

Seed Identification Resources

Included here are a few valuable resources for seed identification. This is not a comprehensive list but is a good place to start on your quest for seed identification information. Additionally, local and regional floras from all over the world often contain valuable information about fruit and seed descriptions. There are too many to list here, but many are available as books, journal articles, and online websites. If purchase is not an option for you, be sure to check your local university libraries for the books and journals listed. Not all resources are published in the English language, but you can easily use online translation programs to translate to English or any other language of your choice. Good luck with your search for answers.

Books:

Barkworth, M. E., K. M. Capels, S. Long, and M. B. Piep. 2003. Flora of North America. Vol. 25. Magnoliophyta: Commelinidae (in part): Poaceae, part 2. Oxford University Press. 783 pp. <http://floranorthamerica.org/Poaceae> or http://floranorthamerica.org/Volume_25 [Excellent line drawings of whole grass plants and detailed floral structures; sufficient in many cases to assist in identification of grass seed units.]

Barkworth, M. E., K. M. Capels, S. Long, L. K. Anderton, and M. B. Piep. 2007. Flora of North America. Vol. 24. Magnoliophyta: Commelinidae (in part): Poaceae, part I. Oxford University Press. 911 pp. Hard copies available for purchase or digital versions available online at <http://floranorthamerica.org/Poaceae> or http://floranorthamerica.org/Volume_24 [Excellent line drawings of whole grass plants and detailed floral structures; sufficient in many cases to assist in identification of grass seed units.]

Baxter, D. and L. O. Copeland. Seed Purity and Taxonomy. 2008. Michigan State University Press. 719 pp. [Contains seed descriptions and illustrations grouped by family.]

Bojňanský, V. and A. Fargašová. 2007. Atlas of Seeds and Fruits of Central and East-European Flora: the Carpathian Mountains Region. Springer. 1046 pp. [Nearly 4,800 excellent line drawings and detailed seed/fruit descriptions.]

Bonner, F. T., R. P. Karrfalt, (eds.). 2008. The Woody Plant Seed Manual. Agriculture Handbook 727. United States Department of Agriculture Forest Service. https://www.fs.usda.gov/nsl/nsl_wpsm.html or https://www.fs.usda.gov/rm/pubs_series/wo/wo_ah727.pdf [Excellent reference for tree and shrub species with illustrations of internal seed/fruit morphology and black and white images of seeds]

Bryson, C. T. and M. S. DeFelice (eds.). 2009. Weeds of the South. University of Georgia Press. 468 pp. [More than 1,500 full-color photographs (seed photos included for most species), diagnostic descriptions and distribution information on 400 of the most troublesome weedy and invasive plants found in the southern United States.]

Clark, L. G. and R. W. Pohl. 1996. Agnes Chase's First Book of Grasses: The Structure of Grasses Explained for Beginners. 4th ed. Smithsonian Institution Press. 127 pp. [Excellent well illustrated publication to assist with understanding grass floral structures – highly recommended for anyone new to grass identification.]

Cornejo, F. and J. Jonovec. 2010. *Seeds of Amazonian Plants*. Princeton University Press. 155 pp. [Covers 544 genera and 131 families of Amazonian plants and includes 750 color photographs and seed identification key.]

Davis, L. W. 1993. *Weed Seeds of the Great Plains: A Handbook for Identification*. University Press of Kansas. 145 pp. [Information about the seeds of 280 species of weedy plants of the Great Plains, including ones commonly found in crops, rangeland, lawns, and along roadsides. Includes 600+ photographs and drawings.]

Delorit, R. J. 1970. *Illustrated Taxonomy Manual of Weed Seeds*. Available at www.amazon.com. [Color photographs of seeds]

Delorit, R. J, and C. R. Gunn. 1986. *Seeds of Continental United States Legumes (Fabaceae)*. Agronomy Publications. 134 pp. [Morphology definitions, table of contents separated by morphological features, each page has four seed kinds and the other page has great in color pictures of those seeds. Available to purchase on Amazon at: <https://www.amazon.com/Continental-United-States-Legumes-Fabaceae/dp/0961684704>]

DiTomaso, J. M. and E. A. Healy. 2003. *Aquatic and Riparian Weeds of the West*. University of California Agriculture and Natural Resources Publication 3421. 442 pp. [Comprehensive identification manual for aquatic and riparian weeds west of the Rocky Mountains. Includes full descriptions of 82 species representing 42 plant families (also provides information on another 96 species compared as similar species). Contains 560+ color photographs of plants and in many cases seeds. Currently out-of-stock at the UC Davis Bookstore but used books may be found on Amazon.]

