

A REVISION OF ASIMINA AND DEERINGOTHAMNUS (ANNONACEAE)¹

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The Annonaceae, a woody tropical or sub-tropical family of flowering plants, are represented in the United States and Canada by eleven species. One, *Annona glabra*, is the northernmost-ranging member of a large, principally tropical American genus and is itself restricted in the United States to southern peninsular Florida and the Florida Keys. This work is concerned with the remaining ten species which occur, for the most part, in the southeastern Coastal Plain. Only one recent standard reference work, that of J. K. Small (1933), contains descriptions of all ten. Small, working with a basis of long and comprehensive field study, considered them as belonging to three genera, *Asimina*, *Deeringothamnus*, and *Pityothamnus*. Fries (1939), in the most complete revision of the Annonaceae thus far undertaken, retained Small's genus *Deeringothamnus* but rejected the genus *Pityothamnus*. Further, Fries considered none of the Central American plants previously described as *Asimina* as actually belonging to that genus. The generic limits decided on by Fries are those adhered to in this revision.

That some clarification of the species comprising *Asimina* and *Deeringothamnus* is necessary is evident from the large number of misidentified specimens extant in herbaria, and from the difficulty one has in applying existing treatments. Some of the species have become weedy with the increasing acreage of habitats burned, cleared, drained, or plowed since the advent of the white man's civilization. Thus, where there is a breakdown of former ecological barriers, the species are hybridizing to produce a bewildering spectrum of intermediates which thrive in the altered habitats. Specimens of such hybrids are not rare in some herbaria; this adds to the difficulty of gaining satisfactory concepts of the species.

In the course of this study a total of 2566 specimens from 19 herbaria were examined in order to supplement the collection, comprising 350 numbers, at Florida State University. Specimens most widely distributed in herbaria were selected for citation on a basis of one for each county, with the exception of *Asimina triloba*, *A. tetramera*, and the two species of *Deeringothamnus*. For the well known, widely distributed *A. triloba*, no more than two records per state are listed; for the latter three species, each of which has a very narrow distribution, several records for each county are given. A mimeographed list of practically all the collections examined may be obtained from the author upon request. Only *A. triloba* and *A. parviflora* are incompletely cited in the list; no more than two localities per state are given for the former, no more than two localities per county are given for the latter. All collections from hybrid shrubs examined by the author have been cited in the text and are therefore (with the exception of those representing *Asimina* × *nashii*) not included in the mimeographed list.

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Lending institutions are here listed together with their corresponding abbreviations according to Lanjouw and Stafleu (Index Herbariorum, ed. 4. Part I, pp 1-249. 1959): A, Arnold Arboretum, Harvard University; BH, Bailey Hortorium, Cornell University; DUKE, Duke University; F, Chicago Natural History Museum; FLAS, Agricultural Experiment Station, University of Florida; FSU, Florida State University; GA, University of Georgia; GH, Gray Herbarium, Harvard University; IA, State University of Iowa; MIAMI, Buswell Herbarium, University of Miami, Coral Gables; MICH, University of Michigan; MO, Missouri Botanical Garden; NA, United States National Arboretum; NCSC, North Carolina State College; NCU, University of North Carolina; NY, New York Botanical Garden; PH, Academy of Natural Sciences of Philadelphia; SMU, Southern Methodist University; UC, University of California; US, United States National Herbarium; VPI, Virginia Polytechnic Institute.

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The species of *Asimina* and *Deeringothamnus* are admirably suited for field study because of their limited regional distribution. Only one species, *Asimina triloba*, extends north of the Coastal Plain. All ten occur in Florida, so by using the Herbarium of Florida State University as a base of operations, I was able to reach populations of all species with comparative ease. Type-localities of the species, if indicated by authors, were visited, and the itineraries in Florida of such collectors are Bartram, Rugel, Curtiss, Nash, and Small were consulted. The illustrations reproduced in this paper were made from pencil sketches of plants in flower or fruit, the sketches having been made either in the field or from living material brought to the herbarium.

The Genus *Pityothamnus*. Small (1933) separated six species from the genus *Asimina* and placed them in a new genus, *Pityothamnus*. The latter was distinguished from *Asimina* in two respects; first, by the corrugations toward the base of the inner side of the inner petals, a condition which is lacking in *Asimina* as restricted by Small, and second by the leathery texture of the leaves in contrast to the membranaceous texture of *Asimina* leaves. Yet both *Pityothamnus* and *Asimina* as treated by Small have two unequal cycles of petals, three petals per cycle, numerous stamens crowded into a ball on an elevated receptacle, and similar gynoecea consisting of from three to several free, fusiform carpels. Further, the difference in leaf texture is not always distinctive. Leaves of *Asimina triloba* or *A. parviflora* (which together comprise *Asimina* in the sense of Small) collected from sea-coast shrubs are often leathery. Therefore, a preponderance of evidence against retention of the name *Pityothamnus* has influenced all other authors to reject it.

***Deeringothamnus* and *Asimina*.** A generic description of *Asimina* broad enough to include the two species of *Deeringothamnus* would not indicate the true biological distinctness of *Asimina* in its relation to other genera of the Annonaceae. It is significant that Fries (1939), with his experience of revising

all the genera of Annonaceae, retained *Deeringothamnus* as distinct. It is also significant that both species of *Deeringothamnus* frequently occur in mixed populations with at least one species of *Asimina*, yet no evidence of hybridization between the genera has been found.

The two genera may be distinguished as follows:

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| <p>Petals usually 6, oblong to lanceolate, elliptic, ovate or obovate, never linear, the inner members saccate-based; stamens no fewer than 30, arranged in a globose mass on a prominently convex torus surface.</p> | <p><i>Asimina.</i></p> |
| <p>Petals 6-12, linear to oblong, subequal, in 2-3 cycles; none of the petal members saccate-based; stamens no more than 25, arranged in a flat to slightly convex-topped mass on a flat to slightly convex torus surface.</p> | <p><i>Deeringothamnus.</i></p> |

HISTORICAL ACCOUNT

The genus *Asimina* was proposed by Adanson (Fam. Pl. 2: 365. 1763). Ten years prior to this date, Linnaeus had published the type species as *Anona triloba*, based upon an illustration of Mark Catesby (Nat. Hist. Car. 2: 85. t.85. 1733). On the basis of William Bartram's book (1791), his letters to his English sponsor Dr. John Fothergill, his specimens, and his illustrations, it appears that he had, in his Florida and Georgia travels, encountered five then undescribed species of *Asimina*. Bartram's published descriptions have been taken into account by European and American botanists, yet his illustrations and descriptions have been variously interpreted by later workers.

Differences of opinion regarding the validity of Bartram's names have been so well argued (Rhodora 46: 389-391. 1944; Bartonnia 23: 10-35. 1945) that there is no need to review them further. I am inclined toward the view of Merrill (1945) that the names used by Bartram were originally published as binomials and should be recognized as valid.

Willdenow (Sp. Pl. 2: 1268, 1269. 1797) was the first to acknowledge two of Bartram's species. One, *Anona pygmaea*, he took directly from the German edition of the "Travels" (1793). The other, *Anona grandiflora*, he renamed *Annona obovata* because of an earlier homonym of the former name (*Annona grandiflora* Lamarek). Michaux (Fl. Bor. Am. 1: 329-330. 1803) published the three taxa treated by Willdenow (the two above and *A. triloba* L.) under a new generic name, *Orchidocarpum*, and added a fourth species, *O. parviflorum*.

Persoon (Syn. Pl. 2: 95-96. 1807) transferred the species (now four in number) to a new genus *Porcelia*. However Dunal (1817), recognizing the adequacy of Adanson's generic description, placed the four species in *Asimina*, modifying the descriptions of the species, and adding illustrations to clarify his concepts. Torrey and Gray (Fl. N. Am. 1: 45. 1838) added to the synonymy by transferring the species to the tropical genus *Uvaria*. However, after further study of the floral morphology of these plants, Gray (1886) again placed the species in question in *Asimina*, described a fifth species, *A. angustifolia*, and noted the occurrence of a sixth, *A. reticulata* Chapman. Nash (1896), in a revision of the genus *Asimina*, clarified the species by adding many pertinent field data and by clearing up the confusion between the Bartram names *Anona grandiflora* and *A. "incarna."* In resolving these Nash described a seventh species, *A. speciosa*.

The species were not again critically investigated until Exell (1927) noted the discrepancies between some of Bartram's published and unpublished plates and descriptions and the few Bartram specimens. Exell changed the nomenclature of four species and in addition included *A. tetramera* described just a

year before by Small. Uphof (1933) discussed in considerable detail the ecology and gross morphology of the individual species. This same year marked the date of Small's Manual of the Southeastern Flora in which two genera, *Pityothamnus* and *Deeringothamnus*, were treated as distinct from *Asimina*. In 1939, when the eastern North American species of Annonaceae were included by Fries in his treatment of the family, the opinions of Exell and Nash were largely followed, except that Fries treated Small's genus *Deeringothamnus* as distinct.

The genus *Asimina*, as typified by *Asimina triloba* (L.) Dunal, now has become well established as a biological and nomenclatural unit. A good proportion of the specific epithets in the genus must be credited to Felix Dunal, who apparently had access to Bartram's specimens and drawings and who was the first to transfer the species (other than *Asimina triloba*) to their correct genus.

All earlier investigators based much of their descriptive work on *Asimina* upon the observations, drawings, and specimens of Bartram. Any current work on the genus must therefore begin with a study of Bartram's "Travels," notes, specimens, and itineraries.

With the exception of the work of Bartram, Nash, and Small, most of the previous work on *Asimina* has been done by herbarium botanists. Considerable field study was essential before any significant contribution to the biology of *Asimina* could be made.

MORPHOLOGY OF ASIMINA

Of all the revisions of *Asimina* only that of Uphof (1933) has been directed toward an understanding of the morphology and ecology of the individual species. Therefore, the findings of Uphof, together with some of my own field observations, form the basis for what follows.

Habit. The members of the genus are erect to ascending or arching alternately-branched shrubs, with the exception of three species: *Asimina triloba* which frequently reaches tree size; *A. parviflora*, which occasionally reaches tree size; and *A. obovata*, which reaches 12 to 15 feet in height in one restricted locality near Ocala, Florida. Branching is alternate in all species. Extent of branching may serve to distinguish specific groups. Young shrubs of the three above-mentioned species may have numerous primary shoots, but one shoot usually becomes dominant with eventual suppression of the rest. Secondary shoots develop from the alternately arranged buds and these continue to rebranch, conforming roughly to a single plane and lending a flattened, frond-like appearance to the older shoots. In another type, exemplified by *A. pygmaea*, there may be several primary shoots of which none dominates, doubtless because of their short duration. In this species there is little to no secondary branching; both shoots and branches are arching to decumbent. In the remaining species a single plant may have as many as 30-40 primary shoots, each of these abundantly and rigidly rebranched. All species of *Asimina* have a woody, fusiform to linear taproot, and the crown which surmounts the root is, except for some old individuals, usually below the ground line.

The genus has three types of flowering habit. In one type, exemplified by *Asimina triloba*, *A. parviflora*, *A. speciosa*, and *A. reticulata*, flowers are produced prior to, or during, leaf emergence on wood of previous seasons. The ovoid hairy buds develop as axillary growths on the new shoot growth of one season, and flower the following spring after overwintering. In the second type, exemplified by *A. pygmaea*, *A. longifolia*, and *A. tetramera*, flowers develop

from the axils of the expanding shoot leaves, hence reaching anthesis after leaf emergence. In the third type, represented solely by *A. obovata*, flower buds terminate the new shoot growth. In the species of *Asimina* which flower before or during leaf emergence, flower development may be extremely irregular. The first bud to open may be the terminal one on the leafless overwintering shoot, or a median bud, or a lowermost bud; the tendency in this group, however, is for uppermost buds to open first. In the type in which flowers are axillary to new shoot leaves, the sequence of flowering is from base to tip of the new shoot in the order of the developing leaves.

Wood and bark. The wood of *Asimina* is soft and very aromatic when freshly cut. Wood rays are both prominent and abundant, readily visible to the naked eye if one examines a cross section of root or shoot. The young bark is thin, smooth, long-fibered, and has a scattering of pale, raised lenticels. The color of the bark may range within a species from tan to deep reddish-brown, hence bark color has little taxonomic value. The older bark is gray or gray-brown and smooth, except in larger trees of *A. triloba*, in which the bark is shallowly furrowed.

Leaves and buds. In *Asimina triloba* and *A. parviflora*, the leaves are usually membranaceous; in the remaining species the leaves are subcoriaceous, moderately to prominently revolute, and give the appearance of being evergreen. This difference in texture may be related to ecological factors, resulting from the mesic woodland habitat of the first group and the drier or physiologically drier habitats of the second. It must therefore be interpreted with reservations, as occasional seacoast specimens of *A. triloba* or *A. parviflora* have leaves which tend to be both revolute and leathery. The leaves of all the species are deciduous, though some South-Florida shrubs are tardily so. The leaf scars have five bundle traces which are arranged in a broad "V."

Immediately above the raised leaf scars are oval or ovoid winter buds of the shoot, and flower buds, in such species as *Asimina triloba*, *A. parviflora*, *A. speciosa*, and *A. reticulata*. The bud scales of these species are hairy, triangular, and not completely closed over the buds. The terminal buds are usually elliptic-lanceolate in outline, the scales of the same shape and closure as in the lateral buds, but with the protruding, densely hairy, outermost leaves of the bud closed together in a valvate fashion. The shoot buds of such species as *A. longifolia*, *A. pygmaea*, *A. tetramera*, and *A. obovata* are smaller, ovate-lanceolate, and completely closed within the bud-scales. In this latter group new shoot growth is extremely rapid, the new leaves of the first three species unfolding to reveal the accrescent axillary flower buds. Flower buds of *A. obovata* terminate the shoot growth and are consequently enclosed by the uppermost shoot leaves.

Indument. Pubescence in all the species is of simple hairs. Color, amount, and duration of pubescence are important criteria in the distinction of species, especially valuable in determining the identities of dried specimens.

Flowers. The species of *Asimina* are especially distinct in the characters of their flowers. All are accrescent-pedunculate, the peduncles variable in length and indument as well as in number and placement of bracts. All have a similarly shaped, three- or sometimes four-parted calyx, which is less variable in size from species to species than is the corolla. The character of the calyx indument is distinctive in individual species. The most reliable field characteristics of the *Asimina* flower actually lie in the color, size, and aroma, and in the shape and

thickness of its petals. The genus may be segregated into two groups on the basis of these criteria; one group is composed of species with small, maroon-pigmented, fetid flowers and the other is composed of species with large, white, pink or yellow-pigmented, fragrant flowers. The relationship between pigmentation and aroma of the flowers is especially interesting. Although some of the species of the white-flowered group are, to some observers, not pleasant in aroma, the definite fetid aroma of flowers of the reddish-pigmented group is always agreed upon by those same people. The white-flowered species are most fragrant when the flowers are freshly open, but the aroma becomes less pleasing as the flower reaches, then passes, anthesis.

The petals of all the species occur in two cycles of three, or occasionally four members, those of the inner cycle being smaller and different in shape than those of the outer. One species, *A. tetramera*, was separated by Small partly on the basis of its being four-merous, yet many three-merous individuals occur in populations of this species, and in all the other species some four-merous individuals occur. Odd or atypically shaped petals are by no means uncommon in *Asimina*. There are flowers in which inner and outer petals are double or triple the customary number; flowers which have no inner or no outer petals; flowers in which inner and outer petals are freakishly fused. Change of color of petals is common to all the species as anthesis of the accrescent flowers is approached and passed. Young petals in all the species are yellowish-green or greenish-white. As the petals mature and expand they turn maroon, pink, or yellowish-white, depending on the species. In *A. pygmaea*, the inner petals are the first to turn maroon, while the outer may still be greenish-white or flesh-colored. Later, during or after anthesis, these same outer petals will deepen to maroon. In *A. longifolia*, the outer petals will mature to white and remain white (except for a form of far western Florida) while the inner petals may age to a pinkish or maroon tint.

An especially interesting feature of the *Asimina* flower is the grooved, saccate, inner surface of the inner petal. Corrugations are present in this region in all species save *A. triloba* and *A. parviflora*, in which the saccate area is merely impressed-veiny within. In the other species this "nectary" area differs in its relative size and color and is perhaps one of the best ways of distinguishing species in the field. The androecium of all the species comprises a large, indefinite number of short-lineal, extrorse, four-locular stamens. The stamens are joined, up to the time of pollen release, by their globose or sub-cuboid connectives into a tight, greenish or pinkish-green ball and are attached at their bases to the fleshy torus. Almost the total length of the stamen is anther, the filament being extremely short. Surmounting the torus are three to twelve carpels which at anthesis are concealed for about $\frac{1}{3}$ their length by the stamens. The carpels are narrowly fusiform, sparsely to copiously appressed-short-hairy, and tipped by globular or lenticular glandular stigmas.

The stamens mature later than the carpels, the tight ball breaking down into a brownish-gray, soft mass as the connectives of the anthers deteriorate and the pollen is shed from the dehiscing locules. Almost immediately upon pollen release the petals drop, leaving the persistent sepals, expanding torus, and the burgeoning fruit.

Fruits. The fruit of all the species is a many-seeded, short to elongate-cylindric, uneven-sided or terete, pulpy berry, the flesh of which is edible if not palatable. It is mentioned by many early authors as having been eaten (even

relished) by the Indians and settlers of eastern North America. Experimental work has been done on the northward-ranging "pawpaw," *Asimina triloba*, to improve the quality and quantity of the fruit (Zimmerman 1941). In some parts of the United States, particularly in the southeastern mountains and the central Mississippi Valley region, the fruit of this species has appeared on local markets, and farmers prize their pawpaw groves. I have tried the ripe fruit of some Florida species. These have a taste and texture somewhat reminiscent of a sweetish avocado.

The fruit has a primitive morphology. Point of closure of the carpel wall is evident in the often prominent suture which extends ventrally from torus to tip of the fruit. Placentation is in two, sometimes irregular, rows and is ventral.

The seeds of *Asimina* are best described as "bean-shaped." They are brown to deep chestnut in color, and shiny. They vary in size depending on the number per berry, so that little can be said regarding seed differences between species. The average size is about that of a kidney bean. The seed coat is tough, except near the point of attachment. The endosperm is a close series of white plates perpendicular to the long axis of the seed. The embryo, located near the hilum, is very minute and develops slowly. Germination can be accelerated by refrigeration (Bowden 1948), but even then the development of the hypocotyl requires several weeks, while that of the epicotyl is correspondingly slow.

POLLINATING AGENTS

Zimmerman (1941), bemused in his attempt to ascertain what agents pollinate the *Asimina* flower, proposed the idea that the flowers are not cleistogamous, for while carpels of *Asimina* are fertilized some time before the pollen of the same flower is shed, the early flowers in each population are barren. Zimmerman also ruled out wind as an agent, perhaps because of the large size of the pollen grains. He commented on the possibility of the flowers being pollinated by the cumbersome but omnipresent pollen beetles (*Trichius* spp.).

Uphof (1933), also interested in pollinating agents of *Asimina*, observed some species of flies around the reddish, fetid flowers of *A. pygmaea*, and speculated that such insects might be the agents of pollination, for the aroma of this flower, and its color as well, could be likened to those of ripe beef. Uphof also observed bumblebees (*Bombus* spp.) around the larger, white, fragrant flowers of *A. longifolia* in West Florida.

I have seen no instance of pollination by any Hymenoptera, but have observed pollen beetles (*Trichiotinus piger* Fab.), flower beetles, and thrips in abundance in the flowers of all species. The foliage of *Asimina* is eaten by larvae of the zebra swallowtail butterfly (*Papilio marcellus* Cramer) yet in no instances have the adults been observed in the flowers. It must be admitted that the exact agents pollinating *Asimina* are not known, a frustrating admission in view of the quantity of fruit set by the species.

REACTION TO DISTURBANCE

On a basis of reaction to disturbance, *Asimina* species conform to two groups. In one group, composed of *Asimina speciosa*, *A. triloba*, *A. reticulata*, *A. parviflora*, and *A. obovata*, the immediate response to cutting or burning back is vegetative; the disturbed plants put up several leafy shoots on which are forming flower buds that will not open until the following growing season. In the other group, composed of *Asimina longifolia*, *A. tetramera*, and *A. pygmaea*, the immediate response to disturbance is both vegetative and reproductive,

the molested plants putting up leafy flowering shoots during the season of disturbance. *Asimina longifolia* and *A. pygmaea* are, in fact, so much a part of the fire-climax longleaf pine forests that they seldom flower except in response to such disiturbance.

GEOLOGIC HISTORY

Two representatives of *Asimina* and two of *Annona* are known from the Cretaceous and Eocene rocks of North America (Knowlton 1898; Berry 1916). The range of *Asimina* then extended farther north, fossilized leaves (*Asimina eocenica* Lesq.) having been recovered from the lower Tertiary of Colorado, Montana, and Wyoming. Fossil fruit (*A. leiocarpa* Lesq.) has been recovered from the Eocene of Mississippi along with remains of some tropical genera such as *Combretrum*, *Terminalia*, *Mimusops*, and *Cinnamomum*, which connote a warmer, perhaps more humid climate than now exists in that area. Of the presently known species only one, *A. triloba*, has been recovered as a fossil; it is definitely known from the Pleistocene with a possibility of a Miocene origin.

On a basis of such limited fossil evidence it is difficult even to speculate upon how large a genus *Asimina* might have been, for all but two of the presently known species grow in relatively dry habitats where chances for their fossilization are slight.

