

Hartmann and Kester's Principles and Practices of Plant Propagation: A Sneak Preview of the 9th Edition[©]

Sandra B. Wilson¹, Fred T. Davies, Jr² and Robert L. Geneve³

¹University of Florida, Department of Environmental Horticulture, Gainesville, Florida, 32611, USA

²Texas A&M University, Department of Horticultural Sciences, College Station, Texas, 77843, USA

³University of Kentucky. Department of Horticulture, Lexington, Kentucky, 40546, USA

Email: sbwilson@ufl.edu

INTRODUCTION

The first edition of “Plant Propagation: Principles and Practices” was published in 1959. Dr. Hudson Hartmann envisioned writing a comprehensive plant propagation text in 1955 and invited his colleague Dr. Dale Kester at the University of California, Davis to be his co-author. Hudson and Dale taught or co-taught plant propagation together at UC Davis from 1945 until 1987 and both were active members of the International Plant Propagator’s Society formed in 1951. Together, they co-authored five editions of their foundational textbook that has become the standard reference for teaching plant propagation at most colleges and universities. In 1990, Dr. Fred T. Davies, Jr. from the Texas A & M University joined as a third author for the 5th edition and in 1997 Dr. Robert L. Geneve from the University of Kentucky became the fourth author for the 6th edition. In recognition of the contributions of the initial authors, the textbook was renamed “*Hartmann and Kester’s Plant Propagation: Principles and Practices*” for the 7th edition published in 2002. As the textbook marked its 50th anniversary in 2011, the 8th edition was printed with full color figures throughout the chapters. For the newly revised 9th edition, Dr.

Sandra B. Wilson from the University of Florida became the fifth author for the textbook. With the ninth edition - Davies, Geneve and Wilson strived to continue the tradition and original intent expressed by Hudson Hartmann and Dale Kester in the preface of the first edition that “This book provides a source of information concerning the fundamental principles involved in plant propagation and serves as a manual that describes useful techniques for propagating plants”.

The ninth edition continues the tradition of presenting paired chapters where the principles underlying the science of propagation alternate with the technical practices and skills utilized for commercial plant propagation. As with previous editions, the amount of material between editions has increased substantially (**Table 1**), and many aspects of plant science and horticultural production systems have been integrated into each relevant chapter. The references have been updated substantially to help the reader delve deeper into these subjects depending on their interests and research needs. The majority of figures have been reconfigured and updated for the new edition (**Figs. 1-3**). In addition, this is the first edition that presents a compiled glossary of propagation terms as a separate section following the subject matter chapters.

As in previous editions, the book is organized into five basic parts (**Table 2**). The initial three chapters are introductory chapters meant to support general aspects of propagation including a historical perspective, basic plant biology concepts, and the environmental control of facilities associated with propagation and nursery practices. Part two provides a discussion of seed propagation from the initial aspects of seed development through seed production, dormancy, and germination. Part three covers important aspects of vegetative propagation. This reorganized section begins with a basic discussion of clonal selection followed by the major chapters describing vegetative propagation by cuttings and grafting. It concludes with chapters covering layering and propagation by specialized structures, including bulbs and tuberous roots. The

fourth part of the textbook is a discussion of propagation utilizing tissue culture techniques. This section has been reorganized to reflect the importance of micropropagation in horticultural crop production. The principles and techniques of micropropagation from meristematic tissue (axillary shoot proliferation) are discussed in Chapter 17 whereas the principles and techniques of plant tissue culture from nonmeristematic tissue (adventitious origin) are discussed separately in Chapter 18. The final section includes separate chapters on specific propagation techniques for fruits and nuts, woody perennial nursery crops, and annual and herbaceous perennial crops for the greenhouse and nursery. These final chapters have been updated, new species added and nearly 1,420 references have been compiled to support propagation practices.

INTERACTIVE LEARNING RESOURCES

Supplemental to the text, there are a number of online resources available to assist instructors and students. These include an animated life cycle of angiosperms, online self-review quizzes, a web application for glossary terms, instructor PowerPoints for each chapter, and a test bank of useful questions and answers.