DiTomaso, J. M. and E. A. Healy. 2007. *Weeds of California and Other Western States*. Vol. 1: Aizoaceae – Fabaceae and Vol. 2: Geraniaceae – Zygophyllaceae. University of California Agriculture and Natural Resources Publication 3488. 1 – 834 pp. [A 2-volume set arranged alphabetically by family. Includes full descriptions of 450+ weed species and another 360+ plants compared as similar species, representing 63 plant families. Color photographs of over 700 species including seeds, seedlings, flowers, and mature plants. Available for purchase at <http://anrcatalog.ucanr.edu/Details.aspx?itemNo=3488>]

Elpel, T. J. 2013. *Botany in a Day^{APG}: The Patterns Method of Plant Identification, An Herbal Field Guide to Plant Families of North America*. 6th Ed. HOPS Press, LLC, Pony, MT. [A fun and easy to follow guide to identification of plant families and genera. Beautiful color illustrations of representative family members. Great resource for beginners. Available for purchase online.]

Flora of North America, numerous hard copy volumes for various families are available, but can also be accessed online at http://floranorthamerica.org/Main_Page [See previous comments under Barkworth et al.]

Heywood, V. H., R. K. Brummitt, A. Culham, and O. Seberg. 2007. *Flowering Plant Families of the World*. Firefly Books. [Excellent for general family plant, fruit, and seed descriptions as well as economic uses. Available for purchase online].

Hillman, F. H. and H. H. Henry. 1935. *Photographs of Drawings of Seeds; The More Important Forage-Plant Seeds and Incidental Seeds Commonly Found With Them*. Division of Seed Investigations, Bureau of Plant Industry, United States Department of Agriculture, Washington

D.C.. Revised 1935. <https://frontrangeseedanalysts.weebly.com/usda-plates.html> [Excellent illustrations; note the scientific names may be out-of-date.]

Hitchcock A.S. 1971 Manual of the Grasses of the United States. (2nd Ed., revised by A. Chase). Dover Publications. [Now published as a two-volume paperback set. Very good dichotomous key with illustrations when you ID down to the genus and species level. Available for purchase on Amazon at: Volume 1 <https://www.amazon.com/Manual-Grasses-United-States-1/dp/0486227170> and Volume 2 <https://www.amazon.com/Manual-Grasses-United-States-2/dp/0486227189>]

Hurd, E. G., S. Goodrich, and N L. Shaw. 1997. Field Guide to Intermountain Rushes. U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, General Technical Report INT-306. [Includes diagnostic descriptions, line drawings, black and white and color photographs of each species. Available for free download at <https://www.fs.usda.gov/research/treesearch/24234>]

Hurd, E. G., N L. Shaw, J. Mastrogiuseppe, L. C. Smithman, and S. Goodrich. 1998. Field Guide to Intermountain Sedges. U. S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, General Technical Report RMRS-GTR-10. [Includes diagnostic descriptions and key, illustrations and color photographs of plants and seeds of 112 species of *Carex* from the Intermountain region.]

Jensen, H.A. 1998. Bibliography on Seed Morphology. A.A. Balkema Publ., Rotterdam, Netherlands. 310 pp. [Outstanding compilation of 3775 references focusing on publications containing information useful in seed identification and published before 1990. Unfortunately, this book is no longer in print, so check your local university library for a hard copy. A limited preview of this book is available online at https://books.google.com/books/about/Bibliography_on_Seed_Morphology.html?id=nfudcmH7A8UC]

Jones, S., J. Taylor, and F. Ash. 2004. Seed Identification Handbook: Agriculture, Horticulture & Weeds. 2nd ed. NIAB, Cambridge, UK. 94 pp. [A comprehensive guide to over 200 seeds commonly found in agriculture. Diagnostic descriptions, color photographs, and life-size seed silhouettes provided to aid identification. Available for purchase at <https://www.niab.com/news-views/publications-resources>]

Lentz, D. L. and R. Dickau. 2005. Seeds of Central America and Southern Mexico: the Economic Species. Memoirs of the New York Botanical Gardens. Vol. 91. The New York Botanical Garden. 297 pp. [Descriptions and black and white photographs of seeds of 503 species from Central American and southern Mexico. Available for purchase at <https://www.nhbs.com/seeds-of-central-america-and-southern-mexico-book>]

Mabberley, D. J. 2017. Mabberley's Plant-Book—A Portable Dictionary of Plants, Their Identification and Uses. 4th edition. Cambridge University Press. [An authoritative source of information on the approximate number of species and overall geographic distribution of the genera and families of vascular plants of the world, with helpful comments on morphology, economic uses, and biology. Scientific names are arranged in alphabetical order, and quite a few common names are also listed. Available for purchase from a variety of online vendors.]