CYTOLOGY AND GENETICS

Bowden (1948) has determined a diploid chromosome complement of 18 for all species of *Asimina* except *A. pygmaea*. My own study of the cytology, based solely upon pollen mother cell smears of freshly gathered material, has been fraught with difficulties. The chromosomes are small, tending to clump during all stages so that large numbers of cells have to be examined in order to get a representative count.

From all indications the morphological distinctness of the taxa of *Asimina* is maintained by external rather than internal isolating factors, with the possible exception of *A. tetramera*, in which no evidence of hybridization has been observed. Zimmerman (1941) has successfully crossed *Asimina triloba* with *A. longifolia*, and *A. obovata*. Suspected hybrids between *A. triloba* and *A. parviflora* have been found (see text below); and in addition hybrids between *A. longifolia* and *A. pygmaea*, *A. pygmaea* and *A. reticulata*, *A. reticulata* and *A. obovata*, and *A. pygmaea* and *A. obovata*, have been seen in the field either by Duncan (Bull. Ga. Acad. 15: 9-15. 1957) or by me. Tests of hybrid viability have yet to be made in the genus, but the development of fruit and seed on hybrids I have seen is just as prolific as in the parent species.

The situation in *Asimina* appears to be much the same as that described by Stebbins (1950, pp. 203-206) in some western sympatric species of *Ceanothus*, where morphologically and ecologically distinct species are hybridizing, the progeny surviving upon habitats disturbed by man.

Hybrid swarms are common in *Asimina*, the hybrids occurring with liberal sprinklings of both parents either as intermediate F₁ plants or as backcrosses which express small parts of a continuum. Taxonomic treatment of these backcrosses is difficult. If they are included with the parent species which they most resemble, the description of that species becomes too broad. If, on the other hand, they are regarded as hybrids, their distinctness as such might be questioned. The partial solution propounded by Clausen (1951), who considers species are genetic rather than gross-morphological units, is not practical to those who are daily concerned with macroscopic characters. The observations

of Stebbins are sustaining for he says in effect that, though species in many genera hybridize, their distinctness in every other sense necessitates their retention as species. Further work with *Asimina* ought to entail growing the plants from selected seed, making experimental crosses and backcrosses, and determining more about the nature of those external isolating factors which have had a bearing on keeping such sympatric species distinct.

SYSTEMATIC TREATMENT

Asimina Adanson, Fam. Pl. 2: 365. 1763.

Annona L. Sp. Pl. 536. 1753; Gen. Pl. ed. 5. 241. 1754.

Orchidocarpum Michx. Fl. Bor. Am. 1: 329. 1803.

Porcelia Pers. Syn. Pl. 2: 95. 1807.

Uvaria Torr. & Gray. Fl. N. Am. 1: 45. 1838.

Trees or shrubs from stout-linear to fusiform taproots; twigs glabrous or variously pubescent when young, alternately arranged, with prominent lenticels; leaves membranaceous to coriaceous, estipulate, alternate, deciduous, entire, slightly to prominently revolute; flowers axillary, 1-4 per leaf axil, accrescent, nutant to suberect, on glabrate to tomentose peduncles; calyx-lobes 3 to 4, triangular to deltoid-ovate, equal, distinct nearly to the receptacle, glabrate to persistently hairy without; corolla 3- or 4-merous in two unequal cycles of three or four equal members each, imbricate in the bud, veiny, spreading to erect, the inner saccate-based and with or without an inner, corrugated, nectary zone; stamens numerous, short-columnar, joined when young into a tight ball on the elevated torus; filaments reduced; anther sacs joined into two parallel series on the outer stamen face and surmounted by blunt to sub-spherical or cuboidal connectives; carpels three to several, variously appressed-hairy, sessile on the torus summit, narrowly fusiform placentation in two ventral rows; fruit an oblong-cylindric, few- to many-seeded, pulpy berry; seeds bean-shaped, compressed laterally, with tough, brown to castaneous coats; endosperm in plates; cotyledons rudimentary.

1. Leaves commonly membranaceous, obovate to oblanceolate, acuminate to acute; flowers reddish, with a fetid aroma, arising from the previous year's twigs prior to or during emergence of the present year's leaves; inner petals saccate-based, impressed-veiny but not corrugate within; shrubs or trees of rich woods and river bottoms.
2. Flowers 2-3 (-5) cm broad; peduncles one cm or more long at anthesis, densely hairy with dark brown or reddish-brown hairs. (Fig. 1). *A. triloba.*
2. Flowers 1-1.7 cm broad; peduncles less than 1 cm long at anthesis, usually so short as to make the flowers appear sessile, densely hairy with ferruginous or tan hairs. (Fig. 2). *A. parviflora.*
1. Leaves coriaceous, linear to oval, never acuminate; flowers reddish to white or yellow, unfolding before, during, or after leaf emergence; aroma of flowers fragrant or fetid; shrubs (rarely trees) of pine flatwoods, sand hills or scrub.
3. Flowers arising from wood of the previous year prior to or during emergence of the present year's leaves; leaves oval or oblong, obovate, or cuneate, never linear.
4. Upper and lower leaf surfaces of newly emergent leaves densely tomentose with blond-pale or tan hairs; leaves obscurely revolute, oblong to obovate, obtuse to broadly rounded, rarely emarginate; outer petals white, narrowly oblong to ovate, flat to wavy-margined, 3.5-10 cm long; inner petals yellowish-white with deep yellow corrugated zone. (Fig. 3). *A. speciosa.*
4. Upper surfaces of newly emergent leaves sparsely pubescent, only the lower surfaces densely so; fully emerged leaves evidently revolute, cuneate to oblong, acute to broadly rounded, occasionally emarginate; outer petals 2.5-6 cm long, oblong to ovate, white, flat to wavy-margined; inner petals white or yellowish-white, or pink, with deep maroon to purple corrugated zone.

5. Leaves pale green to glaucous, very leathery when fully mature, cuneate to oblong-ovate, broadly rounded to broadly acute, seldom more than 6 cm long; bark of upper portions of old wood gray or gray-brown. (Fig. 5). *A. reticulata*.
5. Leaves deep green, oblong to oblong-lanceolate (rarely spatulate), obtuse to broadly acute, seldom less than 6 cm long; bark of upper portions of old wood reddish-brown with raised pale lenticels. *A. ×nashii*.
3. Flowers arising after emergence of the present season's leaves, either axillary to new leaves or terminating new shoot growth.
6. New shoots, petioles, veins of lower leaf surfaces, and peduncles bright red-hairy; flower buds, if present, always terminal on new growth. (Fig. 4). *A. obovata*.
6. New shoots, petioles, lower leaf surfaces, and peduncles glabrous to sparsely hairy; new growth with flowers axillary to shoot leaves.
7. Shrubs seldom more than 0.5 m tall with decumbent to arching, sparsely branched, shoots; perianth maroon to reddish, the outer petals seldom longer than 3 cm; leaves sub-erect, secund, elliptic-oblong to spatulate (rarely linear-oblongate); flowers nutant, secund. (Fig. 7). *A. pygmaea*.
7. Shrubs seldom less than 1 m tall with erect to sub-erect, variously branched shoots.
8. Leaves oblong-elliptic or oblong-oblongate to broadly spatulate.
9. Expanded flowers fetid, less than 3.5 cm broad, reddish; tall shrubs of southeastern peninsular Florida. (Fig. 6). *A. tetramera*.
9. Expanded flowers more than 3.5 cm broad, fragrant, the outer petals white, pink, or with maroon streaks; shrubs of north-central Florida. *A. ×nashii*.
8. Leaves linear, linear-elliptic, oblanceolate, or narrowly spatulate. (Figs. 8, 9). *A. longifolia*.

1. *Asimina triloba* (L.) Dunal, Monogr. Anonac. 83. 1817. Fig. 1.

Annona triloba L. Sp. Pl. 537. 1753.

Annona pendula Salisb. Prodr. 380. 1796.

Orchidocarpum arietinum Michx. Fl. Bor. Am. 1: 329. 1803.

Porcelia triloba (L.) Pers. Syn. Pl. 2: 95. 1807.

Uvaria triloba (L.) Torr. & Gray. Fl. N. Am. 1: 45. 1838.

Asimina glabra Hort. ex C. Koch, Dendrol. 1: 384. 1869.

Shrub or small tree 1.5–11 (–14) m tall from a stout, sometimes branched, taproot; bark of older trees gray-brown, shallowly furrowed; that of new shoots moderately to copiously dark brown-hairy toward the summit, aging smooth, gray-brown; winter buds globose, dark brown-hairy, 2.5–5 mm in diameter; leaves membranaceous, oblong-obovate to oblanceolate, 15–30 cm long; apex acute to acuminate; base more or less gradually attenuate to the short (0.5–1 cm) petiole; margin flat or scarcely revolute; young surfaces sparsely appressed-reddish-pubescent above; densely so beneath, becoming glabrous above and sparsely hairy on the veins beneath; flowers maroon, 2–3 (–4) cm broad with a faintly fetid aroma, on densely dark brown-hairy, nodding peduncles (1–) 1.5–2 (–2.5) cm long which develop from the axils of the prominent leaf scars; calyx 8–12 mm long, of three triangular-deltoid sepals which are striate with brown hairs on the outside, glabrous within; outer petals 1.5–2.5 cm long, oblong-elliptic, with ascending bases and slightly to conspicuously recurved tips, copiously appressed-hairy along the veins outside, glabrous and impressed-veiny within; inner petals $\frac{1}{3}$ – $\frac{1}{2}$ the length of the outer, elliptic, saccate-based, recurved-tipped, glabrate without, glabrous and impressed-veiny within; androecium globular, 0.5–1 cm broad, pale green at anthesis; gynoecium of 3–7 (–10) fusiform appressed-red-hairy carpels; fruit oblong-cylindric, 5–15 cm long, yellow-green to brownish when ripe; seeds 1.5–2.5 cm long, brown to castaneous, shiny when mature, bean-shaped, somewhat laterally compressed.

Rich hardwoods forests and river bottoms, northern Florida to Ontario, west to Nebraska and Texas. Flowering February to April.

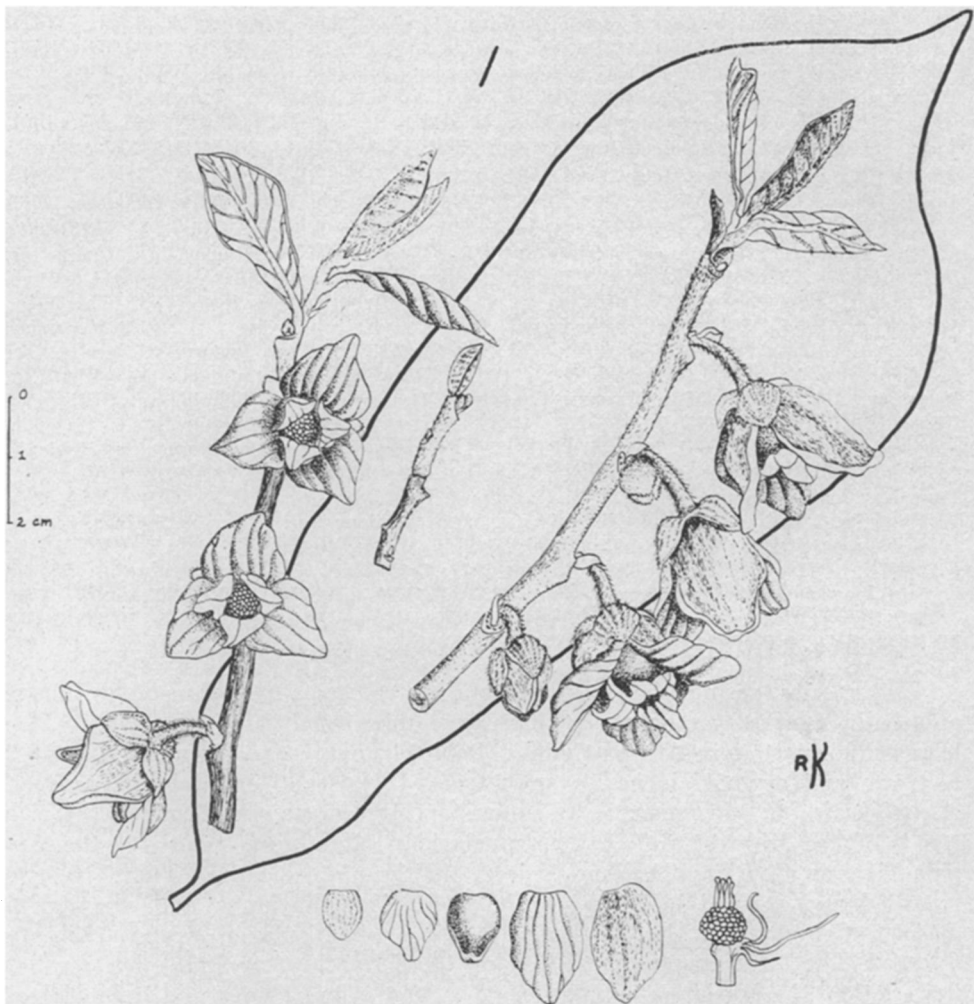


FIG. 1. *Asimina triloba* (L.) Dunal. At left and right, flowering twigs; at center, a winter twig with terminal bud; at bottom, dissected flower.

Type: Not seen. The Linnaean reference is wholly to *Catesb. Car.* 2, p. 85, t. 85.

CANADA: ONTARIO: Lincoln Co.: Conc. VIII, Niagara Twp., 1 mi n of St. David's RR station, *Soper & Dale 3792* (GH, MO, US). UNITED STATES: ALABAMA: Tuscaloosa Co.: ca. 9 mi above Tuscaloosa, *Harper 3712* (A, MICH, MO, NY, US). ARKANSAS: Garland Co.: Hot Springs, *Palmer 23198* (A, GH, MO). Hempstead Co.: Fulton, *Palmer 6835* (A, NY, US). DELAWARE: Faulkland, 23 Mai 1881, *A. Commons* (GH, MO). FLORIDA: Jackson Co.: Marianna, *Kral 4251*². (BH, BM, FLAS, FSU, GH, IA, MIAMI, MICH, MO, NA, NY, PH,

²My own collections and those of Messrs. Godfrey and Kurz have been distributed from Florida State University as widely as possible to the institutions that loaned material for study, and to the University of South Florida (USF). To conserve space in the citation of specimens of this and other species, lengthy lists of abbreviations for herbaria are omitted hereafter for these collections only.

UC, US, USE, VPI). Liberty Co.: Aspalaga, 14 Apr 1956, *Godfrey & Kurz* (FSU). GEORGIA: Elbert Co.: ca 8 mi s e Elberton, *Duncan 3881* (A, DUKE, FLAS, GA, GH, NCSC, NCU, US). White Co.: 1.7 mi s Unicoi Gap, *Duncan 9255* (GA, GH, IA, MO). IOWA: Lee Co.: Keokuk, 31 Mai 1933, *Shimek* (GH, IA, MO, NCSC). ILLINOIS: Menard Co.: Athens, 1861, *Hall* (GH, US). INDIANA: Wells Co.: 11 Mai & 14 Jun 1906, *Deam 761* (NY, US). KANSAS: Douglass Co.: Baldwin, *Horr 3603* (DUKE, FLAS, GH, IA, NCSC, US). KENTUCKY: Harlan Co.: Harlan Court House, Aug 1893, *Kearney* (GH, NY). LOUISIANA: Iberia Parish: Avery Island, *Correll & Correll 9523* (DUKE, GH, NY, US). Ouachita Parish: Okaloosa, *Kral 3459* (VPI). MARYLAND: Cecil Co.: Octoraro Creek below Porters Bridge, *Pennell 14604* (NY). Talbot Co.: Longwoods, *Earle 3760* (PH). MICHIGAN: Washtenaw Co.: Ann Arbor, *Hermann 7416* (GH, MO, NA, NY, PH). MISSISSIPPI: Oktibbeha Co.: Agricultural College, 11-17 Aug 1896, *Pollard* (F, GH, MO, NY, US). MISSOURI: De Kalb Co.: Weatherby, *Steyermark 69535* (F, IA, MO). NEBRASKA: Otoe Co.: Nebraska City, Mai 1915, *Muenschner* (GH). Richardson Co.: 27 Aug 1889, *H. J. Webber* (MO). NEW JERSEY: Gloucester Co.: Swedesboro, 5 Mai 1892, *G. L. Lippincott* (PH). NEW YORK: Chautauqua Co.: Westfield, *Muenschner 15508* (GH, MO). NORTH CAROLINA: Brunswick Co.: Wilmington, *Godfrey & White 7088* (DUKE, GH, NCSC, UC, US). SOUTH CAROLINA: Berkeley Co.: Pineville, *Godfrey & Tryon 1533* (GH, MO, NY, UC, US). OHIO: Coshocton Co.: *Coshocton, Moldenke 14161* (NCSC, SMU, US). OKLAHOMA: Osage Co.: Myers, *Stevens 2072* (A, GH, MO, US). PENNSYLVANIA: Lancaster Co.: Safe Harbor, 2 Aug 1889, *Small* (F, NY). York Co.: Wrightsville, 2 Mai 1891, *Small* (F). TENNESSEE: Cheatham Co.: Kingston Springs, 24 Jun 1922, *Svenson* (GH). TEXAS: Sabine Co.: 7 mi n Milam, *McVaugh 8432* (F, GH, MICH, NA, SMU). VIRGINIA: Bedford Co.: 15 Apr 1871, *Curtiss* (F, GH, NY). Giles Co.: wooded base of limestone cliffs, Eggleston, *Fogg 13328* (DUKE, GH, MO). WEST VIRGINIA: Wirt Co.: Palestine, *Bartholomew 1244* (A, BH, DUKE, GH, IA, MICH, MO, NA, NCSC, NCU, NY, PH, SMU, UC, US).

This species, despite the luxuriant, almost tropical appearance of its foliage and fruit, ranges farther north than any other member of the genus. The largest known tree, in Adams County, Pennsylvania, has a circumference of 9 feet two and one-half inches, a spread of 54 feet, and a height of 50 feet. *A. triloba* is fairly common as an understory tree or thicket-shrub in the rich woods of the Midwest and in the Appalachian Mountains. South of the Appalachians in Georgia it becomes scarce and the plant smaller. There are two recorded and verified localities for it in Florida: Marianna and vicinity in Jackson County, and the Apalachicola River bluff area in western Liberty County. The latter population (*Godfrey & Kurz*, 14 Apr 1956) has smaller flowers than the Marianna population (*Kral 4251*), but length and indument of the peduncles make it incontestably *A. triloba*.

Differences between *A. triloba* and the closely related *A. parviflora* are mainly quantitative. Hybridization between them would seem likely as they occupy similar habitats and flower at about the same time, yet the only evidence that such hybridization may occur is in those rare specimens which have intermediate flower sizes, e.g. *Godfrey & White 7088*.

2. *Asimina parviflora* (Michx.) Dunal, Monogr. Anonac. 82. 1817. Fig. 2.

Orchidocarpum parviflorum Michx. Fl. Bor. Am. 1: 329. 1803.

Porcelia parviflora (Michx.) Pers. Syn. Pl. 2: 95. 1807.

Uvaria parviflora (Michx.) Torr. & Gray, Fl. N. Am. 1: 45. 1838.

