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A SEED KEY TO FOURTEEN SPECIES OF GERANIACEAE*

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A program of seed identification by keys has been initiated in the Iowa State College Seed laboratory. The recognition of external structural characteristics of seeds is of primary importance to the seed analyst who has no material to serve as a basis of classification and identification other than seeds or fruits. Descriptions of features that aid in placing a seed in its family, genus, or species are of value not only for the seed analyst but for the taxonomic botanist as well.

The Geraniaceae has been chosen for a beginning in this investigation. Fernald (1935) working on the annual and biennial species of *Geranium* found the seeds to have some characters of taxonomic value. Jones and Jones (1943) in their revision of the perennial species of *Geranium* stated, "the seeds of the perennial larger flowered species, contrary to our expectations, have proved to be altogether too uniform for taxonomical purposes." Possibly other characters were sufficient and they felt no need for a detailed study of the seed.

The Geraniaceae is characterized by a five lobed pistil, with each lobe or carpel prolonged into a style. At maturity the carpels split apart elastically from the central axis and the twisted or coiled style often remains attached to the carpel. Each carpel bears one seed. The carpel wall may be hairy, smooth, reticulate, or wrinkled transversely (Jepson, 1925). The persistent style, method of dehiscence, and the character of the surface of the ovary are aids in the identification of the family and even the genus and species. However, these characters are not always present or obvious, and in such cases seed characters alone must be used.

The seeds of the Geraniaceae usually have a radicle ridge, a visible raphe and a seed coat with reticulations and pits. This combination of characters is representative of the family. Having developed from an anatropous ovule, the radicle is curved and greatly enlarged. The outline of the radicle is seen externally as a bulge or ridge pointing toward the hilum and chalaza. This character is used in the key and is referred to as the "radicle ridge." The term "raphe" has several interpretations. Hayward's (1938) definition has been accepted and used in this paper, namely, "the ridge of an ovule extending from the hilum to the chalaza." Fragments of cuticle, in the sloughing stage, appear on the seed coat as glistening deposits. The cuticle is most noticeable on those species with large pits.

The following key includes the two genera of the Geraniaceae native in the United States—*Geranium* and *Erodium*, and the widely used introduced genus *Pelargonium*. The seeds of fourteen species were available and could be separated taxonomically by seed characters (Plate 1, Fig. 1 to 14; Plate 11, Fig. 1 to 14.)

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A Seed Key to Fourteen Species of GERANIACEAE

A. Length of seed 2.5 mm. to 4.2 mm. (exception, shorter in *Geranium mexicanum*): shape of seed oblong or spindle-like; radicle ridge pronounced; hilum usually prominent.

B. Shape of seed essentially oblong.

C. Position of hilum more than one-third, usually one-half the distance between the chalazal and radicle ends.

D. Average size 1.5 mm. wide, 2.5 mm. long, reticulations and pits present but small; shape of seed ovoid, plump. (Plate 1, Fig. 1; Plate 11, Fig. 8)

Geranium erianthum

DD. Average size 1.6 mm. wide, 3 to 3.7 mm. long.

E. Reticulations fine, pits small; average length of seed 3 mm.; shape of seed narrowing and truncate at the radicle end. (Plate 1, Fig. 2; Plate 11, Fig. 5).

EE. Reticulations and pits larger, average length of seed 3.4 mm. to 3.7 mm.

F. Seeds flattened laterally; pits in fairly straight rows. (Plate 1, Fig. 3; Plate 11, Fig. 14)

Geranium pratense

FF. Seeds plump; pits in irregular rows. (Plate 1, Fig. 4; Plate 11, Fig. 3)

Geranium viscosissimum

CC. Position of hilum one-third or less from chalazal end.

D. Average length of seed 2.1 mm.; seeds plump, reticulations present. (Plate 1, Fig. 5)

Geranium mexicanum

DD. Average length of seed 2.9 to 3.6 mm.

E. Pits usually elongated; seed tapering at the radicle end. (Plate 1, Fig. 6; Plate 11, Fig. 2)

Geranium Richardsonii

EE. Pits usually 4 to 5 sided, not many elongated; seeds same width throughout. (Plate 1, Fig. 7; Plate 11, Fig. 6)

Geranium Fremontii

BB. Shape of seed spindle-like or at least tapering at the chalazal end.

C. Average length of seed 2.7 mm.; seed coat almost smooth. (Plate 1, Fig. 8)

Erodium cicutarium

CC. Average length of seed 4.2 mm.; seed coat finely reticulate (appearing granular). (Plate 1, Fig. 9)

Pelargonium hortorum

AA. Length of seed 2.2 mm. or less; shape of seed oblong to sub-spherical; radicle ridge may or may not be pronounced; hilum sometimes obscure.

- B. Seed coat almost smooth; color orange to burnished red.
- C. Carpel wall reticulate; shape of seed essentially oblong; average length of seed 2.1 mm. (Plate 1, Fig. 10; Plate 11, Fig. 9, 13)
Geranium Robertianum
- CC. Carpel wall with appressed hairs, seed curved or crescent-shaped in lateral view; average length of seed 1.75 mm. (Plate 1, Fig. 11; Plate 11, Fig. 11, 12.)
Geranium pusillum
- BB. Seed coat reticulate; color tan, dark brown, or grey.
- C. Reticulations fine.
- D. Pits shallow, usually elongated; tan; raphe very short, shape either ovoid or with conspicuous furrows on both sides of radicle ridge. (Plate 1, Fig. 12; Plate 11, Fig. 7, 10).
Geranium carolinianum
- DD. Pits deeper, not always elongated; tan to dark brown. (Plate 1, Fig. 13; Plate 11, Fig. 1).
Geranium Bicknellii
- CC. Reticulations greatly thickened; ashy grey; raphe obscure. (Plate 1, Fig. 14; Plate 11, Fig. 4).
Geranium dissectum

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PLATE I. SEEDS OF THE GERANIACEAE X 9.

