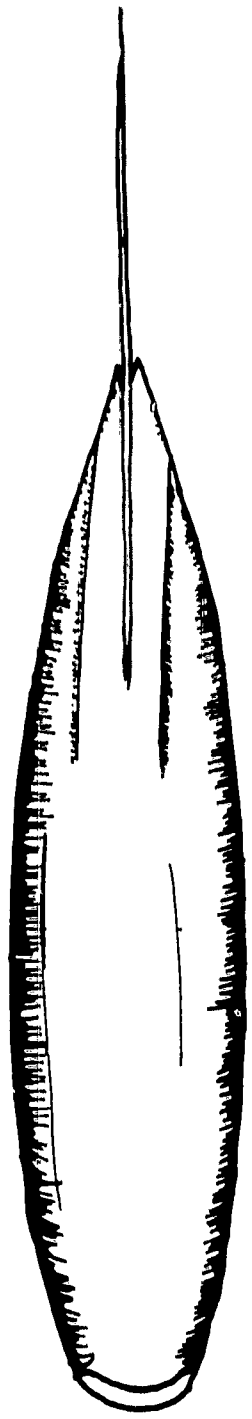
Perennial

QUACKGRASS

INFLORESCENCE

SPIKELET





SEED

QUACKGRASS

(Agropyron repens (L.) Beauv.)
Couchgrass, Devil's grass

Inconspicuous flowers

Grows 1 to 4 feet tall

Leaves are somewhat rough

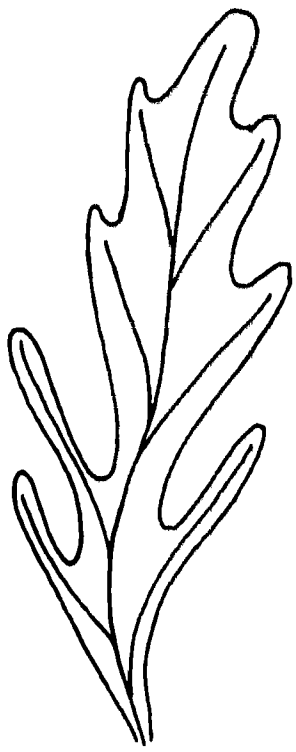
Lower leaf sheaths are somewhat hairy

At base of each leaf a small pair of claws (auricles) clasp the stem

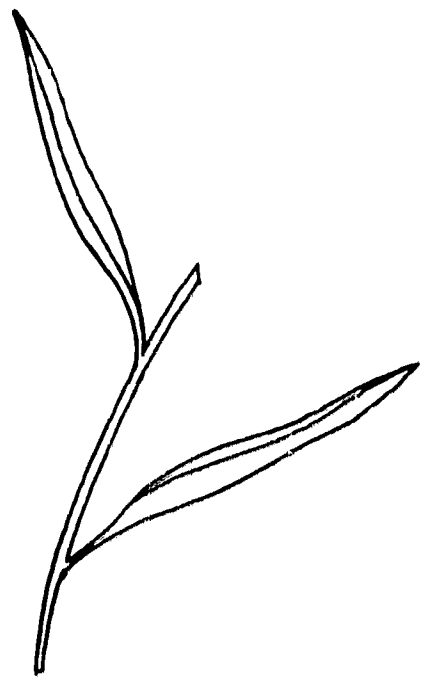
Forms dense mat of white to straw-colored rootstocks

Perennial

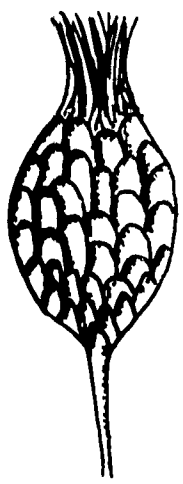
RUSSIAN KNAPWEED



LOWER LEAF



UPPER LEAF



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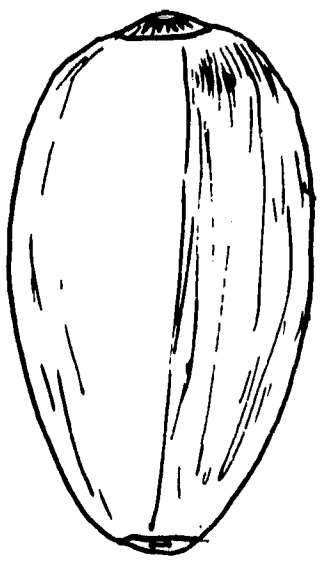


SEED

RUSSIAN KNAPWEED

(Centaurea repens Pall.)