Tall shrub or low tree 1-6 m tall from a stout, vertical taproot; bark of old wood gray-brown, that of new wood reddish-brown and reddish-tomentose toward the summit; winter buds globose, reddish-hairy, about 2.5 mm in diameter; leaves membranaceous, oblong-obovate to oblanceolate, 6-15 (-20) cm long; apex acute to acuminate; base more or less gradually attenuate to the short (0.5-1 cm) petiole; margin scarcely revolute; surface glabrous and bright

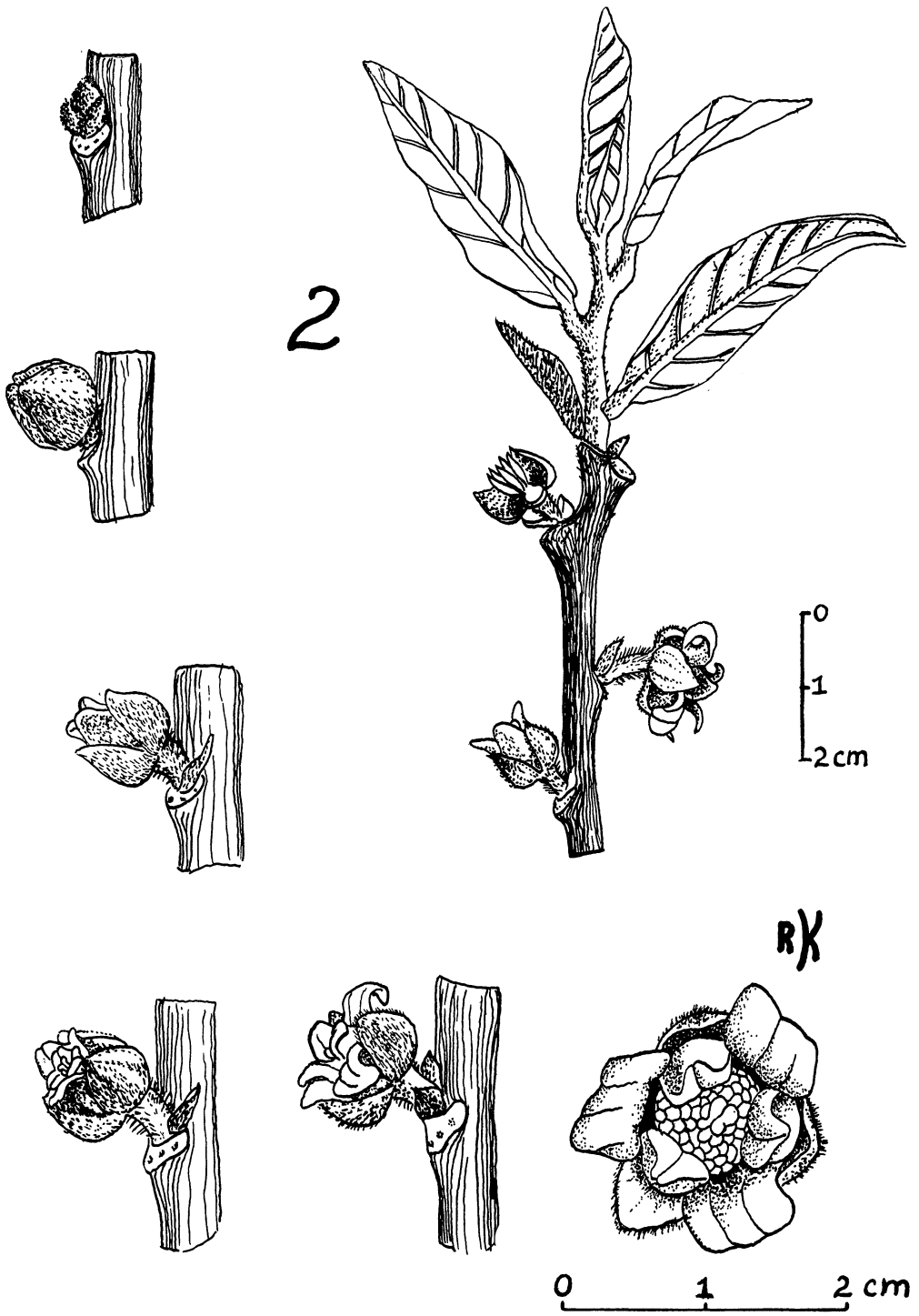


FIG. 2. *Asimina parviflora* (Michx.) Dunal. At left, bud and flower development; at upper right, a flowering twig; at lower right, an enlarged view of a flower.

green above, densely reddish-tomentose beneath when young, aging to sparsely red-hairy on the veins beneath; flowers maroon, 7–15 mm broad, with a faintly fetid aroma, subsessile or slightly nodding on reddish-hairy peduncles 0.3–0.8 cm long which develop from the axils of the prominent leaf scars; calyx 4–7 mm long, of three triangular-deltoid sepals which are striate with brown hairs on the outside, glabrous within; outer petals 1–1.3 cm long, fleshy, oblong to ovate, acute, with recurved tips, moderately reddish-hairy on the outside, glabrous and impressed-veiny within; inner petals about half the length of the outer, fleshy, ovate with strongly recurved tips and saccate bases which are incised-veiny within; androecium globular 4–6 mm in diameter, pale green at anthesis; gynoecium of 5–7 erect, fusiform, appressed-red-hairy carpels which surmount the receptacle; fruit 3–6 (–7) cm long, glabrate, oblong-cylindric, pale green in youth, ripening to a greenish yellow; seeds castaneous, 1–1.5 (–2) cm long.

Rich woods, borders of lime sinks, alluvial (or occasionally sandy) soil of coastal hammocks, Coastal Plain, Piedmont, and Appalachians, Florida to southeastern Virginia, west to Tennessee and eastern Texas. Flowering February to April.

Type: "In Carolina et Georgia," [Michaux], not seen. Representative flowering material: Wakulla Co., Florida, 3 Apr 1958, *R. Kral 6364* (BH, BM, DUKE, F, FLAS, GA, GH, IA, MIAMI, MO, NA, NCSC, NCU, PH, UC, US).

ALABAMA: Clay Co.: Valley Head, *Ruth 203* (MO, NY). Cullman Co.: 21 Jun 1897, *Eggert* (MO, NY). Geneva Co.: Geneva, *Duncan & Hardin 14876* (GA). Jefferson Co.: Birmingham, *Palmer 35346* (A, MO, NY). Lawrence Co.: 25 Mai 1925, *Ashe* (NCU). Lee Co.: Auburn, 18 Apr 1896, *Earle & Underwood* (NY). Sumter Co.: York, *Palmer 27195* (MO). St. Clair Co.: 12 mi w Pell City, *McVaugh 8595* (MICH, SMU). Winston Co.: Alabama National Forest, 1 Aug 1928, *Ashe* (NCU).

FLORIDA: Alachua Co.: Poe Springs, *Kral 2543*. Bay Co.: Panama City, 16 Mar 1937, *Exploration Party* (FLAS). Brevard Co.: n w shore South Lake, *Kral 5506* (DUKE, FSU, VPI). Clay Co.: Magnolia, 1 Mar 1883, *J. D. Smith* (US). Columbia Co.: Lake City, 1893, *P. H. Rolfs* (MO). Dixie Co.: Old Town, 3 Jun 1947, *Hume et al.* (FLAS). Escambia Co.: Pensacola, *Kral & Godfrey 6109*. Flagler Co.: Flagler Beach, 5 Oct 1941, *Kurz* (FLAS). Franklin Co.: Lanark, dune hammock, 24 Oct 1941, *Kurz* (FLAS); coastal dunes, Alligator Harbor, *Kral 4681*. Gadsden Co.: Lake Talquin, *Godfrey & Reese 54728* (DUKE, FSU, NCSC, VPI). Highlands Co.: Sebring, *Correll & McFarlin 6271* (DUKE). Holmes Co.: e bank of Choctawhatchee River, *Ford 3474* (FLAS). Jackson Co.: Marianna, *Kral & Godfrey 5929B* (FSU). Jefferson Co.: Wacissa Springs, *Kral 4169*. Lake Co.: Mt. Dora, *Hunnell 14957* (GH). Leon Co.: 10 mi s Tallahassee, *Kral 4183*. Levy Co.: Fannin Springs, *Kral 4175*. Liberty Co.: Alum Bluff, *Palmer 38541a* (GH, MO); *Kral 5051a*. Marion Co.: Eureka, 27 Mai 1941, *West & Arnold* (FLAS). Nassau Co.: Fort Clinch State Park, *Hood 4397* (FLAS). Okaloosa Co.: Mary Ester, 11 June 1955, *Kurz* (FSU). Orange Co.: Rock Springs, *Uphof 296* (F.) Osceola Co.: Kissimmee, 8 Mai 1901, *E. A. Mearns* (US). Pinellas Co.: Maximo Point, *Thorne 9452* (IA). Polk Co.: 10 mi n e Hesperides, *McFarlin 5305* (MICH). Putnam Co.: Welaka, 29 Mar 1940, *Laessle* (FLAS). Santa Rosa Co.: Jay, *Godfrey & Kurz 54769*. Suwannee Co.: Itchtucknee Springs, *Kral & Godfrey 3107* (FSU, VPI). Taylor Co.: Cabbage Grove, *Godfrey 55783* (FSU). Volusia Co.: New Smyrna, *Small et al. 11551* (NY). Wakulla Co.: 12 mi s Tallahassee, *Kral 6364*. Washington Co.: Caryville, *Kral & Kurz 4219*.

GEORGIA: Baker Co.: Ichawaynockaway Creek near Field Station, *Thorne & Muenscher 2842* (GA, IA). Bulloch Co.: Statesboro, 24 Apr 1940, *Harper* (PH). Carroll Co.: Carrollton, *Pyron & McVaugh 1743* (GA, US). Clarke Co.: Winterville Country Club, *Duncan 1128* (GA). Clay Co.: Ft. Gaines, *Thorne & Muenscher 2725* (F). Dekalb Co.: Stone Mountain, 1–18 Mai 1895, *Small* (F, NY). Dougherty Co.: Albany, *Pollard & Maxon 506* (NY, US). Early Co.: Hilton, *Thorne 7400a* (GA, IA). Effingham Co.: Stillwell, *Duncan & Hardin 15154* (GA). Elbert Co.: Elberton, *Duncan 11705* (GA). Forsyth Co.: Roswell, *Duncan 9123* (GA). Glascock Co.: Gibson, *Duncan & Hardin 15802* (GA). Greene Co.: 10 mi n Greensboro, *Duncan 1584* (GA). Gwinnett Co.: Yellow River, 20 Jul 1893, *Small* (F, NY, US). Hall Co.: Gainesville, *Duncan & Adams 18359* (GA). Harris Co.: Columbus, *Hardin*

276 (GA). Hart Co.: junction Tugaloo and Seneca Rivers, *Duncan 4865* (GA). Jackson Co.: Talassee Shoals, *Reade 18279* (GA). Jasper Co.: Monticello, Apr 1847, *Collector unknown* (PH). Jefferson Co.: Louisville, *Duncan 3777* (GA). Johnson Co.: Wrightsville, *Duncan 14497* (GA). Lee Co.: Gus Muse's Philoma Place, *Gillespie 5081* (SMU). Lincoln Co.: Price's Island, *Duncan 9481* (GA). Lowndes Co.: Columbus, 5 Aug 1926, *Ashe* (NCU). Lumpkin Co.: New Hope Church, 18 Mai 1926, *Ashe* (NCU). Madison Co.: between Ila and Carnesville, *Duncan 11313* (GA). McIntosh Co.: Crescent, *H. H. Smith 2255* (F). Meriwether Co.: Buzzard's Roost Mountain, *Duncan 9149* (GA). Morgan Co.: Hard Labor Creek, *Duncan 7734* (GA). Oconee Co.: Alcovy Mountain, 13 Jul 1893, *Small* (F). Putnam Co.: Eatonton, *Duncan 1652* (GA). Randolph Co.: Cuthbert, *Harbison 14226* (NCU). Richmond Co.: Augusta, 23 Aug 1916, *Harbison* (NCU). Screven Co.: e side Brier Creek, *Harper 2087* (GH, MO, NY, US). Stevens Co.: Currahee Mountain, *Pyron & McVaugh 594* (GA, US). Sumter Co.: Leslie, *Duncan et al. 17161* (GA). Tatnall Co.: Reidsville, *Duncan & Hardin 16139* (GA). Taylor Co.: 10 mi n Reynolds, *Pyron 500* (GA). Telfair Co.: 10 mi s McRae, *Wilbur 3351* (FSU, SMU). Union Co.: Flint River canyon just s of Elkins Creek, *Duncan 6525* (GA). Walton Co.: Logansville, *Wiegand & Manning 1246* (GH). Wilcox Co.: Lake Wilco, *Duncan & Hardin 16139* (GA).

LOUISIANA: De Soto Parish: Logansport, *Correll & Correll 10218* (DUKE, GH). Natchitoches Parish: woods, *Palmer 7979* (GH, MO). Ouachita Parish: 15 mi s w West Monroe, *Kral 3707B* (FSU, VPI). St. Tammany Parish: Covington, *Bro. G. Arsène 12332* (US). Vernon Parish: Cravens, *Shinners 23038* (SMU). Union Parish: Farmerville, *Kral 8863* (FSU, VPI).

MISSISSIPPI: George Co.: Ramsey Springs, *Schuster A-7449* (DUKE). Hirds Co.: Byram, *Harbison 191* (GH). Jackson Co.: Ocean Springs, *Schuster M-1109* (DUKE, GA). Lowndes Co.: Columbus, *G. M. Tracy 1401* (MO, NY, US). Wayne Co.: Waynesboro, *Pollard 1242* (US).

NORTH CAROLINA: Brunswick Co.: Southport, *Fox & Wells 467* (NCSC). Carteret Co.: Harker's Island, 10 Mai 1942, *Smith* (NCU). Craven Co.: bank of White Oak River near US 17, *Radford & Duke 5620* (NCU). Cumberland Co.: Cedar Creek, 2 Aug 1954, *Silliman & Munson* (NCU). Dare Co.: Sand Creek Bridge on Cornwallis Road, *Thomas 127* (US). Gates Co.: near swamp on Rte 158, ca 2½ mi e of bridge across Chowan River, *Fox & Whitford 351* (NCSC). Granville Co.: Camp Butner, *Batson 848* (DUKE). Hertford Co.: Experimental Forest, 28 Aug 1948, *Woods & Moreland* (NCSC). Jones Co.: Island Creek, *Radford 6058* (NCU). Moore Co.: Eagle Springs, *Fox & Whitford 3815* (NCSC). New Hanover Co.: Wilmington, *O'Keefe* (DUKE). Onslow Co.: Lake Catherine, *House 4505* (US). Orange Co.: Chapel Hill, 1 Mai 1935, *Totten* (NCU). Pender Co.: Burgaw, 17 Mai 1925, *Martin* (NCSC). Wake Co.: Crabtree Creek Area, *Jones 305* (DUKE). Wayne Co.: Seven Springs, *Fox & Godfrey 2727* (NCSC). Washington Co.: Plymouth, *Wiegand & Manning 1245* (GH).

SOUTH CAROLINA: Abbeville Co.: Lowndesville, *Duncan 10233* (GA). Anderson Co.: Portman Dam, Seneca River, 7 Jul 1946, *Totten* (NCU). Beaufort Co.: Blufftown, 1887, *Mellichamp* (GH, US). Burlington Co.: Hartsville, 3 Apr 1939, *Coker* (NCU, NY). Georgetown Co.: along PeeDee River, *Correll 5286* (GH). Greenville Co.: Marydell, *Peattie 1423* (NCU). Horry Co.: South Carolina State Park, 15 Jul 1946, *Coker* (NCU). Lexington Co.: Batesburg, *McGregor 142* (US). McCormick Co.: McCormick, De La Howe School property, *Duncan 11012* (GA). Oconee Co.: Seneca, *Palmer 35401* (GH). Pickens Co.: Table Rock, *Rodgers 570* (DUKE).

TEXAS: Angelina Co.: Keltys, sand hill, *Hamby 1488* (US). Caldwell Co.: 12 Jun 1931, *J. D. McBryde* (MO, NY). Hardin Co.: Pine Knot, *Cory 52713* (NCSC, SMU). Nacogdoches Co.: Nacogdoches, *Parks 1339* (MO). Newton Co.: Newton, *McVaugh 6361* (SMU). Polk Co.: Livingston, *Palmer 6774* (GH, MO, PH, US). San Augustine Co.: San Augustine, *Palmer 12701* (GH, MO, UC). Tyler Co.: Woodville, *Tharp 54806* (SMU).

VIRGINIA: Greenville Co.: Taylor's Millpond, *Fernald & Long 10268* (GH). Isle of Wight Co.: Lee's Mill, *Fernald & Long 12657* (GH). Nansemond Co.: Factory Hill, *Fernald & Long 10268* (GH). Southampton Co.: Drewryville, *Fernald et al. 5779* (GH, NY, US).

Asimina parviflora is distinguished from its closest relative, *A. triloba*, by its smaller flowers and fruit, the reddish tomentum of its shoots and young leaf surfaces, its shorter peduncles, and its generally smaller size. Specimens that lack flowers or fruit, however, are difficult to separate from similar specimens *A. triloba*. Examination of a very large series of specimens fails to reveal any,

save quantitative, differences between the two except for the minor ones of indument. It is recommended that collectors desiring valuable herbarium material of either of the species should select flowering or fruiting specimens only.

Unlike *Asimina triloba*, *A. parviflora* is a plant of the lowlands of the southeastern and southern Coastal Plain. It has been found in quantity in coastal hammocks within reach of the salt spray. In such areas, and on drier habitats in general, the shrubs are stunted. The leaves of such plants are more leathery and revolute-margined, and are also reduced in size, and tend to lose their acumination, so that vegetative specimens might well be likened to the obovate-leaved *A. obovata*. Yet, in general, plants of this species are indicators of fertile soil. The shrubs, in most respects like miniatures of the northern pawpaw, *A. triloba*, are pleasing in appearance, and emergence of the small but sturdy maroon flowers is a true harbinger of the southern Spring. The only unattractive feature of the species is the faintly fetid aroma of its flowers which is suggestive of putrid meat. It is interesting that this same aroma is peculiar to all those species of *Asimina* that have maroon flower coloration. The pigment and the aroma seem to be interrelated.

3. *Asimina speciosa* Nash,³ Bull. Torrey Club **23**: 238. 1896. Fig. 3.

Anona incarna Bartr. Travels. 171. 1791. (As to plant described, but not as to figure facing p. 20 nor as to Bartram specimens, Nos. 1 and 23, nor as to their accompanying manuscript description.)

Asimina grandiflora Dunal, sensu Elliott, Sk. 2: 43. 1821. (In part as to plant described.)

Asimina grandiflora Dunal, sensu A. Gray, Syn. Fl. N. Am. 1¹: 64. 1895. (As to plant described.)

Asimina incarna (Bartr.) Exell, Jour. Bot. **65**: 69. 1927. (As to plant described, not as to Bartram specimens, drawings, or accompanying manuscript descriptions.)

Pityothamnus incanus (Bartr.) Small, Man. SE. Fl. 530. 1933.

³Dr. Kral presents below, at some length, his case for accepting this name as the valid and correct one for this species. In the opinion of the editor the correct name is *Asimina incarna* (Bartr.) Exell (assuming always that the names published by Bartram in the "Travels" are valid in the first place). As Dr. Kral says, "Bartram described but did not collect or figure the plant he called *Anona incarna*." It is also [in Dr. Kral's words] "reasonable to assume that Bartram was also able to [distinguish between the two species confused by later botanists], else he would not have used two epithets, *A. incarna* and *A. grandiflora*." It is thus apparent that Bartram described and clearly distinguished a species that is today readily recognizable from the description. Bartram's description, in the absence of a type-specimen, may stand as the type of his *Anona incarna* (Art. 10). According to the views expressed above, Exell was correct in transferring the name *Anona incarna* to *Asimina*. The fact that he (in Dr. Kral's view) typified the name wrongly and interpreted the species too broadly does not invalidate the transfer. The name *Asimina speciosa* Nash, on the other hand, was at the time of publication a synonym of *Anona incarna* Bartr., which Nash should have adopted and transferred to *Asimina* (but of which he was apparently ignorant). The error, because of which Dr. Kral proposes to invoke Art. 65 of the Code, was that of Nash who, in attempting to name the species that had been confused with *Anona grandiflora* Bartr., neglected to ascertain that it already had a name, *Anona incarna* Bartr. Those who invoke Art. 65 will do well to remember that this article is vague at best, and at its worst impossible to apply satisfactorily; those who made it a part of the Code surely did not mean it to apply to every case in which strict application of the rules of priority necessitates the discontinuance of a well known but incorrect name.

The name *Asimina speciosa* Nash, however, has one thing in its favor. If, as it seems to the editor, the new names proposed by Bartram in the "Travels" are not validly published under the Code, then *Asimina speciosa* is the earliest valid name for the species in question. Of the two names proposed by Bartram for other species, one is a later homonym (*Anona grandiflora*), and the other was validated by other authors within a few years after the appearance of Bartram's "Travels" (*A. pygmaea*).—R. McV.

Copiously and stiffly branched shrub to 1.5 m tall, the one to numerous primary shoots from a deep, narrow taproot; bark of old wood gray to gray-brown, that of second year wood brown to gray-brown and gray- or pale-tomentose toward the summit, that of new shoots reddish brown or tan, with color subdued by a dense blonde or whitish tomentum; leaves coriaceous, obovate to ovoid or elliptical (occasionally cuneate), 5-8 cm long; apex obtuse or rounded-emarginate; base rounded or abruptly narrowing to the short (2-6 mm) petiole; margin weakly revolute; surface densely white- or blonde-tomentose above and beneath when young, at maturity sparsely tomentose above and moderately so on the veins beneath; flowers 1-4 per node, fragrant, nodding on slender, densely blonde-hairy peduncles 2-3.5 cm long, these developing from the axils of the prominent leaf scars; calyx 8-12 mm long, of three (or four) triangular-deltoid sepals which are striate with orange hairs on the outside, glabrous within; outer petals 3-7 cm long, oblong to obovate, wavy-margined, white or yellowish white, tan-hairy on the outer vein surfaces, glabrous and impressed-veiny within; inner petals $\frac{1}{3}$ - $\frac{1}{2}$ the length of the outer, lanceolate-hastate, revolute, fleshy, saccate-based, with the lower $\frac{1}{3}$ of the inner face largely covered by yellow corrugations; androecium 0.5-1 cm in diameter, pale green to pinkish at anthesis; gynoecium of 3-5 (-11) narrowly fusiform, pale, appressed-hairy carpels; fruit short-oblong, up to 8 cm long, terete to irregularly bulging, glabrate, yellow-green when ripe; seeds pale to rich brown, dull, 1-2 cm long.

Well drained sands of turkey oak-longleaf pine sand ridges, sandy old fields, and pine flatwoods (where there is little or no saw-palmetto), central peninsular Florida north to north-central and northeastern Florida and southeastern Georgia. Flowering March to May.

Lectotype: FLORIDA: Duval Co.: dry sandy soil near Jacksonville, *Curtiss 86* (NY). Isotypes at F, GH, IA, MO, NY, PH, UC, US.

