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Studies on the Germination of Some Woody Plants

L. H. Pammel

C. M. King

STUDIES IN THE GERMINATION OF SOME WOODY PLANTS

L. H. PAMMEL AND C. M. KING

The following brief study is a continuation of those previously reported to the academy. In the past these papers have been published in the Report of the Academy. One paper is in the hands of the Secretary. It is hoped to finally report on the germination of all of the native woody plants of Iowa, as well as the germination of a few exotics. In a study of the germination of these plants one is apt to notice striking characters, that cannot well be described. For instance, the young dogwood plants have an aspect peculiar to the family. For the first time, this year, a study has been made of the sugar maple (*Acer saccharum*). The glaucous character of the under surface of the leaf is just as pronounced in the young plants as in older leaves. Some seeds, like the maple, walnut and oaks, make a rapid progress in growth during germination. The eleagnus or oleaster on the other hand makes little progress at first.

Seeds of trees and shrubs were placed in the garden for stratification October 25, 1920, and transferred to soil in the greenhouse March 15, 1921.

Germinations were as follows: Beech (from White Lake, Michigan) (already sprouting) March 16, 1921.
Sugar maple (already sprouting) March 17, 1921.
Ptelea trifoliata (from Keokuk, Iowa) April 1, 1921.
Cornus Amomum (from Mason City, Iowa) April 1, 1921.
Cornus Amomum (from Avoca, Iowa) April 1, 1921.
Hemlock (from White Lake, Michigan) April 2, 1921.
Pecan (from Iowa) April 7, 1921.

Seeds of the following were not yet showing germination March 1, 1921: Mountain ash, speckled alder, paper birch, cherry birch, *Arbor vitae,* soft maple; *Rosa blanda, R. setigera, Cornus paniculata, Rhus glabra,* Yucca, dewberry, *Cornus circinata, Carpinus Caroliniana,* papaw, *Symphoricarpos occidentalis, Robinia Pseudo-Acacia, Sorbus scandia, Viburnum Opulus, Tilia americana,* sycamore and *Evonymus.* (The sycamore, *Evonymus* and

Tilia were not stratified, but were taken from the trees in March, 1921.)

Pinaceae

Tsuga canadensis (L.) Carr. Hemlock. See figure 36.

These seeds lay protected on the surface of garden soil from October 25, 1920, to March 25, 1921, when they were planted in the greenhouse. On April 2, 1921, first leaves made their appearance above ground.

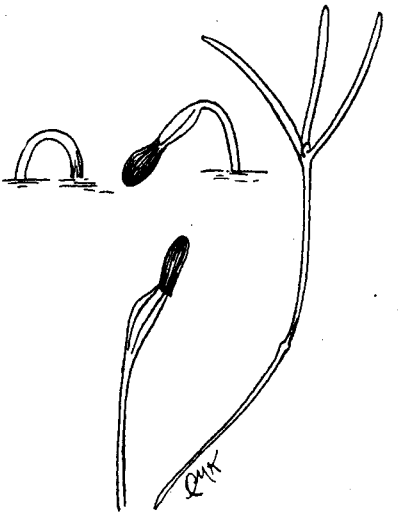

Fig. 36. ***Tsuga canadensis.*** **Hemlock. Hypocotyl, arched as it emerges. Young seedling bearing hull on tips of leaves. Seedling freed from hull. Drawn by C. M. King.**

The first part to be seen is the arched hypocotyl; as soon as the leaves straighten they bring the hull of the seed with them, holding the tips of the leaves together. This hull clings to the seedling for some days before it is thrown off. When it is cast the cotyledons, three or four in number, emerge. They are of equal length (about half an inch), green with steel blue cast, slender, uniformly linear, faintly margined. The caulicle soon assumes an upright position and the cotyledons spread wide apart. The first series of true leaves, three to six in number, soon appear.

Juglandaceae

Carya illinoiensis (Wang.) K. Koch. See figure 37.

Placed in the garden for stratification October 28, 1920. Lifted after a mild winter, March 15, 1921, and transferred to the greenhouse. The shoot appeared above surface April 7, 1921; at end of two weeks had put out the first three leaves. Germination hypogaeous.