Plant Life Cycle. Sexual reproduction (fusion of male and female gametes) occurs in the flower. The sexual cycle of plant reproduction starts with the development of a pollen microspore mother cell and a female megaspore mother cell, which undergo meiotic cell divisions (**Fig. 4**). This eventually leads to functional male pollen cells within the pollen sac and female cells within the embryo sac. Within a typical angiosperm, the steps to pollen development (microsporogenesis), ovule development (megasporogenesis), pollination, fertilization, and embryo development have been fully illustrated and narrated to enhance student learning. These concepts are discussed in detail in Chapter 4 of the text (Davies et al., 2018) and can be viewed online at: http://irrecenvhort.ifas.ufl.edu/creative_tools.html.

Online Self-review Quizzes. A series of online interactions was created for students to review concepts introduced in the text (**Fig. 5**). These were developed for each of 18 chapters and include a variety of exercises including: multiple choice, true/false, drag and dropping the correct term to its description, and identifying the correct sequence of events. For example, using a drop down menu, the user could be asked to identify the correct sequence of events that occurs in a successful graft as illustrated in Chapter 12 of the text (Davies et al., 2018). The questions are automatically graded for each chapter, allowing instant feedback. Self-review quizzes can be found at: http://irrecenvhort.ifas.ufl.edu/creative_tools.html.

Web Glossary. Throughout the first 18 chapters of the text (Davies et al., 2018), nearly 500 glossary terms appear in orange bold the first time they are defined. As a reference, a cumulative list of all glossary terms can be found at the end of the text. This is new to the 9th edition. In addition, a web application has been built using an alphabetical collection of glossary pages, a navigational menu system organized by topic categories, and an internal search function. This allows the glossary terms and corresponding images to be readily available on any computer or mobile device by clicking on the following link:

http://irrecenvhort.ifas.ufl.edu/creative_tools.html. For example, if interested in seed terminology, the user could select ‘seed propagation’ from the menu, and then select from four choices: development, technology, germination, and dormancy. If the user selects ‘dormancy’, then another menu appears listing the types of dormancy to choose from. Exogenous seed dormancy is described and illustrated with a cross section of a seed showing the macrosclereid layer in the seed coat when this glossary term is selected (**Fig. 6**).

Online Instructor Resources. To access supplementary materials online, instructors need to request an instructor access code at www.pearsonhighered.com/irc. Within 48 hours of registering, instructors can enter their access code, locate the textbook in the online catalog, and select the instructor resources button to find PowerPoint slides containing all of the figures for each of the chapters. There are also nearly 450 test questions (and answers) including multiple choice, true/false, fill in the blank, and short answer that students should have an understanding of upon completion of the chapters.

LITERATURE CITED

Davies, F.T., R.L. Geneve, and S.B. Wilson. 2018. Hartmann and Kester's Plant Propagation-Principles and Practices. 9th Edition. Pearson Education Inc., New York.

Table 1. A timeline representing each of the nine editions, publication year, total pages, figures, references and authorship.

Edition	Year	Pages	Figures	References	Chapters	Authorship and content
1	1959	531	201	986	18	Hartmann and Kester
2	1968	659	232	1464	19	Hartmann and Kester Addition of chapter on micropropagation methods
3	1975	664	249	1497	19	Hartmann and Kester
4	1983	716	282	2104	20	Hartmann and Kester Addition of chapter on micropropagation principles
5	1990	631	315	2390	20	Hartmann, Kester and Davies Addition of Fred Davies as third author
6	1997	757	462	2930	21	Hartmann, Kester, Davies and Geneve Dedication to Hudson Hartmann; Addition of Bob Geneve as fourth author; Addition of chapter on biology of propagation'; Instructors manual with transparency masters
7	2002	840	490	3225	21	Hartmann, Kester, Davies and Geneve Renamed "Hartmann and Kester's Plant Propagation: Principles and

						Practices”; CD ROM included; Color included in layout
8	2011	869	622	3292	21	Hartmann, Kester, Davies and Geneve Dedication to Dale Kester; Color images; Study questions at the end of chapters; Instructors resource website
9	2018	945	679	3798	21	Davies, Geneve, and Wilson Addition of Sandy Wilson as fifth author; illustrations designed by Geneve; Complete reorganization of tissue culture chapters; 500 term glossary

Table 2. New chapter organization of the ninth edition (Davies et al., 2018).