Light purple flowers

Seed heads scaly and do not open up at maturity

Upper leaves simple, small and linear

Lower leaves larger and deep notched and covered with downy white hairs

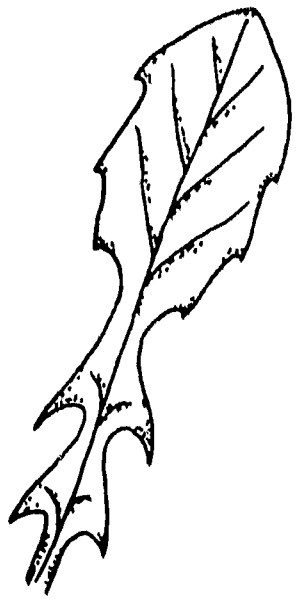
Roots are usually dark brown or black

Entire plant has a lingering bitter taste

Reproduces by seeds and rootstocks

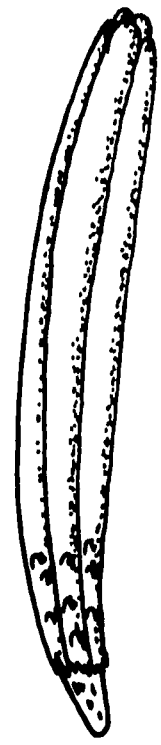
Perennial

SKELETON WEED



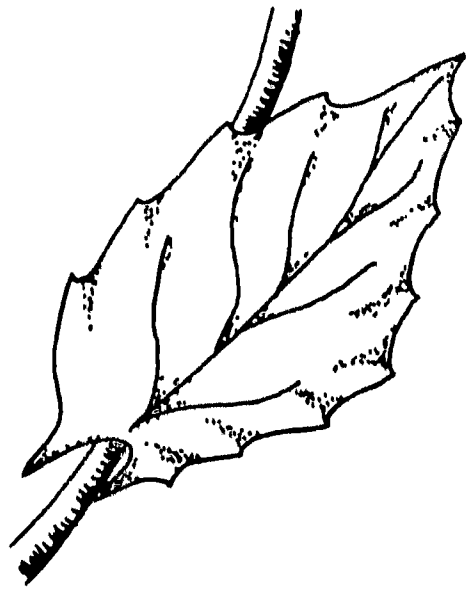
BASAL LEAF

UPPER LEAVES

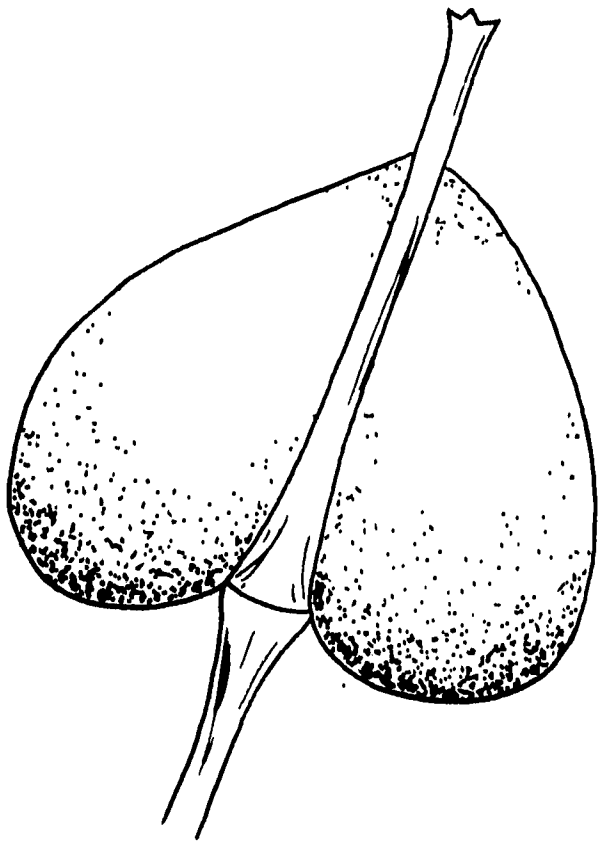


SEED

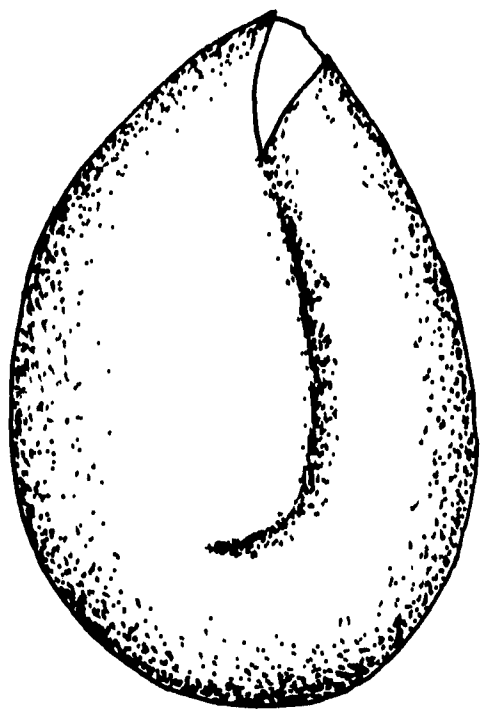
WHITE TOP



LEAF



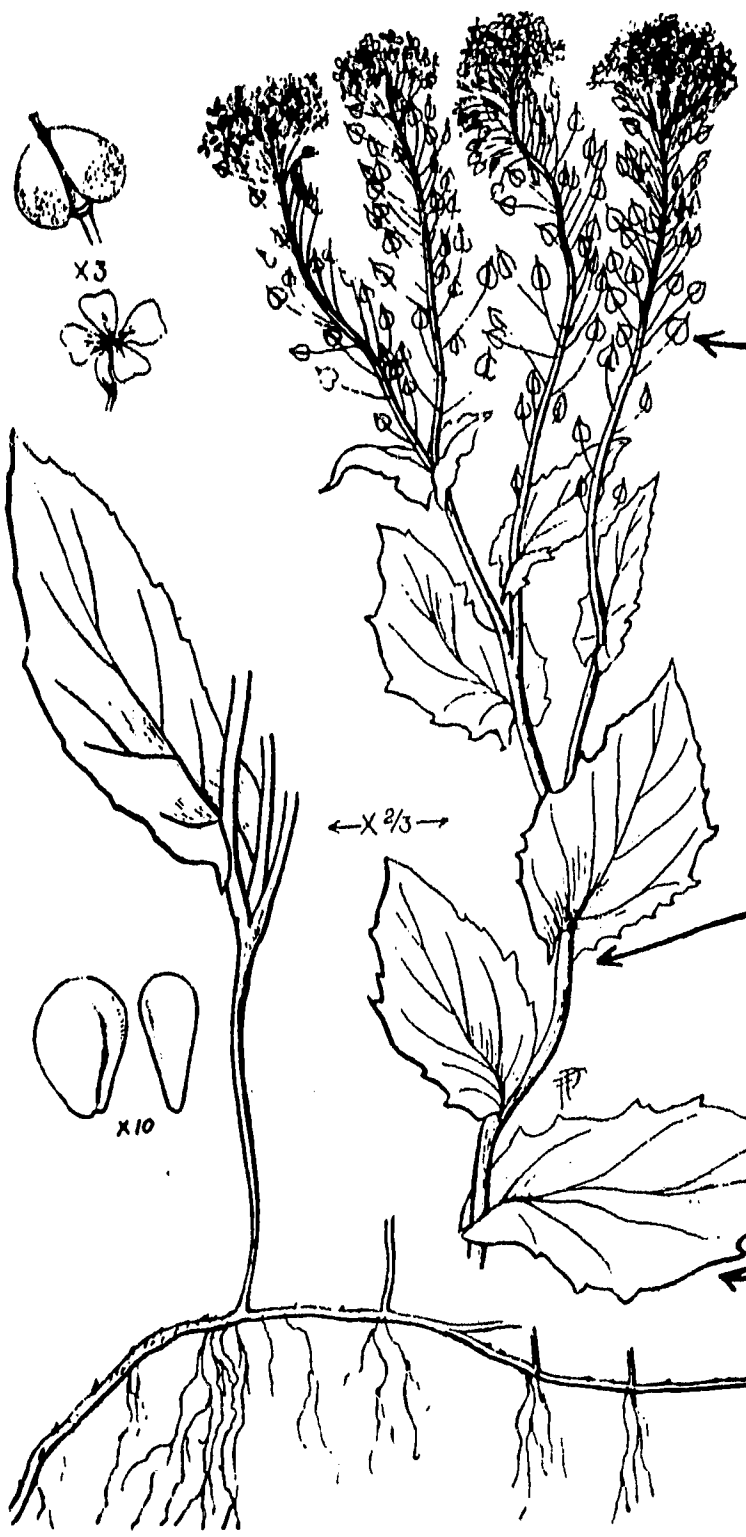
SEED POD



SEED

WHITE TOP

(Cardaria draba)
Hoarycress, Perennial peppergrass



Creamy-white flowers

Seed pods flattened and heart-shaped

Upper stem branches profusely

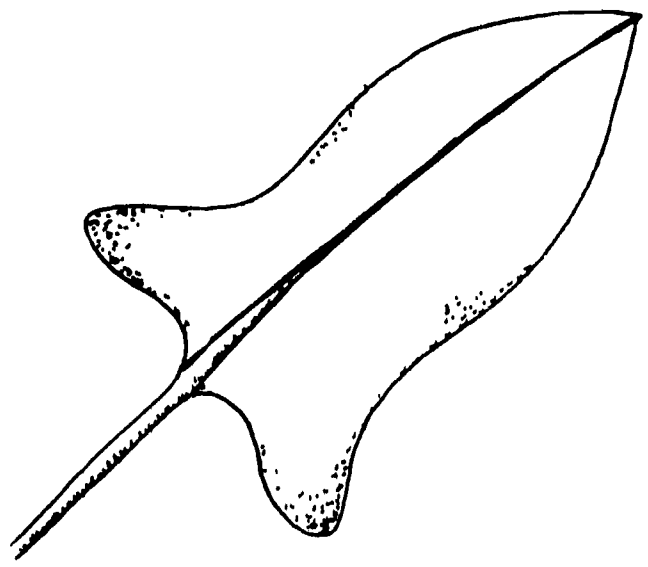
Upper leaves clasp the stems

Leaves greyish-green

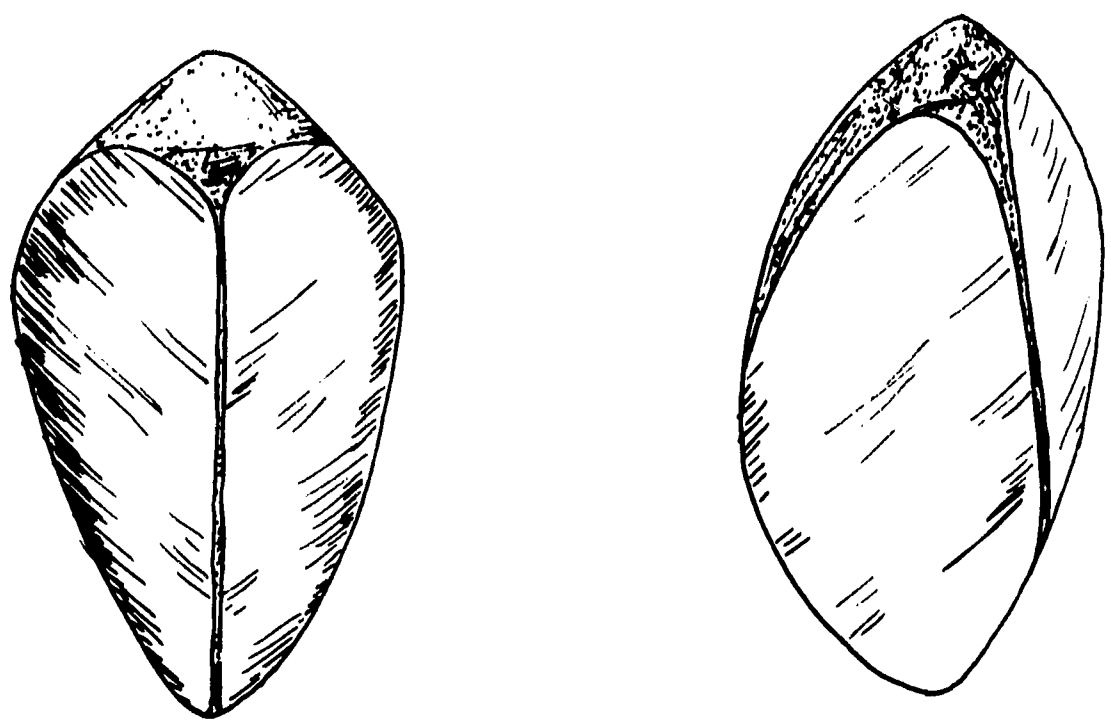
Reproduces by seed and root-stocks

Perennial

WILD MORNING-GLORY



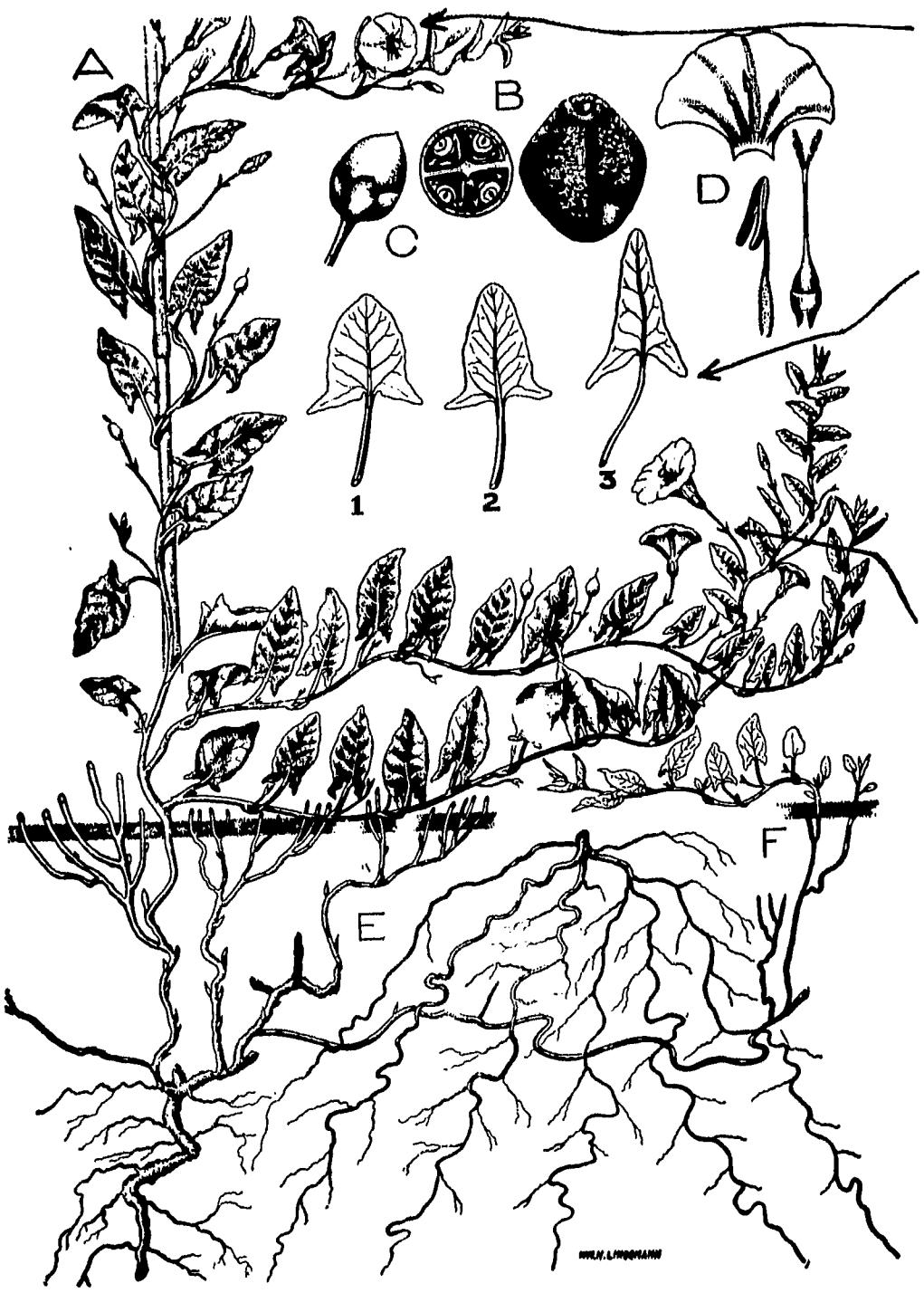
LEAF



SEED

WILD MORNING-GLORY

(Convolvulus arvensis L.)
Field bindweed, Creeping jenny,
European bindweed



White to pinkish, funnel-shaped flowers

Leaf size and shape may vary somewhat but are essentially heart or arrow-shaped

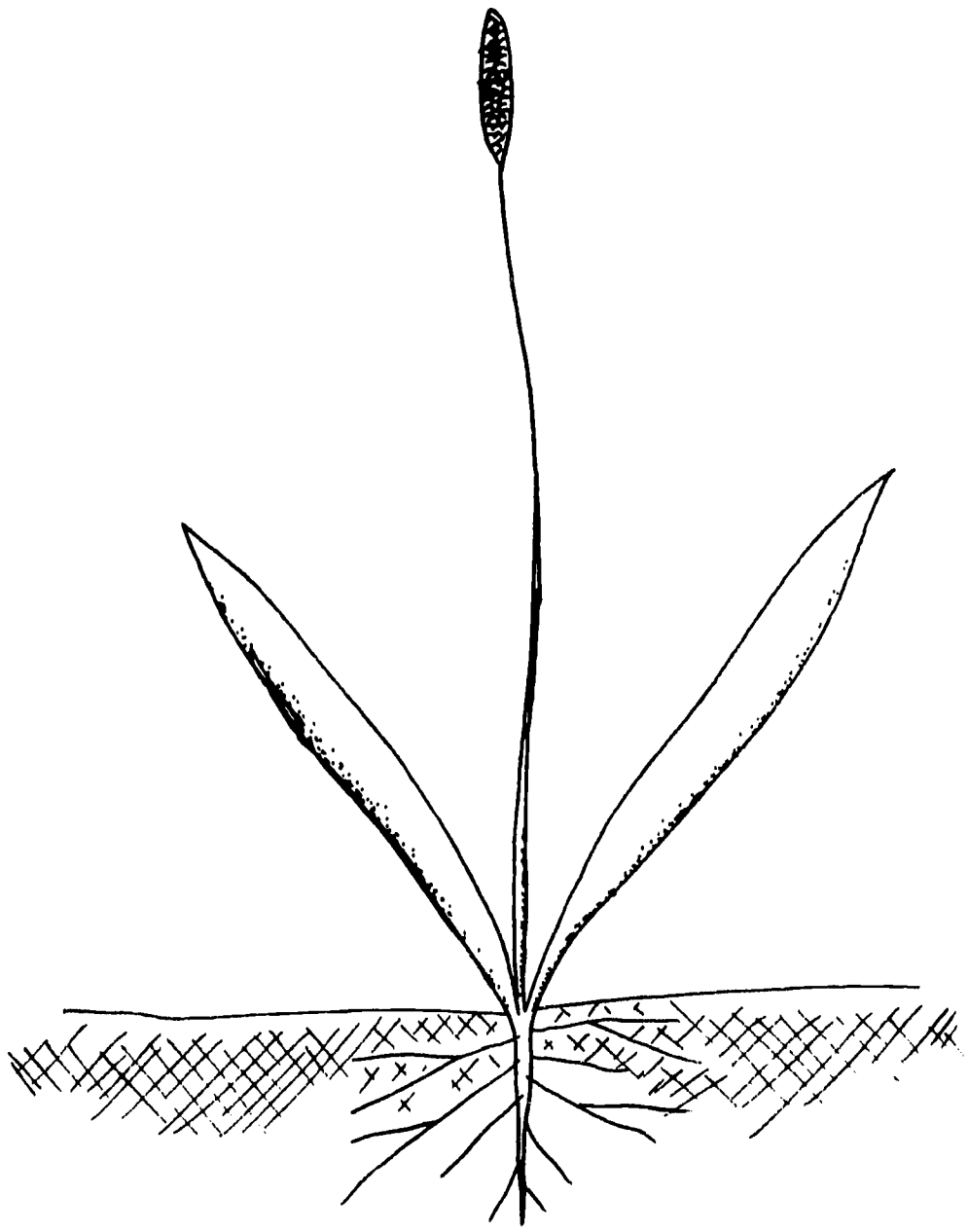
Has 2 bracks about midway on flowering stalk

Stems are prostrate or twining

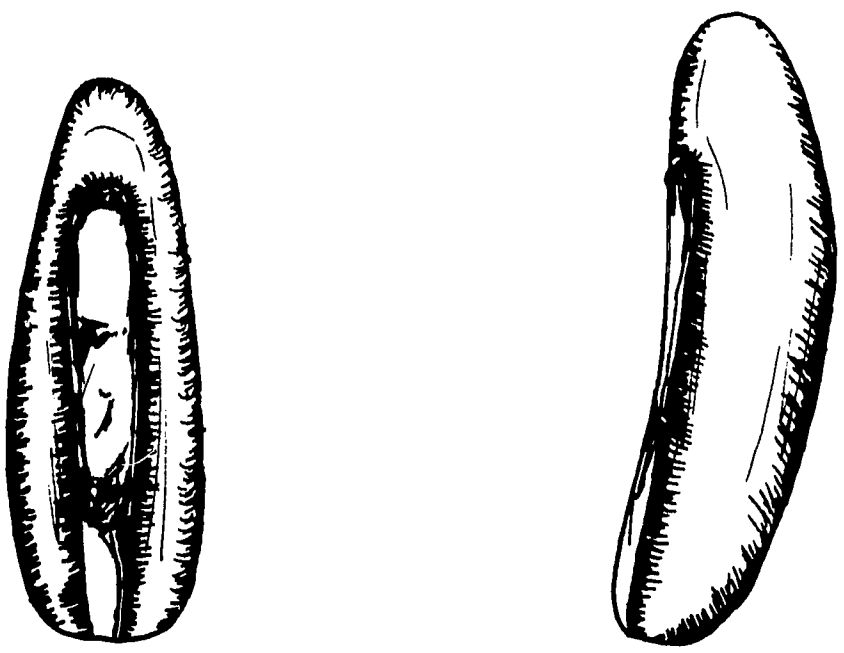
Reproduces by seed and underground rootstalks

Perennial

BUCKHORN PLANTAIN



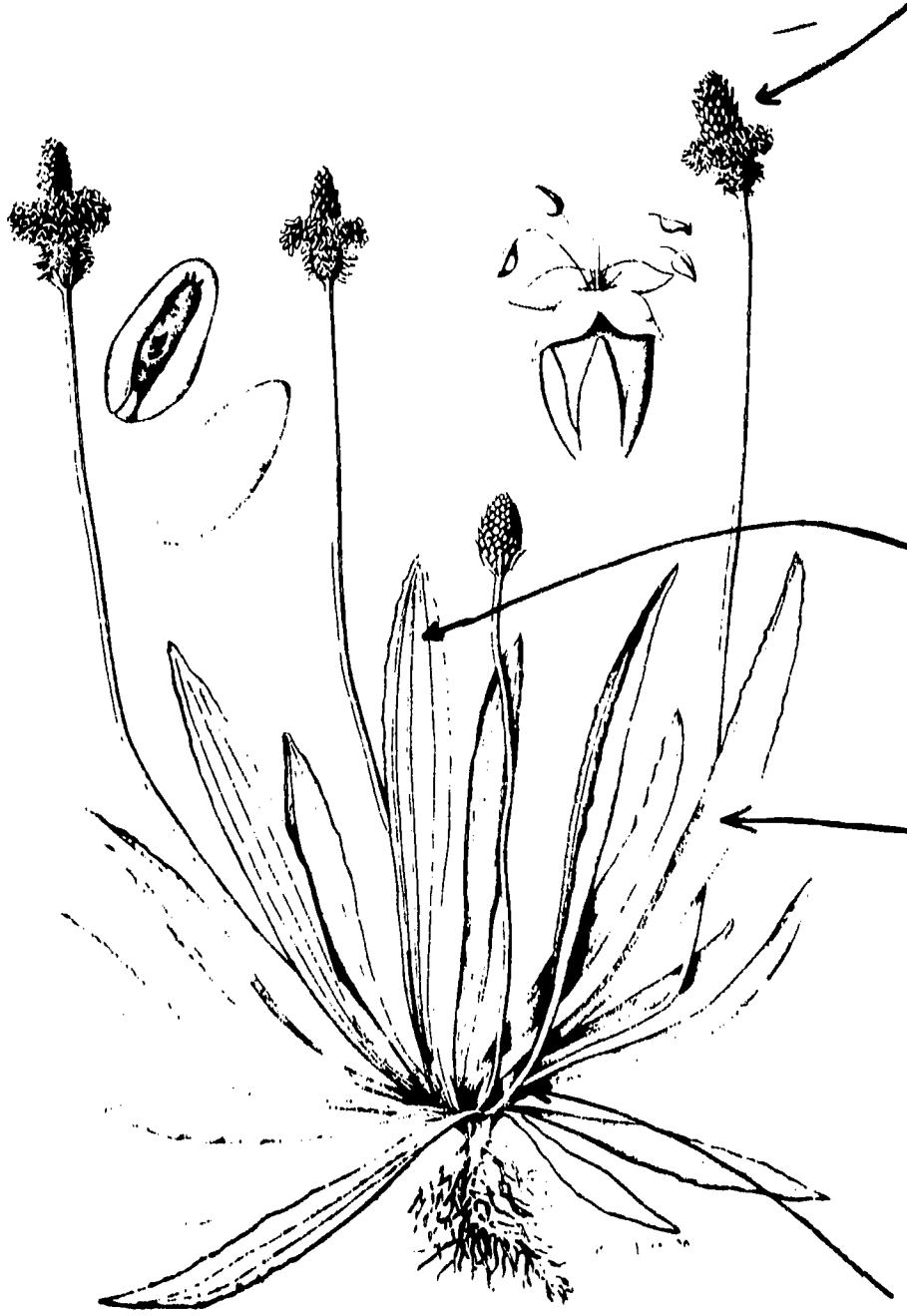
PLANT



SEED

BUCKHORN PLANTAIN

(Plantago lancelolata)
Buckhorn, Ribgrass



Resembles timothy head

Seed brown, canoe-shaped

3 to 5 prominent veins

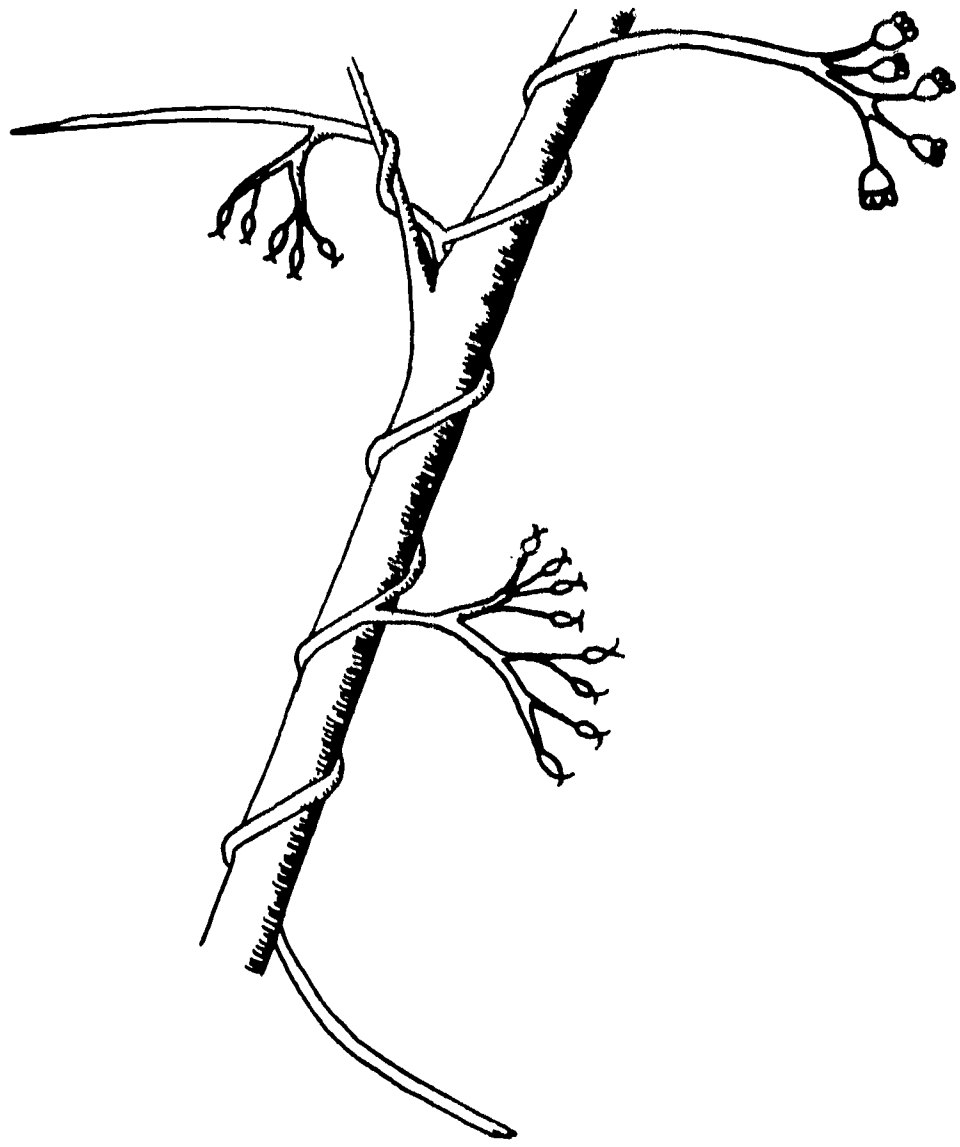
Long, narrow lance-shaped leaves

Basal leaves

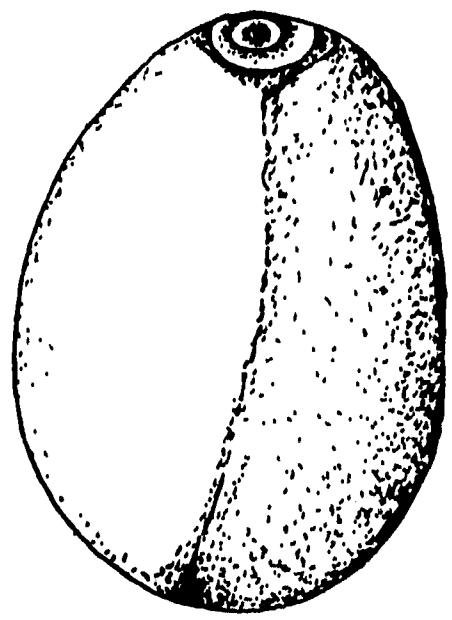
A tuft of brown hairs are at the base of each leaf

Perennial

DODDER



PLANT



SEED

DODDER

(Cuscuta sp.)

Devil's hair, Field dodder

Small whitish flowers

Stems hair-like yellow to reddish

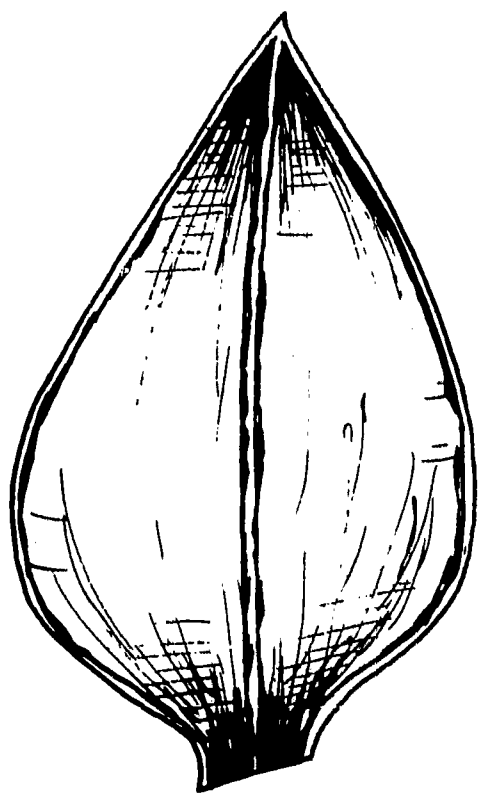
No leaves

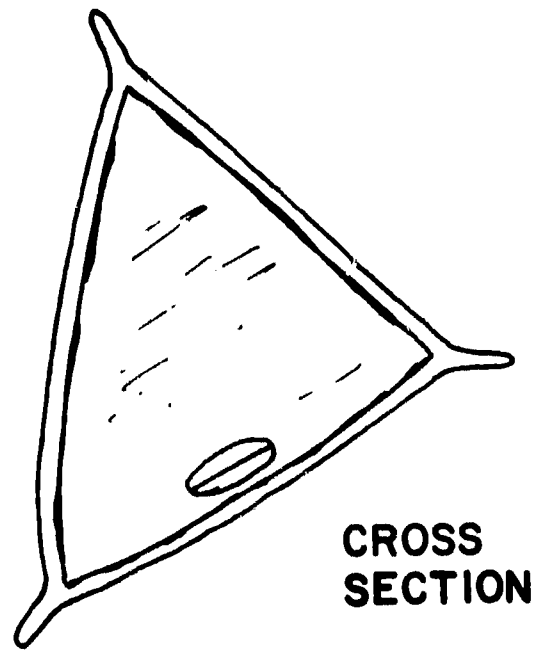
Yellowish seed, remain viable five years or more

Plant is parasitic, ground stem soon breaks off

CURLY DOCK

LEAVES





CROSS SECTION

SEED

CURLY DOCK

(Rumex crispus L.)