Martin, A. C. and W. D. Barkley. 1961. Seed Identification Manual. University of California Press. 221 pp. [There are a couple of more recent reprints of this book, but all are basically the

same content. Contains 824 black and white photographs of seeds from 600 species encountered in farmlands, wetlands, and woodlands found in various locations in the United States. Available for purchase at <https://www.amazon.com/Seed-Identification-Manual-Alexander-Martin/dp/1932846034>]

Musil, A. F. 1963. Identification of Crop and Weed Seeds. Agriculture Handbook No. 219. U.S. Department of Agriculture, Washington, D.C. 171 pp. + plates. [Contains diagnostic keys and detailed seed illustrations of many common crops and weed seeds. A classic reference found in many seed labs. It is out-of-print but occasionally copies appear for sale on the internet. A scanned copy is available online at <https://www.biodiversitylibrary.org/item/295013#page/184/mode/1up>]

Neal, J. C., R. H. Uva, J. M. DiTomaso and A. DiTommaso. 2023. Weeds of the Northeast. (2nd Ed.) Cornell University Press. 397pp. [Newly revised and expanded to include the Northeast and Mid-Atlantic states with description of weeds, plants, and seeds, every plant has a color image of the plant and there are also images of their seeds. Available to purchase on Cornell University Press at: <https://www.cornellpress.cornell.edu/book/9781501755729/weeds-of-the-northeast/#bookTabs=1>]

Nesbitt, M. 2006. Identification Guide for Near Eastern Grass Seeds. Institute of Archaeology University College London. 129 pp. [Very detailed descriptions and illustrations of grass caryopses from 122 genera, as well as multi-access diagnostic keys. Available for purchase from various online sources.]

Royer, R. and R. Dickinson. 2004. Weeds of the Northern U.S. and Canada. The University of Alberta Press. 434 pp. [In addition to descriptions plants, fruits, and seeds, there are color images of plants and seeds. Available for purchase at: <https://www.amazon.com/Weeds-Northern-U-S-Canada-Identification/dp/1551052210>]

Sweedman, L. and D. Merritt. Australian Seeds: a Guide to Their Collection, Identification and Biology. 2006. CSIRO Publishing. 258 pp. [Includes information on seed biology, evolution and morphology, and all aspects of harvesting, processing and storage of seeds, and seed germination requirements for species found primarily in western Australia. Features photographs of more than 1,200 species showing clearly their size and shape. Out-of-print, but available in Kindle format at www.amazon.com]

Lobova, T. A., C. K. Geiselman, and S. A. Mori. Seed Dispersal by Bats in the Neotropics. Memoirs of the New York Botanical Garden. [Has numerous color images of seeds of many tropical species. Available for purchase at: <https://nybgshop.org/seed-dispersal-by-bats-in-the-neotropics-mem-101/>]

Webb, C. J. and M. J. A. Simpson. 2001. Seeds of New Zealand Gymnosperms and Dicotyledons. Manuka Press. 428 pp. [Describes the seeds, and other persistent parts of fruits, of native New Zealand gymnosperms and dicotyledons and covers 1,058 species, representing 255 genera from 94 plant families. A key and 1,750+ photographs are available to aid seed. Available for purchase at: https://www.manukapress.co.nz/seed_atlas.html]

Young, J. A. and C. G. Young. 1992. Seeds of Woody Plants in North America. Dioscorides Press. 407 pp. [Covers 386 genera of woody plant seeds, including numerous line drawings and black and white photographs that are useful for seed identification. Available for purchase at: <https://www.amazon.com/Seeds-Woody-Plants-North-America/dp/1604691123>]

United States Department of Agriculture. 1952. Testing Agricultural and Vegetable Seeds. Agriculture Handbook No. 30. [Contains historical information on seed testing procedures, seed descriptions, and excellent illustrations of crop and weed seeds (note the nomenclature may be out-of-date for some species). Available for free PDF download at: <https://www.govinfo.gov/app/details/GOVPUB-A-PURL-gpo17393>]

Zomlefer, W. B. 1994. Guide to Flowering Plant Families. The University of North Carolina Press, Chapel Hill, NC. [Excellent technical information of plant families, contains hundreds of illustrations, and includes beautifully illustrated botanical glossary. Available for purchase from various online sources].

Journal Articles:

Baskin, C. C. and J. M. Baskin. 2007. A revision of Martin's seed classification system, with particular reference to his dwarf-seed type. Seed Science Research 17:11-20. [Provides a revision to Martin (1946) related to dwarf-seed type embryos and a revised key to seed embryo types. https://www.researchgate.net/publication/231945377_A_revision_of_Martin's_seed_classification_system_with_particular_reference_to_his_dwarf-seed_type. [Does not contain illustrations or photos.]

Baskin, C. C. and J. M. Baskin. 2021. Relationship of the lateral embryo (in grasses) to other monocot embryos: a status up-grade. Seed Science Research 31:199-210. <https://doi.org/10.1017/S0960258521000209>

Isely, D. 1947. Investigations in seed classification by family characteristics. Iowa State College Research Bulletin 351:317-380. <https://core.ac.uk/download/pdf/128978283.pdf> [Descriptions and key for seeds and fruits of various plant families. Numerous illustrations.]

