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GERMINATION AND SEEDLING FORMS OF SOME WOODY PLANTS

L. H. PAMMEL AND C. M. KING

The seeds and seedlings used in the studies presented in this paper, were collected in southern states and Cuba by L. H. Pammel, during the winter of 1929-1930.¹

Several of the seedlings were observed in native situations and described in the field.

Seeds collected, were planted in the greenhouse at Ames. The germination of those which grew is described in the following paper.

The following is the list of seedlings described:

CYCADACEAE

Zamia floridana (D. C.) Coontee.

PALMACEAE

Thrinax floridana (Sarg.) Thatch.

Chrysalidocarpus lutescens H. Wendl. — Feather Palm

Roystonea regia O. F. Cook — Royal Palm.

Martinezia Lindeniana Wendl. Spiny-stemmed Palm.

FAGALES

Quercus Phellos L. — Willow Oak.

ARISTOLOCHIALES

Aristolochia macrophylla Lam. — Pipe-vine.

POLYGONALES

Coccolobis uvifera Jacq. — Sea Grape.

RANUNCULALES

Magnolia virginiana L. — Laurel Magnolia, Sweet Bay.

ROSALES

Pithecolobium Guadalupense (Desv.) Chapm.

Erythrina coralloides D. C. — Coral Tree.

SAPINDALES

Acer rubrum L. — Red maple.

Aesculus glabra Willd. — Ohio Buckeye.

Koelreuteria paniculata Laxm. — Torch-tree.

MALVALES

Sida acuta Burm. — Sida.

¹ This contribution is the thirteenth of a series presented in Proceedings of the Iowa Academy of Science.

GENTIANALES

Ligustrum amurense Carr. — Privet.

POLEMONIALES

Bignonia capreolata L. — Cross-vine.

CYCADACEAE

Zamia floridana
(D. C.) Coontee.

Germinated by Dr.
G. W. Carver, Tus-
kegee, Alabama, in
the winter of 1930.

Early stage not
seen.

First leaf pinnate-
ly compound, long-
petioled. Leaflets ses-
sile, in 3 pairs, nar-
row, elliptical, nar-
rowed toward apex
and base, rather

thick, with numerous parallel
veins.

PALMACEAE

Thrinax floridana (Sarg.)
Thatch.

Seedling collected at Ma-
tanzas, Cuba, February 8,
1930, by L. H. Pammel.

Germination hypogaeous.

First leaf rather wide,
prominently parallel-veined,
margin entire; leaf slightly
paler beneath.

Chrysalidocarpus lutescens
H. Wendl. Feather Palm.

Seedlings collected in Jar-
din Botanico Universidad,
Havana, Cuba, January 22,
1930, by Miss Luisa Marie
Alvarez, Miss Theresa Her-
nandez Figuerosa and L. H.
Pammel.

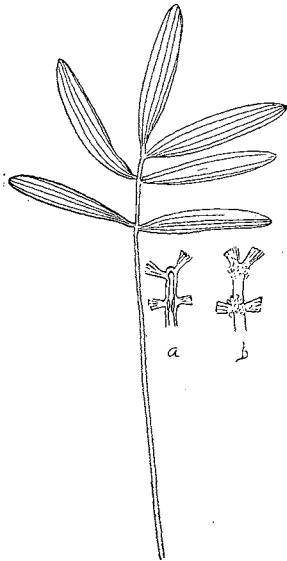


Fig. 1. *Zamia floridana* Attachment of leaves at stem, upper side, a; underside, b.



Fig. 2. First leaf (part) of *Thrinax floridana*

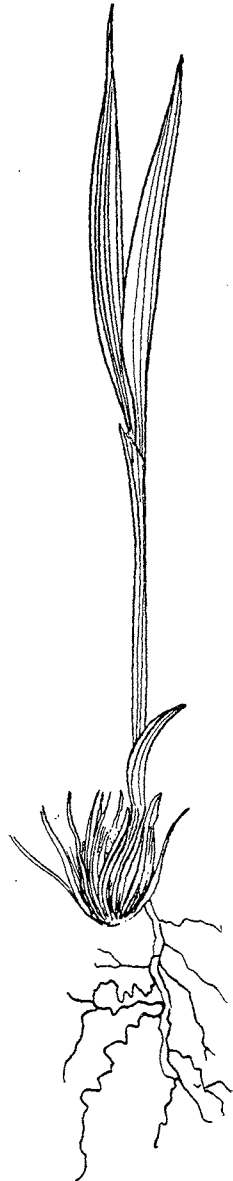


Fig. 3. Seedling of *Chrysalidocarpus lutescens* — Feather Palm



Fig. 5. Silver Palm near Matanzas, Cuba. Photograph by L. H. Pammel

Seeds germinating freely in red clay soil.