Curled dock, Indian tabacco, Sour dock

Flowers form a triple winged pod

Reddish brown at maturity

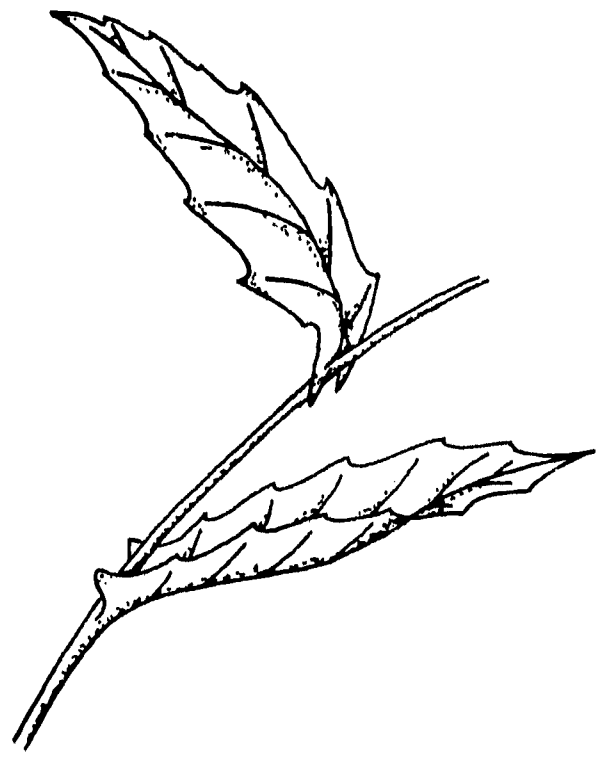
Upper leaves clasping and less wavy than the lower leaves

Lower leaves 6 to 8 inches long and wavy

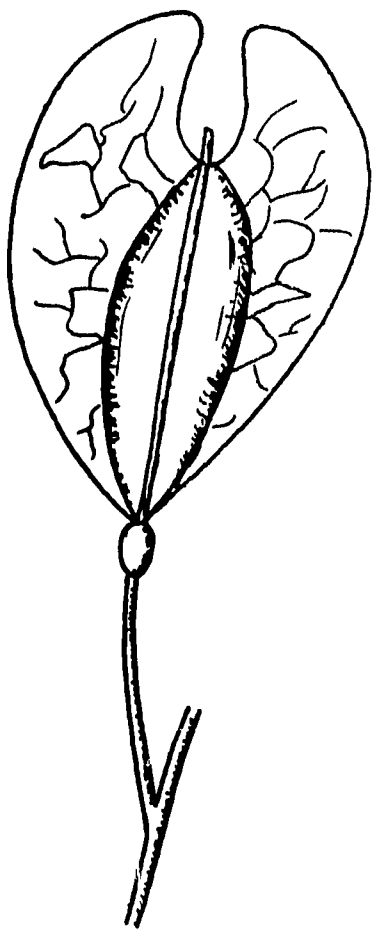
Reproduces by seed

Perennial having a deep taproot

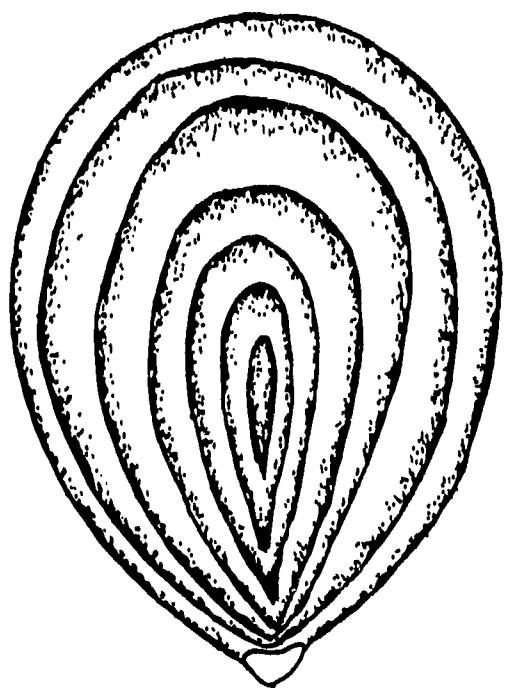
FANWEED



LEAVES



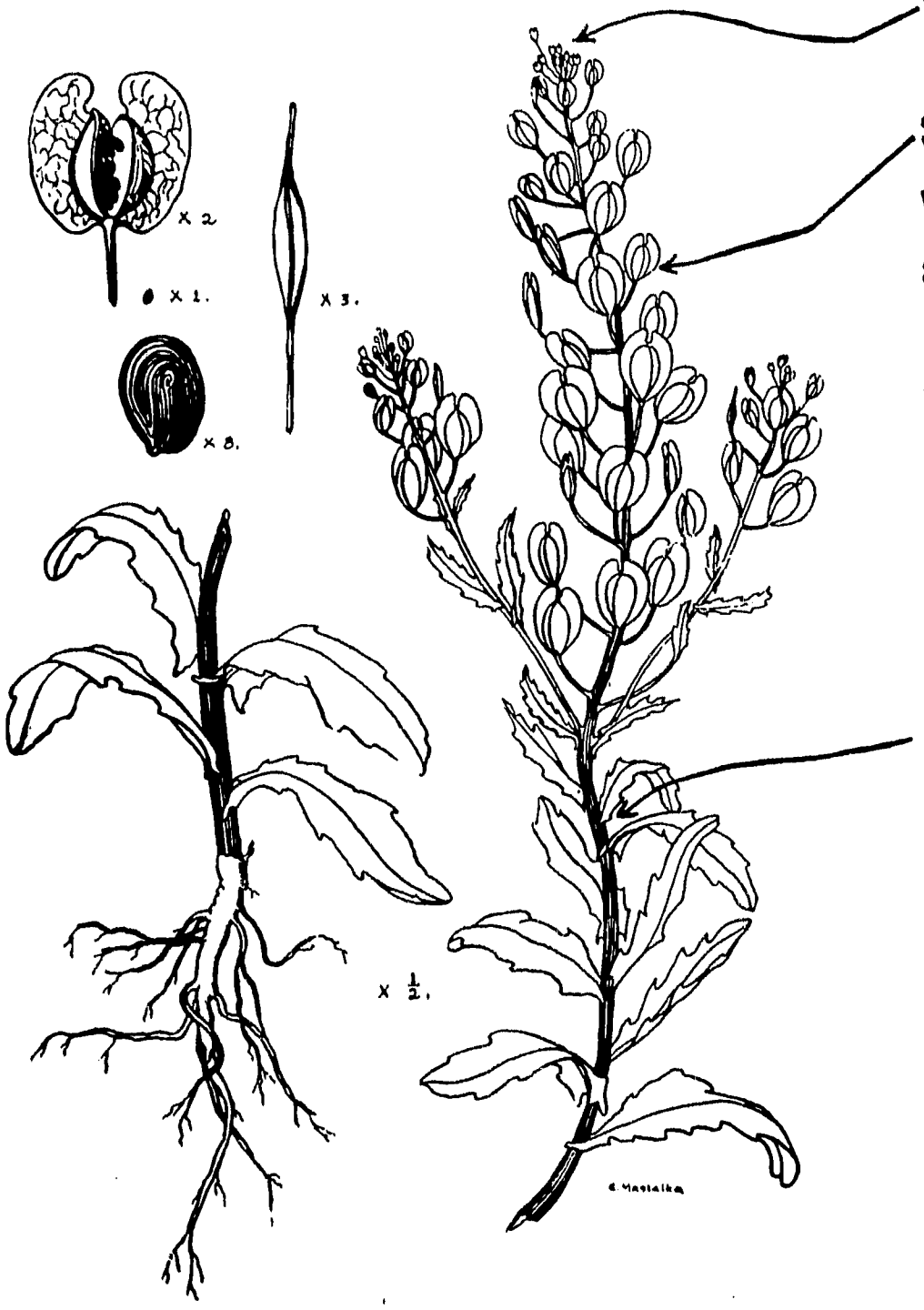
CAPSULE



SEED

FANWEED

(Thlaspi arvense L.)
Pennycress, Frenchweed, Stinkweed



White flowers

Seed pods flat, winged and notched at the top

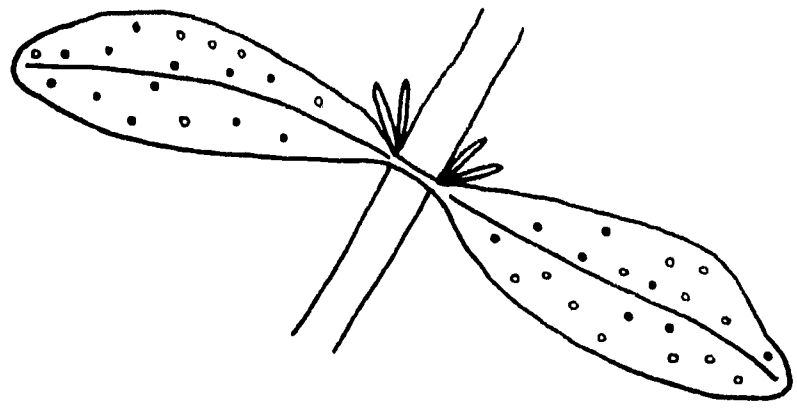
Seed pods turn light brown to nearly yellow at maturity