Plant Propagation Principles and Practices			
1	How plant propagation involved in human society	12	Principles of grafting and budding
2	Biology of plant propagation	13	Techniques of grafting
3	The propagation environment	14	Techniques of budding
4	Seed development	15	Layering and its natural modifications
5	Principles and practices of seed selection	16	Propagation by specialized stems and roots
6	Techniques of seed production and handling	17	Principles and practices of micropropagation from meristematic tissue
7	Principles of propagation from seeds	18	Principles and techniques of plant tissue culture from nonmeristematic tissue
8	Techniques of propagation by seeds	19	Propagation of fruit and nut species
9	Principles and practices of clonal selection	20	Propagation of ornamental trees, shrubs, and woody vines
10	Principles of propagation by cuttings	21	Propagation of ornamental annuals and perennials

11	Techniques of propagation by cuttings		Glossary- 500 terms
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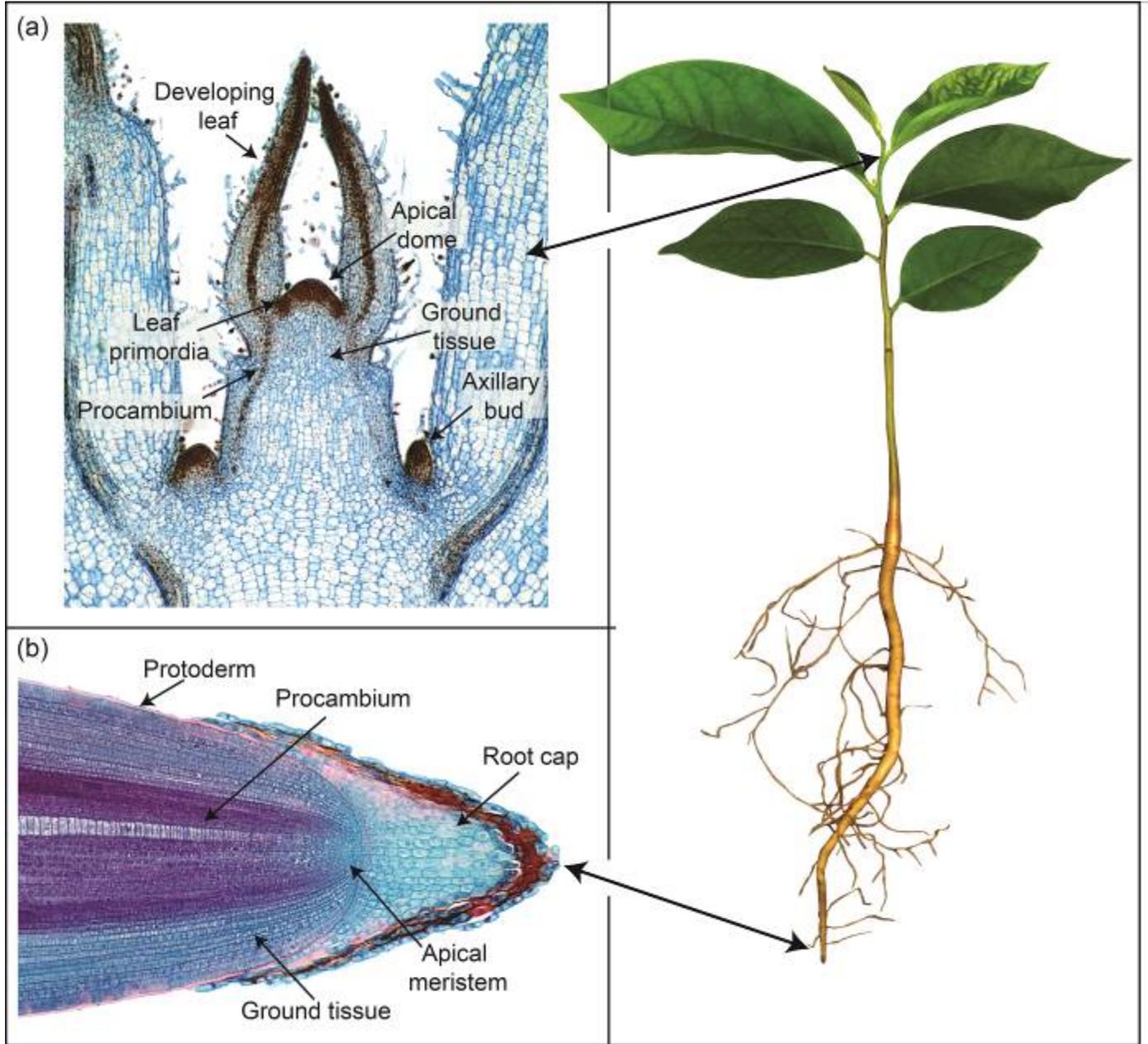