Radicle and caulicle reddish brown from the soil, whitish as the plant emerges from the seed coat.

Epicotyl straight. First and second leaves scale-like, 1 and $\frac{1}{4}$ inches apart. Third leaf folded, at first expanded, then strongly bilobed, parallel-veined. Veins conspicuous. The expanded leaf deeply 2-lobed, green in color, both surfaces smooth, fourth leaf pointed at first, and lobed.

Radicle straight, brownish in color. Tap-root with many lateral rootlets. Two or three rootlets arising near base of caulicle.



Fig. 4. Royal Palm near Matanzas, Cuba. Photograph by L. H. Pammel

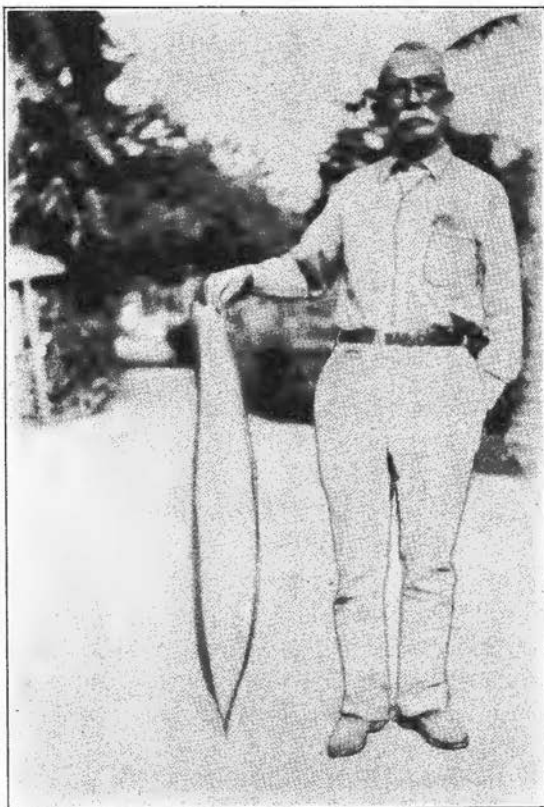


Fig. 6. Showing spathe of Royal Palm. Photograph by L. H. Pammel

Roystonea regia O. F. Cook — Royal Palm.

Young seedlings observed growing freely in reddish clay soil, under parent trees, in Jardin Botánico Universidad, Havana, Cuba, January 22, 1930, by L. H. Pammel.

Collections made by Miss Luisa Marie Alvarez, Theresa Hernandez Figüerosa and L. H. Pammel.

Germination hypogaeous. The caulicle emerges from the seed, in an ox-bow form, length $1\frac{1}{4}$ inches, whitish brown in color. Stem straight and thickened; hypocotyl swollen or enlarged; tap-root straight with numerous rootlets, brownish white in color, beginning near the caulicle. First scale emerging near base of the stem, colorless, 1 inch in length. The stem bears 2 or 3 of these scales. Following the scales comes the first green leaf, parallel-veined, narrow at the base, widening somewhat at the middle; apex slightly pointed, the veins terminating in points.

The early leaves are all simple.

Martinezia Lindeniana Wendl. Spiny-stemmed Palm.

Seedling collected January 22, 1930, under tree, by Professor Filberto Lago and L. H. Pammel at Santiago, near Habana, on the sub-station grounds.

Germination frequent, under trees, in reddish clay-loam soil.

Germination hypogaeous. Radicle brownish white, lateral roots appear soon after germination. First leaf a short, pointed scale, second leaf a scale more elongated, third leaf expanded, prominently parallel-veined, bifurcated, green, lower surface slightly paler than top surface. Leaf smooth. Later leaves with small spines, tip somewhat irregularly toothed, smooth.

Stem at first whitish and soon becoming tinged with the color of the soil.

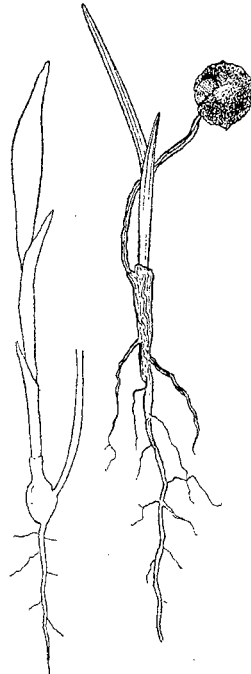


Fig. 7. *Roystonea regia* O. F. Cook — Royal Palm

FAGALES

Quercus Phellos L. — Willow Oak.