FLORIDA: Alachua Co.: Melrose, *Kral 2199*. Baker Co.: MacClenny, *Duncan 3126* (GA). Bradford Co.: Starke Road near s edge of Union Co., *Murrill 525* (GA, US). Citrus Co.: 11 mi ne Red Level, 14 June, 1941, *West & Arnold* (FLAS). Clay Co.: Goldhead Branch State Park, 19 June, 1929, *West* (FLAS). Columbia Co.: Ft. White, *Kral 2180*. Duval Co.: dry pine barrens near Jacksonville, *Curtiss 6358* (F, GH, MO, NY, UC, US). Flagler Co.: 15 mi n Bunnell, *Kral 2506*. Gadsden Co.: Quincy, *Small et al 11348* (GH, NY, US). Gilchrist Co.: oak woods 5 mi s of junction 27-49, *Kral 4399*. Hamilton Co.: White Springs, *Godfrey, et al. 54702*. Lafayette Co.: Mayo, *Kral 2633B*. Lee Co.: Fort Myers, 1929, *Buswell* (BH). Levy Co.: Williston, *Kral 4473*. Madison Co.: 15 mi sse Madison, *Kral 2709* (FSU, VPI). Marion Co.: Belleview, *Kral 2255*. Nassau Co.: Trail Ridge, *Bailey 6863* (BH). Polk Co.: open sandy places, 1 May 1941, *Schallert* (NY). Putnam Co.: Florahome, turkey oak sand ridge, *Kral 2205*. St. Johns Co.: St. Augustine, *Kral 2504*. Suwanee Co.: Branford, *Kral 2266*. Union Co.: Dukes, *Murrill 768* (MO, US). GEORGIA-FLORIDA: inter Centreville, Ga. et Black-creek, Fla., *Rugel 7* (F, NY).

GEORGIA: Bacon Co.: Alma, *Duncan & Hardin 16249* (GA). Berrien Co.: Alapaha, *Thorne et al. 2248* (GA). Brantley Co.: 14 mi w Nahunta, *Kral 2496*. Camden Co.: Kingsland, *Kral 3493* (FSU, NCU, VPI). Charlton Co.: Folkston, *Leeds 2520* (DUKE,) F, MO, NY, PH). Coffee Co.: Douglass, *Harper 1438* (F, GH, MO, NY, US). Dodge Co.: 10 mi s of Eastman, *Duncan 5045* (GA). Lanier Co.: Lakeland, *Wilbur 3084* (FSU, NCSC, SMU). Pierce Co.: Wayeross, *Godfrey, et al. 54700*. Wayne Co.: Jesup, *Duncan & Hardin 13774* (GA). Ware Co.: dry oak & pine barrens, *Henry 1522* (UC).

William Bartram (1791) was the first to describe the plant here treated as *Asimina speciosa*. His description, on page 171 of the "Travels", is as follows:

Of the low shrubs many were new to me and of a very pleasing appearance, particularly a species of Anona (*Anona incarna*, floribus grandioribus paniculatis;) this grows three, four

or five feet high, the leaves somewhat euniform or broad lanciolate, attenuating down to the petiole, of a pale or light green color, covered with a pubescence or short fine down; the flower very large, perfectly white and sweet scented, many connected together on large loose panicles or spikes; the fruit of the size and form of a small cucumber, the skin or exterior surface somewhat rimose or scabrous, containing a yellow pulp of the consistence of a hard custard, and very delicious, wholesome food. This seems a variety, if not the same that I first remarked, growing on the Altamaha near Fort Barrington, Charlotta and many other places in Georgia and east Florida. . . .

Opposite page 20 of the "Travels" is a drawing of an *Asimina* which shows a leafy shoot terminating in a single, large-petaled flower. The plate bears the Bartram name *Anona grandiflora*. Most students of *Asimina* (Chapman, Gray, Exell) in interpreting Bartram's work have coupled this plate with the plant described on page 171 as *Anona incarnata*, in the belief that the two represent one species. As a result of such interpretations the nomenclatural bases of what are actually two distinct species have been confused.

The species described by Bartram as *Anona incarnata* is a shrub of medium height (1-1.5 m), which flowers from the axils of leaf scars, thus flowering upon one year old wood prior to or during the emergence of new leaves and shoot growth. It is the most tomentose of all the species of *Asimina*, the new leaf surfaces, new shoots and peduncles being densely coated with a mat of pale hairs.

The species figured by Bartram as *Anona grandiflora* is a tall shrub (attaining tree size in one locality), at maturity seldom less than 1.5 m tall, with flowers terminating new shoot growth, and thus reaching anthesis after the emergence of the new leaves. Its new shoots, petioles, and lower leaf surfaces are reddish-pubescent.

The above differences are sufficient adequately to separate the species. It is reasonable to assume that Bartram was also able to do so, else he would not have used two epithets, *A. incarnata* and *A. grandiflora*.

Exell (1927), in his revision of *Asimina*, considered the Bartram name *Anona incarnata* as valid. He used as evidence the above quoted description in the "Travels," and selected Bartram's specimen 23, in the British Museum, as the nomenclatural type for *Asimina incana* (Bartr.) Exell. He quoted its accompanying manuscript description as follows:

This fine flowering shrub is likewise stoloniferous, sending upward a many divergent stems from the same source, rising 5, 7 feet high, dividing alternately into several branches, which subdivide again, which terminate with very showy panicles or clusters of very large snow white flowers, of an agreeable scent, these flowers are succeeded by large oblong or kidney form berries, or frute, the skin or rind of which are scabrous and contain several large compressed seed immerst in a soft yellowish delicious pulp somewhat of the consistence and taste of a hard custard. They are eaten by the indians and other inhabitants; the white people call them custard apples; I have frequently eat of this delicious fruit and found them nourishing and innocent.—It is an inhabitant of the barren sandhills; & near the high banks of rivers. So. Georgia & Et. Florida. Lat. 28, 29, 30, 31.

Upon examination of a photograph of the supposed type of *Asimina incana* (Bartr.) Exell, kindly sent from the British Museum (Bartram specimen #23), I was surprised to note that it did not represent the species in question. On the contrary, it showed flowers terminating new shoot growth and was therefore a photograph of the first known collection of the plant figured as *Anona grandiflora* by Bartram ("Travels," illus. facing p. 20). Further, the unpublished description quoted by Exell refers to a shrub much taller than almost any

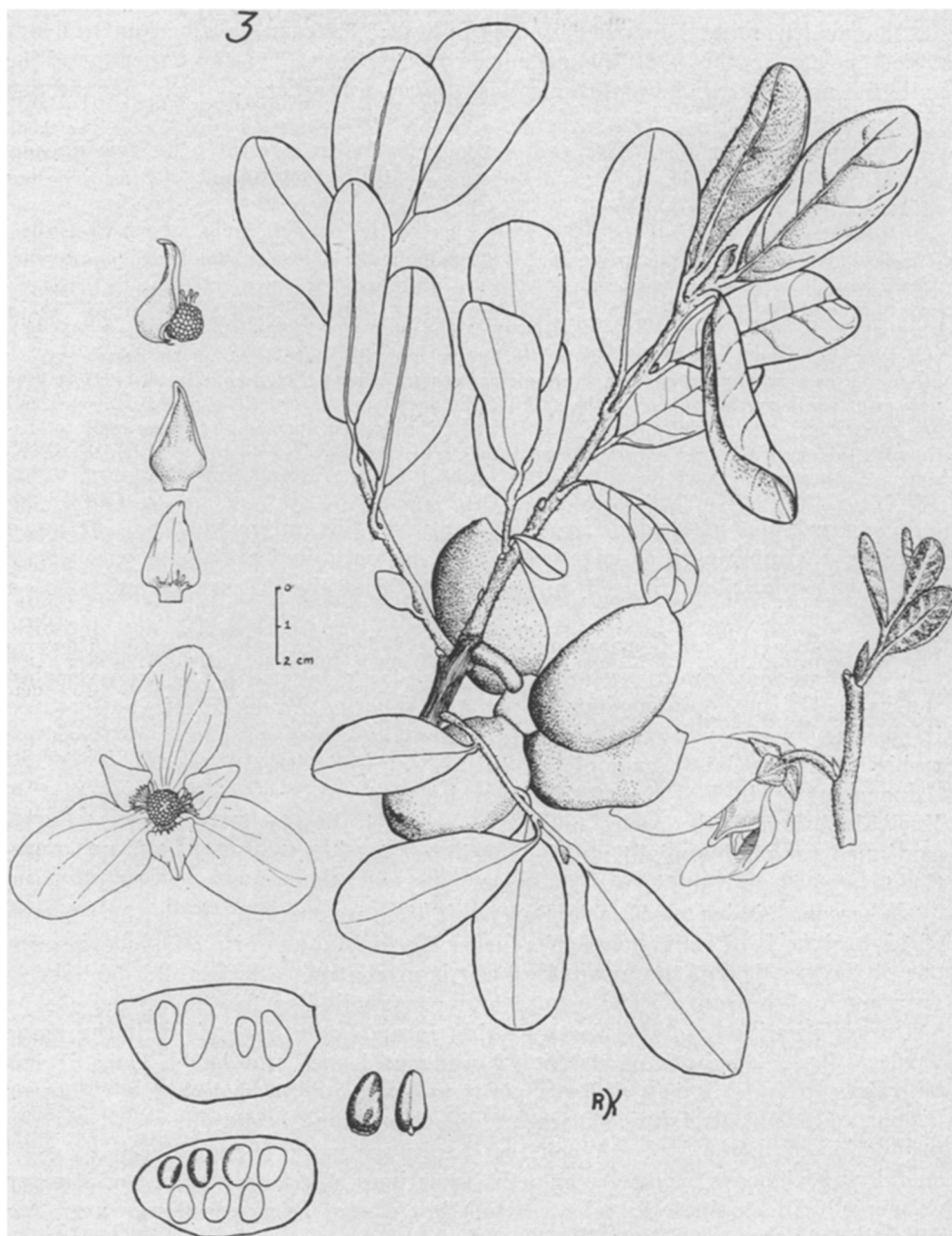


FIG. 3. *Asimina speciosa* Nash. At left, top to bottom, inner petal as it infolds the gynoecium and androecium; outer view of inner petal; inner view of inner petal; top view of flower, and two longisections of a fruit with extracted seeds; at center, a fructing twig; at right a flowering twig.

known specimen of the woolly-leaved *Anona incarnata*. The description calls for a plant with a terminal flowering habit, which is at variance with the flowering habit of *Anona incarnata*.

The evidence may be summarized as follows: Bartram described but did not collect or figure the plant he called *Anona incarnata*. On the other hand he collected and figured the plant he called *Anona grandiflora*, but did not publish a description of this species.

The first worker after Bartram's time clearly to separate the two species was G. V. Nash (1896), who renamed the woolly-leaved plant (*Anona incarnata* of Bartram) as *Asimina speciosa*. Nash wrote:

This plant has been referred to the *A. grandiflora* Dunal, which was based on *Annona grandiflora* Bartram. It is not that plant, as is plainly indicated by a reference to the excellent figures of Bartram (*Travels pl. 2. 1791.*) and of Dunal (*Monog. Anon. pl. 11. 1817*) where the flowers are shown as terminating the branchlets. The description of Dunal (l.c. 84), moreover, calls for a plant with sub-sessile flowers and the branchlets and the lower surface of the leaves "rufo-pubescentibus," characters certainly not to be found in *A. speciosa*, the flowers of which are lateral, from the axils of the deciduous leaves of the preceding year, and the pubescence merely yellowish white or tawny. The long peduncles also serve well to distinguish this from the true *A. grandiflora* Dunal, which is described in this revision under the name *A. obovata*.

The treatment of Exell is in direct contrast; this author retained the name *A. incarnata*, supposing it to have been based not only on the description on page 171, but on that plant figured opposite page 20 at the "Travels" and also on Bartram specimens 2 and 23.

Thus, since the publication of Bartram's "Travels," the senses of the two epithets *Asimina grandiflora* and *A. incarnata* have become almost inextricably confused. It is my opinion that the name *A. incarnata* should be rejected because it has been used by several authors to include two species, and is therefore ambiguous. The latest example of this is found in recent treatment of the Annonaceae by R. E. Fries (1939) in which that author accepts the concept of Exell, including both species under the name *A. incana* (Bartr.) Exell. The continued use of this might well be considered in violation of Article 65 of the Code.

Whereas *Asimina speciosa* in Bartram's time was a plant of the deep sands of high river banks and longleaf pine-turkey oak ridges, it has since become one of the weediest of the pawpaws for it is presently a common old field shrub over much of its range. The beauty of its magnolia-like flowers appears to be lost upon a majority of the North-Florida farmers who have given it the name "polecat bush" because of its highly pungent leaves and bark. Once it has become established it is a difficult plant to eradicate for ordinary plowing or discing of a field of *Asimina* merely divides the tough roots and results in the production of more plants. When the shrubs are cut or burned back they respond with vigorous vegetative growth (sometimes attaining a height of a meter or more during a single growing season) but do not as a rule flower until the following season.

4. *Asimina obovata* (Willd.) Nash, Bull. Torrey Club **23**: 240. 1896. Fig. 4.

Anona grandiflora Bartr. Travels [Plate facing p. 20]. 1791. Not *A. grandiflora* Lam., 1786.

Anona obovata Willd. Sp. Pl. **2**: 1269. 1797.

Orchidocarpum grandiflorum (Bartr.) Michx. Fl. Bor. Am. **1**: 330. 1803.

Porcelia grandiflora (Bartr.) Pers. Syn. Pl. **2**: 95. 1807.

Asimina grandiflora (Bartr.) Dunal, Monogr. Anonac. **82**. 1817.

Uvaria obovata (Willd.) Torr. & Gray, Fl. N. Am. **1**: 45. 1838.

Pityothamnus obovatus (Willd.) Small, Man. SE. Fl. **531**. 1933.

Shrub (occasionally a small tree) 2–3 (–4.5) m tall from a stout-linear or sometimes branched root; primary shoots one to few, sub-erect to arching from the subterranean crown and branching alternately and regularly in one plane; bark of third year and older twigs glabrous, gray; that of second year wood glabrous, reddish-brown or light brown, with raised, pale lenticels; that of young shoots densely short red-tomentose toward the tips, sparsely so toward the base; leaves coriaceous, obovate to oblong, oblanceolate or ovate, 4–10 (–12) cm long; apex rounded, emarginate, or obtuse; base rounded to subacute, more or less abruptly narrowing to the short (3–5 mm) petiole; margin scarcely to prominently revolute; young surface sparsely appressed-reddish-hairy above, densely so on the veins beneath, becoming glabrous and lustrous above and sparsely reddish-hairy on the veins beneath; flowers white (sometimes with pink inner petals), 6–10 (–15) cm broad, fragrant, subsessile on the tips of new shoot growth or on densely red-hairy terminal peduncles no longer than 5 mm; sepals 0.5–1.5 cm long, elliptic to ovate, rounded, red-hairy along the veins on the outer surface, glabrous within; outer petals white, 4–6 (–8) cm long, oval to obovate, spreading, sparsely appressed-hairy along the veins outside, glabrous and impressed-veiny within; inner petals $1/5$ – $1/2$ the length of the outer, oblong-oval to oblong or occasionally lanceolate, white or occasionally rose, slightly revolute, slightly saccate-based and with the basal $1/3$ – $1/2$ of the inner surface covered with purple corrugations, glabrous; androecium globular, 0.5–1 cm broad, pale green to pinkish at anthesis; gynoecium of from 3–8 (–11) narrowly fusiform sparsely appressed-red-hairy, glabrate carpels; fruit 5–9 cm long, short-oblong, terete to irregularly bulging, sometimes rugose, yellow-green when ripe; seeds 1–2 cm long, brown to castaneous, in two irregular rows.

Dry sand ridges, coastal dunes and hammocks, and pine-turkey oak sand ridges, southeastern to north-central and northeastern peninsular Florida. Flowering from late March to June.

Type: [Southern Georgia or eastern Florida], *Bartram 23* (BM). Another specimen, *Bartram No. 1* (BM), cited by Exell (1927) as *A. incarnata*, probably also represents *A. obovata* (*grandiflora*).

FLORIDA: Alachua Co.: Archer-Bronson road, *Murrill 366* (US). Brevard Co.: Eau Gallie, *Small et al. 11544* (DUKE, FLAS, MO, NY). Citrus Co.: Hernando, *Kral 3537*. Clay Co.: Camp Blanding, 19 Apr 1942, *Totten* (NCU). Dade Co.: Miami *Popenoe* (US). Hernando Co.: Jun–Jul 1898, *Hitchcock* (F, MO). Highlands Co.: low sandscrub, Lake Annie, *Brass 14757* (GH, US). Indian River Co.: Fort Pierce–Vero Beach, 16 Apr 1936, *McDaniels* (FLAS). Lake Co.: Mt. Dora, *Kral 2154*. Levy Co.: Meredith, *Correll & Correll 8898* (NA). Marion Co.: Glen Silver Springs, *Kral 4573*. Orange Co.: Intercession City, *Kral 2246* (FSU, VPI). Osceola Co.: 10 mi nw Kissimmee, *Kral 2243* (FSU, MICH, VPI). Pasco Co.: Port Richey, *Kral 2102* (FSU, VPI). Polk Co.: Bartow, *Kral 2543*. Putnam Co.: sandy soil, *Harbison 7* (GH, NCU). St. Lucie Co.: Fort Pierce, *Kral 2515*. Sumter Co.: Wildwood, 4 Apr 1946, *West & Arnold* (FLAS). Volusia Co.: Ormond Beach, *Kral 2217*.

Much of the pertinent written history of this species has been taken up in the discussion of *Asimina speciosa*. The published illustration of Bartram (“Travels,” plate opposite page 20) is an excellent likeness as it shows the unique terminal-flowering habit of the species. Specimens of *Asimina obovata* are also conspicuous by the reddish pubescence of their lower leaf surfaces and new shoots. By bearing these characteristics in mind, one may easily trace this *Asimina* through the literature.

Willdenow was the first formally to describe it. As the Bartram epithet *Anona grandiflora* was preoccupied Willdenow gave the Florida plant a new name. In drawing his description Willdenow referred only to the Bartram plate in the "Travels." He could have interpreted with ease from this plate the terminal position of the flower, the shape of the leaves, outer petals and fruit. Yet he also referred to the shape of the inner petals. As Bartram published no diagnosis of this species in the "Travels," and as his drawing did not reveal the shape of the inner petals, it is quite possible that Willdenow either had access to the Bartram specimens 1 and 23 or was sent some kind of diagnosis of the specimens.

The description of Michaux, though brief, also seems to stem from an examination of an actual specimen. He described a plant with reddish-pubescent twigs and leaves and oblong inner petals. but the Bartram plate to which be referred in his synonymy shows none of these characteristics. Whatever the truth may be, the plant Michaux defined as *Orchidocarpum grandiflorum* is undeniably the same as the plant here treated as *Asimina obovata*.

Dunal (1817) was the first correctly to transfer the Bartram plant to *Asimina*, accompanying the new name with a remarkably accurate definition, taking into account most of the features which distinguish this species from *A. speciosa* with which it has often been confused. Further, Dunal accompanied his description with a plate (Plate 11) which is a reasonably detailed drawing of the species, done in a way that shows the shape and relative size of the inner petals. This plate, plus the description of the pubescence characters, indicates that Dunal must also have had access to actual specimens of *Asimina obovata*.

Asimina obovata is, like *A. speciosa*, a plant of well drained sands. It is restricted in distribution to peninsular Florida, with a range oddly coincidental to that of the State's orange groves. It is the tallest of the large-flowered pawpaws. Heights of 12 to 15 feet have been recorded for it is in one small area on the west side of Lake George, Marion County, where it is an understory tree growing with sand pine. Individuals eight or ten feet in height are not uncommon over most of its range. The large fragrant flowers of *Asimina obovata* are perhaps the most showy of the genus; some Floridians refer to it as "Florida dogwood."

5. *Asimina reticulata* Shuttlew. ex Chapm. Fl. South. U. S. ed. 2. 603. 1883. Fig. 5.

Asimina cuneata Shuttlew. ex A. Gray, Bot. Gaz. 11: 163. 1886.

Pityothamnus reticulatus (Chapm.) Small, Man. SE. Fl. 530. 1933.