Figure 1. Photomicrographs of (a) shoot and (b) root meristems (Davies et al., 2018).

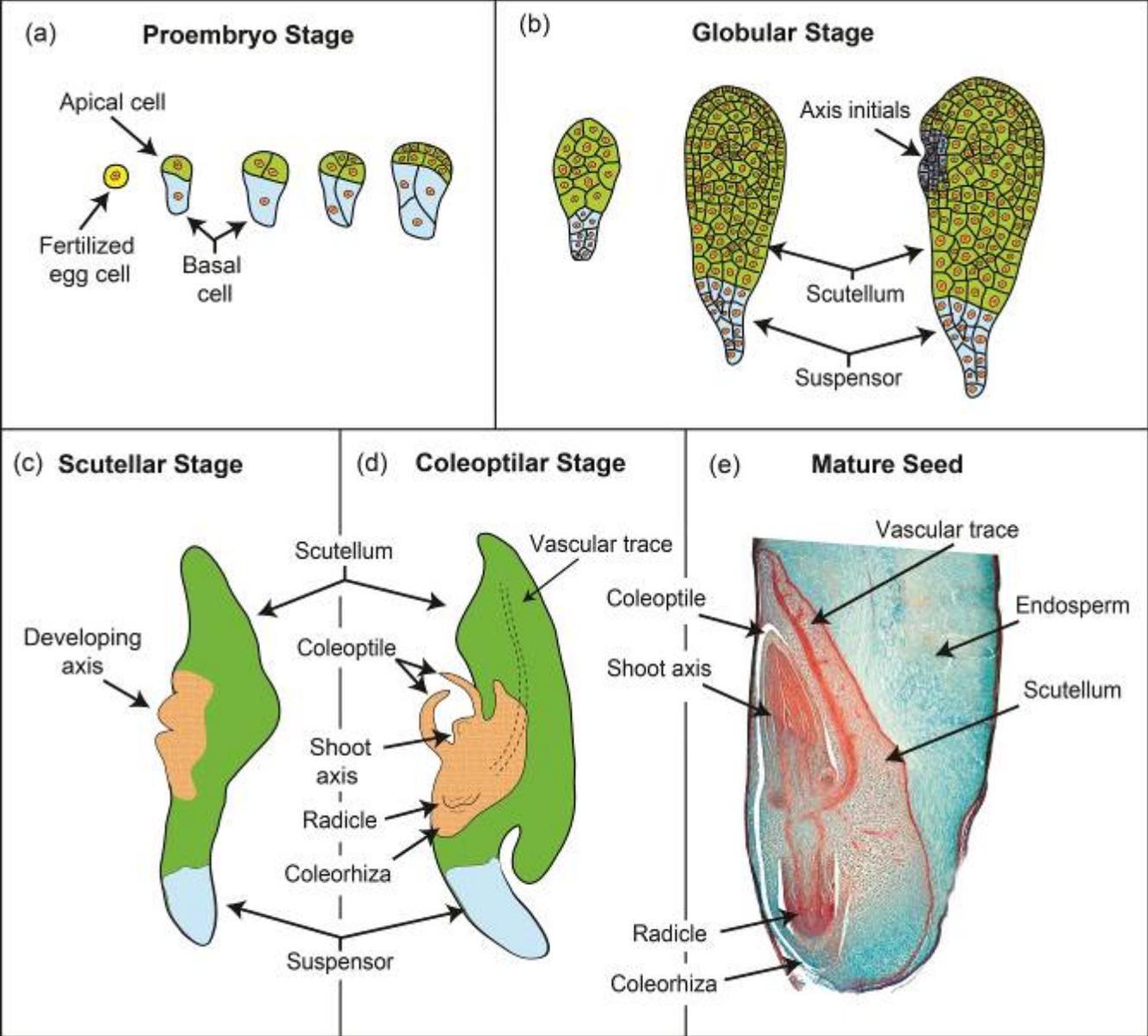


Figure 2. Embryo development in a typical monocot (corn) (Davies et al., 2018).