One year old seedlings observed under parent trees, Auburn, Alabama, March 7, 1930, by L. H. Pammel and J. L. Seal.

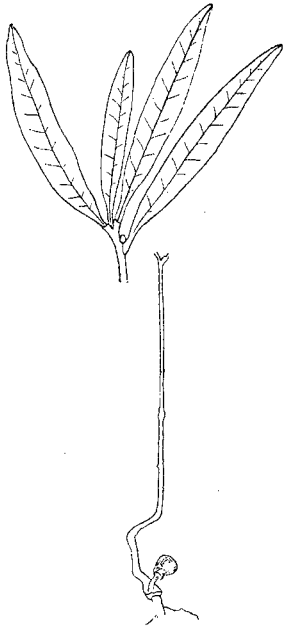


Fig. 8. One year old seedling of *Quercus Phellos*—Willow Oak

Germination hypogaeous.

Early leaves small, scale-like; epicotyl slightly curved, stem soon becoming woody. Lower leaves soon fall, some remaining during the winter. Leaves short-petioled linear, — lanceolate, paler beneath, mid-rib prominent, depressed, leaf penni-nerved at nearly right angles to midrib.

Radicle soon becoming wood, dark in color. Remnant of seed adhering to top of root.

ARISTOLOCHIALES

Aristolochia macrophylla, Lam. —

Pipe-vine.

Seeds germinated in greenhouse, Auburn, Alabama, March, 1930, by Dr. Fick.

Percentage of germination low, two only of several seeds germinated.

Germination epigaeous. Hypocotyl smooth, brownish. Radicle straight.

Cotyledons fleshy, linear, entire, slightly broader at the middle, sessile, pale green above and below. First leaves sessile, at first pressed together, paler than the cotyledons.

POLYGONALES

Coccolobis wifera Jack. — Sea Grape.

Plants collected under tree by L. H. Pammel, January 11, 1930, at Miami. They were fairly numerous growing in the sand dunes near the Atlantic Ocean.

Germination epigaeous. Cotyledons roundish, sessile, somewhat fleshy, green above, slightly rusty beneath, smooth, slightly notched.

Hypocotyl brownish, gradually tapering. Radicle brownish, straight, tap root, leaves alternate.

First leaf broadly ovate, prominent-ly veined, reddish. Second leaf similar



Fig. 9. Seedling of *Coccolobis* — Sea Grape

in shape. Third leaf simple, somewhat broader, veins reddish, short-stalked. Some of the first leaves broadly ovate, paler beneath.

RANUNCULALES

Magnolia virginiana L. — Laurel Magnolia, Sweet Bay.

One year old seedling collected in dooryard, Columbus, Georgia, March 9, 1930, by L. H. Pammel and J. L. Seal.

In this early stage, root tortuous, tap-root brownish in color.

Early germination not observed. Stem slightly enlarged at base, early leaves scale-like. Leaves fragrant; petioled, elliptical, rounded at apex, slightly narrowed toward the apex. Leaves with entire margin, pale beneath, penni-nerved with prominent depressed midrib. Upper surface green.

ROSALES

Pithecolobium Guadalupense (Desv.)

Chapm.

Seeds collected at Key West January 12, 1930, by L. H. Pammel.

Germination in greenhouse at Ames, February 20.

Germination epigeaeous. (Cotyledons elliptical, fleshy, sessile.)

Hypocotyl whitish to green.

Root soon brown.

First two leaves entire, elliptical, petiolate. Following leaves alternate, long petioled. Third leaf with three leaflets, the terminal leaflet large, ovate, the lateral leaflets ovate to obovate. Stem nearly smooth.

LEGUMINOSAE

Erythrina coralloides DC — Coral Tree.

Seedlings collected by L. H. Pammel under tree, Jardin Botanica, Havana, Cuba,

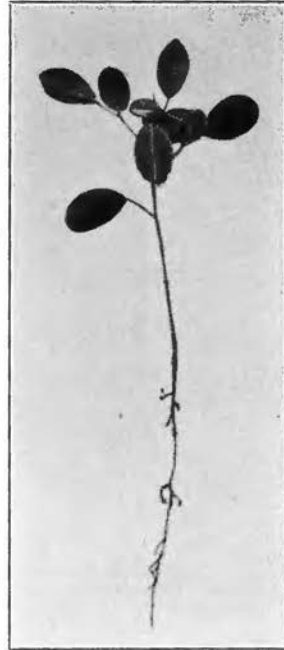


Fig. 11. Seedling of *Pithecolobium Gaudalupense*. (Photograph by Photograph Section Ia. Agr. Exp. Sta.)