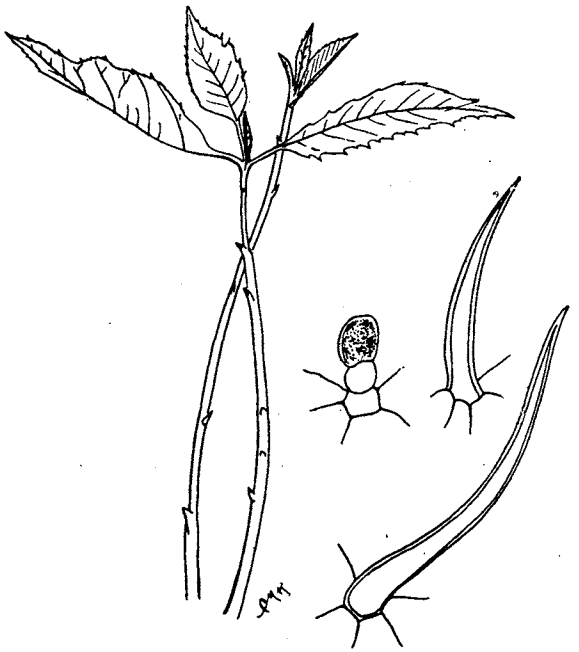

Fig. 37. *Carya illinoiensis.* Hickory. Young seedlings, two stages. Trichomes, and glandular hair, from stem. Drawn by C. M. King.

The stem reddish; bears numerous bracts, glandular pubescence. First leaf is simple; second is also simple; the third leaf shows beginning of separate leaflet at base; the fourth leaf bears the small leaflet; all leaves with sharp serrations and with fine scattered hairs along the veins on the under side. Upper surface of the leaves slightly pubescent.

Upon the plant, quite generally occur glandular hairs; these are short with the terminal cell enlarged, dark in color. The simple trichomes also numerous, are slender, pointed and colorless.

Fagaceae

Fagus grandifolia Ehrh. Beech. See figures 38, 39, 40.

Placed in soil, out of doors for stratifying October 25, 1920; transferred to greenhouse March 25, 1921. Many of the seeds were germinating when examined and all grew immediately upon being bedded in the greenhouse.

The three valves of the shell split apart, showing how the cotyledons are keeled and folded together in the seed. The ridge of the cotyledon folds into a corresponding groove of the other, the plumule lying between. The outer or lower side of the cotyledon is whitish becoming decidedly pink; the inner or upper one

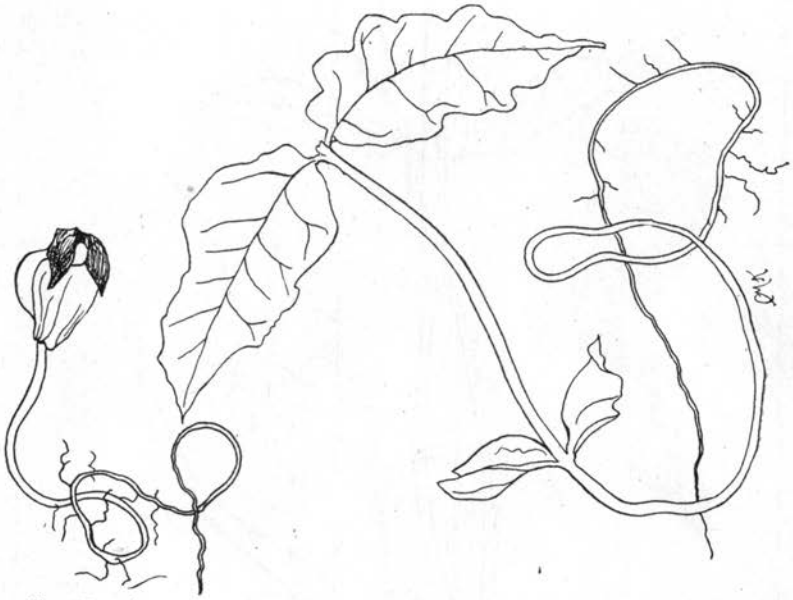

Fig. 38. *Fagus grandifolia.* Beech. Cotyledons emerging from 3-valved shell. Young seedling, showing cotyledons and first pair of leaves. Drawn by C. M. King.

soon becomes light green. The radicle is long and slender, becoming brownish, the hypocotyl is thick, whitish in color. The feathery plumule is borne upon a slender stalk and is pubescent.