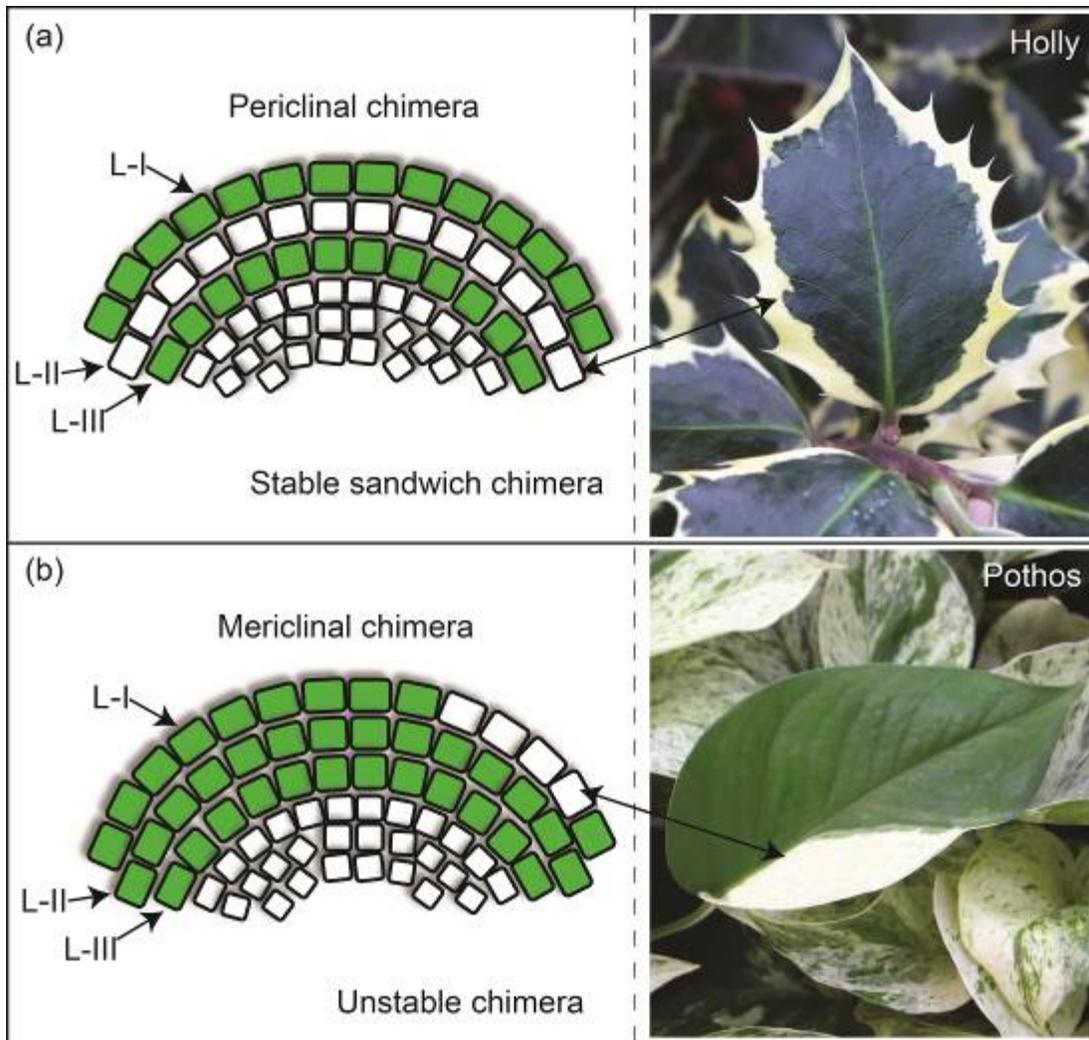


Figure 3. Two types of chimeras in variegated leaves are (a) periclinal and (b) mericlinal (Davies et al., 2018).