Fig. 10. Seedling of *Bigonia capreolata* Crossvine. (Photographed by Photograph Section Ia. Agr. Exp. Sta.)

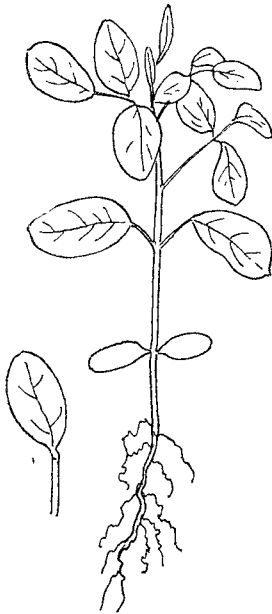


Fig. 12. Seedling of *Pithecolobium Guadalupeense*

January 22, 1930. Plants growing in grayish loam.

Seeds germinating freely. Cotyledons not seen (whether hypogaeous undetermined). Radicle stout, straight. No lateral roots for distance of two inches. Epicotyl swollen near the base, curved, whitish, soon becoming brown. At base of hypocotyl three nodular processes.

Leaves alternate, stipules small, brownish, more or less persistent. Stem green. Second leaf simple, roundish, pale beneath, short petioled, prominently veined. Third leaf simple, strongly veined, long-petioled, stipules pointed. Fourth leaf pinnately compound, leaflets three, lower pair lanceolate, or sometimes obovate, pale beneath; terminal leaflet roundish, veins conspicuous, smooth.

SAPINDALES

Aceraceae

Acer rubrum L., Red Maple.

Mature fruits collected under trees at Silver Springs, Florida, February 25, 1930, by M. D. Cody and L. H. Pammel, were placed in damp cotton.

The seeds began to germinate March 1. Germination epigaeous. The radicle appeared first, rather thick, with conical point, white.

Epicotyl white soon becoming green. The middle part of the cotyledons

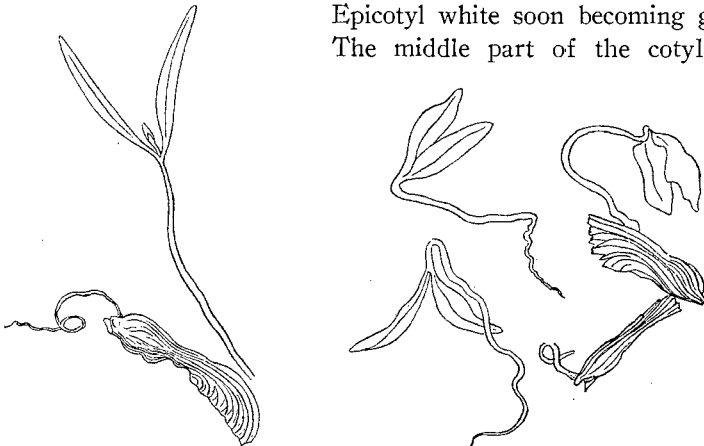


Fig. 13. Germinating seeds and seedlings of *Acer rubrum*. Red Maple

push out first. Cotyledons sessile, strap-shaped, fleshy, smooth, green, rounded at top.

SAPINDACEAE

Aesculus glabra Willd. Ohio Buckeye.

One year old plants were collected at Blaylock, Alabama, March 16, 1930, by J. Givahn.

Tap root, much swollen below, lateral roots slender. Root immediately below more slender.

Second year plant, leaves opposite, palmately compound, long-petioled, petiole reddish, near attachment side of leaf, leaflets 5, sessile, lower leaflets smaller, ovate, pointed, margin entire, prominently pinnately-veined. Terminal and middle leaflets ovate to elliptical. Leaflets slightly paler beneath. Smooth, or almost smooth. No stipules. Stem slightly pubescent. Bark grayish.



Fig. 14. Torch-tree, *Koelreuteria*, Torch-tree

Koelreuteria paniculata Laxm. Torch-Tree.

Fruit picked from the tree, Auburn, Alabama, March 1, 1930, by L. H. Pammel.

Planted in greenhouse, March 3.

First germination, April 28.