Copiously and stiffly branched shrub to 1.5 m tall, the one to many primary shoots from a deep, linear or narrowly fusiform taproot; bark of old wood gray; that of second year wood brown to gray-brown, gray or pale-tomentose distally; that of new shoots reddish-brown to tan, with a light to dense coat of reddish-tan hairs toward the tips, leaves coriaceous, oblong to elliptic or cuneate, 5-8 cm long; apex acute, obtuse, or rounded-emarginate; base cuneate or abruptly rounded to the short (2-6 mm) petiole; margin strongly to moderately revolute; surfaces sparsely appressed-orange-hairy above, and densely so beneath when young, aging to glabrous and pale green above, sparsely hairy along the veins beneath, so pale beneath as to appear glaucous; flowers one to

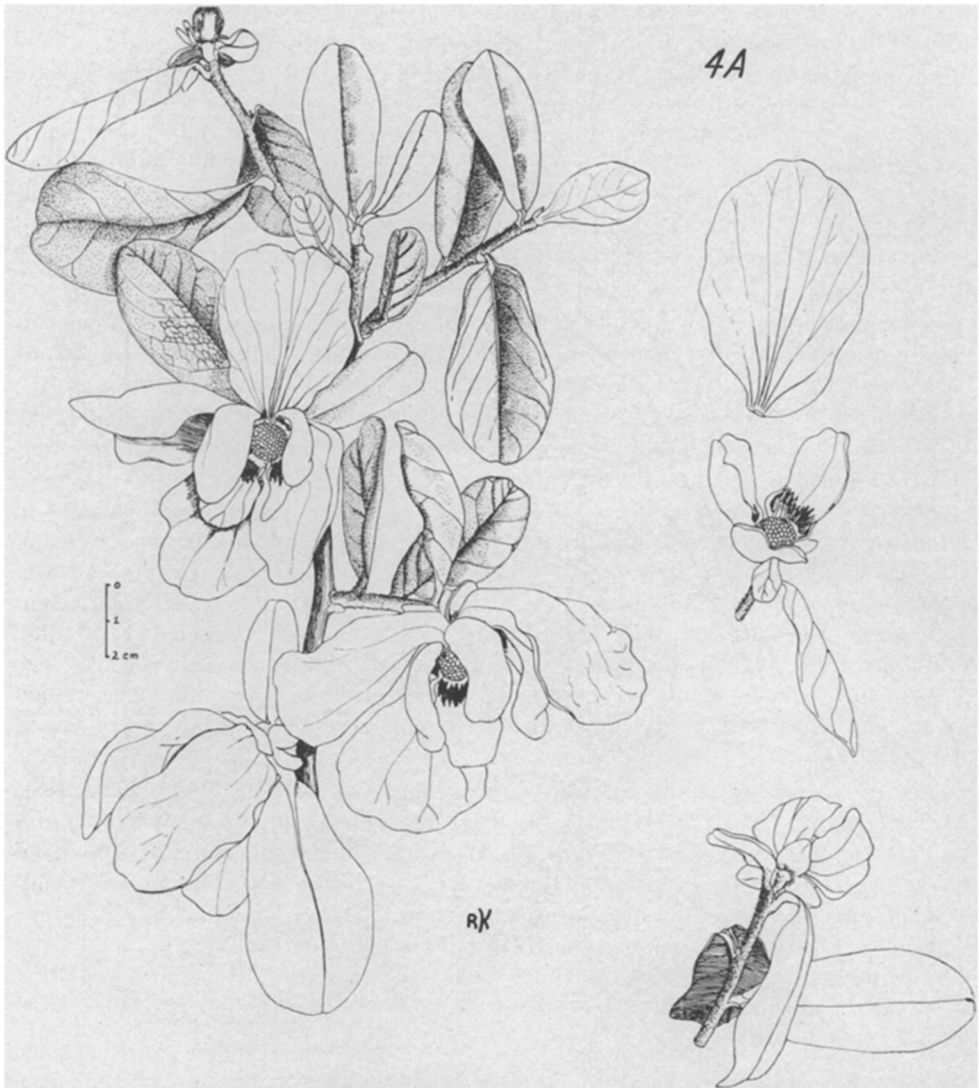
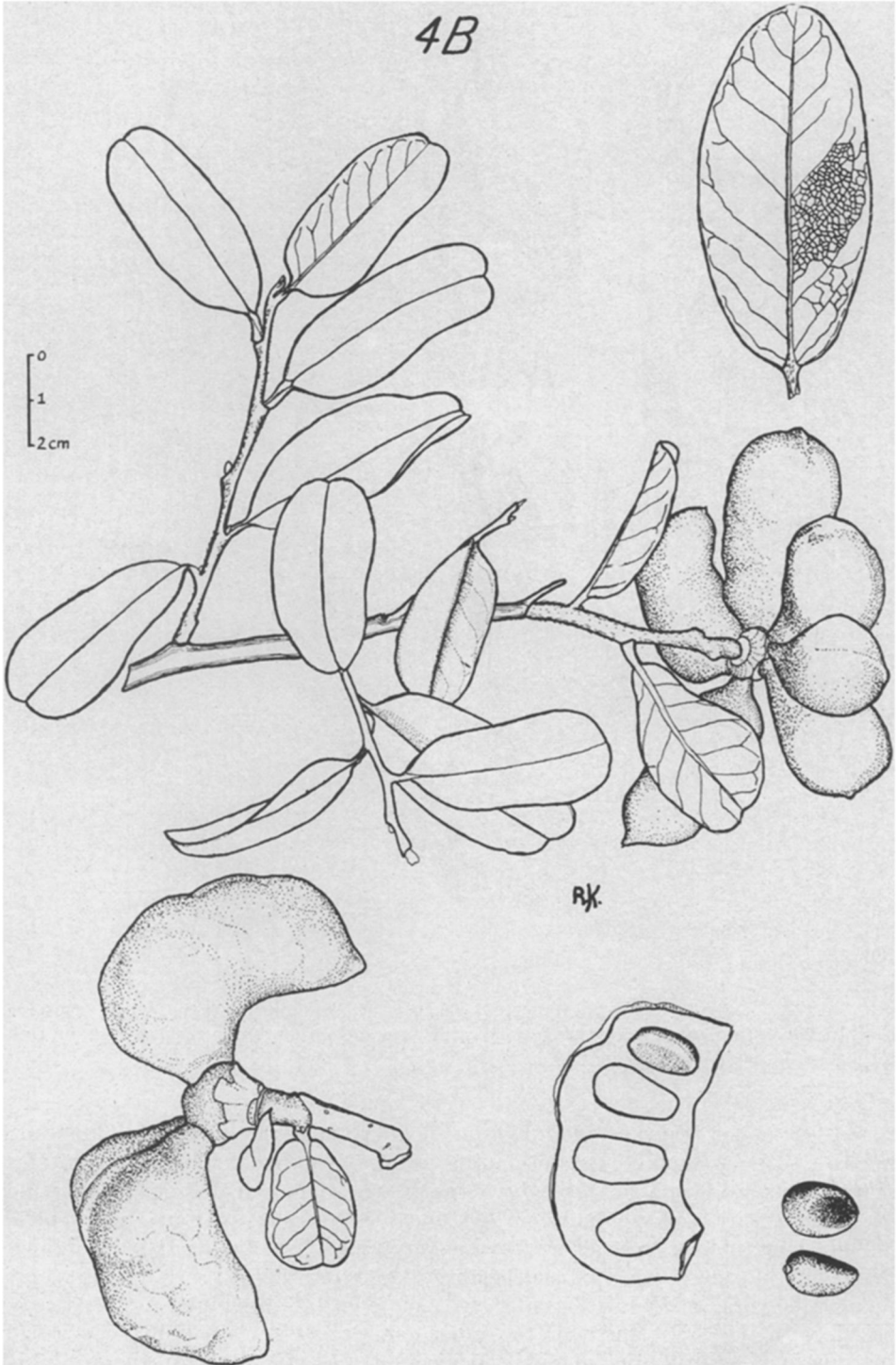


FIG. 4A. *Asimina obovata* (Willd.) Nash. At left, a flowering twig; upper right, an outer petal; right center, a flowering shoot with outer petals of flower removed; lower right, a shoot with young flower.

three per node, fragrant, nodding on slender, moderately orange-hairy peduncles 2-3.5 cm long, these developing from the axils of the prominent leaf scars; calyx 8-10 mm long, of three (or four) triangular-deltoid sepals which are striate with reddish hairs on the outside, glabrous within; outer petals 3-7 cm long, oblong to oval or obovate, wavy margined, white, tan- or orange-hairy on the outer vein-surfaces, glabrous and impressed-veiny within; inner petals $\frac{1}{3}$ - $\frac{1}{2}$ the length of the outer, lanceolate-hastate, revolute, fleshy, saccate-based, with the lower third of the inner face largely covered by deep purple corrugations; androecium globular, 0.5 cm in diameter, pale green or pinkish at anthesis; gynoecium of from 3-8 fusiform, appressed-orange-hairy carpels;



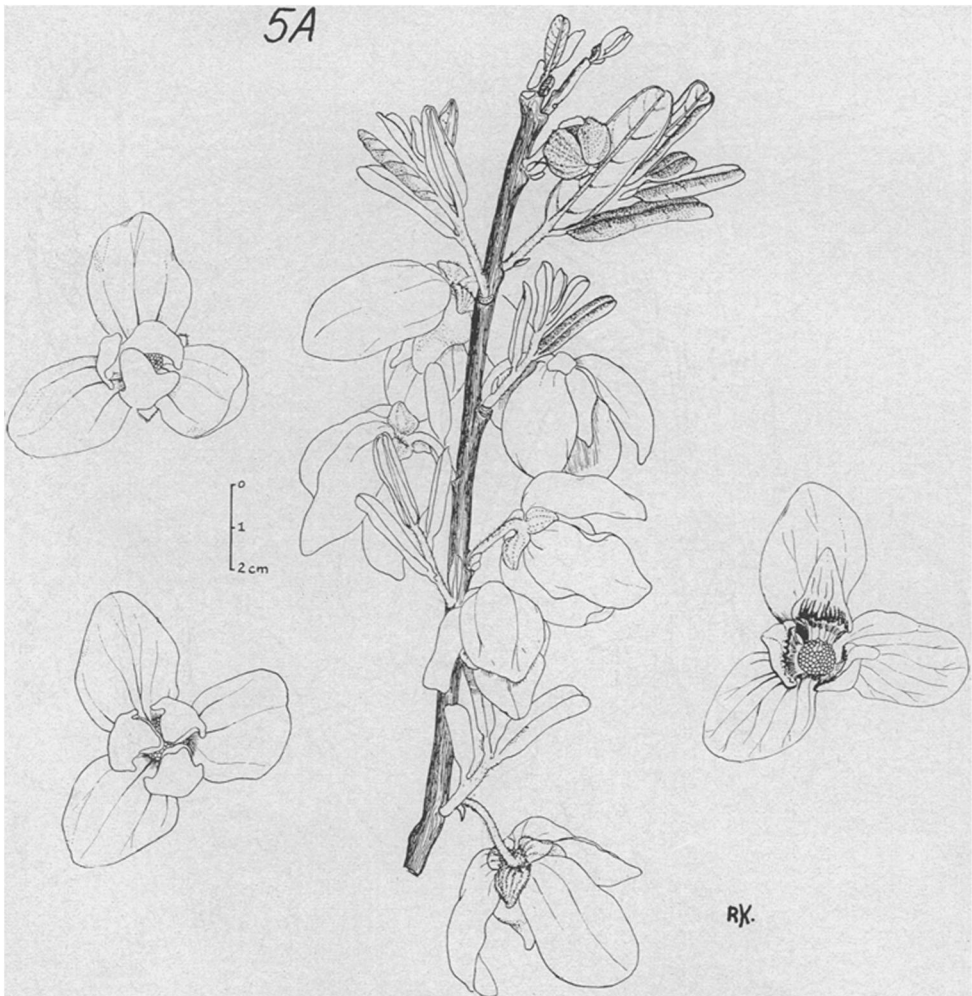


FIG. 5A. *Asimina reticulata* Chapm. At left and right, mature flowers; at center, a flowering twig.

fruit short-oblong, 4–7 cm long, terete to irregularly bulging, glabrate, yellow-green when ripe; seeds 1–2 cm long, dark to pale brown, lustrous, in two irregular rows.

Lectotype: FLORIDA: Seminole Co.: in pinetis, prope lac. Monroe, *Rugel 8* (BH, BM, GH, MO). The original citation by Chapman reads "South Florida, *Rugel, Feay*." The Rugel collection cited by Chapman was apparently a part of the same series that was taken in 1848 from the pine flatwoods of Seminole County, and widely distributed as *Rugel no. 8*. The name *Asimina cuneata* Shuttlew. ex A. Gray (1886) is based on the same type.

FIG. 4B. *Asimina obovata* (Willd.) Nash. At left and center, a fruiting twig; upper right, a summer leaf; lower left, torus with two attached fruit; lower center, a longisection of a fruit; lower right, two seeds.

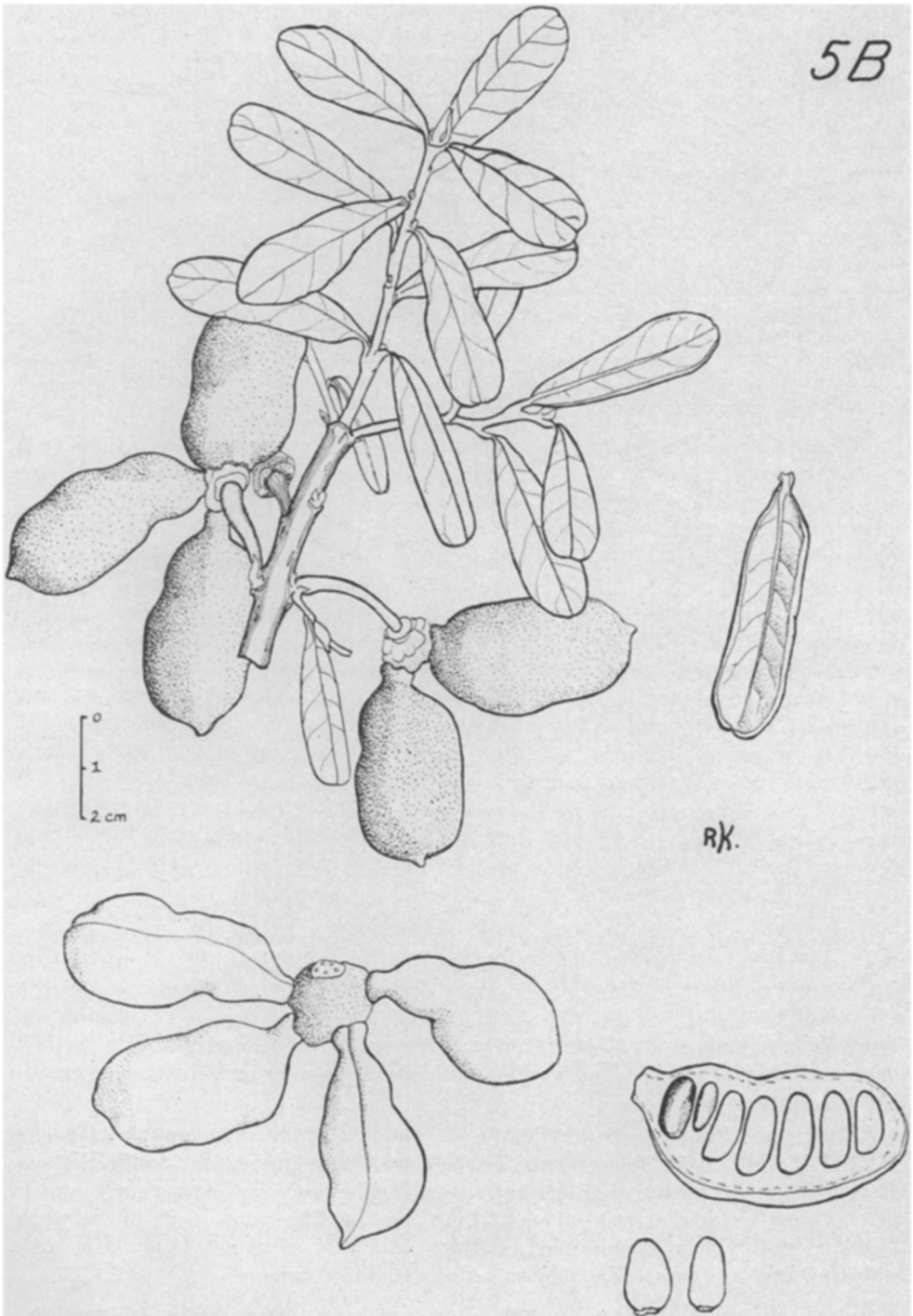


FIG. 5B. *Asimina reticulata* Chapm. At upper left, a fruiting twig; upper right, a lower leaf surface; lower left, top view of torus with four attached fruit; lower right, a longisection of fruit plus two extracted seeds.

FLORIDA: Alachua Co.: Gainesville, *Kral 2149*. Bradford Co.: Starke, 18 Apr 1935, *Arnold & West* (FLAS). Brevard Co.: Indian River City, *Kral 2229*. Broward Co.: Ft. Lauderdale, *Small & Carter 1040* (PH). Charlotte Co.: Murdoek, *Kral 2120*. Citrus Co.: Inglis, *Kral 2100*. Collier Co.: Naples, *Steyermark 63173* (F). Dade Co.: Opa-Locka, *Moldenke 450* (DUKE, MO, NY). De Soto Co.: Nocatee, *Curtiss 6759* (GH, MO, NY, UC, US). Flagler Co.: National Garden, *Kral 2206*. Glades Co.: midway between Brighton & Lake Okeechobee, 21 Mar 1952, *H. Field & Y. Lazar* (GA, NCSC, US). Hardee Co.: Wauchulla, *Kral 2142*. Hernando Co.: open pine-palmetto pasture, *Kral 2066*. Highlands Co.: Venus, 15 Apr 1920, *Small & DeWinkeler* (FLAS, US). Hillsboro Co.: Ucota, near Tampa, *Bailey 5234* (BH). Lake Co.: Cason, *Kral 2072*. Lee Co.: Big Pine Island, *Kral 2124*. Levy Co.: Otter Creek Public School, *Kral 4467*. Manatee Co.: Ellentown, sandy pasture, *Kral 2530* (F, FSU, VPI). Marion Co.: Silver Springs, *Kral 4550* (DUKE, FSU, VPI). Martin Co.: Rio, *Kral 2236*. Okeechobee Co.: Ft. Drum, 22 Apr 1946, *West & West* (FLAS). Orange Co.: Orlando, 10 mi e, *Blanton 6485* (BH, MO, US). Osceola Co.: Kissimmee, *Kral 2238* (FSU, MO, VPI). Palm Beach Co.: Delray Beach, 18 Feb 1945, *Fox* (NCSC). Pasco Co.: Jessamine, *Barnhart 2534* (NY). Pinellas Co.: Dunedin, 16 Apr 1900, *Tracy 6737* (F, GH, MO, NY, US). Polk Co.: Ft. Meade, *Kral 2147* (FSU, VPI). Sarasota Co.: Nokomis, *Kral 2119*. Seminole Co.: prope lac. Monroe, *Rugel 8*, Mai 1848 (BM, GH, MO, NY). Sumter Co.: Bushnell, *Kral 2535*. Volusia Co.: New Smyrna, *Kral 2218* (FSU, MICH VPI).

Asimina reticulata is largely a plant of moist, poorly drained sands such as one finds in the slash pine or longleaf pine-saw palmetto flatwoods, where it is often abundant enough to be classed as an understory dominant. Taxonomically it is most nearly like *A. speciosa* which resembles both in flowering habit and petal shapes. Yet its pubescence is rusty or orange whereas that of *A. speciosa* is whitish to yellow; its inner petals are white to pink with a dark purple corrugated zone. Its leaves are predominantly revolute, with a typically oblong or spatulate outline whereas *A. speciosa* has inner petals with a yellow corrugated zone and broader, less revolute, leaves. Though the northern limits of the range of *A. reticulata* overlap the southern limits of *A. speciosa*, the habitats of the two species are markedly distinct and they are not known to occur in mixed populations. In those northern peninsular Florida counties where both occur, *A. reticulata* frequents the low pinelands whereas *A. speciosa* is found on the longleaf pine-turkey oak ridges where drainage is comparatively much better. Although *A. reticulata* is found in the coastal dune scrub in eastern Florida, it is generally in association with other such flatwoods species as *Serenoa repens*, *Lyonia lucida*, *L. ferruginea*, and *Befaria racemosa*.

Reaction of *Asimina reticulata* to disturbance is much the same as that of *A. speciosa*. Though cut-back shrubs produce abundant shoots and ovoid flower buds develop in the axils of the leaves of these new shoots, flowers are not usually produced until the next growing season. In those rare cases in which flowers appear on the new shoot growth, the flowers are usually undersized, and the flowers, new shoots, and leaves have a paler, more copious, tomentum than usual in the species. Such specimens have occasionally been collected (e.g. *Small 11502*; *Kral 2522*) but have been variously identified because of their atypical morphology. In no instances during the course of this study have I seen cases in which such abnormal flowers produced fruit.

6. *Asimina tetramera* Small, *Torreya* 26: 56. 1926. Fig. 6.

Pityothamnus tetramerus (Small) Small, Man. SE. Fl. 531. 1933.

Shrub 1-3 m tall from a stout-linear or sometimes branched taproot; primary shoots one to few, sub-erect to arching from the subterranean crown and branching alternately and regularly in one plane; bark of third year and

older twigs glabrous, gray; that of second year wood glabrous, reddish-brown or light brown, with raised pale lenticels; that of young shoots sparsely red-tomentulose toward the tips; leaves coriaceous, oblanceolate to elliptic or elliptic-spatulate, 5–10 cm long on undisturbed shrubs (–15 or –18 cm long on disturbed shrubs); apex rounded to obtuse; base acutely narrowing to the petiole 2–3 mm long; margin slightly revolute; surface glabrous and rich green above, glabrate and paler green below, the reticulation evident; flowers pale to deep maroon, 2.5–3 cm broad, fetid, nodding or sub-erect on glabrate peduncles 1–2 cm long, these arising from the leaf axils on new growth; sepals three or four, about 1 cm long, elliptic or ovate, sparsely rusty-hairy along the veins on the outer surface, glabrous within; outer petals flesh-pink toward the tips, shading to maroon or maroon-striped toward the bases, 2–2.5 cm long, lanceolate to oblong-lanceolate, slightly revolute and recurved, sparsely stippled with pale hairs without, glabrous within; inner petals about half the length of the outer, maroon, ovate-acute or acuminate, saccate-based, revolute, and sharply recurved; androecium globular, 0.8–1.1 cm broad, pale green to pinkish at anthesis; gynoecium of from 3–11 narrowly fusiform glabrate carpels; fruit 5–9 cm long, oblong-cylindric with a prominent ventral suture, smooth to rugose, yellow-green when ripe; seeds 1–2 cm long, castaneous, in two irregular rows.

Sands of ancient coastal dunes, Martin and Palm Beach Counties, peninsular Florida. Flowering from May through August, or all year if disturbed.

Type: FLORIDA: Martin Co.: St. Lucie River, “ancient dunes, scrub, near the estuary,” 19 July 1924, *J. K. Small* (Holotype, NY; isotypes seen at GH, US). The holotype, supposedly at NY, has not been located. A topotype, widely distributed, is *Kral 2516*.