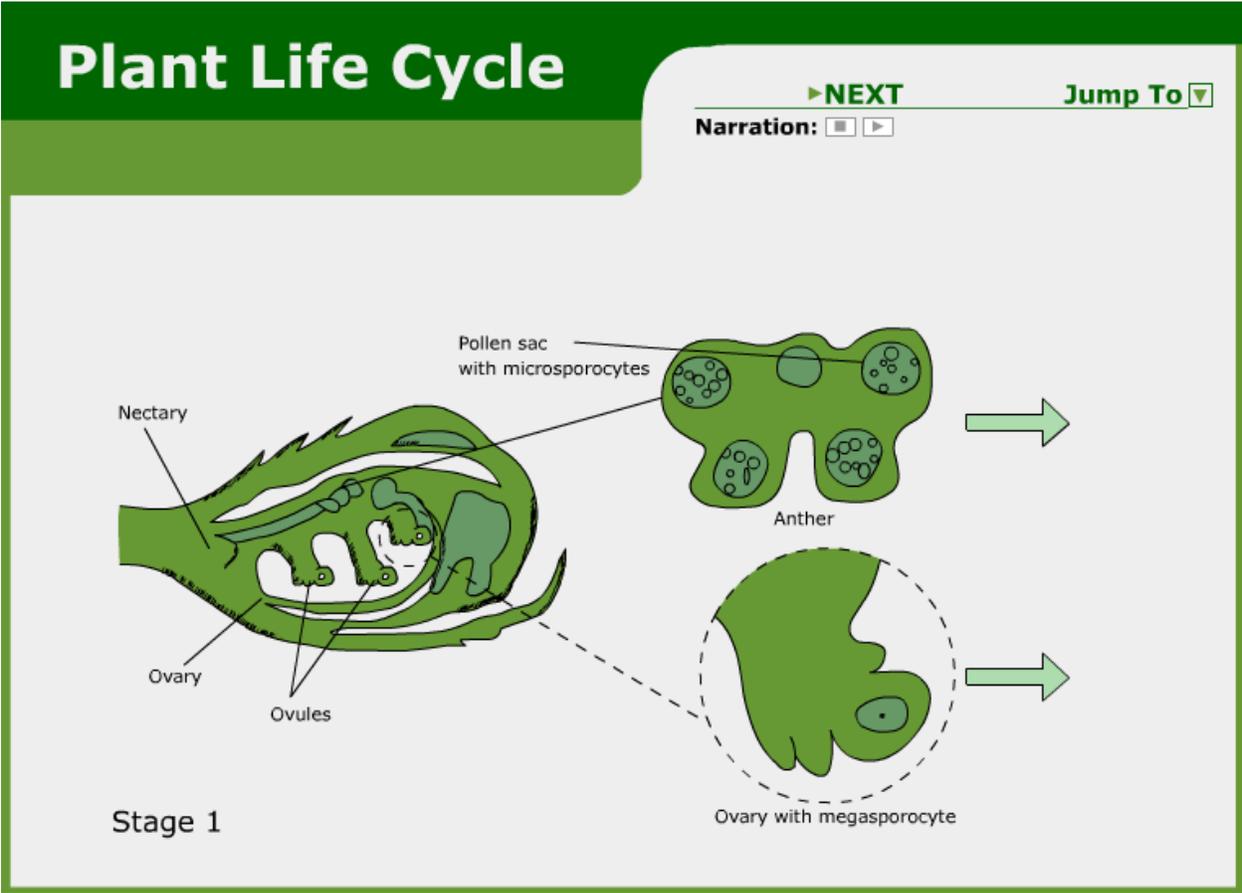


Figure 4. Screen capture of a representative angiosperm life cycle beginning with the development of microspore and megaspore mother cells. The user can advance to any stage of development using a drop down menu that is synchronized with audio narration.

Menu

- Chapter 5
 - Chapter 5
 - Seed Propagation
 - Genetics matching
 - Breeding
 - Breed True
 - Breeding 2
 - Breeding 3
 - Breeding 4
 - Floral Composition
 - Pollinators
 - Perfect Flower**
 - Genetics
 - Primitive Variety
 - Roguing
 - Hand Pollination
 - Hand Pollination 2
 - END

Ch 5 Seed Selection - KN

Which statement best describes a perfect flower?

- Flower containing only stamens; the pistil is reduced and nonfunctioning
- Flower containing only the pistil; stamens are reduced and nonfunctioning
- Both male and female structures are nonfunctioning