Leaves alternate and clasp the stem

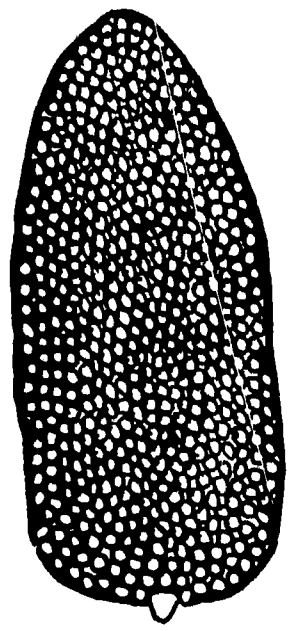
Plant grows one to three feet tall

Annual

KLAMATH WEED



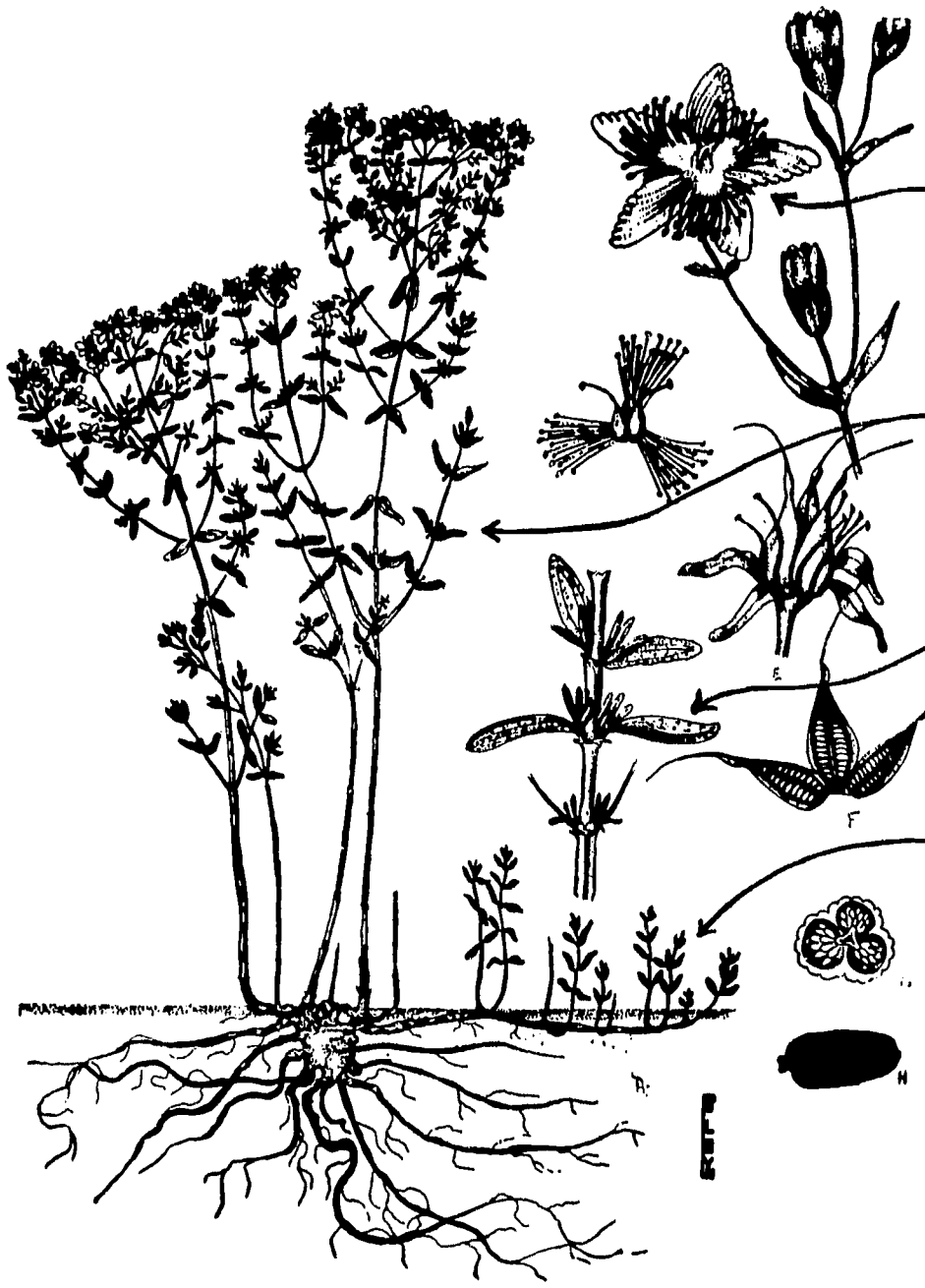
LEAVES



SEED

GOATWEED

(Hypericum perforatum L.)
Klamath weed, St. Johnswort



Yellow to orange

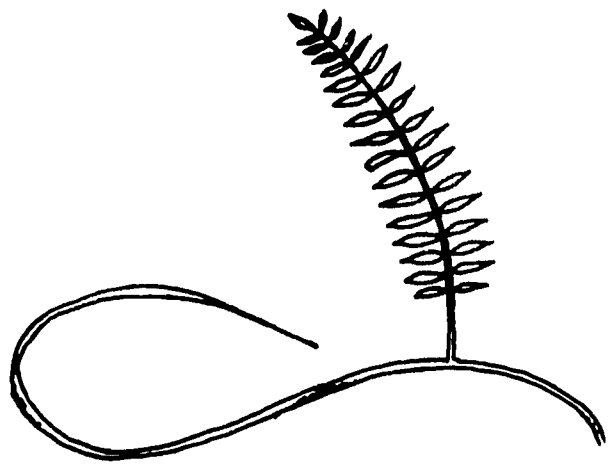
Opposite leaves

Holes in the leaves

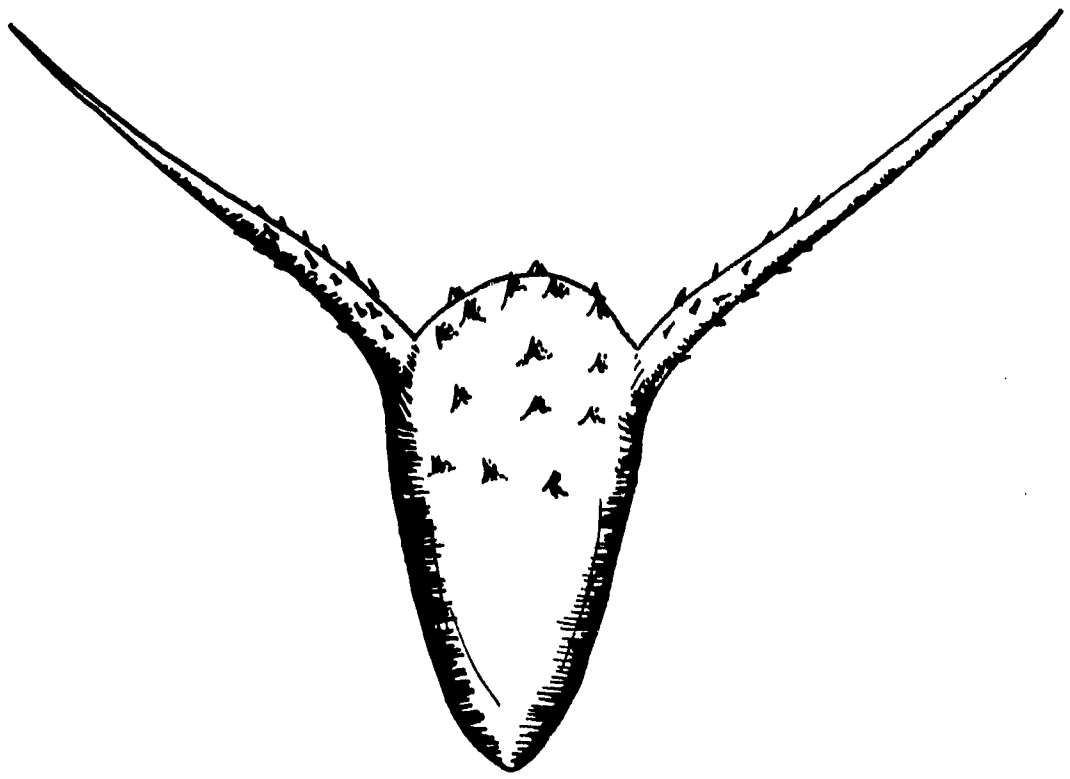
Short underground stems

Shallow-rooted perennial

PUNCTURE VINE



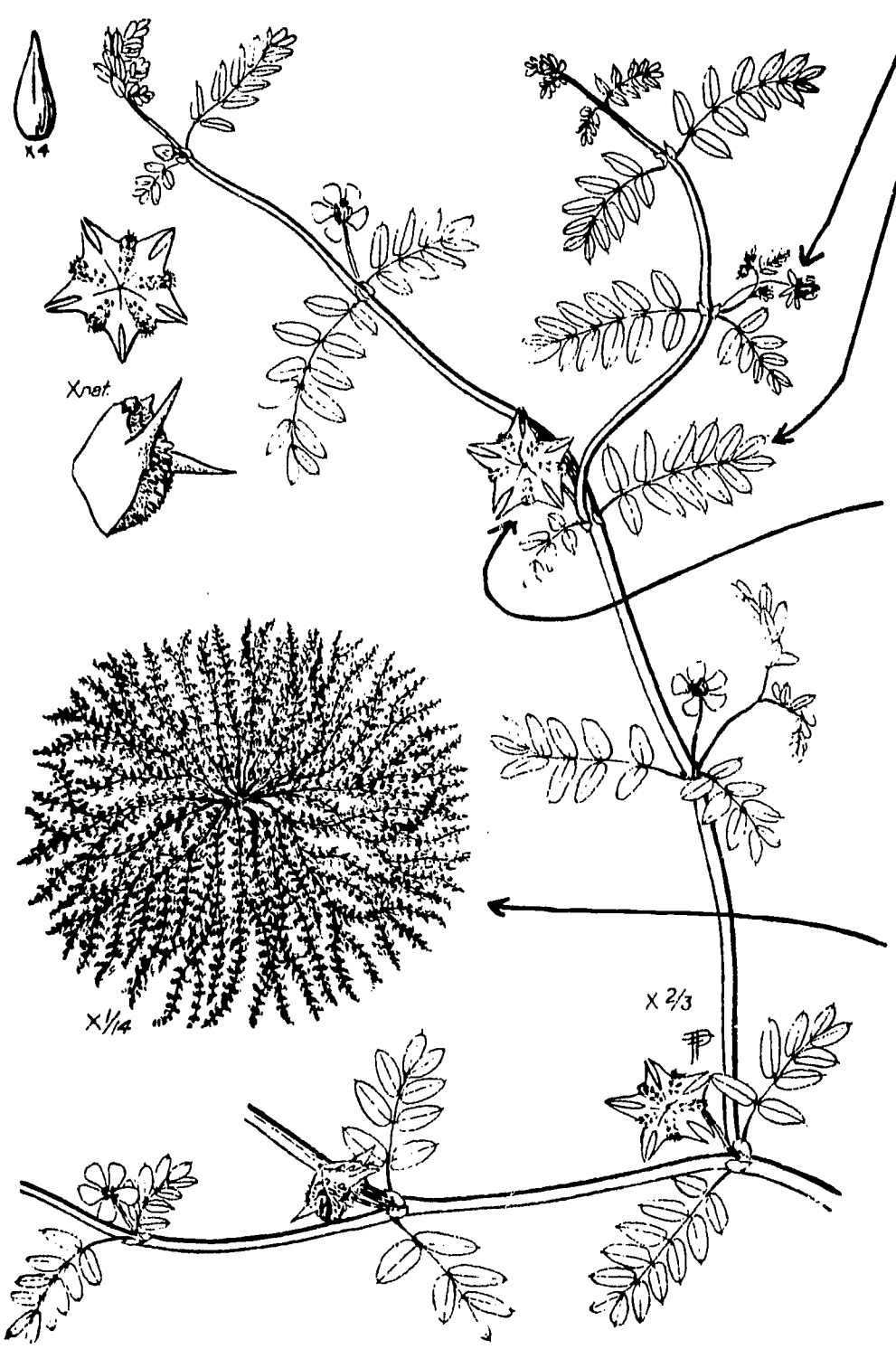
LEAF



SEED

PUNCTURE VINE

(Tribulus terrestris L.)
Mexican sandbur, Texas sandbur



Yellow flower

Each leaf is composed of several pairs of leaflets

Seed pods contain 5 spiny burs, they readily separate

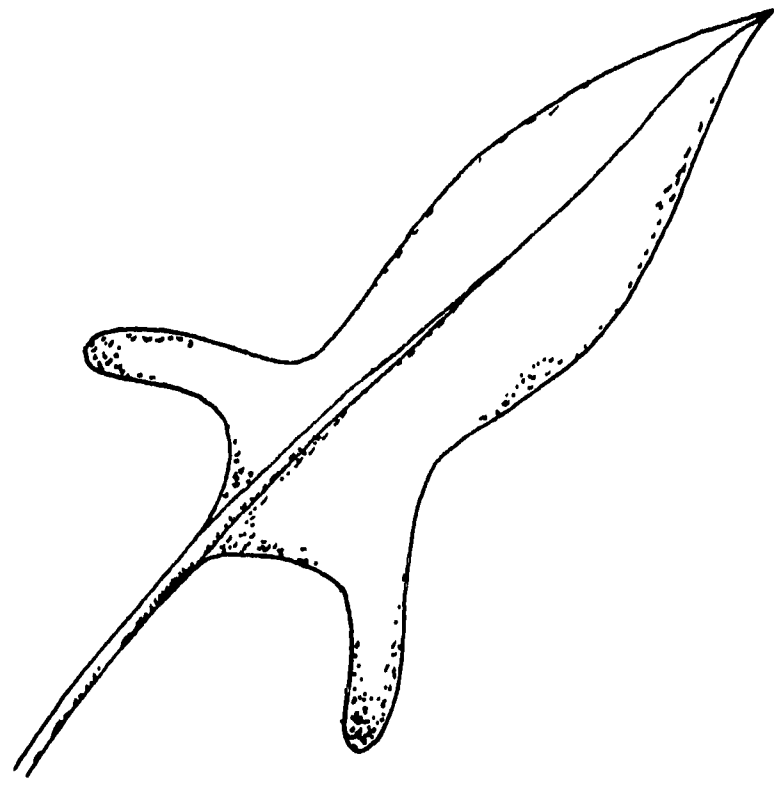
Covered with dense silky hairs

Much branched prostrate plant radiating from taproot

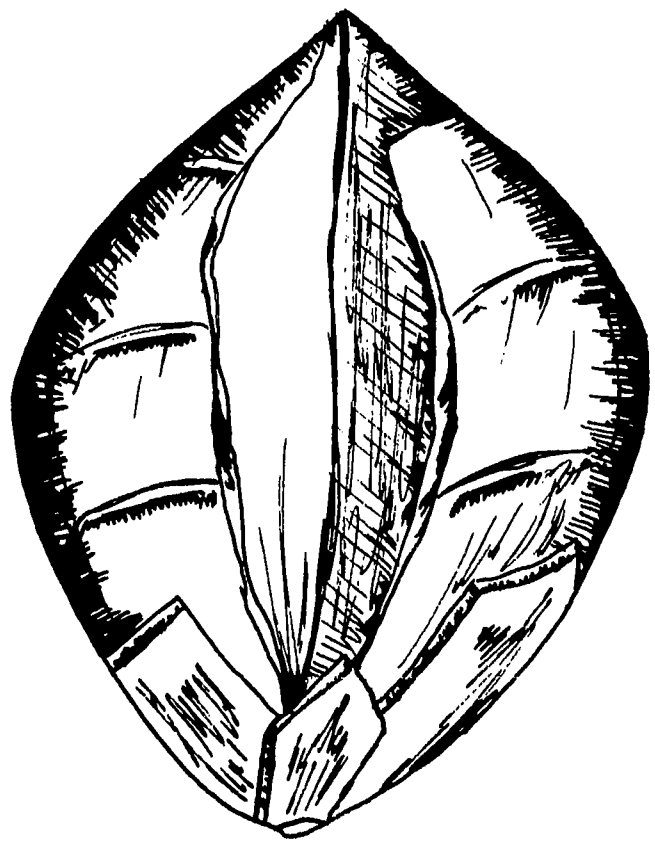
Reproduces by seed

Annual

SHEEP SORREL



LEAF



SEED

SHEEP SORREL

(Rumex acetosella L.)
Sourgrass, red sorrel

Reddish color

Grows 6 to 24 inches tall

Leaves are arrow-shaped

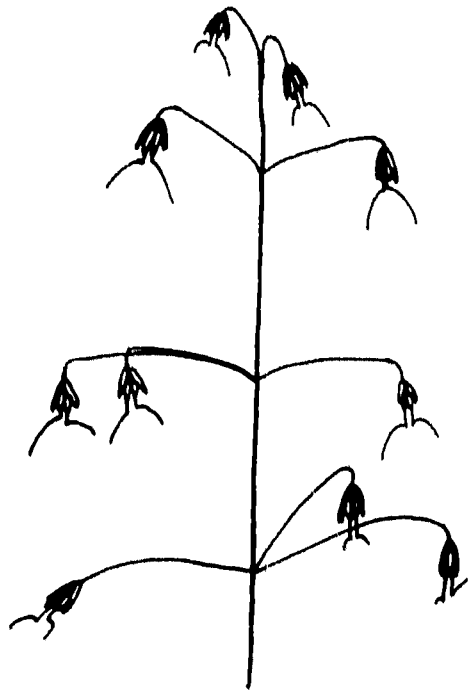
Plant sour taste

Dense rosette at base of plant

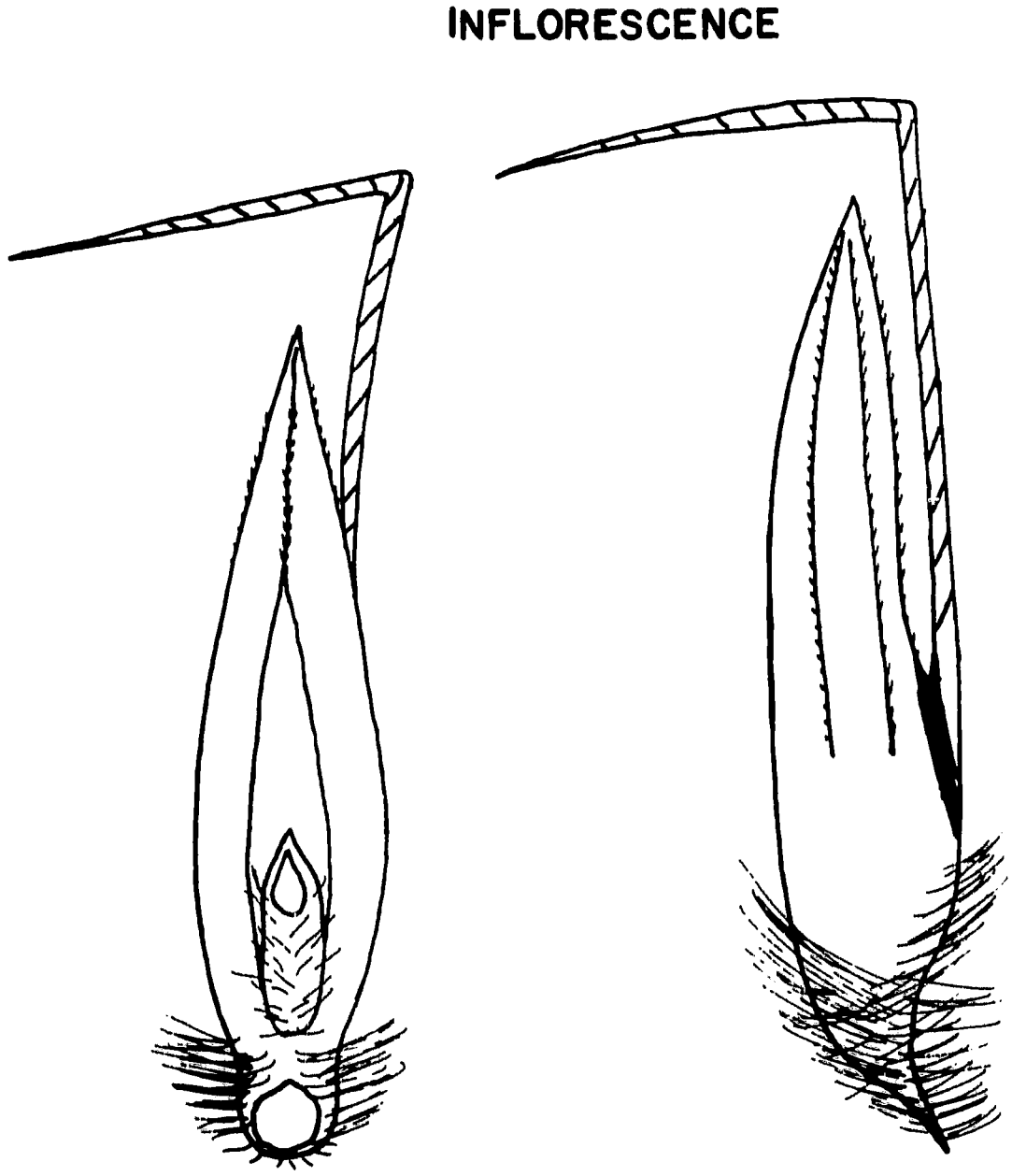
Shallow rooted

Perennial

WILD OATS



INFLORESCENCE



SEED

WILD OATS

(Avena fatua L.)
Oatgrass

Resembles tame oats but has a more open head or panicle

Blackish, twisted and bent awns

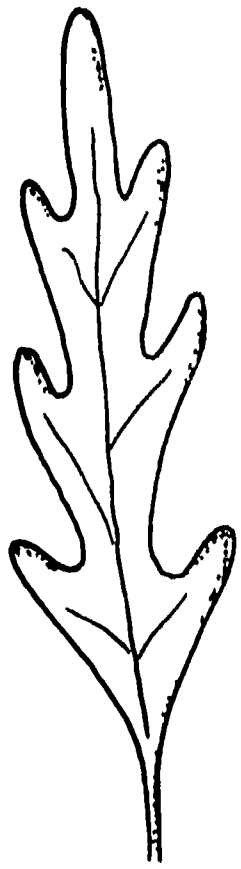
Seeds tend to shatter at maturity

Seeds have a "sucker mouth" and a hairy rachilla

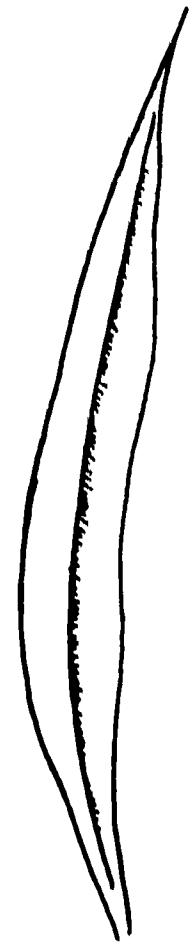
Reproduce by seed

Annual

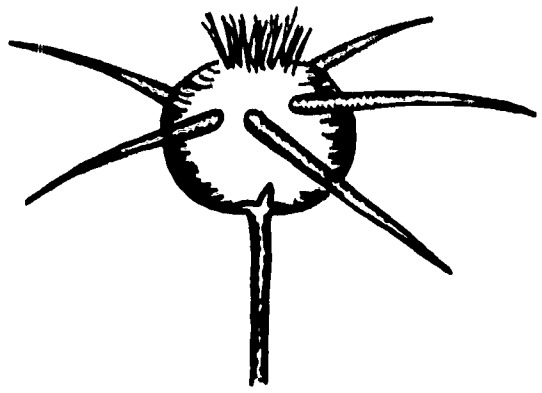
YELLOW STARTHISTLE



LOWER LEAF



UPPER LEAF



SEED HEAD

SEED

YELLOW STARTHISTLE

(Centaurea solstitialis L.)

Yellow flowers

Flower heads are armed with long yellow spines

Stems and leaves are somewhat whitened with a loose cottony fuzz

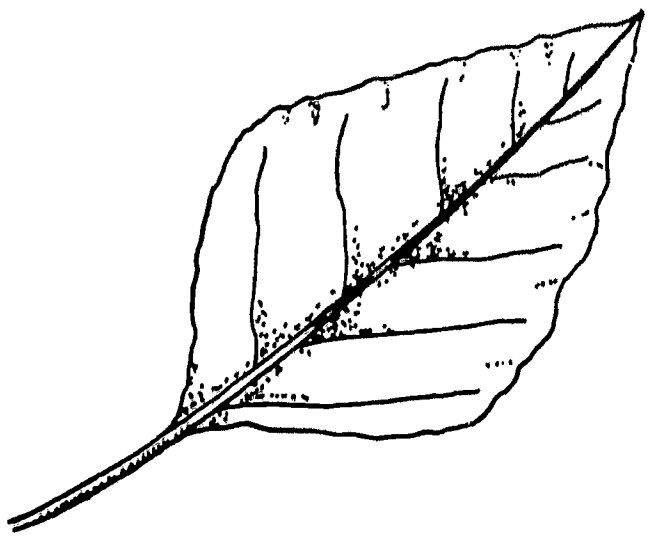
Upper leaves are entire and sharp pointed

Lower leaves are larger and deeply lobed

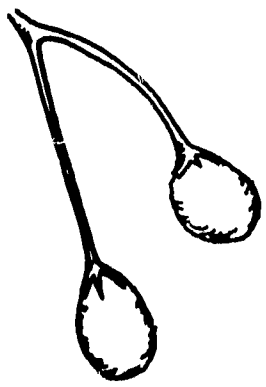
Reproduces by seed

Annual

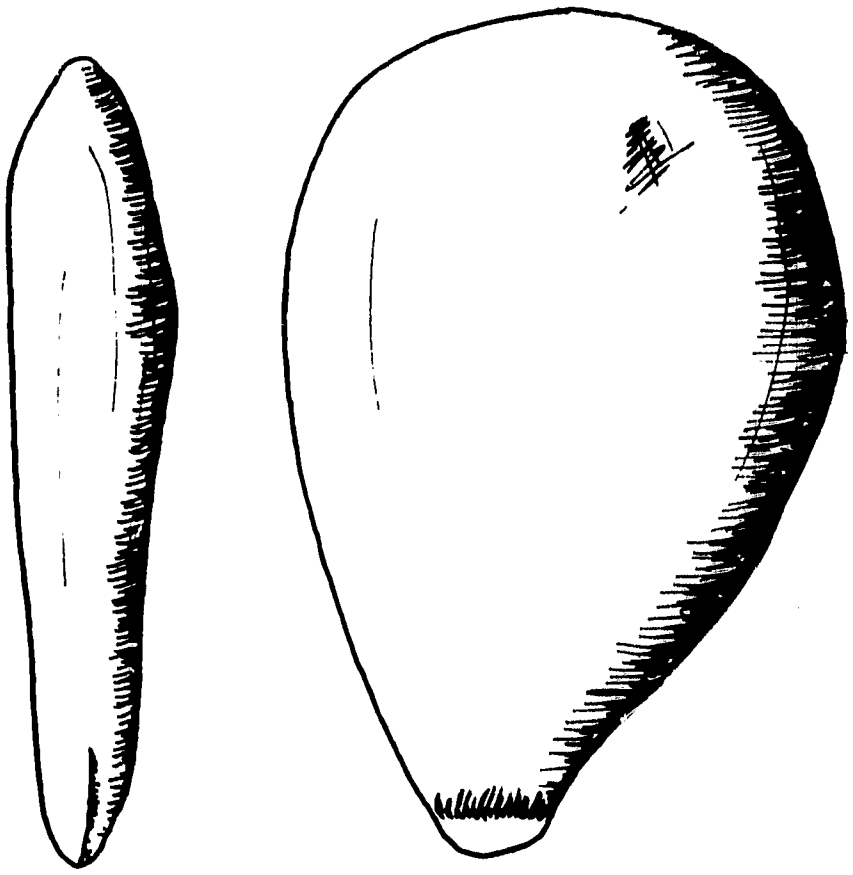
BLACK NIGHTSHADE



LEAF



BERRY



SEED

BLACK NIGHTSHADE

(Solanum nigrum)

Garden nightshade, Deadly nightshade

Small, white flowers produced in clusters

Berries are round and smooth, turn black when ripe

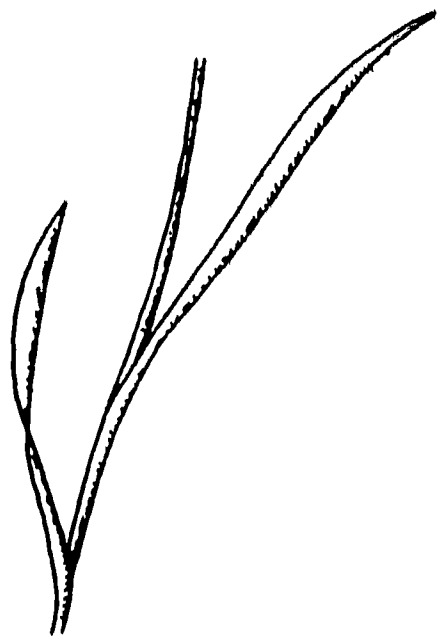
Plant often found in peas, stubble fields, and in the summer fallow

Plant freely branching and bushy

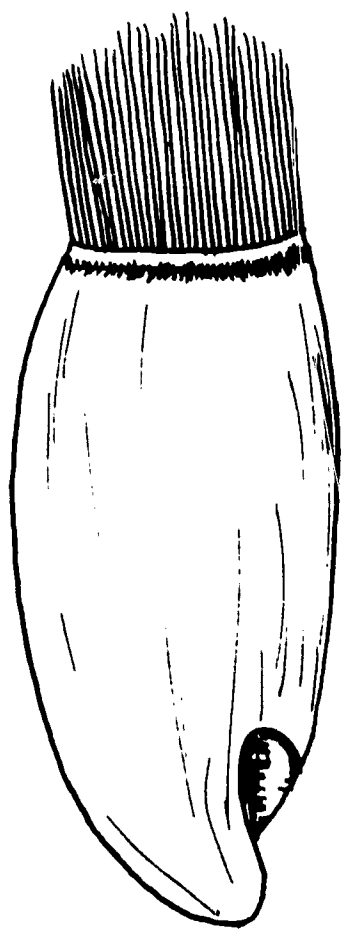
Reproducing by seed

Annual

BACHELORS BUTTON

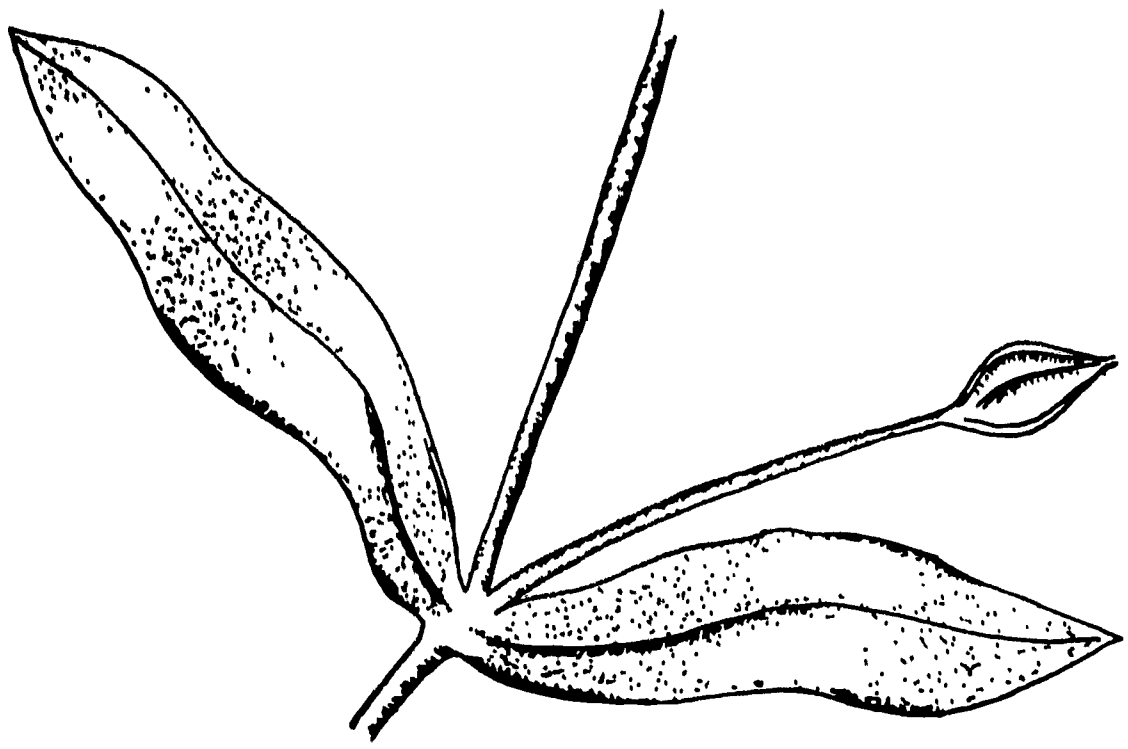


LEAVES

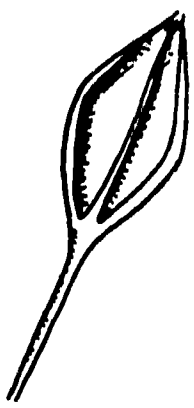


SEED

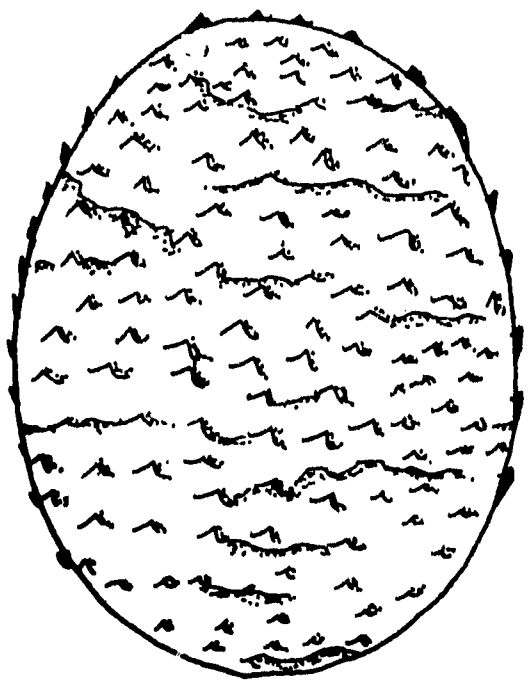
COW COCKLE



LEAVES



CAPSULE



SEED

COW COCKLE

(Vaccaria vulgaris Host.)