Germination epigeaeous. Usually two cotyledons, occasionally three. Hypocotyl reddish, rather thick, smooth. Cotyledons broadly linear, to narrow, elliptical, fleshy, slightly rolled in at the edges. Lower surface paler than upper surface. Epicotyl pubescent, first

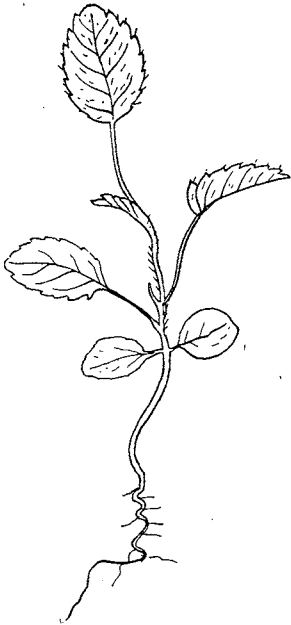


Fig. 14. Seedling of *Sida acuta*,
Sida

leaves nearly opposite, short petioled, without stipules. Leaves pinnately compound, odd pinnate, terminal division longest.

Leaflets deeply cut, and lobes serrate.

Young leaves distinctly reddish; upper surface with coarse hairs, especially the midrib on under side; the third leaf similar, prominently hairy.

In the plant with three cotyledons, one cotyledon smaller than the others.

MALVALES

Malvaceae

Sida acuta Burm. Sida.

Spontaneous, under mature plants, near Havana, Cuba.

Seedlings, January 27, 1930, by L. H. Pammel.

Germination hypogaeous, radicle straight, extending into a tap-root with small lateral roots.

Cotyledons roundish to oblong, stalked, paler beneath, margin crenate. Second leaf elliptical, margin crenate, leaves alternate, slim, pubescent below insertion of leaf. Third and fourth leaf similar. Stipules small, acuminate. Subsequent leaves similar to early leaves. All stalked, slightly pubescent, lower surface paler in color, petiole pubescent.

GENTIANALES

Oleaceae

Ligustrum amurense Carr. Privet.

Young plants collected at Auburn, Alabama, March, 1930, from under parent bushes by L. H. Pammel.

Shrub a prolific seeder, and seedlings very abundant.

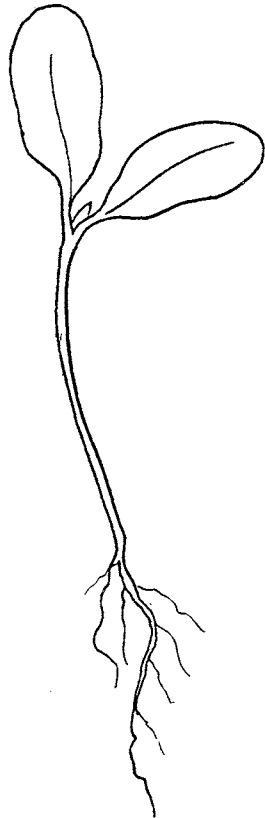


Fig. 15. Seedling of *Ligustrum amurense* — Privet showing cotyledons

Germination epigaeous. Seed lifted above ground, when germination begins.

Cotyledons fleshy, elliptical, sessile, paler beneath than above. Epicotyl elongated, slightly reddish. Radicle straight, brownish.

Second year plant. Leaves evergreen, opposite, petioled, elliptical, fleshy, paler beneath.

Axillary buds and cluster of branches in axils of leaves.

Succeeding leaves entire, opposite.

POLEMONIALES

Bignoniaceae

Bignonia capreolata L. Cross-vine.

Germination epigaeous.

Cotyledons oblate, fleshy, stalked, bilobed.

Hypocotyl smooth, greenish, woody, becoming brown. Radicle straight.

First and second leaves opposite, with shoots in axils of petioles; leaves ovate, lanceolate, dentate, smooth, prominently veined, paler beneath. Third and fourth leaves similar to first pair petioled. New shoot at axil of leaf.

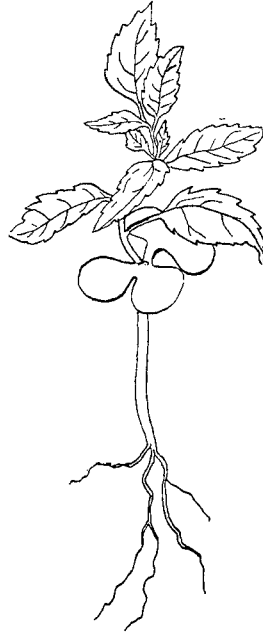


Fig. 16. Seedling of *Bignonia capreolata*, Cross-vine