The first young leaves of the beech when unfolding are slightly

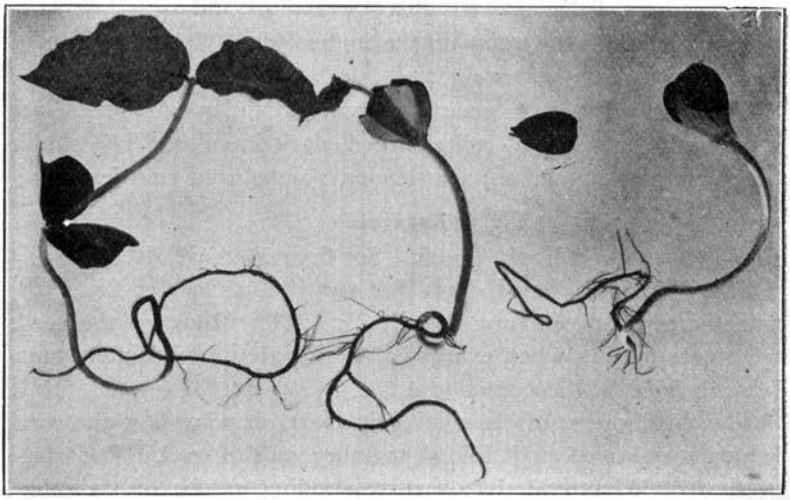

Fig. 39. Beech seedling at three early stages, showing shell borne on tip of folded cotyledons, and first pair of leaves. Photo by Mr. Richardson.

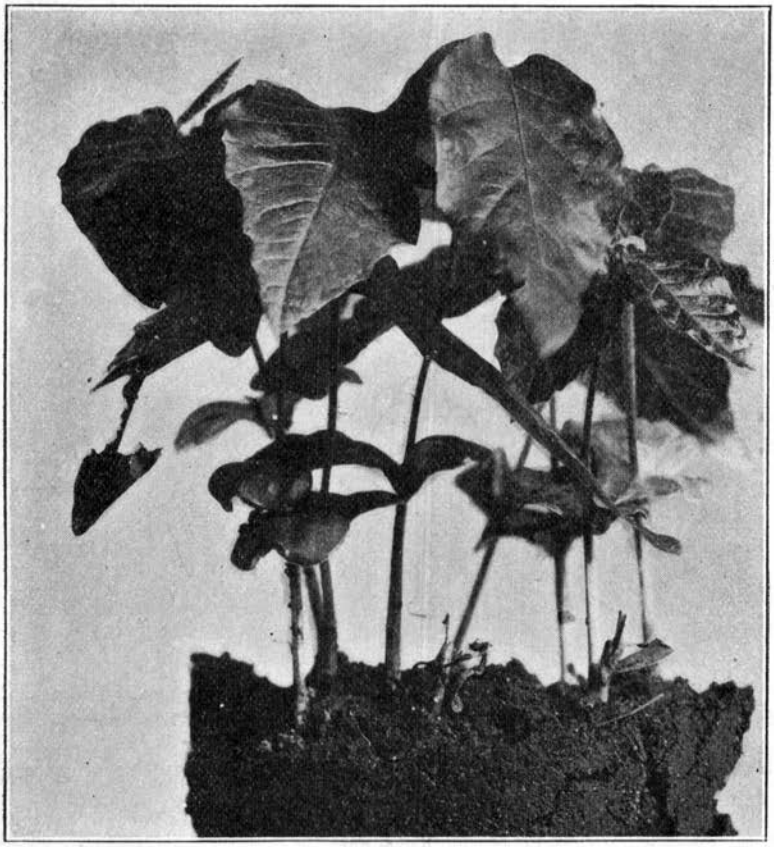

Fig. 40. Young seedlings of beech. Photo by Mr. Richardson.

rugose; they are ovate, pointed, with wavy margins and prominent veins. These leaves are sparsely hairy beneath, but decidedly hairy upon the upper surface, margins and petioles. The stem also is pubescent. The stipules are small, ovate, brownish and pubescent, falling early. Secondary roots soon appear upon the roots of the beech.

Saxifragaceae

Ribes floridum L'Her. Wild Black Currant. See figure 41.

Seeds from Backbone State Park; placed for outside stratifying October 25, 1920. Removed to greenhouse March 25, 1921. Germinated April 5, 1921. Growth of seedling rapid. Germination epigaeous, stem below cotyledons whitish; cotyledons oval, petiolate, smooth, somewhat fleshy. Leaves alternate; first leaf extipulate, smooth, petiole hairy. Second leaf similar. Leaves shallowly 5-lobed, dentate. Glandular hairs are numerous upon the

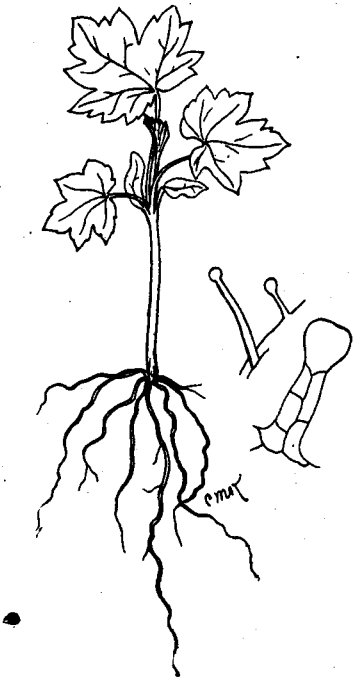

Fig. 41. *Ribes floridum.* Wild black currant. Seedling showing cotyledons and early leaves. Glandular hairs, on leaves and petioles. Drawn by C. M. King.

stem and petioles. These trichomes differ in length; they are slender, the cell at the top being enlarged.