Pinkish red flowers

Calyx five angled

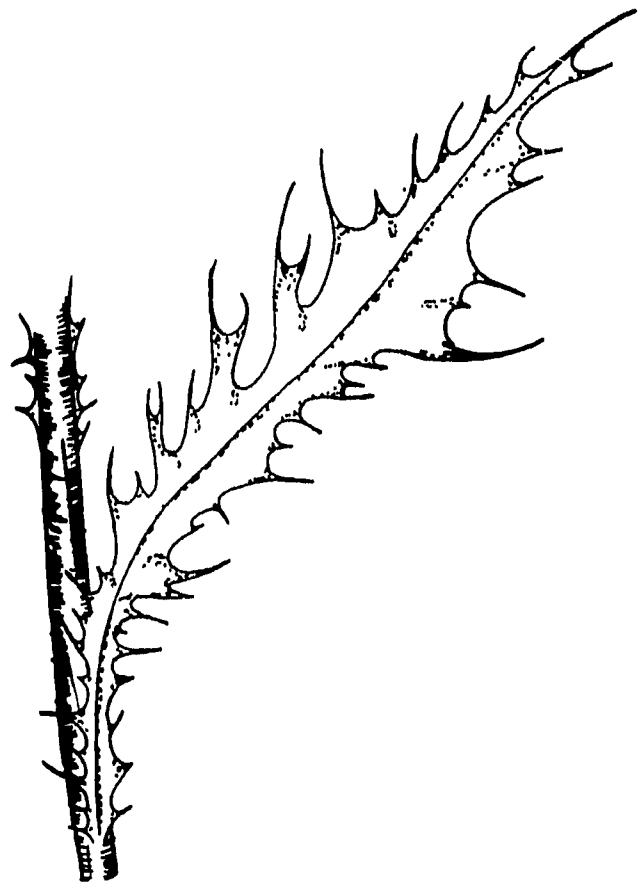
Stem forked branching

Leaves opposite and clasp the stem

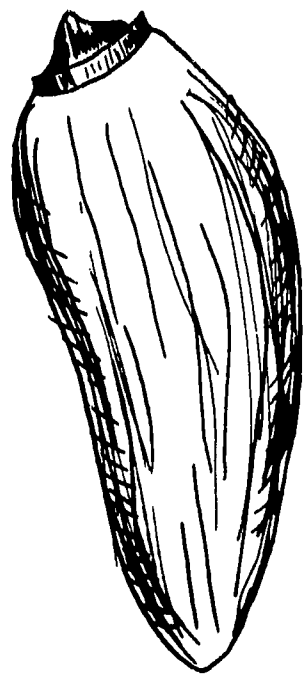
Reproduces by seed

Annual

BULL THISTLE



LEAF



SEED

BULL THISTLE

(Cirsium lanceolatum)
Common thistle, Roadside thistle

Purple to pink flowers

Rosette growth stage first year growth

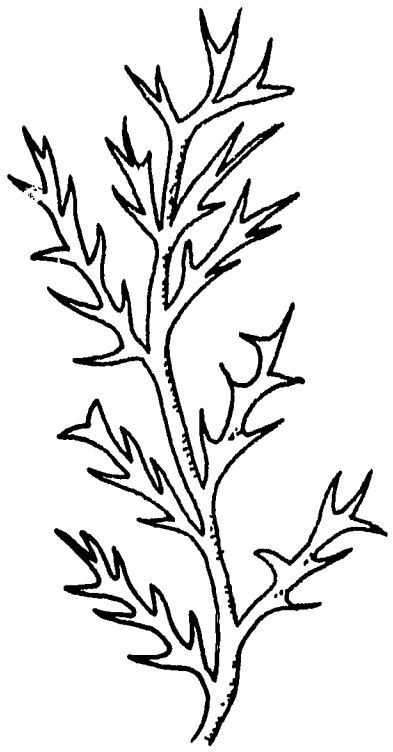
Upper leaf surface green

Under surface finely haired

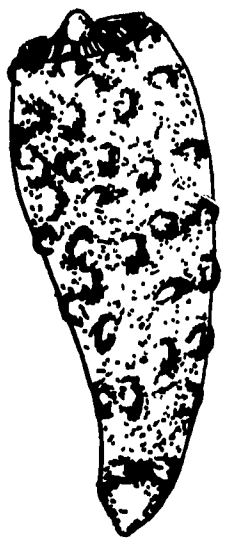
Prickly stalk

Biennial

DOG FENNEL



LEAF



SEED

DOG FENNEL

(Anthemis cotula L.)
Mayweed, Field camomile

Petals white, centers yellow

Leaves light green and finely divided

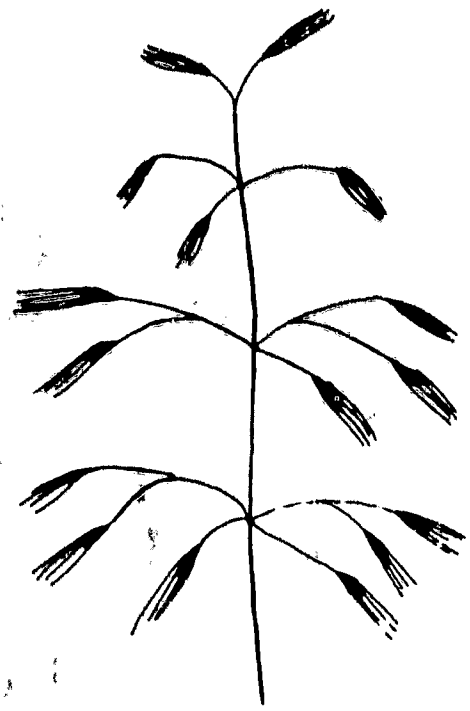
Plants have a bitter taste and an unpleasant odor

Plant branched growing from 1 to 3 feet tall

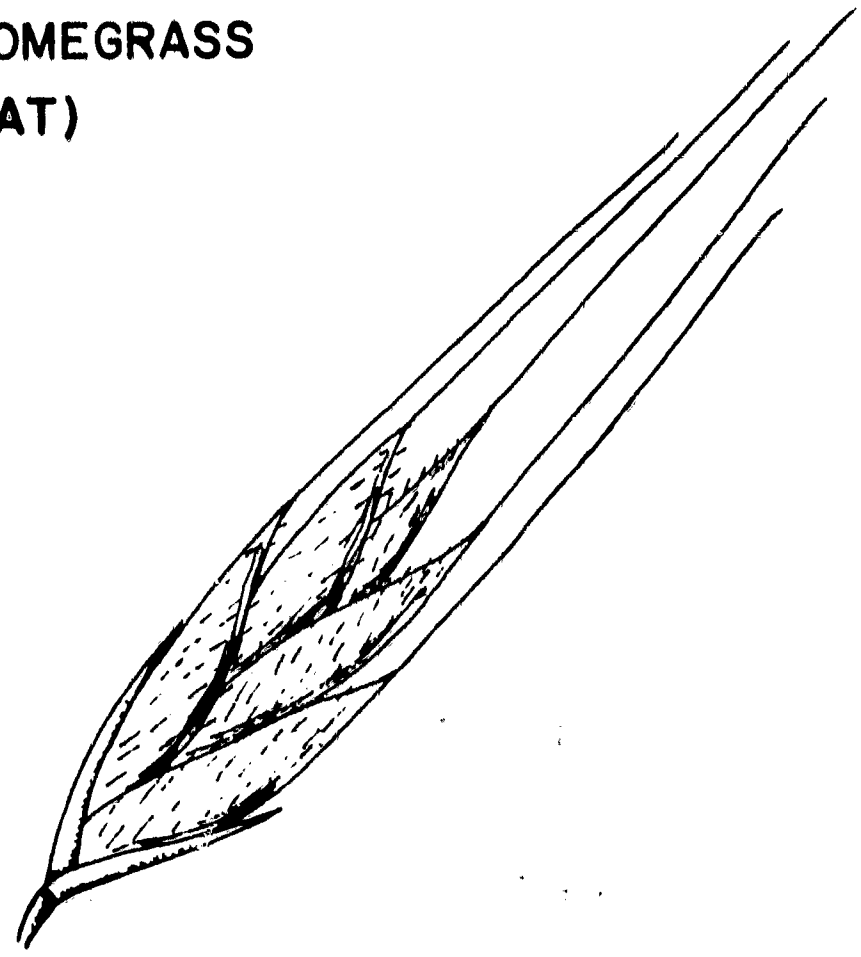
Reproduces by seed

Annual

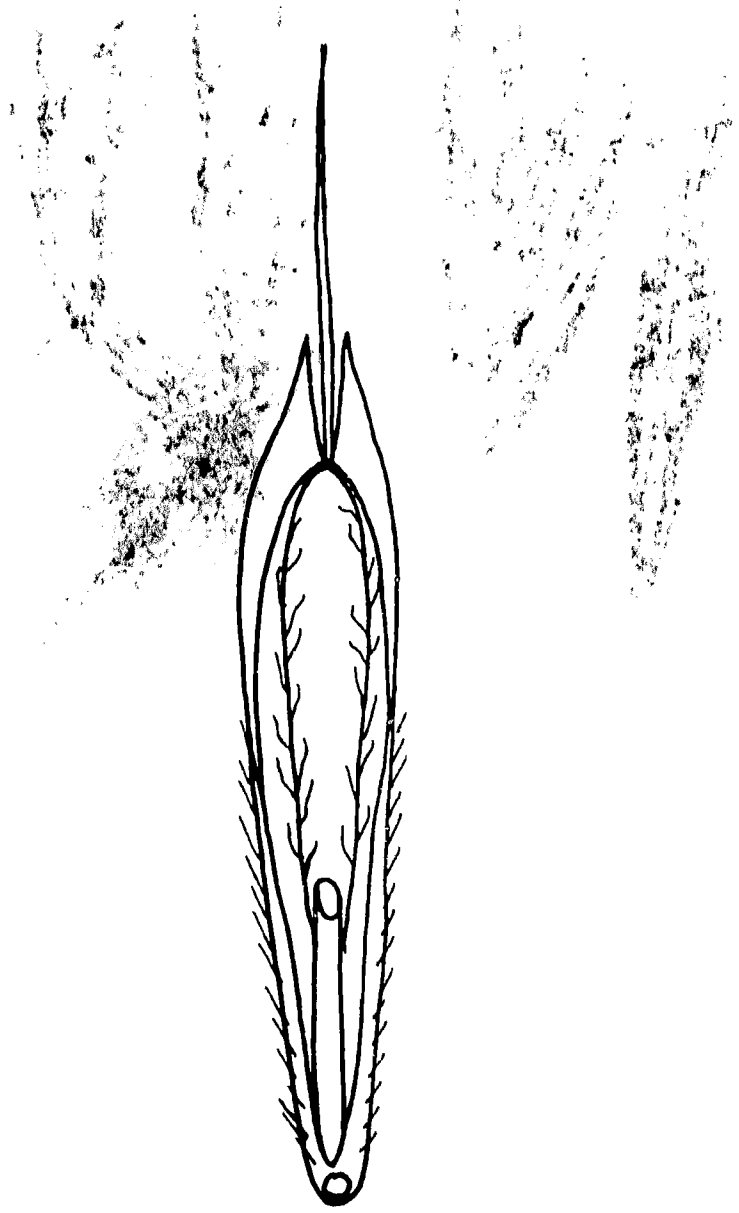
DOWNY BROMEGRASS
(CHEAT)



INFLORESCENCE



SPIKELET



SEED

CHEATGRASS

(Bromus tectorum L.)

Head loose and nodding

Grows 6 to 24 inches tall

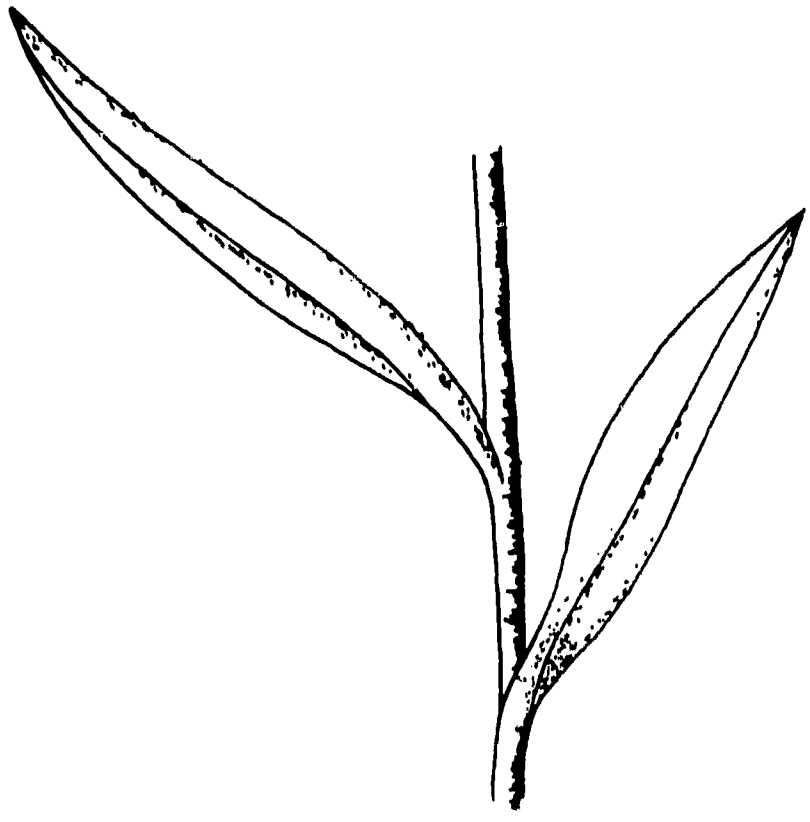
Seeds contain a long rough awn or beard

Turns reddish purple upon maturing

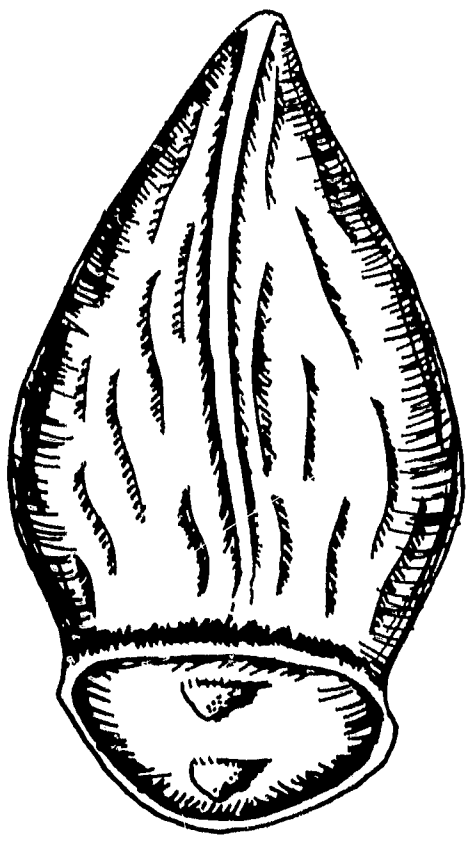
Leaves covered with soft hairs

Annual

GROMWELL

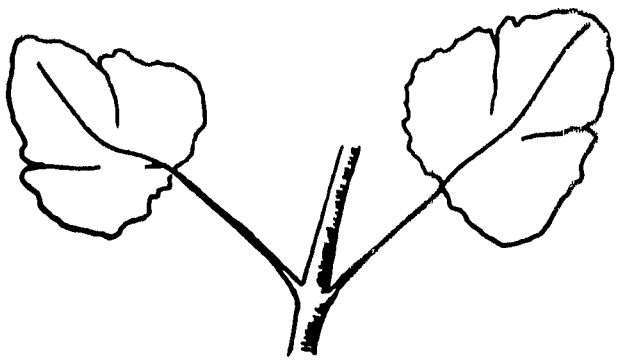


LEAVES

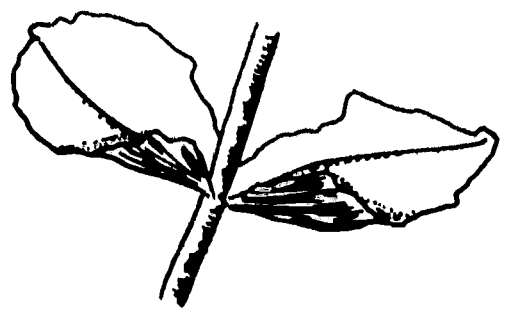


SEED

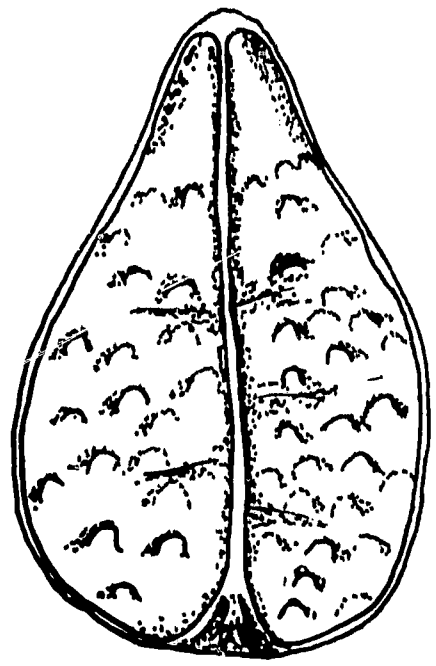
HENBIT



LOWER LEAVES



UPPER LEAVES



SEED

HENBIT

(Lamium amplexicale L.)
Dead nettle

Pink to purplish tubular flowers

Upper leaves clasp the stem and are rounded and lobed

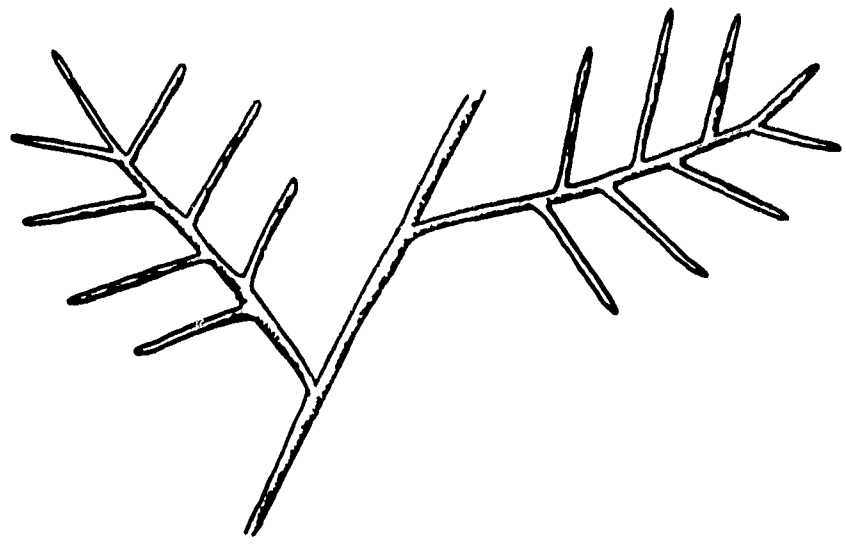
Stems are semi-prostrate with upright numerous branches