FLORIDA: Martin Co.: Jensen Beach, 26 Jan 1940, *Buswell* (MIAMI); scrub near Rio, 19 Jul 1924, *Small* (GH, US); Jensen Beach Community, *Kral 2517*; ancient dunes, Rio, *Kral 2235*. Palm Beach Co.: Palm Beach, *Kral 5372*.

Asimina tetramera is one of the most distinctive species of the genus. It has thus far been collected only from the dune-scrub country in the coastal strip of eastern Florida which extends from just north of Stuart south to West Palm Beach. Small’s keen eyes were the first to perceive it, in the dunes near Rio, a beach community just north of Stuart. According to his diagnosis, flowers of this species are exclusively four-merous. This is not the case; about as many three-merous as four-merous flowers may be found in one population. Small accurately noted the resemblance between *A. tetramera* and *A. pygmaea*. Both have maroon-pigmented, fetid smelling flowers with the same general petal outline. Yet the two are distinct in that the pygmy is indeed true to its name, whereas older individuals of *A. tetramera* may reach heights of ten feet and have a much larger gynoecium.

Asimina tetramera reacts as vigorously to disturbance as do the other species, sprouting quickly from the cut or burned-back stumps to reach up to 2 meters in height in one growing season. On such sprouts a complete cycle of flowering and fruiting may be observed. The taste of the ripe fruit resembles that of the other Florida species—that is to say, palatable but not pleasant. The only other species of *Asimina* known to occur in the same general area is *A. reticulata*; there is no morphological similarity between the two, nor is there any evidence that they hybridize.

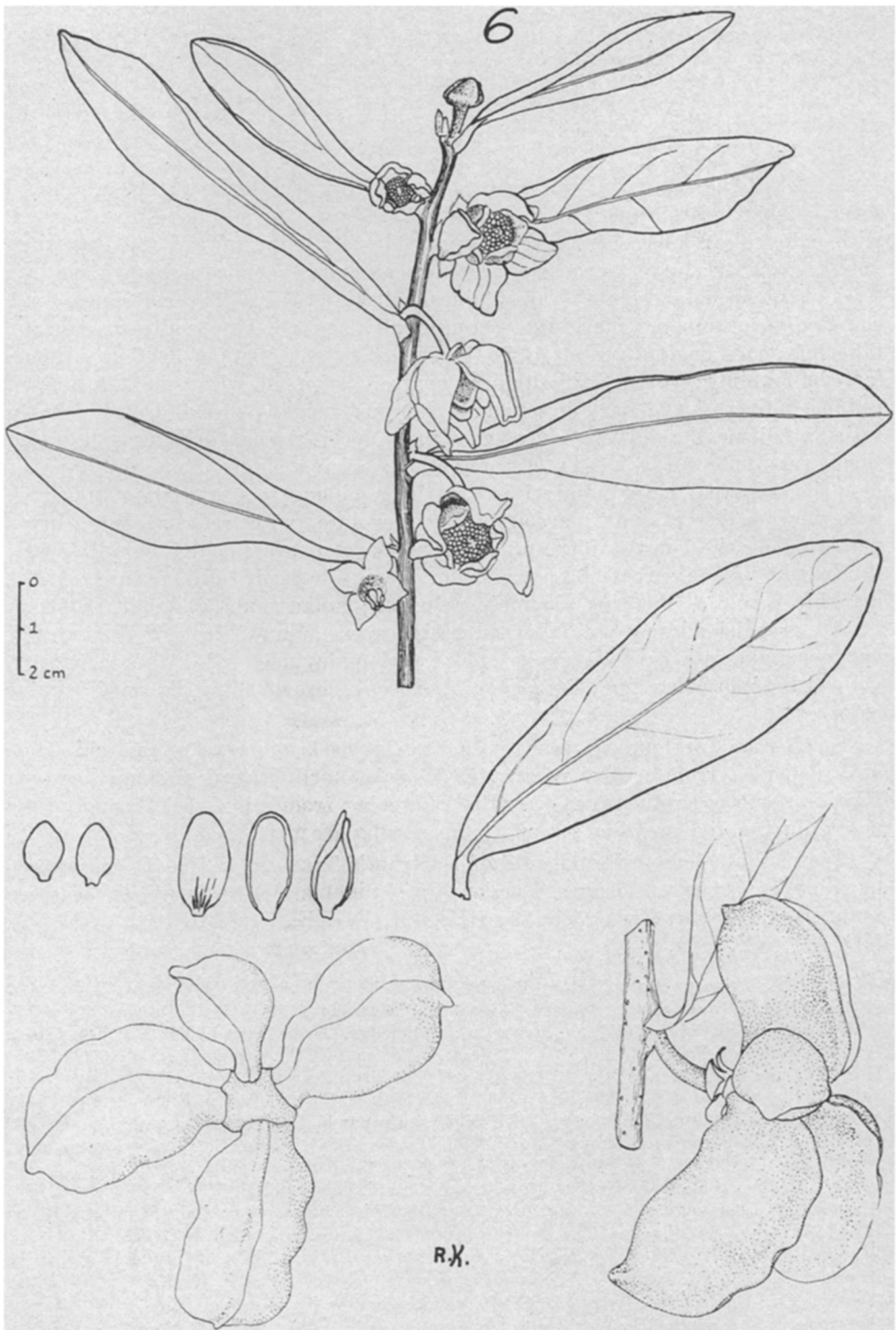


FIG. 6. *Asimina tetramera* Small. At top, a flowering twig; left center, outer and inner petals; right center, an upper leaf surface; at bottom, top and side views of fruit.

7. *Asimina pygmaea* (Bartr.) Dunal, Monogr. Anonac. 84. 1817. Fig. 7.

Anona pygmaea Bartr. Travels 18. pl. 1. 1791.

Orchidocarpum pygmaeum (Bartr.) Michx. Fl. Bor. Am. 1: 330. 1803.

Porcelia pygmaea (Bartr.) Pers. Syn. Pl. 2: 96. 1807.

Uvaria pygmaea (Bartr.) Torr. & Gray, Fl. N. Am. 1: 45. 1838.

Asimina secundiflora Shuttlw. ex Exell, Jour. Bot. 65: 65. 1927.

Pityothamnus pygmaeus (Bartr.) Small, Man. SE. Fl. 531. 1933.

Dwarf shrubs, 2–3 dm tall from a stout, fusiform taproot; shoots one to several, sparingly branch or unbranched, reddish- to reddish-brown-barked, with pale, raised lenticels, sparsely appressed-rusty-hairy toward the tips when young, glabrate; leaves coriaceous, ascending-secund, variously shaped, obovate to cuneate or oblanceolate (rarely linear-elliptic), 4–7 (–11) cm long; apex rounded to obtuse or emarginate (occasionally acute); base acute to cuneate, tapering more or less gradually to the short twisted petiole 3–10 mm long; margin revolute; young leaf surfaces sparsely stippled with small appressed reddish hairs, in age dark green and glabrous above, paler and prominently reticulate beneath; flowers maroon, with a fetid aroma, nodding-secund on slender peduncles 1.5–3 (–4) cm long, these arising singly from the axils of new shoot leaves; outer petals 1.5–3 cm long, oblong to ovate-lanceolate, pink with maroon streaks, or maroon, fleshy, revolute, with reflexed tips; inner petals $\frac{1}{3}$ – $\frac{2}{3}$ the length of the outer, deep maroon, ovate-acute to lance-ovate, fleshy and with a saccate base which on the inside is densely corrugated, the margins revolute, the tips abruptly recurved; androecium globular, 4–7 mm broad, greenish-white to pink at anthesis; gynoecium of from 2–5 narrowly fusiform, glabrate carpels; fruit curved, oblong-cylindric, 3–4 (–5) cm long, yellowish green when ripe; seeds about 1 cm long, brown, shiny, in two irregular rows.

Slash pine (or longleaf pine)-palmetto flatwoods and savannahs, old fields and roadsides, from central peninsular Florida, north-central and northeastern Florida north to southeastern Georgia. Flowering from mid-April through June or all during the growing season if the shrubs are disturbed.

Type: Plate 1 opposite page 17 of Bartram's Travels (1791). Specimen approximating type: Florida: Flagler Co.: pine-palmetto flatwoods between Dunnell & Dupont, *Kral 2508* (A, BH, BM, DUKE, F, FLAS, GA, GH, IA, MO, NA, NY, US).

FLORIDA: Alachua Co.: Earlton Beach, *Kral 3109*. Baker Co.: MacClenny, *Kral 3503* (FSU, VPI). Bradford Co.: Starke, *Wiegand & Manning 1247* (GH). Brevard Co.: Oak Hill, *Small et al. 11548* (US). Citrus Co.: Dunnellon, *Kral 4529* (DUKE, FSU, VPI). Clay Co.: Penney Farms, 6 Mai 1945, *Totten & Totten* (NCU). Columbia Co.: Lake City, Mai 1942, *B. Douglas* (NCSC). Dixie Co.: Cross City, *Palmer 27306* (GH). Duval Co.: Jacksonville, *Curtiss 4002* (MO, NY, UC, US). Flagler Co.: 15 mi n Bunnell, *Kral 2507*. Gilchrist Co.: Trenton, *Kral 4613* (FSU, VPI). Hernando Co.: Dade City, *McFarlin 4968* (MICH). Hillsboro Co.: Tampa, 6 June 1886, *Curtiss* (GH). Lake Co.: Lake Louisa, *Kral 2249*. Levy Co.: 14 mi ne Cedar Key, *Kral 4454*. Marion Co.: Ocala, *Kral 4863* (FSU, VPI). Madison Co.: Lee, *Kral 2322*. Nassau Co.: Callahan, *Kral 3498* (FSU, IA, VPI). Osceola Co.: Loughman, *M. L. Singeltary 286* (DUKE). Orange Co.: Lake Brantley, 7 Jun 1894, *Lewton* (US). Pinellas Co.: Dunedin, *Tracy 6785* (F, GH, MO, NY, US). Polk Co.: Winter Haven, *McFarlin 5000* (MICH). Putnam Co.: Putnam Hall, 29 Mai 1942, *West & Arnold* (FLAS). St. Johns Co.: just w of causeway to Crescent Beach, *Kral & Godfrey 2772*. Seminole Co.: Golden Rod, *Kral 6551* (FSU, VPI). Sumter Co.: Bushnell, *Kral 2253*. Taylor Co.: near mouth of Spring Warrior River, *Small et al. 11456* (NY). Union Co.: Raiford, 17 Mai 1940, *Murrill* (MO). Volusia Co.: Astor, *Kral 4878*.

GEORGIA: Charlton Co.: Folkston, *Kral 2497* (F, FSU, GH, IA, NA, VPI).

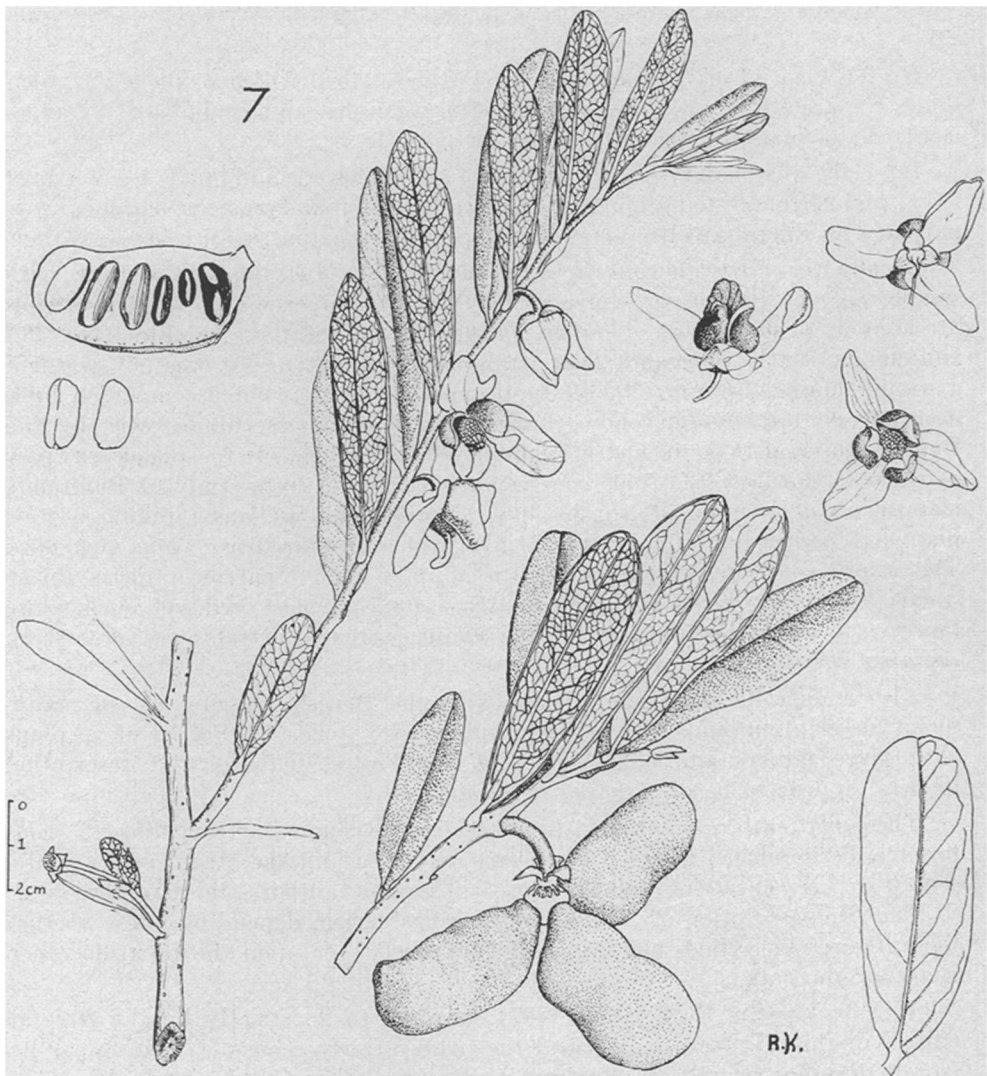


FIG. 7. *Asimina pygmaea* (Bartr.) Dunal. Upper left, longisecton of fruit and extracted seed; above, center, a flowering twig; below, center, a fruiting twig; upper right, flowers; lower right, an upper leaf-surface.

William Bartram (1791) described a dwarf *Anona* from the pine flatwoods of southeastern Georgia, a species with flowers similar to the "antrilobe" (contraction of *Annona triloba* L.) in size and color. His account follows (from page 18 of the first edition of the "Travels"):

In similar situations, and commonly a near neighbor to this new *Kalmia*, is seen a very curious species of *Annona*. It is a very dwarf, the stems seldom extending from the earth more than a foot or eighteen inches, and are weak and almost decumbent. The leaves are long, extremely narrow, almost lineal. However, small as they are, they retain the figure common to the species, that is, lanciolate, broadest at the upper end, and attenuating down to the petiole, which is very short; their leaves stand alternately, nearly erect, forming two series, or wings, on the arcuated stems. The flowers, both in size and colour, resemble those of the

Antriloba, and are single from the axillae of the leaves on incurved pedunculi, nodding downwards. I never saw the fruit.

Facing page 17 of the same edition is a plate labelled *Anona pygmaea*, which shows the arching shoot habit, small, nodding flowers, and second leaf arrangement of the plant Bartram described on page 18.

Both the plate and the description quoted above could have been drawn from plants found today in southeastern Georgia and eastern Florida. Apparently no Bartram collections of this species are extant.

Among the Bartram collections in the British Museum, however, are two samples of a linear-leaved, larger flowered but superficially similar species (treated in this paper as *Asimina longifolia*). One of these samples (No. 22) is accompanied by Bartram's own manuscript description but was not assigned a specific epithet by him. The other specimen (No. 2) is not accompanied by a description. I have seen photographs of both specimens, kindly sent by the British Museum. It is quite clear that they do not represent the pigmy pawpaw of Bartram's "Travels." This conclusion is borne out by a study of Bartram's manuscript description of No. 22; it is apparent that he was thinking of this plant as distinct from the entity he described and figured as *Anona pygmaea*. The unpublished description refers to a plant with "narrow, almost linear leaves," with moderately large, pleasantly scented purple to red, yellow or white flowers; it seems likely from all the evidence that Bartram was describing *Asimina longifolia*.

Also among the Bartram collections in the British Museum, are a manuscript description and sketch, both published by Exell (1927), of a plant with large flowers and oblanceolate leaves. The sketch and the description likewise appear to be of *Asimina longifolia*.

These matters are mentioned here because, although Bartram himself seems to have distinguished between his *Anona pygmaea* and the other species represented in his collections and sketches, subsequent authors did not always do so. The circumscription of *Anona pygmaea* has varied, depending upon whether the authors have relied solely upon the "Travels," or upon the Bartram specimens, or on both.

Willdenow (Sp. Pl. 2: 1268. 1797), seeming to go strictly by the German edition of the "Travels," described the pygmy fairly accurately. He apparently relied rather heavily on Bartram's plate for a good part of his diagnosis: "corolla campanulate magnitudine A. squamosae, petalis oblongis acutis apice reflexis, interioribus longioribus." It is interesting that Willdenow perpetuated the only error present in Bartram's plate, for in no known species of *Asimina* are the interior petals longer than the exterior.

Michaux's description is similar to that of Willdenow, though he corrected the error of petal lengths in characterizing his *Orchidocarpum pygmaeum*. Persoon's description of the pygmy is much the same as that of Michaux and Willdenow.

Bartram's unpublished data assume greater significance when one reads the account published by Dunal (Monogr. Anonac. 84. pl. 10. 1817) and studies his illustration. Dunal differs from previous authors in describing Bartram's *Anona pygmaea* and one is therefore led to believe that he had access to the Bartram collections, related drawing, and manuscript descriptions. Dunal writes of "linear" or elongate-lanceolate leaves. He figures a larger-flowered plant

than the one described by Bartram. Much of his description suggests a plant very similar to the narrow leaved, larger-flowered Bartram specimen which, we have established, bears no Bartram name and which is here treated as *Asimina longifolia*. Yet, although the Bartram concept of the pygmy and the plant described and figured by Dunal are not the same, the formal nomenclatural transfer to *Asimina* is attributed to Dunal.

Asimina pygmaea appears to have two habitat responses. The low, pine-forested savannahs and flatwoods of peninsular Florida (all the "Et. Florida" of Bartram's time) support the truly diminutive form, whose flowers frequently have deep maroon outer and inner petals at anthesis. On the dry, well drained sands of the central highlands of Florida there is another form whose petals at anthesis are pink or white streaked with maroon, only the inner retaining the pure maroon pigmentation. This form flowers and fruits abundantly. To the west of the central highlands the species frequents both flatwoods and higher ground. Both the above mentioned forms bear the colloquial name "gopher-berry." The "gophers," a species of large burrowing turtle common in the sandy pinelands of Florida, reportedly eat the fruit.

8. *Asimina longifolia* Kral, nom. nov.

Asimina pygmaea sensu Dunal. Monogr. Anonac. 4. 1817, as to plate 10 and in large part as to description.

Asimina angustifolia Raf. Aut. Bot. 77. 1840

Asimina angustifolia A. Gray, Bot. Gaz. 11: 163. 1886.

Pityothamnus angustifolius (A. Gray) Small, Man. SE. Fl. 531. 1933.

Leaves linear-elliptic to linear-oblongate, acute to obtuse (occasionally emarginate or rounded), therefore broadest near or shortly above the middle, quite visibly revolute; new growth from disturbed shrubs sub-erect; foliage, flowers, and epidermis of new shoots tomentulose toward the tips when young; foliage sparsely hairy beneath when young; outer petals sparsely hairy along the outer vein-surfaces. Shrubs of northern peninsular Florida, north-central and northeastern Florida and southeastern Georgia, principally east of the Suwannee River drainage.

A. longifolia var. *longifolia*.

Leaves linear-spatulate to spatulate, obtuse, rounded, or emarginate (occasionally broadly acute), therefore broadest toward the tip, slightly revolute; new growth from disturbed shrubs arching to almost decumbent; foliage, flowers, and epidermis of new shoots glabrous, or very sparsely short-hairy when young. North-Florida, principally west of the Suwannee River drainage, southern Georgia, and southeastern Alabama.

A. longifolia var. *spatulata*.

8a. *Asimina longifolia* Kral, var. *longifolia*. Fig. 8.

Shrubs 1-1.5 (-1.75) m high, with abundant, sub-erect, rigid shoots from a linear, vertical root, the shoots branching more or less distichously from the midpoint upward; bark of new shoots red-brown to yellow-brown, that of second year wood gray-brown to tan, that of third year or older wood gray; all stems with abundant, raised lenticels; leaves coriaceous, arranged along the twig in two horizontal to slightly elevated wings, 5-15 (-20) cm long, linear-elliptic to linear-oblongate, commonly broadest near the middle; apex acute to obtuse (occasionally rounded or emarginate); base acute or tapering gradually to the petiole 2-4 mm long; margin revolute; surface dark green and glabrous above, paler green, glabrate, and raised-reticulate beneath; flowers fragrant, nodding from the leaf axils of new shoot growth on glabrate peduncles 2-4 cm long; outer petals white, 3-8 cm long, oblong, or obovate, sparsely stippled without along the veins with short pale hairs, glabrous within; inner petals white (very rarely pink), commonly oblong or lanceolate, $\frac{1}{3}$ - $\frac{1}{2}$ the length

of the outer, revolute, saccate-based, with the lower $\frac{1}{3}$ – $\frac{1}{2}$ of the inner surface striated with purple corrugations; androecium globular, 5–7.5 mm in diameter, pale green or pinkish at anthesis; gynoecium of from 2–7 (–12) fusiform glabrous or glabrate carpels; fruit 4–10 cm long, oblong-cylindric, terete, or with unevenly bulging sides distended by crowded seeds, yellowish-green when ripe; seeds 1–2 cm long, dark brown, lustrous, in two uneven rows.