Rutaceae

Ptelea trifoliata L. Hop tree. See figure 42.

Seeds stratified out of doors; planted in greenhouse March 25, 1921. First germination appeared April 1, 1921, the seedling growing rapidly. Germination hypogaeous. The hypocotyl whitish, slightly hairy. Cotyledons fleshy, broadly elliptical, about 1/3 of an inch in length, margin finely crenulate.

First leaf shining, crenate-margined, smooth above, simple. The following leaf compound, three crenately margined leaflets; third leaf the same.

Aceraceae

Acer saccharum Marsh. Sugar or Rock Maple. See figures 43, 44, 45, 46.

The seed was stratified out of doors in garden soil from October 25, 1920, till April 15, 1921. When lifted several seeds were already germinating and all grew readily when transferred to the greenhouse bench.

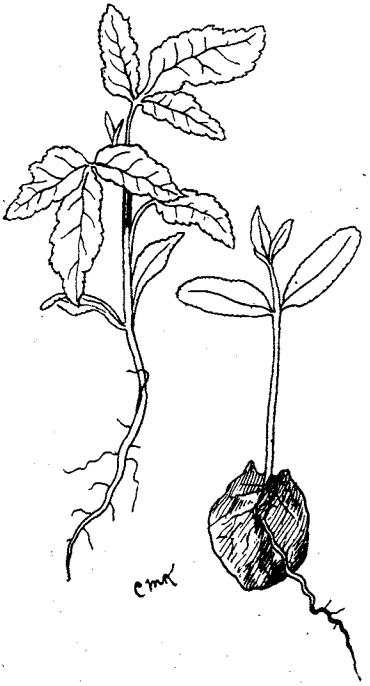

Fig. 42. *Ptelea trifoliata.* Hop tree. Young seedling, early stage, with seed coat still attached; cotyledons and plumule exhibited. Older seedling showing 3-parted leaves. Drawn by C. M. King.

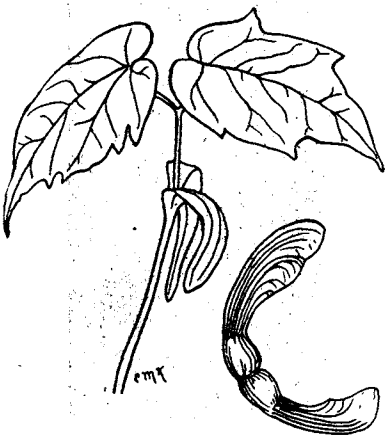

Fig. 43. *Acer saccharum.* Hard maple. Samara. Young seedling showing cotyledons and first pair of leaves. Drawn by C. M. King.

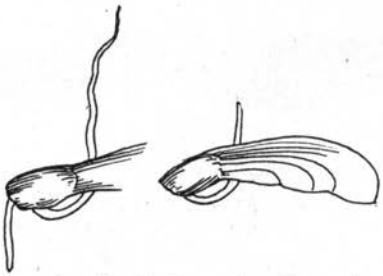

Fig. 44. Hard maple. Germinating seeds. Drawn by C. M. King.

Germination is epigaeous. The white radicle first pushes out of the seed coat at the basal end between the two samaras. The radicle is smooth, at first straight; the slightly curved caulicle is smooth, whitish, slender, slightly narrowed at the base; apex rounded. The first appearance above ground is the arch of the caulicle. The two strap shaped cotyledons are 3-veined. There

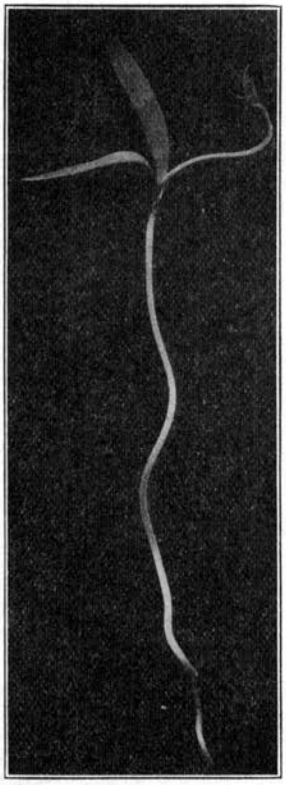

Fig. 45. Hard Maple. Seedling, showing cotyledons and plumule. Photo by Mr. Richardson.