Entire plant may take on a purplish color

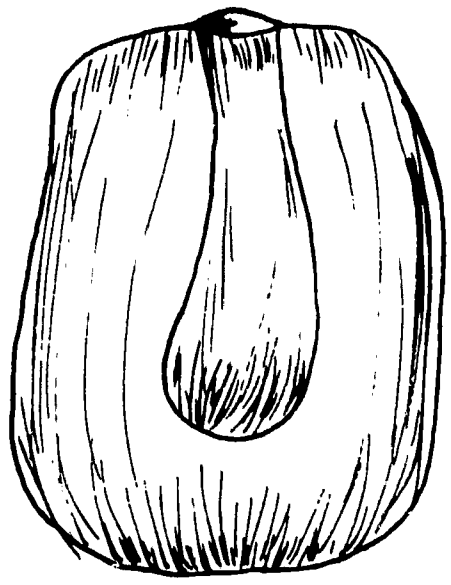
Reproduces by seed

Annual or biennial

JIM HILL MUSTARD



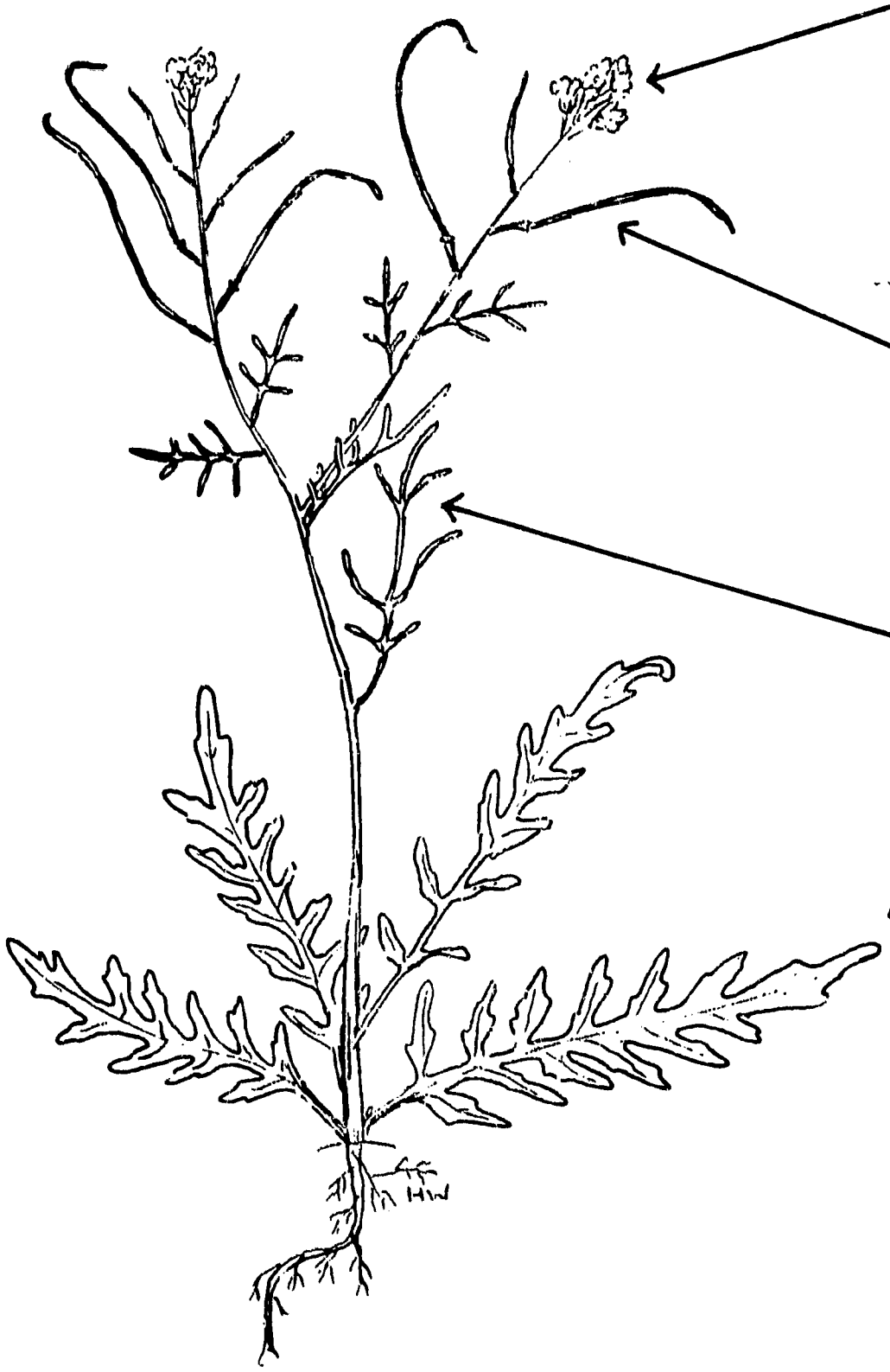
LEAVES



SEED

JIM HILL MUSTARD

(Sisymbrium altissimum)
Tumbling mustard



Light yellow to yellowish white flowers

Seed pods 2 to 4 inches long set on a stem approximately 1/4 inch long

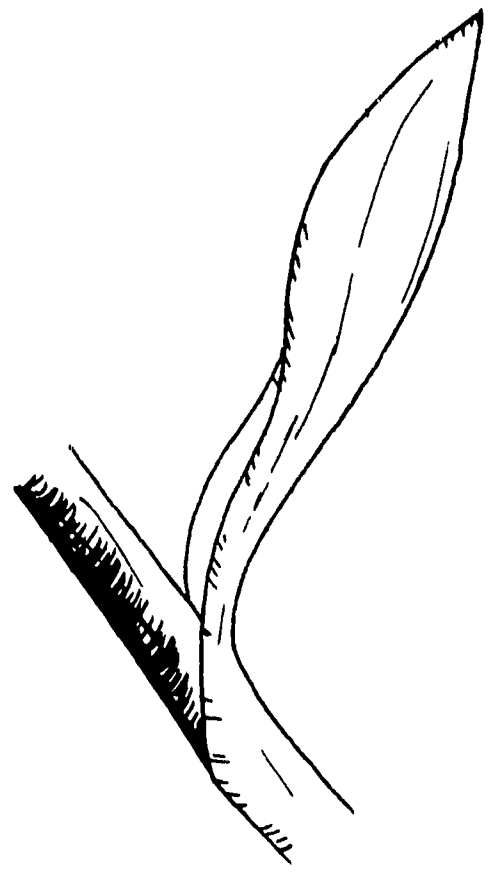
Upper leaves are narrow, linear, segments

Lower leaves are large, deeply lobed and somewhat hairy

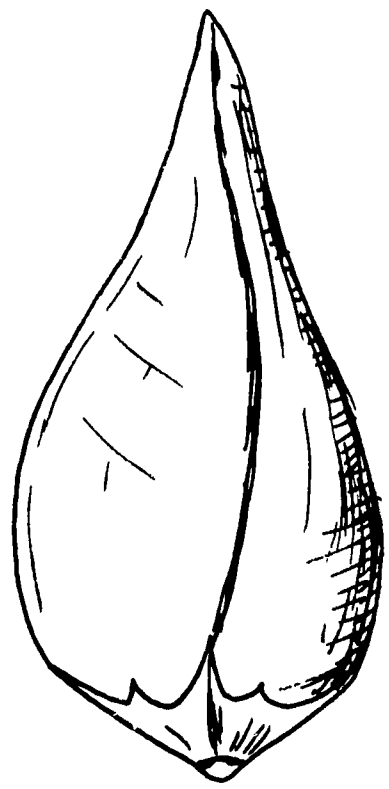
Reproduces by seed

Annual

KNOTWEED



LEAF



SEED

PROSTRATE KNOTWEED

(Polygonum abiculare L.)
Knotgrass, Matweed

Forms a mat especially in hard or trampled areas (driveways, along walkways, etc.)

Leaves have a dull bluish green color and are sometimes covered with a white mildew

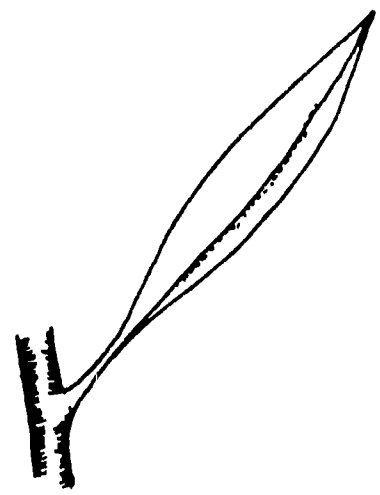
Flowers are small, yellow inconspicuous, borne in the axils of the leaves and stems

Plant is tough, drouth resistant and can survive a great deal of abuse

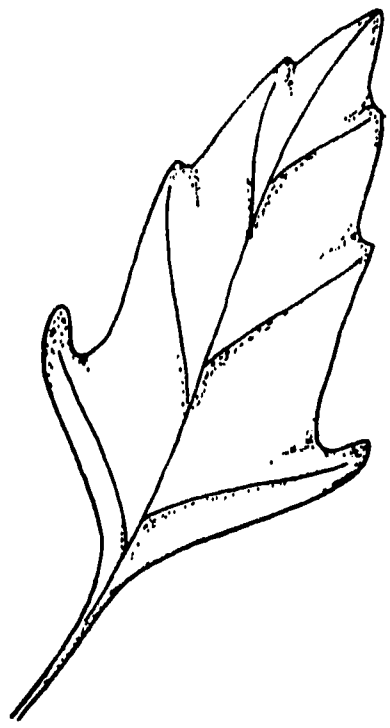
Reproduces by seeds

Annual

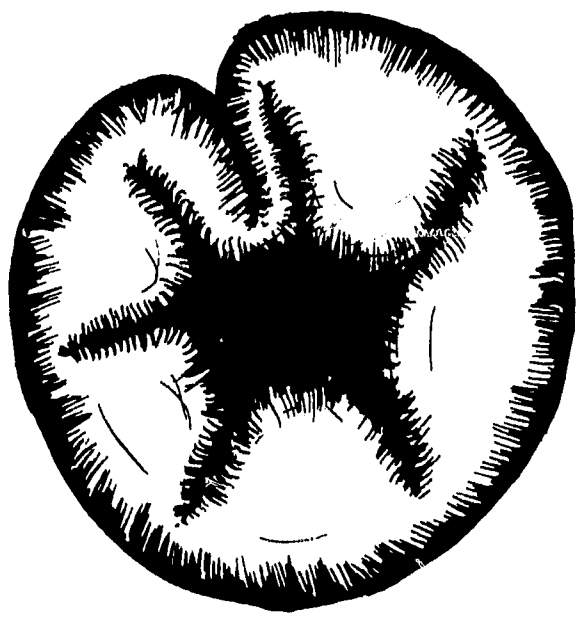
LAMBS-QUARTERS



UPPER LEAF



LOWER LEAF



SEED

LAMBS-QUARTERS

(Chenopodium album L.)
Pigweed

Flowers in clusters, green and inconspicuous

Leaves covered with white mealy substance

Leaves have irregular toothed margins

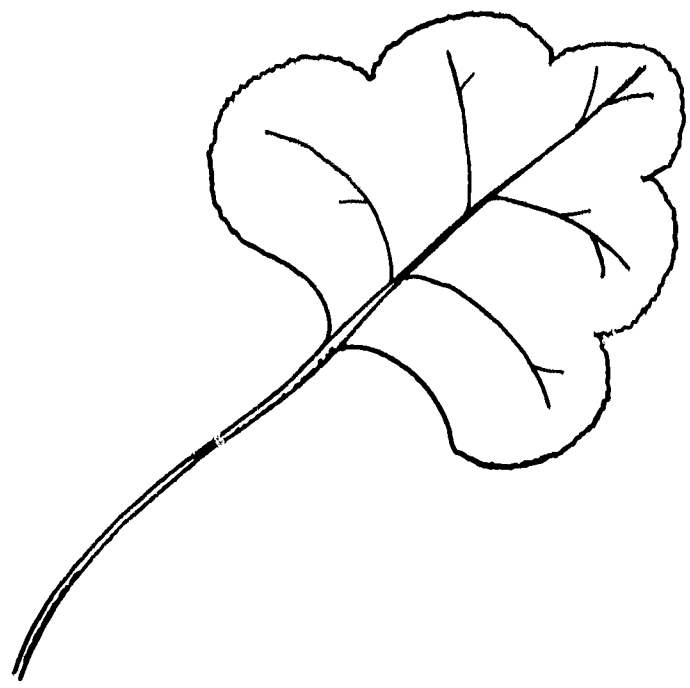
Stems smooth, often striped with pink or purple and are usually ridged and grooved

Plant grows from 1 to 6 feet high

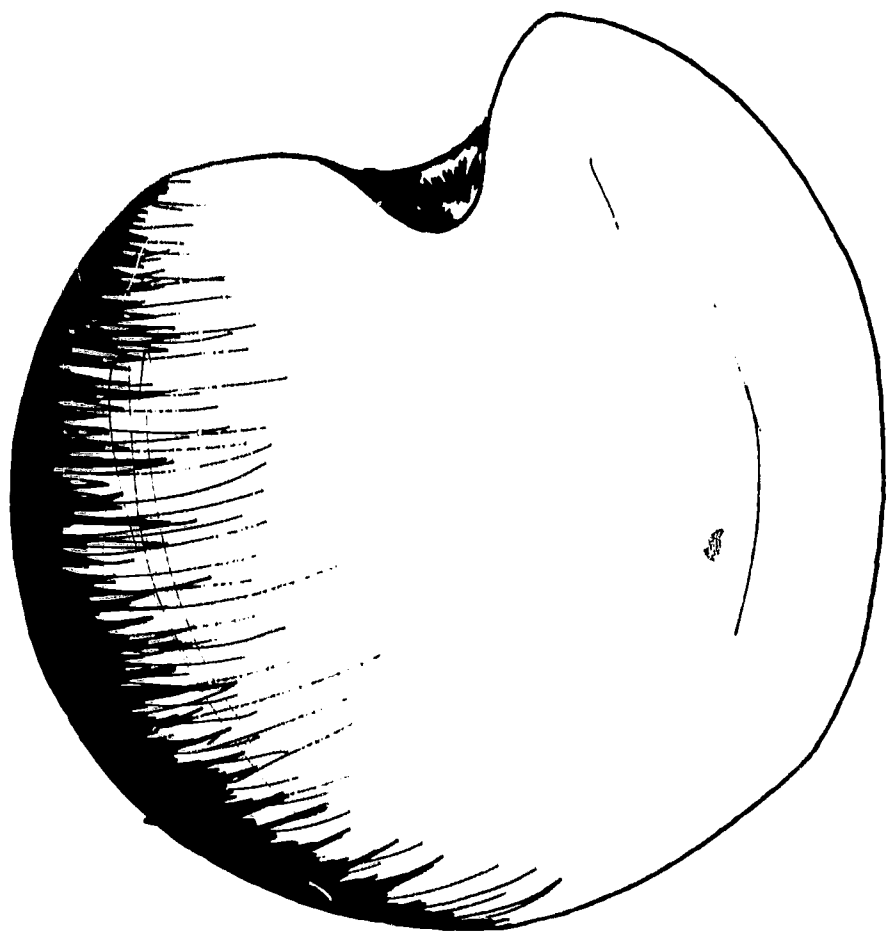
Reproduces by seed

Annual

MALLOW



LEAF



SEED

MALLOW
(Malva rotundifolia L.)
Buttonweed, Cheeseweed

White flowers

Leaves round with the edges slightly lobed

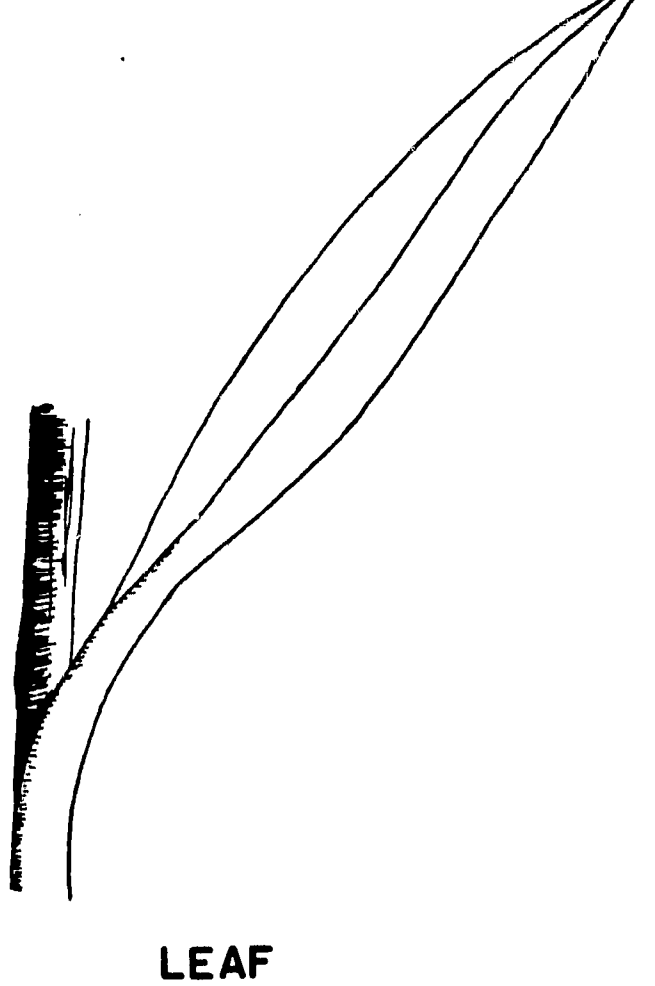
Stems somewhat prostrate extending from the crown