Slash- or longleaf pine-palmetto flatwoods, longleaf pine-turkey oak sandy ridges, old fields, pastures, and roadsides, north-central and northeastern Florida north to southeastern Georgia. Flowering from April to July or all through the growing season if the shrubs are disturbed.

Type [Lectotype of *A. angustifolia* A. Gray]: Dunal, Monogr. Anon. *pl.* 10. 1817. The name *Asimina angustifolia* is based unequivocally on “the *Asimina pygmaea* figured by Dunal in his monograph”; Gray cited also “*Orchidocarpum pygmaeum* of Michaux, in part, perhaps mainly” and “in part the *Uvaria pygmaea* of Torrey and Gray’s Flora.” Gray mentioned also that *Curtiss no.* 87* comprised “good specimens of it.”

FLORIDA: Alachua Co.: High Springs, *Kral 2544*. Columbia Co.: Lake City, *Kral 2546*. Dixie Co.: Old Town, *Palmer 27309* (GH). Gadsden Co.: Quincy, *Small et al. 11394* (NY). Gilechrist Co.: Wilcox, 19 Mai 1940, *Martin et al.* (FLAS). Hamilton Co.: Jasper, old field sands, *Kral 6387* (FSU, VPI). Lake Co.: Sellars Lake, 14 Mai 1924, *Ashe* (NCU). Lafayette Co.: Mayo, *Kral 2714*. Levy Co.: Chiefland, *Kral 2979*. Madison Co.: 15 mi sse Madison, *Kral 2708*. Pasco Co.: Melrose, 29 Mai 1942, *West & Arnold* (FLAS). Suwannee Co.: Live Oak, *Kral 4610*. Union Co.: Providence, 22 Mai 1942, *West & Arnold* (FLAS).

8b. *Asimina longifolia* Kral, var. *spatulata* Kral, var. nov. Figs. 9A, 9B.

A var. *longifolia* differt ramulis novellis laxis, glabrescentibus; foliis angustis oblongo-linearibus vel oblongo-lanceolatis, elongatis cuneatis obtusis supra ab initio glabris subtus primo rufo-sericeis vel glabris mox omnino glabrescentibus, petalis exterioribus albis vel albo-viridibus interioribus albis vel purpurascensibus.

As in var. *longifolia*, but the new shoots more lax, arching to decumbent, very sparsely short-red-hairy toward the tips or glabrous; leaf spatulate to narrowly oblanceolate, obtuse to rounded (to acute or occasionally emarginate), broadest above the middle; outer petals sometimes pale pink; inner petals white to pink-streaked or maroon, fleshy, strongly saccate-based or rarely flat, strongly recurved. Flowers fragrant, except in purplish-flowered form of far western Florida and southeastern Alabama. Undisturbed shrubs have predominantly longer internodes on the new shoots than the preceding variety, thus giving the shrubs a more lax appearance.

On habitats similar to those of var. *longifolia*, northern Florida and southern Georgia, principally north and west of the Suwannee River, west to southeastern Alabama. Flowering mid-April through July, or all during the growing season if the shrubs are disturbed.

Type: FLORIDA: Leon Co.: Abundant in recently burned sandy pine flatwoods 1 mi nw Lake Jackson, *Kral 4714* (NY). Isotypes at BH, BM, DUKE, F, FLAS, FSU, GA, GH, IA, MIAMI, MICH, MO, NA, NCSC, NCU, PH, UC, US.

ALABAMA: Geneva Co.: Geneva, *Kral 2486*.

FLORIDA: Alachua Co.: flatwoods, Apr 1941, *Murrill* (GH). Bay Co.: Clarksville, *Kral 2471*. Dixie Co.: Oldtown, *Sargent 6189* (GH). Franklin Co.: white sand of dunes on the Gulf between Carabelle and Eastpoint, *Kral 2403*. Gadsden Co.: Quincy, *Kral 4761*. Holmes Co.: 2 mi w of county line on US 90, *Kral 2480*. Jackson Co.: Cottondale, *Kral 2477*. Jeff-

erson Co.: 19 mi e Tallahassee, *Godfrey 55538*. Lafayette Co.: opposite Branford along Suwannee River, 21 Mai 1941, *West & Arnold (FLAS)*. Leon Co.: 11 mi s Tallahassee, *Kral 2488*. Liberty Co.: scrub oak barren between Bristol & Hosford, *Godfrey 55585 (FSU, MICH, VPI)*. Madison Co.: Madison, *Kral 2704*. Taylor Co.: Adams Beach, *Godfrey 55971*. Wakulla Co.: rolling sandy pasture, *Kral 2389*. Walton Co.: De Funiak Springs, 20 Jun 1950, *Whitehouse (SMU)*. Washington Co.: Chipley, *Kral 2479*.

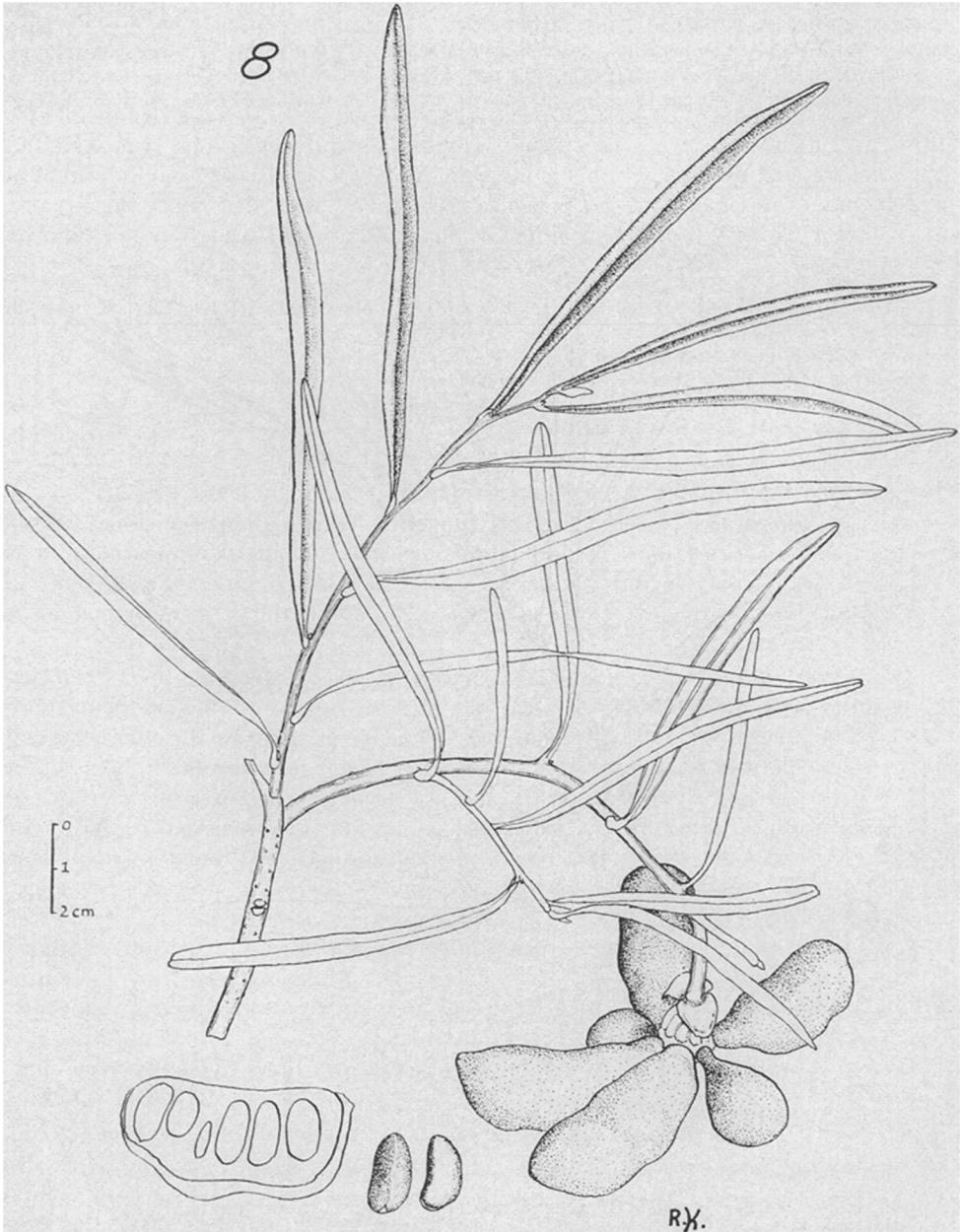


FIG. 8. *Asimina longifolia* Kral, var. *longifolia*. At center, a fruiting twig; lower left, a longitudinal section of a fruit with two extracted seeds.

GEORGIA: Bacon Co.: Alma, *Duncan 16264* (GA). Baker Co.: west bluffs of Flint River near junction with the Ichawaynochaway Creek, *Duncan 6649* (GA). Brantley Co.: 14 mi w Nahunta, *Kral 2495* (FSU, VPI). Brooks Co.: Quitman, *Kral 2490* (FSU, VPI). Coffee Co.: Douglas, *Duncan 11681* (GA). Decatur Co.: Bainbridge, *Thorne & Muenscher 8625* (GA, IA). Dougherty Co.: Albany, *Small* (F, GH, NY). Echols Co.: Mayday, 8 Jul 1937, *A. D. McKellar* (GA). Glynn Co.: Brunswick, 11 Mai 1913, *Harbison 11143* (GH, NCU). Grady Co.: Whigham, *Kral 4793*. Jeff Davis Co.: Hazelhurst on Rte 135, *Wilbur 3193* (NCSC). Lanier Co.: Stockton, *Kral 2492* (FSU, GH, VPI). Lee Co.: dry pine barrens between Rift and Chokee, *Harper 1072* (GH, MO, NY, US). Lowndes Co.: Naylor, *Kral 2491*. McIntosh Co.: Darien, *Kral 3477* (FSU). Mitchell Co.: Pelham, *Hubricht 21690* (MO). Telfair Co.: Lumber City, *Wilbur 3155* (NCSC). Thomas Co.: Thomasville, 7 Jul 1937, *A. D. McKellar* (GA). Tift Co.: Tifton, *Duncan 13663* (GA). Toombs Co.: Lyons, *Duncan 17933* (GA). Wayne Co.: Jessup, *Duncan 13773* (GA). Wheeler Co.: McRae, *Wilbur 3120* (NCSC). Wilcox Co.: Abbeville, *Duncan 16106* (NCU).

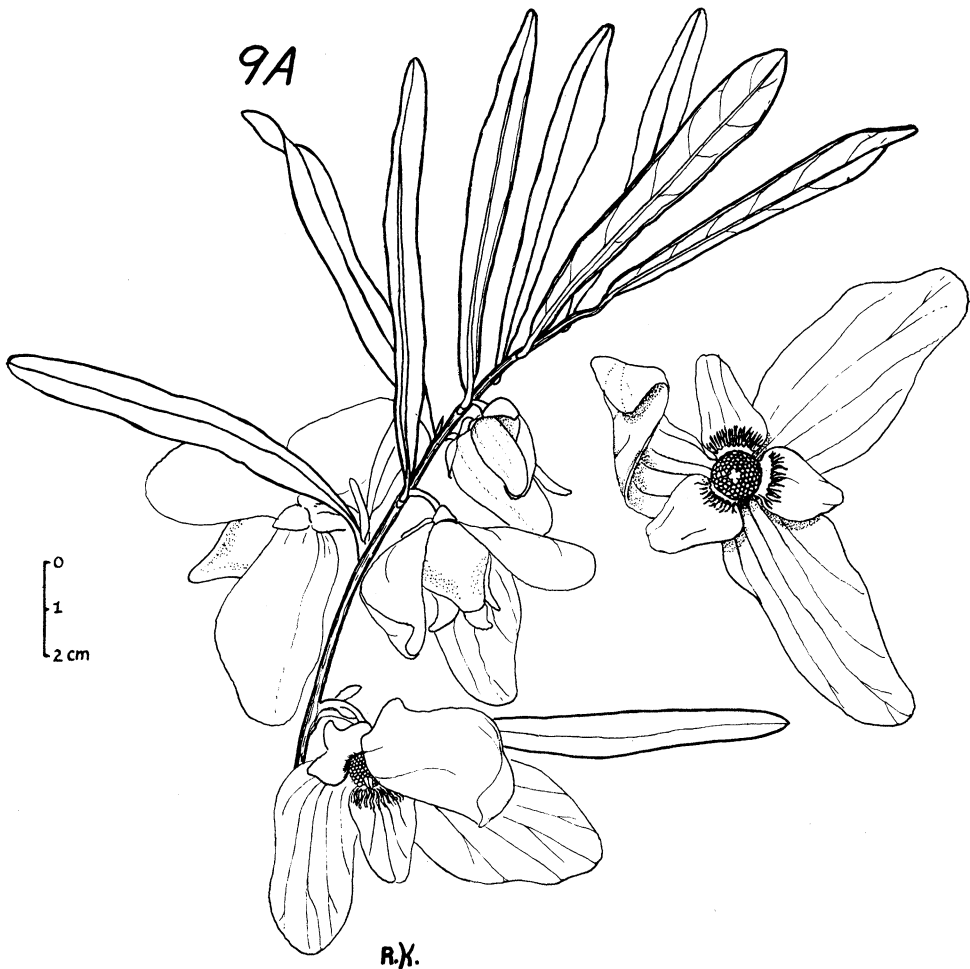


FIG. 9A. *Asimina longifolia* Kral, var. *spatulata* Kral. A flowering twig; at right, top view of a flower.

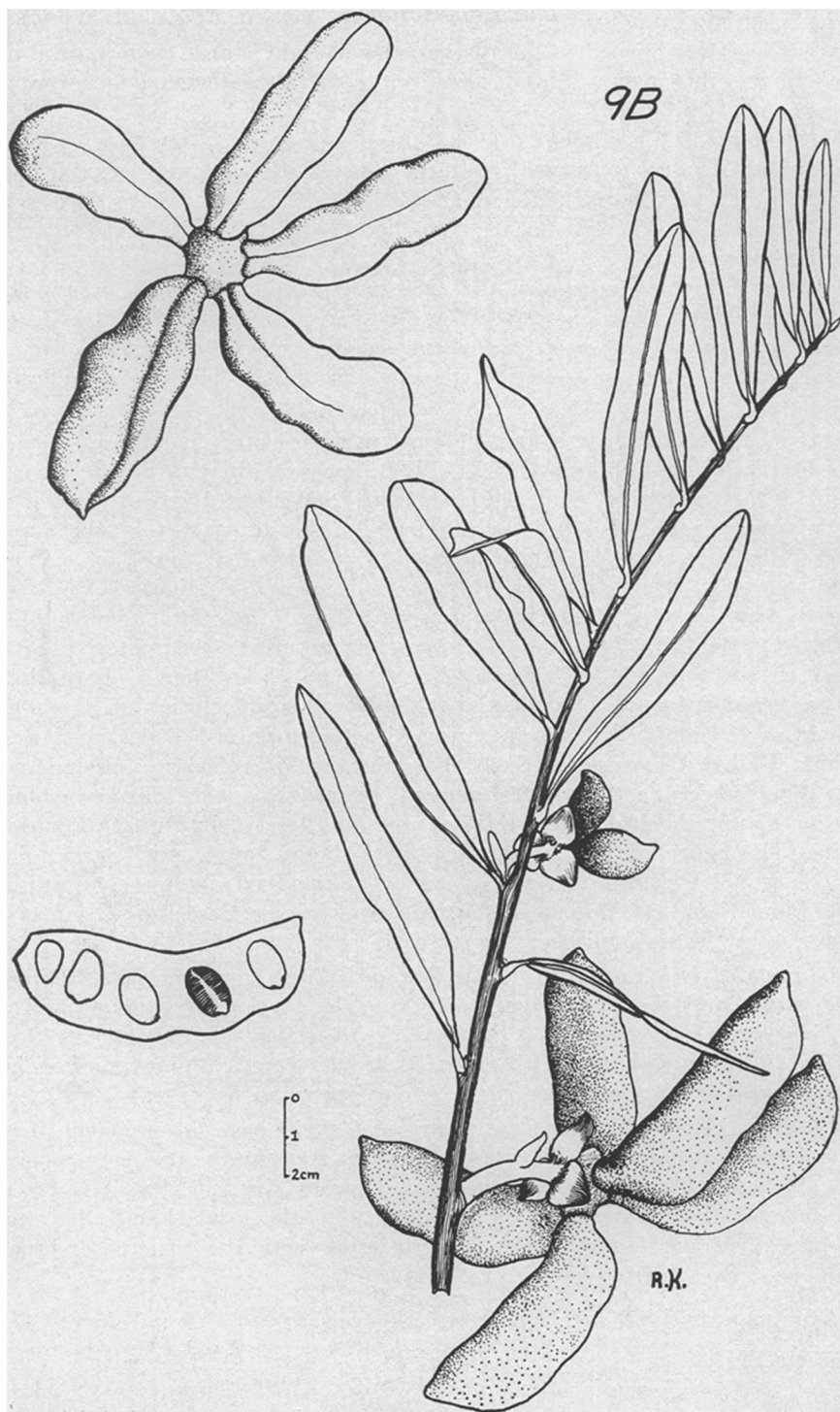


FIG. 9B. *Asimina longifolia* Kral, var. *spatulata* Kral. At upper left, a torus with five fruits; right, a fruiting twig; lower left, longisection of a fruit.

The identity of *Asimina longifolia*, based upon *A. angustifolia* of Asa Gray, has been established in the discussion pertaining to *A. pygmaea* (Bartr.) Dunal. Some other points in the nomenclature of *A. longifolia*, however, need enlargement.

Willdenow (1797), Michaux (1803), and Persoon (1807) based their descriptions of *Asimina pygmaea* upon the description and figure published in Bartram's "Travels," and hence upon one element. In contrast to these earlier works, Dunal's (1817) treatment, as pointed out above, is based upon two discordant elements.

Asa Gray, first to recognize the fact that Dunal's description and plate encompassed two species instead of one, assumed correctly that the Bartram epithet "*pygmaea*" was based upon the smaller, maroon-flowered entity. He therefore gave the name *Asimina angustifolia* to the larger, white-flowered plant figured by Dunal.

Gray's interpretation was, for the most part, accepted in later work on the genus by Nash and Robinson. Exell (1927), however, in elucidating some important, hitherto obscure, evidence pertaining to William Bartram's work with these plants, negated the decision of Gray by stating that the larger plant, described by Gray as *A. angustifolia*, was in actuality the Bartram plant *Anona pygmaea*. Exell cited two Bartram specimens of a linear-leaved, large-flowered *Asimina* as well as two manuscript descriptions and an unpublished drawing by Bartram, claiming that these represented the pygmy plant described on page 18 of the "Travels." Yet it has been shown above, in the discussion under *Asimina pygmaea*, that the Bartram description of *A. pygmaea* is not in accord with these specimens or with the unpublished descriptions and drawing. Rather the work of Exell shows us the basis for two dissimilar elements included in the Dunal treatment of *Asimina pygmaea*. The resemblance between the unpublished figure of Bartram and Plate 10 in Dunal's revision is striking. The figures have similar leaf shapes; both show a much larger flower than one would encounter on any specimen of the Bartram pygmy pawpaw—a strong indication that Dunal, in drawing up his own description, must have had access to the unpublished data of Bartram.

The name *Asimina angustifolia* A. Gray is a later homonym of a Rafinesque (1840) name and therefore invalid. Yet the description of Rafinesque is not definitive enough to permit a decision as to which of the narrow leaved species (*A. angustifolia* or *A. pygmaea*) is being treated. Moreover, the Collins specimen which Rafinesque described is not known to be extant.

Both varieties of *Asimina longifolia* have their best development on the sandy old fields of northern Florida. The variety *spatulata* is the more consistent morphologically. This is probably accounted for by the fact that it is the only *Asimina* over the greater part of its range. On the other hand, the variety *longifolia* is seldom found except in association with the tomentose, broader-leaved *A. incarnata*, with which it freely hybridizes.

10. *Asimina* × *nashii* Kral, hybr. nov. (*A. speciosa* × *A. longifolia*).

Intermedia *A. speciosa* et *A. longifolia*; frutex ad 2 m altus; ramulis novellis minute ferrugineo-tomentosis, mox glabrescentibus et castaneis; vestutioribus cortice cinereis obtectis. Lamina coriacea, supra ab initio glabra vel minute ferrugineo-tomentosa, dein glabrescens subtus praesertim in nervis tomentosa, demum in nervis fere glabrescens, oblonga oblanceolata vel anguste

obovata, basi breviter acutata vel rotundato-acuta, apice rotundata, (5-) 7-15 cm longa. Flores in ramulis anni praeteriti 1-2 in axillis foliorum delapsorum evoluti. Pedicelli rufo-tomentosi, 1.5-4 cm longi. Petala exteriora magna, dilute albo-punicea vel alba; interiora alba, albo-viridia, purpurea.