Martin, A. C. 1946. The comparative internal morphology of seeds. The American Midland Naturalist 36:513-660. <https://www.jstor.org/stable/2421457> [Excellent foundational paper on seed embryo and endosperm placement within seeds. Line drawings of longitudinal and cross-sectional view of embryo/endosperm placement in 1,287 genera including gymnosperms, monocots, and dicots.]

Terrell, E. E. 1971. Survey of occurrences of liquid or soft endosperm in grass genera. Bulletin of the Torrey Botanical Club Vol. 99(5):264-268. <https://www.jstor.org/stable/2483625>

Manuals:

SCST. 2018. Seed Technologist Training Manual. Society of Commercial Seed Technologists. [Excellent reference for all aspects of seed testing. Contains the sample illustrations of crop and weed seeds found in Agriculture Handbook No. 30 listed above. Available for purchase at: <https://analyzeseeds.com/product/seed-technologist-training-manual-2017/>]

Websites:

Australian Centre for International Agricultural Research. Tropical Forages. <https://www.tropicalforages.info/text/entities/index.htm> [Factsheet on tropical forage species of including images of plants, fruits, and seeds.]

Colorado State University Seed Images. www.seedimages.com [Requires a paid subscription for access.]

Groningen Institute of Archaeology (GIA – RUG) and Deutsches Archäologisches Institut (DAI) – Berlin. 2006. Digital Plant Atlas. <https://www.plantatlas.eu/repository> [The database of seed and fruit images included in The Digital Plants Atlas of the Netherlands (2006), The Digital Atlas of Economic Plants (2010), and others.]

Front Range Seed Analysts. Seeds of Cultivated Flowers. <https://fronrangeseedanalysts.weebly.com/flower-seed-images-frsa-1995.html> [Color images of flower seeds from about 54 families. No written seed descriptions.]

International Seed Morphology Association (ISMA). Seed ID Guide. <https://www.idseed.org/> [Excellent high resolution seed images and detailed descriptions.]

International Seed Testing Association (ISTA). Purity Committee Universal List of Species <https://www.seedtest.org/en/services-header/tools/purity-committee/universal-list-species.html> [Seed descriptions and color images of commonly encountered crop and weed seeds.]

Islam, M., A. Miller, M. Maher, J. Scher, and A. J. Redford. 2022. Fruit and Seed Family ID. USDA APHIS PPQ Identification Technology Program. Fort Collins, CO. https://idtools.org/seed_families/ [This tool currently only covers monocot families (79 families)].

Rancho Santa Anna Botanic Garden Seed Photo Website <http://www.hazmac.biz/seedphotoslistfamily.html> [Images of native species, no written descriptions.]

Scher, J. L., D. S. Walters, and A. J. Redford. 2015. Federal Noxious Weed Disseminules of the U.S., Edition 2.2. California Department of Food and Agriculture, and USDA APHIS PPQ Identification Technology Program. Fort Collins, CO. <https://idtools.org/tools/1031/index.cfm> [Excellent high resolution images and seed descriptions.]

South Australian Seed Conservation Centre. Seeds of South Australia. <https://spapps.environment.sa.gov.au/SeedsOfSA/home.html> [Excellent seed images for many of the species included in the database. Handy for comparison of seed, fruit, and plant images of up to four species at a time.]

The James Hutton Institute Arable Seed Identification System – <https://asis.hutton.ac.uk/> [Basic sorting key and color seed images.]

University of Hamburg Collections. The Reference Collection of Bredemann and Nieser from Hamburg. https://www.fundus.uni-hamburg.de/de/collections/loki_schmidt_haus [Excellent color images of seeds. Note: language German.]

USDA, AMS Seed Regulatory and Testing Website. <https://www.ams.usda.gov/rules-regulations/fsa>

USDA, ARS, National Genetic Resources Program. Germplasm Resources Information Network - (GRIN) [Online Database]. <https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch> [Nomenclature source for all scientific names found in the AOSA Rules for Testing Seeds. The database also includes color seed images for some species.]

USDA, NRCS. 2015. The PLANTS Database. <https://plants.usda.gov/home> [Excellent resource for plant distribution in the United States and Canada. Has color seed and plant images for some species. Contains factsheet or plant guides for some species, as well as other useful information associated with natural resource conservation.]

Walters, D. S. 2011. Identification Tool to Weed Disseminules of California Central Valley table grape production areas. USDA CPHST Identification Technology Program. <https://idtools.org/id/weed-tool/key/index.htm> [Excellent high resolution color seed images and descriptions of common weed seeds.]