Has a deep taproot

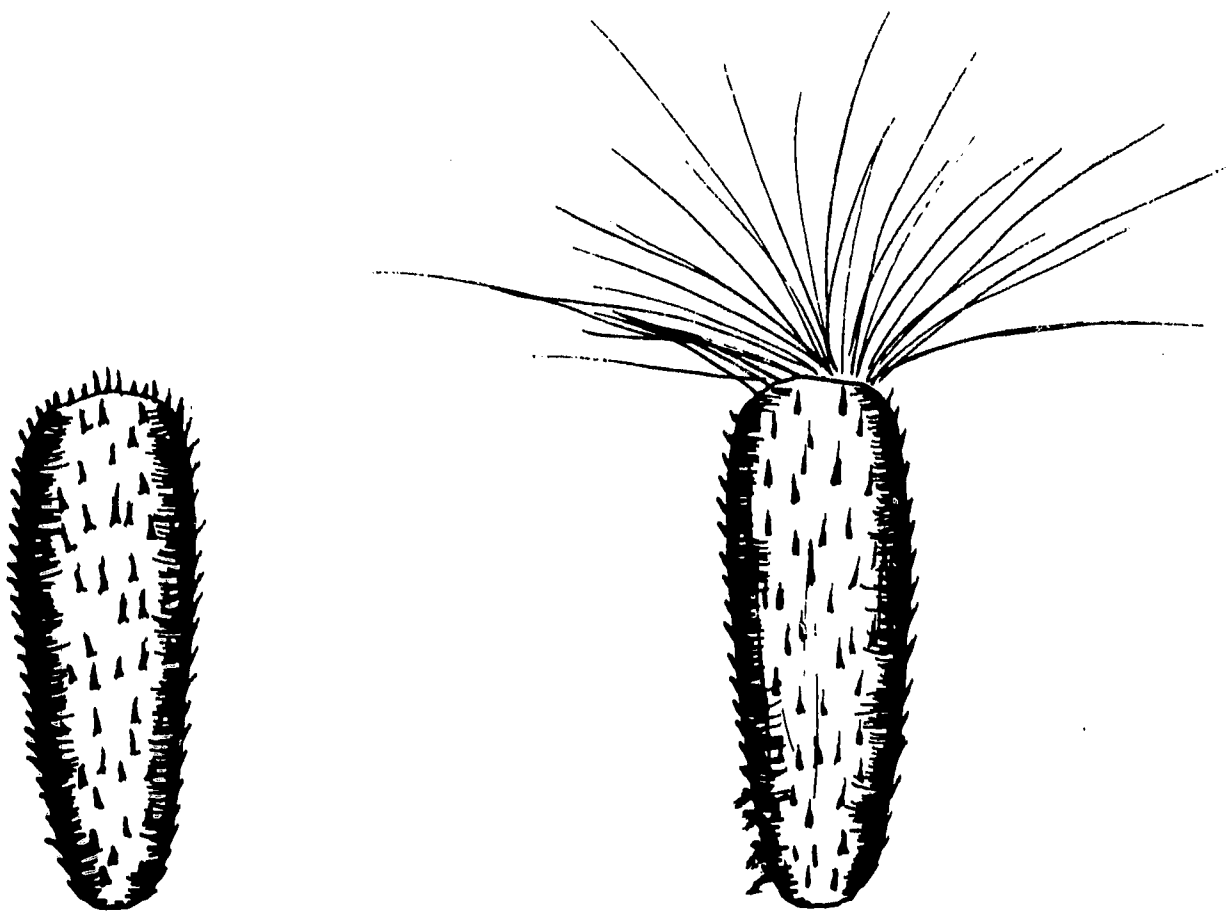
Reproduces by seed

Annual, biennial and possibly perennial

MARES-TAIL



LEAF



SEED

MARES-TAIL

(Eriqeron canadensis L.)
Canada fleabane, Horseweed

Flowers, many small white

Grows 2 to 5 feet high

Leaves alternate and rough to the touch

Upper leaves entire and linear

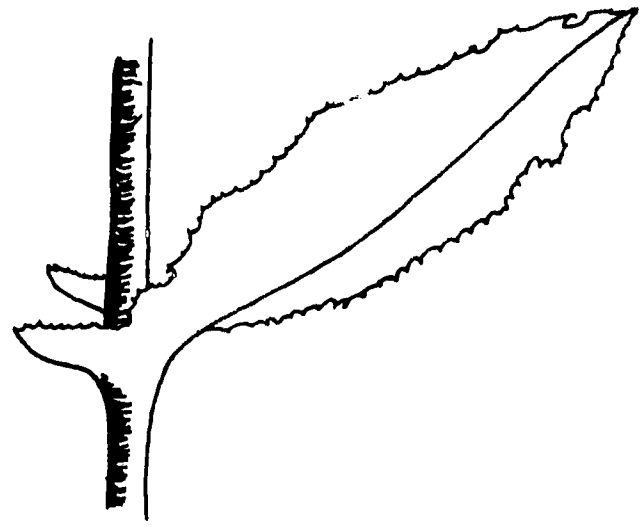
Lower leaves serrate

Leaves and stems hairy

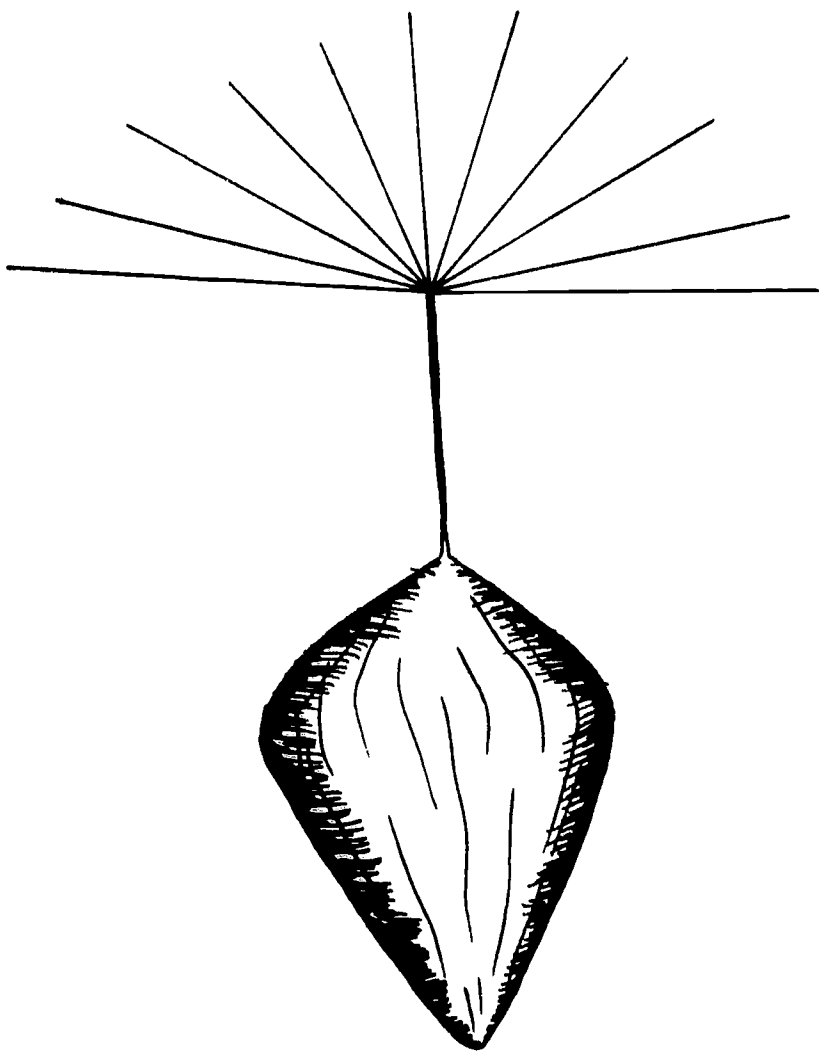
Reproduce by seed

Annual

PRICKLY LETTUCE



LEAF



SEED

CHINA LETTUCE

(Lactuca scariola L.)
Prickly lettuce, Wild lettuce

Light yellow flowers

Upper leaves clasping

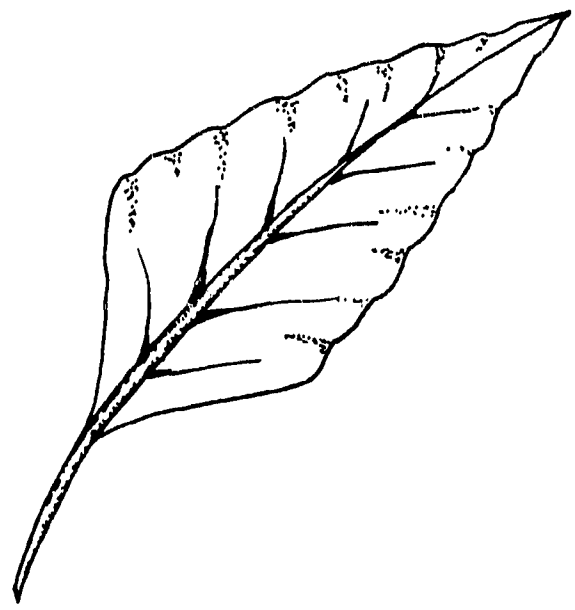
Leaves often take quarter turn

Midrib on under side of leave lighter color and lined with spines

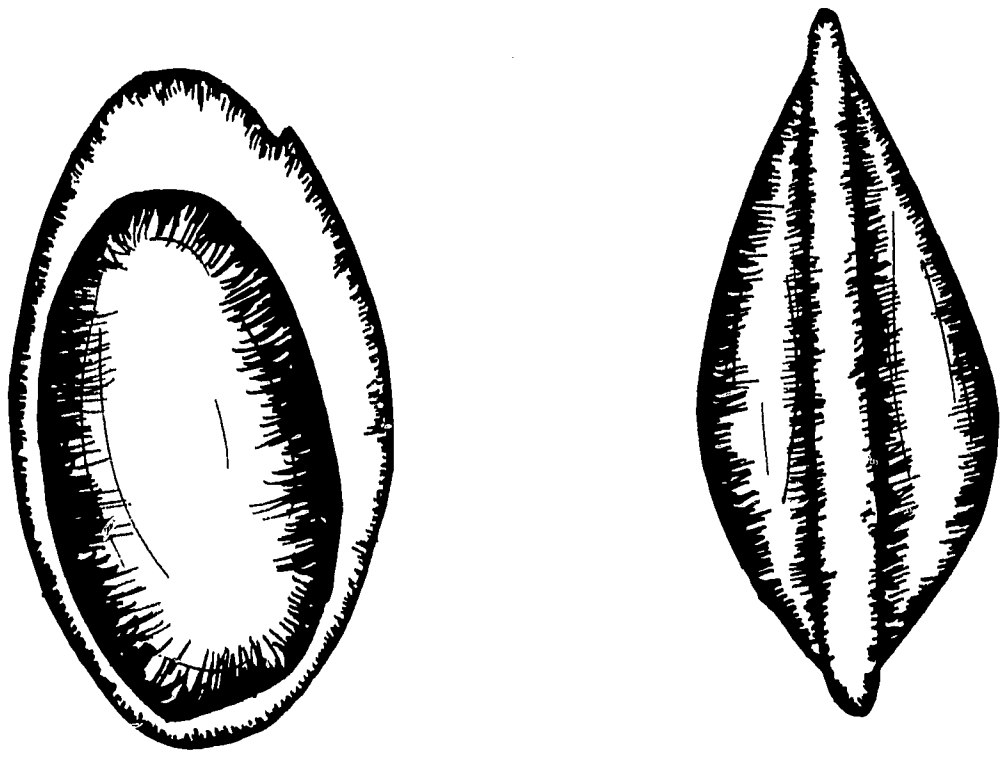
Milky juice

Annual

ROUGH PIGWEED



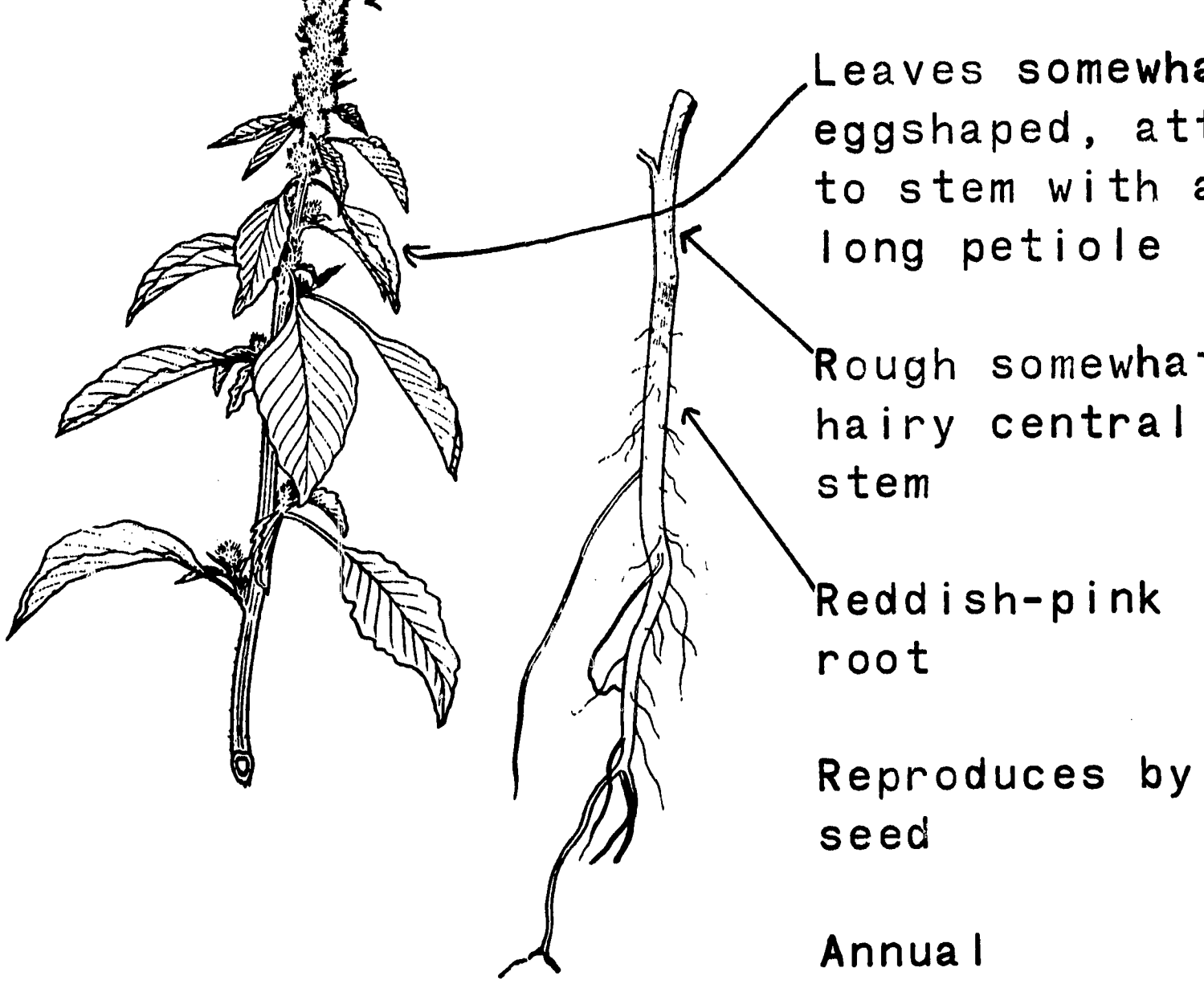
LEAF



SEED

PIGWEED

(Amaranthus retroflexus L.)
Redroot



Dense prickly clusters of inconspicuous flowers

Leaves somewhat eggshaped, attached to stem with a long petiole

Rough somewhat hairy central stem

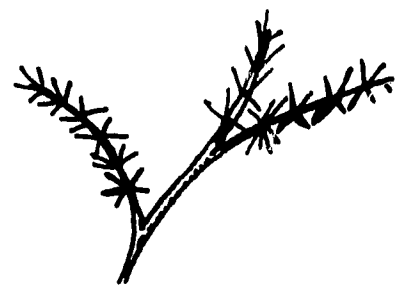
Reddish-pink root

Reproduces by seed

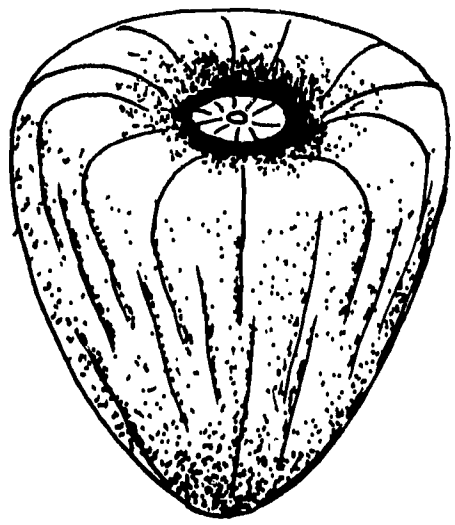
Annual

RUSSIAN THISTLE

YOUNG LEAF



MATURE LEAF



SEED

RUSSIAN THISTLE

(Salsola pestifer A. Nels)
Tumbleweed

Light pink to green (inconspicuous) flowers produced in the axils of leaves and stems

Young plants are succulent and fleshy

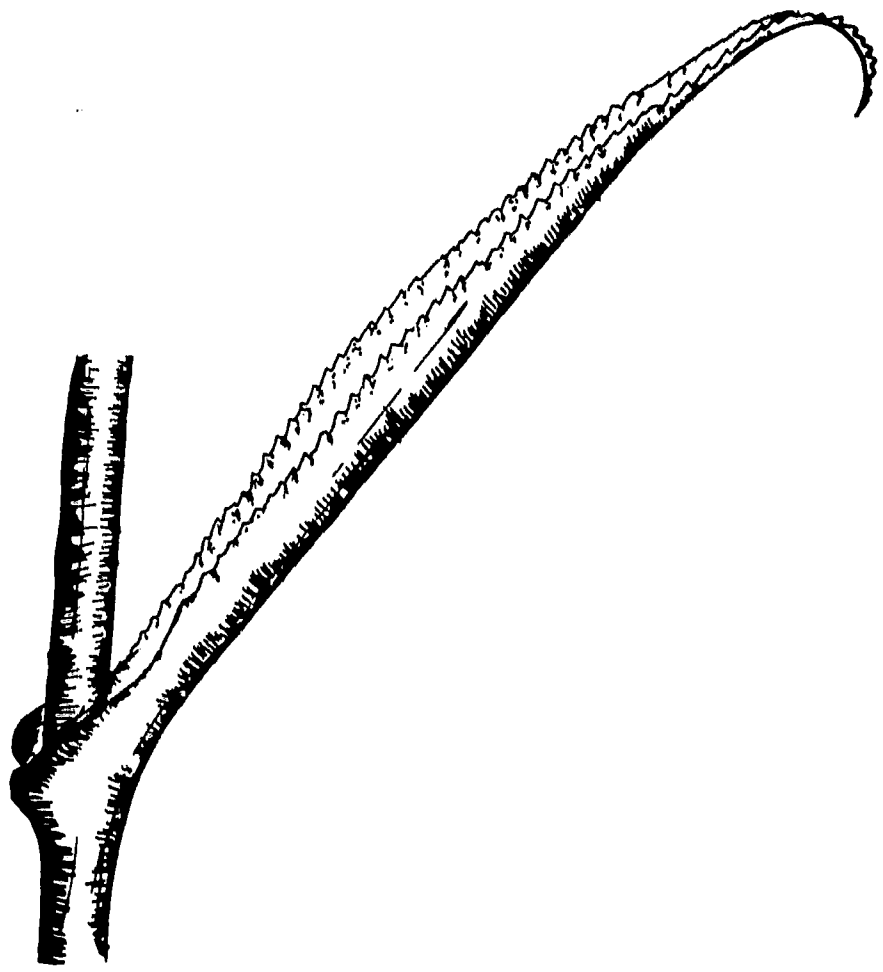
Extensively branched, bushy growth

Purple or reddish strips on stems

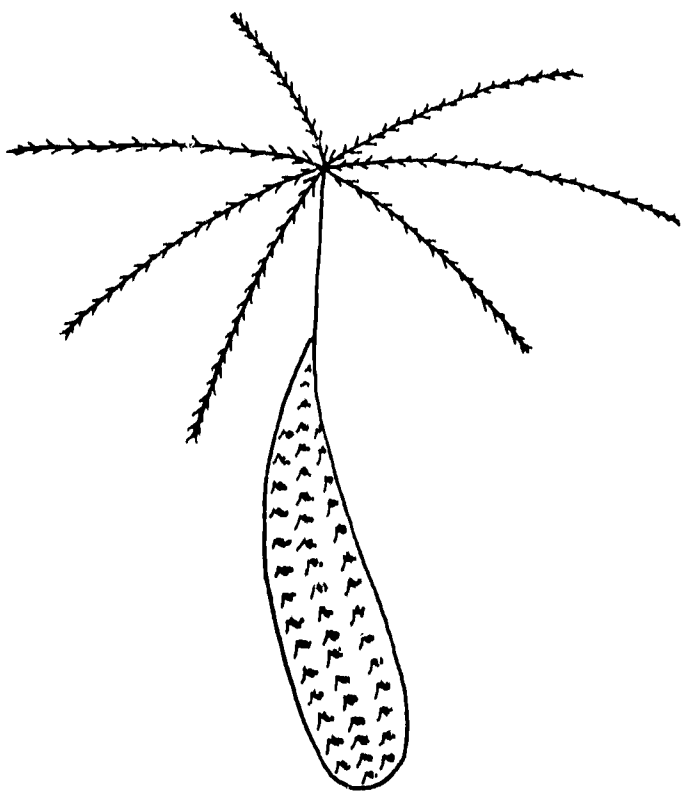
Pest becomes stickery at maturity

Annual

SALSIFY



LEAF



SEED

WILD SALSIFY

(Tragopogon pratensis L.)
Oyster plant, Goatsbeard

Yellow or purplish blue flower

Seed head forms large white puff ball

Leaves long and linear almost "grass-like"

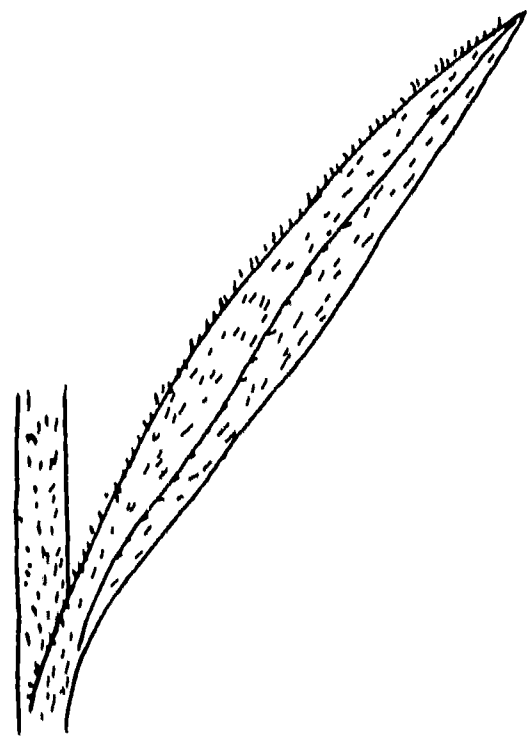
Plant smooth and contains a bitter, white milky juice