Drawn by George Morris

- Fig. 1. *Geranium erianthum* DC.
- Fig. 2. *Geranium maculatum* L.
- Fig. 3. *Geranium pratense* L.
- Fig. 4. *Geranium viscosissimum* Fisch. & Mey.
- Fig. 5. *Geranium mexicanum* HBK.
- Fig. 6. *Geranium Richardsonii* Fisch. & Trautv.
- Fig. 7. *Geranium Fremontii* Torr. ex Gray.
- Diagram a. radicle ridge, b. hilum, c. raphe, d. chalaza.
- Fig. 8. *Erodium cicutarium* (L) L'Her. Seed and Carpel.
- Fig. 9. *Pelargonium hortorum* Bailey.
- Fig. 10. *Geranium Robertianum* L. Seed and carpel.
- Fig. 11. *Geranium pusillum* Burm. f. Seed and carpel.
- Fig. 12. *Geranium carolinianum* L.
- Fig. 13. *Geranium Bicknellii* Britton.
- Fig. 14. *Geranium dissectum* L.

PLATE II. SEEDS OF THE GERANIACEAE X 12.

Photographs by J. N. Martin

- Fig. 1. *Geranium Bicknellii* Britton.
- Fig. 2. *Geranium Richardsonii* Fisch & Trautv.
- Fig. 3. *Geranium viscosissimum* Fisch. & Mey.
- Fig. 4. *Geranium dissectum* L.
- Fig. 5. *Geranium maculatum* L.
- Fig. 6. *Geranium Fremontii* Torr. ex Gray.
- Fig. 7. *Geranium carolinianum* L.
- Fig. 8. *Geranium erianthum* DC.
- Fig. 9. *Geranium Robertianum* L.
- Fig. 10. *Geranium carolinianum* L.
- Fig. 11. *Geranium pusillum* Burm. f.
- Fig. 12. *Geranium pusillum* Burm. f. carpel.
- Fig. 13. *Geranium Robertianum* L., carpel.
- Fig. 14. *Geranium pratense* L.

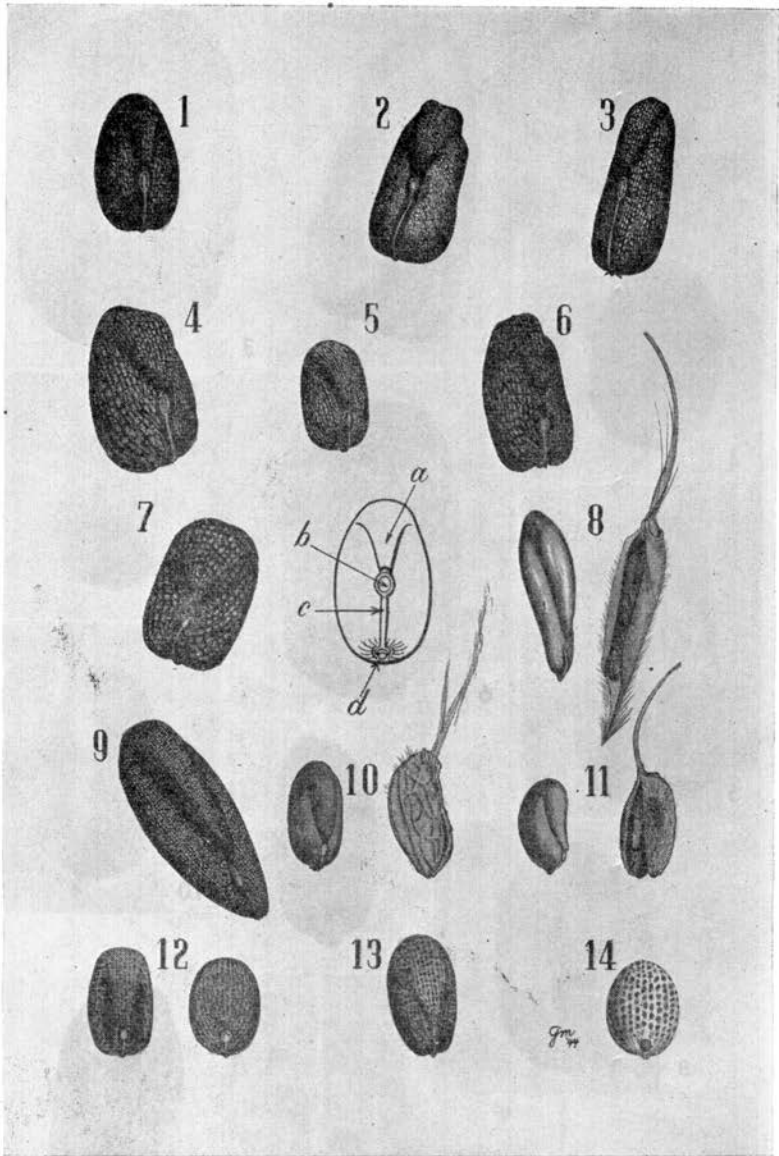


Plate I