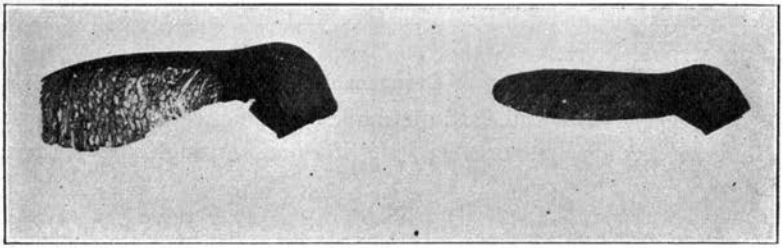

Fig. 46. Hard maple. Samara. parts separated. Photo by E. H. Richardson.

is a slight enlargement at the point where they are attached.

The plumule is feathery in appearance. The first pair of leaves is coarsely dentate and has the characteristic outline of the maple leaf. The stem between the cotyledons and the first pair of leaves is smooth. There are some hairs on the petioles, the leaf margins, and upon the veins on the lower side of the leaf. The lower side is lighter in color than the upper side.

Eleagnaceae

Eleagnus angustifolia L. Russian Olive. See figure 47.

April 5, 1921, young seedlings appeared freely under olive trees on the campus. The germinating seed lies in the soil close to the surface. The seedling cotyledon pushes off the hull and the white radicle descends, arching the hypocotyl.

The seedling develops very slowly. The two cotyledons, at first closely appressed, are about 1/3 of an inch in length, nearly oval, smooth, greenish, fleshy, distinctly auricled at the base. The

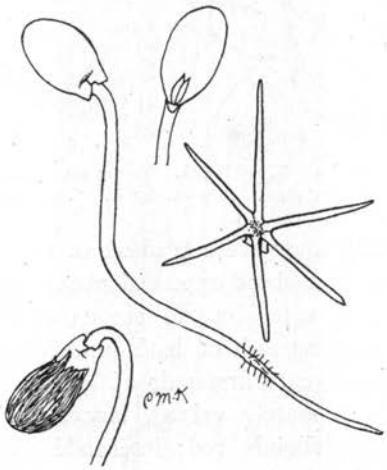

Fig. 47. *Eleagnus angustifolia.* Emerging cotyledons leaving seed coat. Young seedling cotyledons shown separated. Stellate trichome hair. Drawn by C. M. King.

surfaces show no veining. The tiny plumule is fleshy, pubescent with stellate hairs.

Cornaceae

Cornus Amomum Mill. Kinnikinnik. See figure 48.

These seeds were stratified out of doors through the winter;

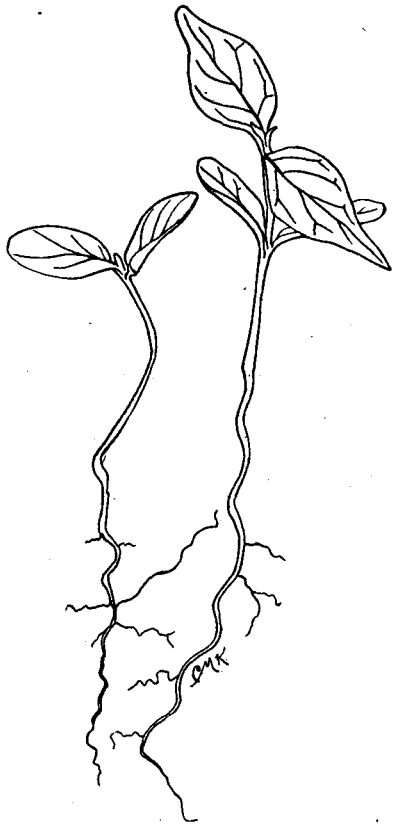

Fig. 48. *Cornus Amomum*. Kinnikinnick. Young seedlings in two stages. Cotyledons and first pair of leaves shown. Drawn by C. M. King.

on March 15, 1921, they were planted in the greenhouse. On April 1, 1921, the first shoot appeared above ground.

Hypocotyl reddish; cotelydons foliaceous, oval to elliptical, 1/2 inch in length, green, smooth on both surfaces, pinnately veined. Plumule small, pubescent; first pair of leaves slightly pubescent on both surfaces, pinnately veined, lanceolate, entire. Petiole pubescent. Plumule slightly red; internode green. Aspect distinctly characteristic of the dogwood.