Plant has a deep fleshy taproot

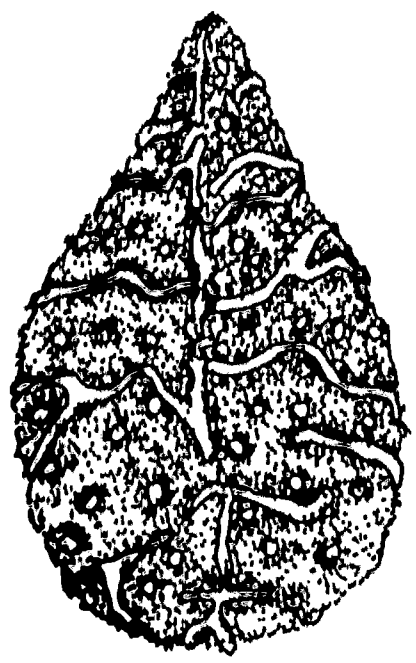
Reproduces by seed

Biennial

TARWEED



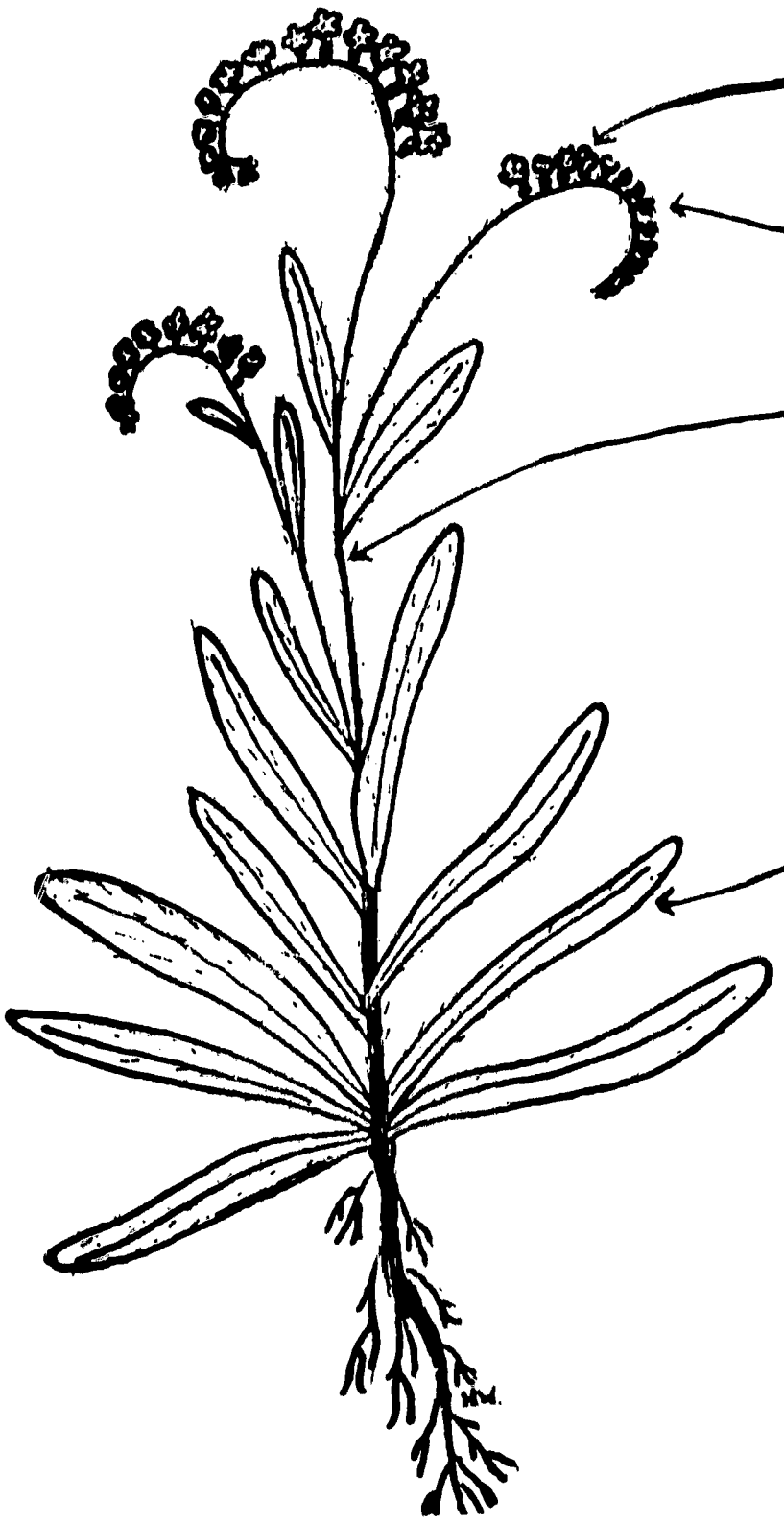
LEAF



SEED

TARWEED

(Amsinckia intermedia F and M)
Fiddleneck



Yellow flowers

Gooseneck flower stalk

Plant covered with hairs

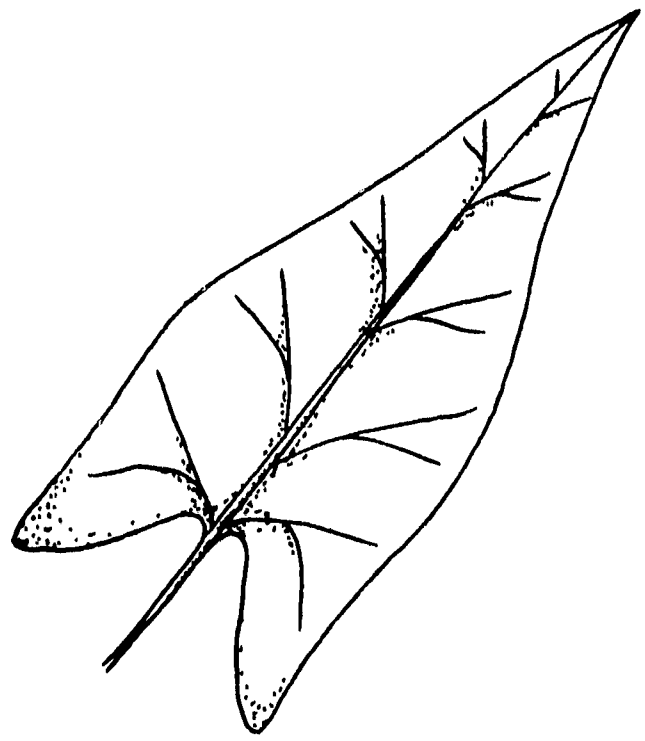
Entire plant rough and stickery

Leaves dull green to grayish

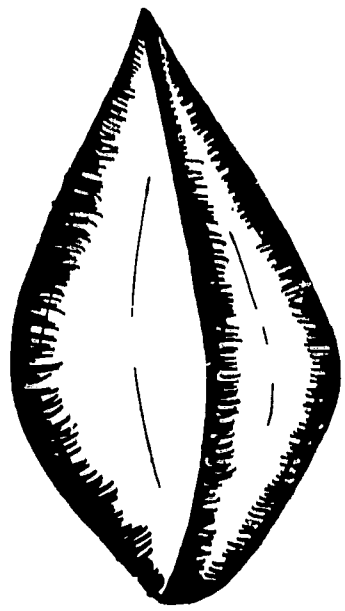
After maturity plant becomes a dull gray

Annual

WILD BUCKWHEAT



LEAF



SEED

WILD BUCKWHEAT

(Polygonum convolvulus)
Black bindweed

Flower inconspicuous borne in clusters on flower stalks

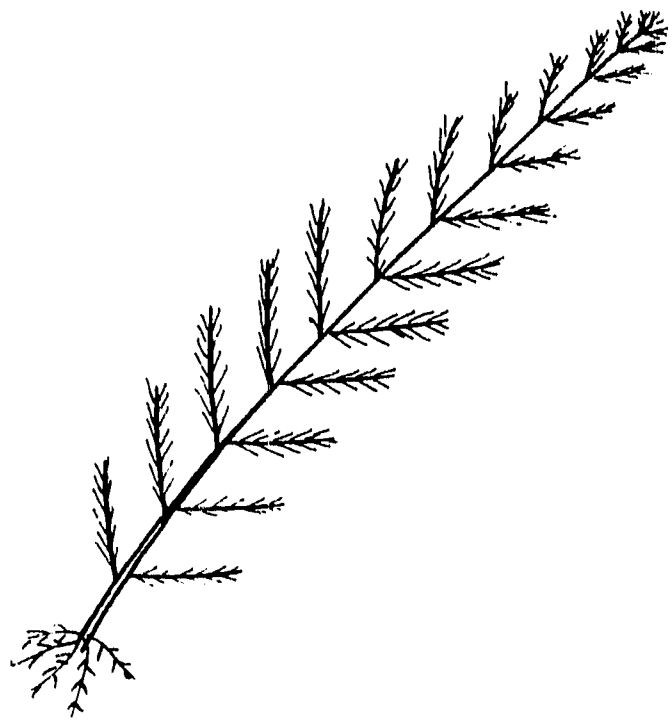
Leaves arrow or heartshaped

Stems long, twining or trailing

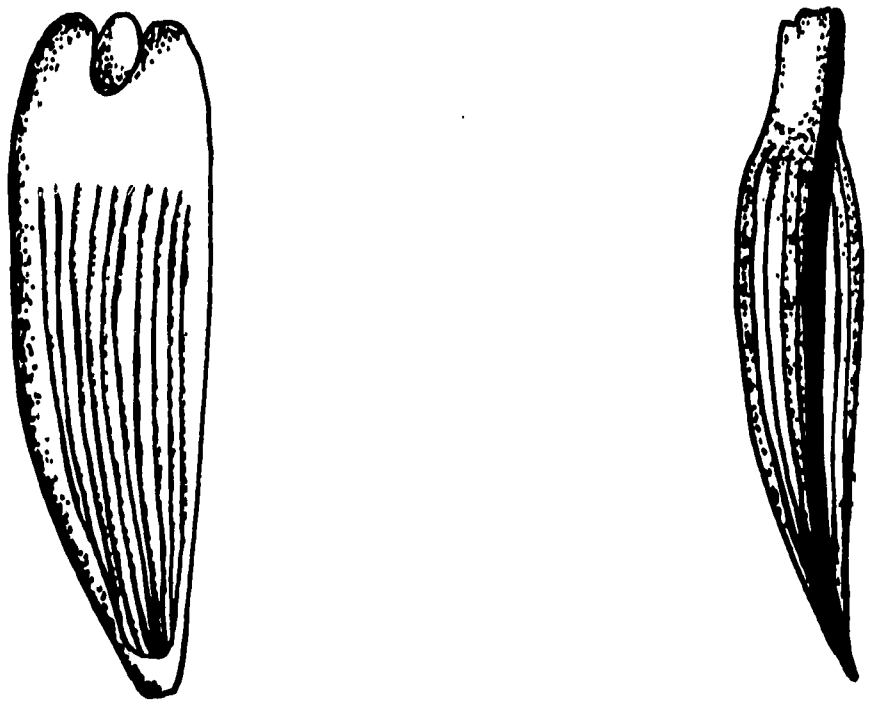
Reproduces by seed

Annual

YARROW



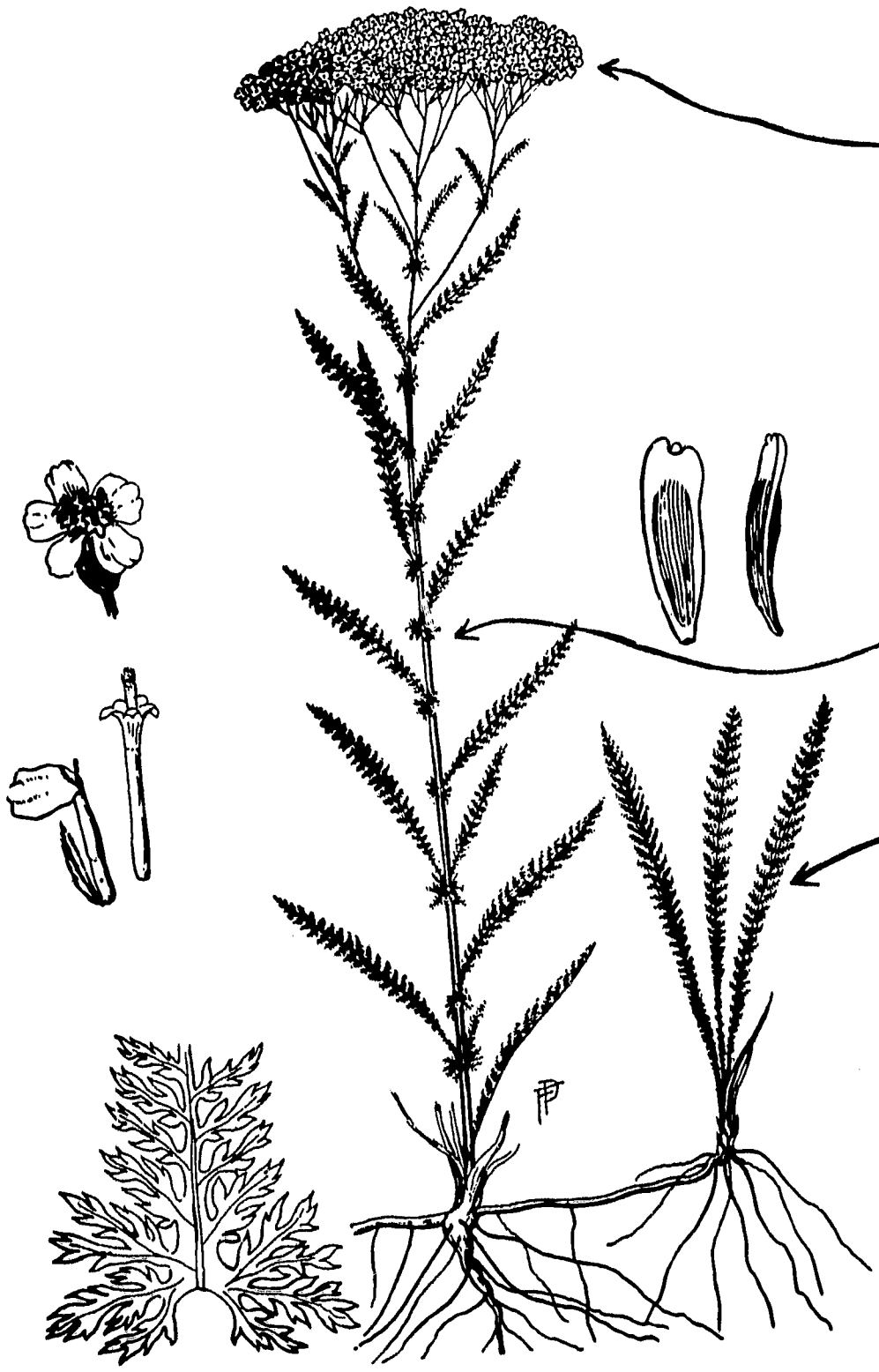
LEAF



SEED

YARROW

(Achillea millefolium L.)
Milfoil, Thousand-leaf



White

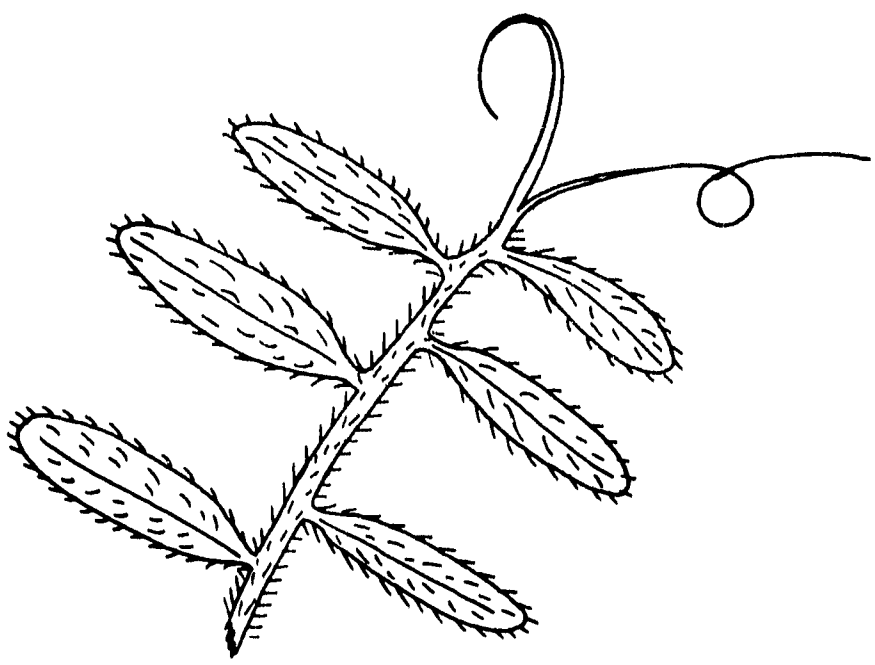
Grows 1 to 2 feet tall

Covered with fine hairs

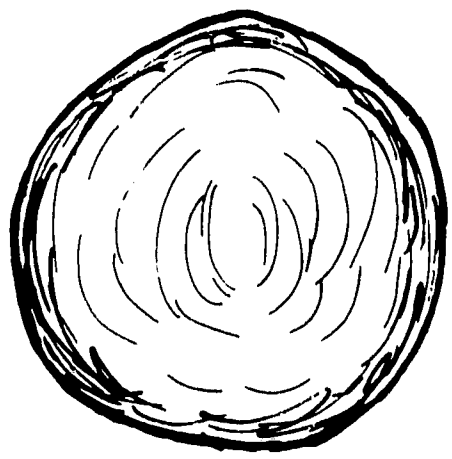
Fine fern-like leaves

Perennial

HAIRY VETCH



LEAF



SEED

APPENDIX

APPENDIX A

This letter is being sent state-wide to the Vocational Agriculture departments in Washington. Would each of you consider for a moment what visual aids would be most beneficial to you in your respective Agronomy or Crops teaching programs. Coordinated efforts between the Agronomy Department and Division of Agricultural Education at WSU are being attempted in hopes of compiling visual aids for instructional use in the field of Agronomy. These aids may be in the form of 2 x 2 slides, transparencies, charts, workbooks, etc.

The purpose of this letter is to ascertain which areas of Agronomy should be emphasized based on the major requests of this survey. In this way visual aids of the most significance can be prepared.

As an example one area which may be applicable, would be 2 x 2 slides and transparencies regarding crop seed judging and identification characteristics of crops appearing on the state identification list. These could include diagrams or actual photos of seed quality, seed damage and other factors used in pan seed judging. Slides could be prepared of crop and weed seeds and seedlings for identification purposes. Other areas which can be diagrammed quite well by visual aids are the overall plant growth pattern and plant reproduction as pertaining to crop species.

Please compile your list in order of preference of about ten general headings in the Agronomic field and forward to the following address as soon as possible:

Gilbert A. Long, Agricultural Education
Washington State University, Pullman, Washington 99163

Let me suggest that you look at the two transparency master publications as you consider this request. Any transparency masters that you have individually developed would be welcomed.

Sincerely yours,

Dwane G. Miller
Assistant Professor of Agronomy

Gilbert A. Long
State Supervisor
Agricultural Education

DGM/GAL:sa

APPENDIX B

Questionnaires Sent to Teachers to Obtain
Evidence Regarding Usefulness of Masters

Dear _____:

Have you used masters from "Transparency Masters for Agriculture (Supplement)"?

YES _____

NO _____

Do you have dry copy equipment available?

YES _____

NO _____

Do you have Diazo process equipment available?

YES _____

NO _____

Which areas have you used most often?

Soils and Fertilizers	YES _____	NO _____
Horticulture	YES _____	NO _____
Animal Reproduction	YES _____	NO _____
Feeding	YES _____	NO _____
Arc Welding	YES _____	NO _____
Future Farmers of America	YES _____	NO _____