- Both male and female structures are present and functioning

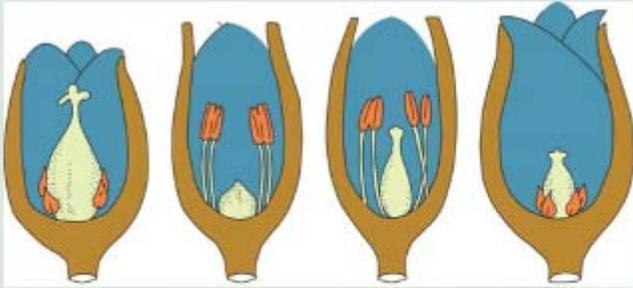


Figure 5. Illustration of a multiple choice question from chapter 5 asking the user to select the statement that best describes a perfect flower.

Seeds

Exogenous dormancy

Exogenous dormancy is imposed on the seed by factors outside the embryo like the fruit or seed coverings. This may involve a physical, mechanical or chemical factor.

The most common exogenous dormancy is caused by impermeability of the seed coat due to a layer of palisade-like macrosclereid cells.

In order to get these seeds to imbibe water, they must first have this outer layer of cells naturally eroded or treated by the process of scarification. (see Chapter 7).

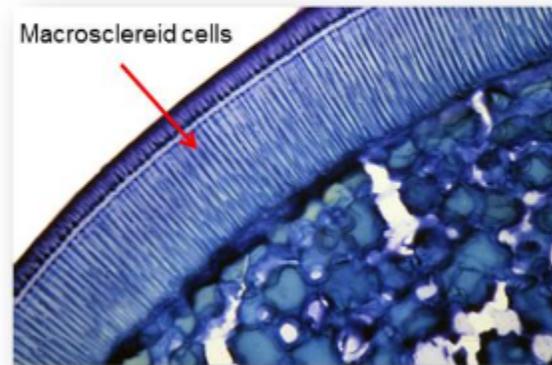


Figure 6. Cross section of a seed showing the macrosclereid layer in the seed coat when this glossary term is selected.