Shrub with numerous primary shoots from a vertical, stout-linear taproot, the branches regularly and alternately rebranched from above the middle; bark of new shoots tan to reddish, copiously red- or tan-tomentulose toward the tips; bark of one year old shoots reddish-brown, glabrous to sparsely hairy toward the tips; that of older wood gray-brown with raised, paler lenticels; leaf-apex rounded to broadly acute; base rounded, acute, more or less abruptly contracted to the short petiole 2-5 mm long; margin conspicuously revolute; surface of young leaves moderately red-hairy on the veins and veinlets below and sparsely appressed-red-hairy above; surface of mature leaves glabrous and dark green above, paler beneath with scattered hairs along the midrib and veinlets; flowers pleasantly fragrant, on stout, erect to slightly nodding, red- or orange-hairy peduncles from the axils of leaf scars of the preceding year or flowering from the leaf axils of new shoot growth of disturbed shrubs; sepals about 1 cm long, ovate-triangular, red-hairy along the veins outside, glabrous within; outer petals white to pale pink, 3-7 cm long (-10 on sprouts from disturbed shrubs), oblong to ovate; inner petals $\frac{1}{2}$ - $\frac{1}{4}$ the length of the outer, white to maroon, oblong to hastate-lanceolate, saccate-based with a deep purple corrugated zone on the lower part of the inner face; androecium globular, about 1 cm broad, pale green to pale pink at anthesis; gynoecium of 4-15 narrowly fusiform, appressed-red-hairy carpels; fruit sparsely hairy when young, aging glabrous to minutely hairy, 6-9 cm long, smooth or rugose with a prominent ventral suture; seeds 1-2 cm long, castaneous.

Sandy soil of longleaf pine-turkey oak sand ridges, old fields, pastures, and roadsides, north-central and northeastern Florida north to southeastern Georgia. Flowering late March to May, or all during the growing season if the shrubs are disturbed.

Type: FLORIDA: Suwanee Co.: From a disturbed shrub in a sandy old field $\frac{1}{2}$ mi e of Mayo, *Kral 2715* (NY). Isotypes BH, BM, DUKE, F, FSU, FLAS, GA, GH, IA, MIAMI, MO, NA, NCSC, NCU, PH, UC, US.

FLORIDA: Alachua Co.: Alachua, *Kral & Godfrey 2774* (FSU, VPI). Columbia Co.: Lake City, *Kral 2550* (BH, FSU, IA, NA, NY, US, VPI). Hamilton Co.: Jasper, *Kral 6837A* (FSU, VPI). Lafayette Co.: Mayo, *Kral 2265* (BH, DUKE, F, FSU, IA, NA, NCSC, NCU, UC, VPI). Levy Co.: Chiefland, *Kral 2978* (FSU, IA, NA, UC, VPI). Madison Co.: 15 mi sse Madison, *Kral 2707* (BH, BM, DUKE, FLAS, FSU, GH, IA, MIAMI, MICH, MO, NA, NCSC, NCU, NY, UC, US, USEF, VPI). Marion Co.: Dunnellon, *Kral 2077* (FSU). Suwanee Co.: Live Oak, old field sands, *Kral 4609* (FLAS, FSU, GH, MIAMI, MICH, PH, VPI).

I first saw this hybrid while collecting *Asimina speciosa* near Mayo, Lafayette County, Florida, in late March of 1956. Some shrubs that were also in flower had the general habit of *A. speciosa*, but had reddish, glabrate twigs and cherry-pink inner petals. The aroma of the flowers was pleasant, but unlike that of *A. speciosa*. That such plants were hybrids became evident later that same season when they were found in several counties, always in mixed populations of *A. speciosa* and *A. longifolia*.

Specimens of *Asimina* \times *nashii* are not uncommon in herbaria, but have been variously identified. Its response to burning or cutting back is to produce leafy flowering shoots, so that the plants appear much like broad-leaved versions of

A. longifolia. On the other hand, the undisturbed shrubs have the flowering habit of the other parent, *A. speciosa*. The morphological consistency of *A. ×nashii* throughout a rather large series of specimens marks it as an F₁ hybrid.

An attempt was made to germinate the seed from one fruit source, but failed. However, the fruit was not quite ripe and it is quite possible that the seed was not yet mature.

OTHER ASIMINA HYBRIDS

There are other putative *Asimina* hybrids in addition to *A. ×nashii*. Some are rather well represented by specimens in herbaria and these specimens have been, since the time of their collection, a source of error in identification. None is consistent enough in its morphology to warrant formal description and though some of the intermediates are, in themselves, strikingly distinct, such herbarium specimens examined in this study were annotated with a formula. Examples of supposed hybrids are listed below.

1. *Asimina pygmaea* × *Asimina speciosa*.

Representative specimens: FLORIDA: Alachua Co.: railroad tracks, Hawthorn, 3 Mai 1925, *O'Neill* (MO); Jun-Jul 1898, *Hitchcock 27* (F, MO). Columbia Co.: 13 mi s of Lake City on roadside sands, *Kral 2283* (FSU). Flagler Co.: old field near Dunnell, *Blanton 6627* (BH, GH, MO, US). Levy Co.: 5 mi s of Trenton, old field, *Kral 3495* (FSU): sandy hillside pasture 1.5 mi w of Williston, *Kral 4474* (FSU). Nassau Co.: flatwoods 2 mi nw of Yulee, *Kral 3495* (FSU). Volusia Co.: Orange City, sandy pine land, 12 Apr 1910, *Hood* (MO); Orange City Junction, *Lewton 945* (US).

A single field containing both *Asimina speciosa* and *A. pygmaea* will have a number of intermediate forms as well, these no doubt representing a large array of genetic recombinations. The "pure" pygmy occurs as a dwarf, decumbent, glabrate- or glabrous-leaved entity with small, maroon, fetid blooms. The "pure" *A. speciosa* occurs as a shrub from one to one-and-a-half meters tall, with stiffly erect shoots, pale hairy new leaves and large, white or cream-yellow blooms which are pleasingly fragrant. Those recombinations closest to the pygmy will be somewhat taller, more erect, moderately reddish-hairy and broader leaved, their outer petals pink or white streaked with maroon, the aroma of their flowers fetid. In such a field are still taller plants, these with still more hairy twigs and leaves, larger flowers with less maroon pigmentation and more fragrance. Other plants will occur in which most of the characters of the pygmy have been lost, the shrubs being of the height of *A. speciosa*, but with narrower leaves, a sparser, deeper colored pubescence, and pink or maroon inner petals. A collection consisting of any one of these intermediate forms has value only insofar as it can be compared to other intermediates of the same population. By itself it can be extremely misleading, as herbarium identification of such hybrids testify.

2. *Asimina pygmaea* × *Asimina reticulata*.

Representative specimens: FLORIDA: South Florida, *Dr. Feay*, Herb. Chapman (US). Lake Co.: Eustis, 1904, *E. Blanchard* (NY); pinelands e of Eustis, *Small 8665* (NY, US). Levy Co.: slash pine-palmetto flatwoods bounding Otter Creek Public School, *Kral 4468* (FSU). Polk Co.: Feb 1890, *J. M. Milligan* (US); Bartow, 19 Apr 1919, *Buswell* (MIAMI); vicinity of Kissenger Spring, 15 mi s of Winter Haven, *McFarlin 3529* (MICH); 1 mi s of Bartow near International Mineral Co. Office, open field, sandy soil, *P. L. Redfearn 323-55* (DUKE, FSU); on sands of old field pasture 1 mi s of Fort Meade, *Kral 2145* (FSU).

These hybrids are much like those between *A. pygmaea* and *A. speciosa*, some

extremely beautiful. One plant (*Kral 4468, 4091*) at Otter Creek in Levy County, has pinkish outer petals, cherry-red inner petals, and an extremely delectable rose fragrance. It has the leaf shape of the pygmy but the flowering habit of *A. reticulata*.

3. *Asimina obovata* × *Asimina reticulata*.

Representative specimen: FLORIDA: Pasco Co.: on sandy soils of open palmetto scrub 5 mi n of Port Richey, *Kral 2102* (FSU).

An apparently rare hybrid, with the flowering habit of *Asimina reticulata* but with the bright red leaf- and shoot-pubesence of *A. obovata*. It also produces terminal flower buds as in *A. obovata* but the shrubs have not been examined later in the season to determine whether or not such terminal buds abort.

4. *Asimina obovata* × *Asimina pygmaea*.

Representative specimen: FLORIDA: Hernando Co.: dry sandy oak woods sw of Brooksville, *Moldenke 1069a* (NY).

A hybrid with the leaf-shape and pubescence of *A. obovata* but with smaller flowers axillary to new shoot leaves.

5. *Asimina longifolia* × *Asimina pygmaea*.

Representative specimens: FLORIDA: Madison Co.: open sandy field and adjacent pine woods 2 mi e of Madison, *Kral 2311* (FSU). Suwannee Co.: burned over turkey oak-longleaf pine woods, 0.5 mi e of Ellaville on the Suwannee, *Kral 2325* (FSU).

This hybrid is not as rare as the cited specimens would indicate, but it is difficult to recognize except from living material. Mixed populations of the two parent species, together with numerous intermediates, are frequent in those counties bounding the Suwanee River. The primary criteria separating the species are provided by flower size, petal coloration, and size and habit of the shrub. Gradation in all these characters is evident in the hybrid swarms.

The hybrids *Asimina* × *nashii*, *A. obovata* × *A. reticulata*, and *A. obovata* × *A. pygmaea* have been collected from forest or sand-scrub habitats although *A.* × *nashii* is most common on disturbed sites. The others have thus far been observed only on sandy old fields, pastures, railroad rights-of-way, or road shoulders. Such hybrids are no doubt the results of habitat disturbance or direct disturbance of the plants—factors which might upset external isolating barriers such as flowering times, soil drainage, and ultimately the local range of species.

Deeringothamnus Small, Bull. Torrey Club 51: 389. 1924.

Shrubs up to 2 dm tall, from stout-linear or fusiform taproots; shoots annual or biennial, arching to semi-decumbent, simple or sparingly branched, reddish or tan with pale lenticels, glabrate; leaves coriaceous, estipulate, alternate, deciduous, prominently revolute, glabrate; calyx lobes usually three, triangular, equal, distinct nearly to the receptacle, glabrate without, glabrous within; flowers axillary, fragrant, accrescent, on glabrate, nodding to sub-erect, ebracteate pedicels; petals 6–15, subequal, linear or oblong, fleshy, impressed-veiny on the inner face; torus flat or slightly convex; stamens 10–20, the anthers extrorse, surmounted by short-cylindric, extruding, blunt connectives, and clustered into a compact, flat-topped mass; carpels 1–5 (–6), narrowly fusiform, glabrate, located on the center of the upper torus surface, the few to several ovules in two placental rows; fruit an unevenly oblong-cylindric, pulpy berry; seeds bean-shaped or ovoid, castaneous, with tough coat; endosperm in plates.

1. Petals oblong, pale yellow, erect to slightly recurved. (Fig. 10). *D. rugelii*.
 1. Petals linear, white or pale pink, conspicuously recurved. (Fig. 11). *D. pulchellus*.
1. **Deeringothamnus rugelii** (B. L. Robins.) Small, *Addisonia* 15: 17. *pl.* 489. 1930. Fig. 10.

Asimina reticulata Shuttlew., nom. nud., in herb.

Asimina rugelii B. L. Robins. Syn. Fl. N. Am. 1: suppl. 465. 1897.

Small shrub 1–2 dm high, with arching to decumbent (or occasionally erect) shoots; bark of two year old shoots gray-brown, glabrous; that of new shoots tan to reddish-brown, sparsely short-red-hairy toward the tips; leaves coriaceous, 1–7 cm long, oblong to oval or obovate; apex rounded to emarginate (–obtuse); base rounded or acute, narrowing abruptly to the short petiole 1–2 mm long; margin inconspicuously revolute; surface glabrate, sparsely short-red-hairy when young, becoming dark green above, paler and raised-reticulate beneath; flowers lemon yellow, fragrant, arising singly from the axils of the new shoot leaves on slender pedicels 1–2.5 cm long; sepals 2 or 3, about 0.5 cm long, oblong, straight or slightly recurved; androecium flat-topped, about 0.5 cm in diameter, pale green at anthesis; gynoecium of 2–7, commonly 5, fusiform, glabrate carpels; fruit 3–6 cm long, oblong-cylindric, terete to bulging-sided, yellow-green when ripe; seeds dark brown, 1–1.5 cm long, more or less laterally compressed.

Poorly drained sands of slash (or longleaf) pine-saw palmette flatwoods, northeastern peninsular Florida. Flowering from April to June, or all through the growing season if the shrubs are disturbed.

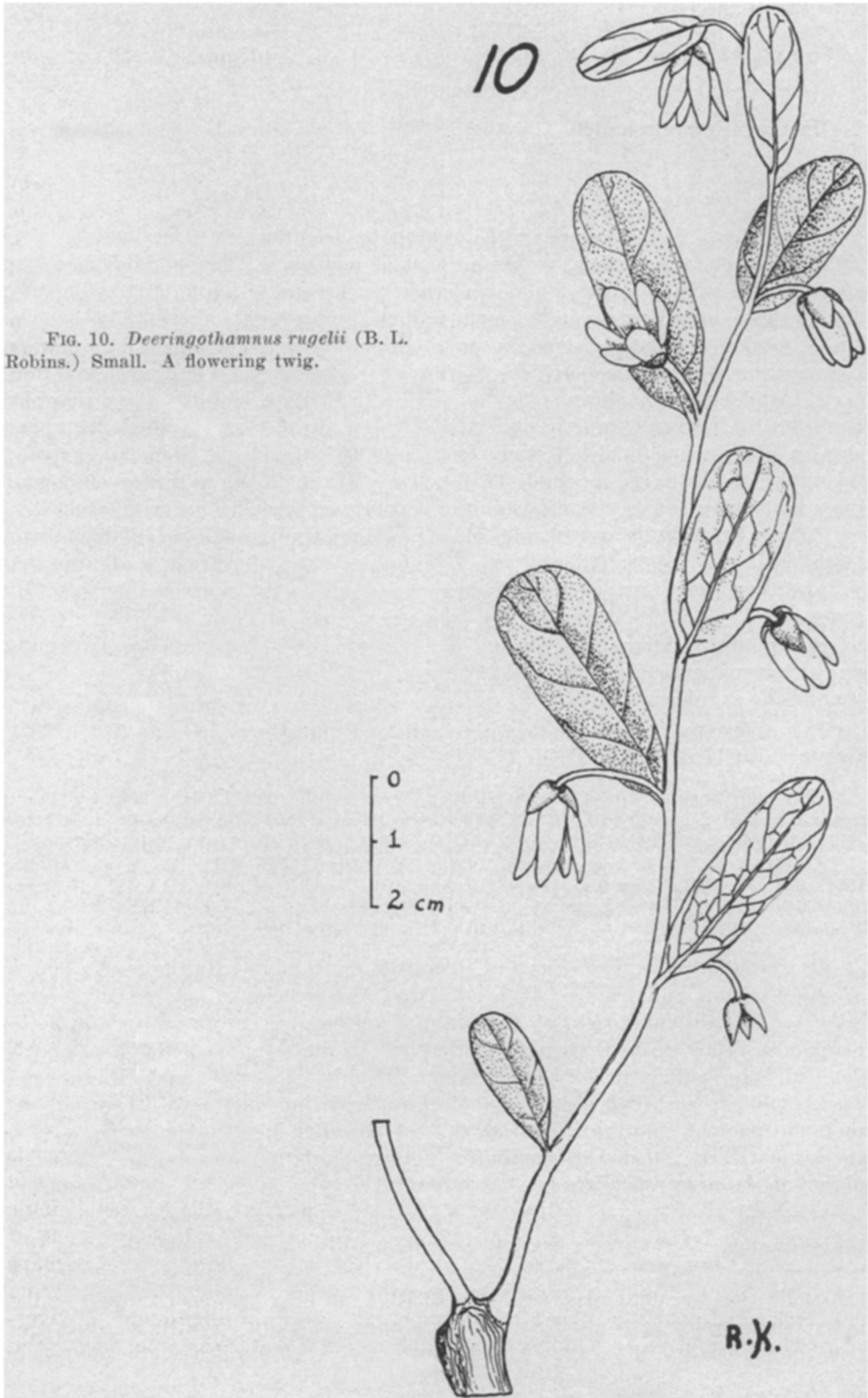
Type: FLORIDA: Volusia Co.: in pinetis prope Smyrna, *Rugel 9* (GH). Isotypes at BM, F, MO, NY.

FLORIDA: Seminole Co.: Alamana, *Kral 6552* (FSU, VPI). Volusia Co.: New Smyrna, *Small 11568* (FLAS, GH, NY, US), 4 Mai 1927, *Small et al.* (BH, GH), Apr 1928, *Small* (BH), Jul 1928, *Mosier* (BH), *Mosier 481a* (MO), 30 Mai *Mosier* (MIAMI), *Kral 2219*, *Kral 2509*, *Kral 6553* (FSU, VPI).

Deeringothamnus rugelii is perhaps the rarest of the North American Annonaceae, and from 1848 to 1927 was known only from the collection made by Ferdinand Rugel who, on the former date, found it in the lonely pine flatwoods of what was then the Florida frontier. Shuttleworth, sponsor of Rugel, in recognizing the collection as from a species new to science, attached to it the herbarium name *Asimina reticulata*. The epithet “*reticulata*” however was validly published by Chapman (1883) for another species of *Asimina*. Therefore B. L. Robinson (in A. Gray, Syn. Fl. 1¹: 465. 1897) renamed the former species *Asimina rugelii* in honor of its collector.

In 1927 Small discovered populations of these little-known plants in the same general area in which they had originally been found by Rugel.

The paucity of good material of *Deeringothamnus rugelii* in herbaria is at once understandable if one visits the region in which this plant grows. A low, inconspicuous shrub, it occurs amidst a tangle of other, more robust, flatwoods species such as *Serenoa repens*, *Befaria racemosa*, *Lyonia ferruginea*, *Lyonia lucida*, *Vaccinium* spp., and *Ilex glabra*. One must search well even for a single specimen and few of these will be in flower. The fine flowering specimens of Rugel, and other collections of the species which bear flowers, are perhaps explained by the reaction of *Deeringothamnus rugelii* to fire. In the spring following a late summer or winter burn, one may see an abundance of vigorously flowering shoots, an indication that fire disturbance may long have been



a factor in the ecology of this species.

Two species of *Asimina*, *A. reticulata* and *A. pygmaea*, grow in mixed populations with *Deeringothamnus rugelii*, yet no hybrids between *Deeringothamnus* and *Asimina* have been observed.

2. *Deeringothamnus pulchellus* Small, Bull. Torrey Club 51: 390. 1924. Fig. 11.

Asimina pulchella (Small) Rehder & Dayton, Jour. Arnold Arb. 25: 84. 1944.

Small shrub 1–2 dm high, with arching to decumbent shoots; bark of two year old shoots gray-brown, glabrous; that of new shoots tan to reddish-brown, sparsely red-hairy toward the tips; leaves coriaceous, 4–7 cm long, oblong to oblong-ovate or spatulate; apex rounded or emarginate, occasionally obtuse; base rounded or acute, narrowing to the short petiole 2–4 mm long; margin inconspicuously revolute; surface glabrate, sparsely short-red-hairy when young, becoming dark green above, paler and raised-reticulate beneath; flowers white (or pink?), fragrant, arising singly from the axils of the new shoot leaves on slender glabrate peduncles 1–3 cm long; sepals 2–4, about 0.5 cm long, ovate-triangular, glabrate, erect; petals 6–10 (–12), 2–3 cm long, narrowly oblong or linear, abruptly recurved; androecium flat-topped about 0.5 cm in diameter, pale green at anthesis; gynoecium of 1–7, commonly 5, fusiform, glabrate carpels; fruit 4–7 cm long, narrowly oblong-cylindric, terete to bulging-sided yellow-green when ripe; seeds dark brown, 1–1.5 cm long, more or less laterally compressed.

Poorly drained sands of slash (or longleaf) pine-saw palmetto flatwoods, southwestern peninsular Florida. Flowering late March to early June, or all year if the shrubs are disturbed.

Type: FLORIDA: Charlotte Co.: pinelands of Punta Gorda, *Small 10925* (NY). Isotypes at GH, MICH, MO, MCU.

FLORIDA: Charlotte Co.: Charlotte Harbor, *Small et al. 10925* (GH); 20 mi e Punta Gorda, *Small et al. 11150* (FLAS, GH, NY, US); 12 mi e Punta Gorda, *Small et al. 11481* (UC); low pinelands 12 mi e Punta Gorda, Mai 1928, *Small* (BH); 14 Mai 1928, *Buswell* (MIAMI). Lee Co.: Tucker's Corner, 29 Apr 1927, *Small* (BH, GH); Ft. Myers, 14 Mai 1928, *Buswell* (BH); Big Pine Island, 10 Apr 1930, *Buswell* (FLAS, MIAMI), *Moldenke 981* (MO, NY, US), *Kral 2129*, *Kral 2123*, *Kral 2523*; near jct. state highways 78 & 31, *Kral 2133* (VPI).

Deeringothamnus pulchellus and *D. rugelii* are undoubtedly the most peculiar of the Florida Annonaceae. It is odd that two species which resemble each other so closely should occur so abundantly, yet locally, on opposite sides of the peninsula. They occupy seemingly identical habitats, namely the low, poorly drained, pine-palmetto flatwoods, emergent only since the late Pleistocene. Their flowers bear little resemblance to any existing species of *Asimina*, yet their morphology is quite similar to that of *Asimina* in all other respects. The species of *Deeringothamnus* remain distinct as populations despite intermingling plants of *Asimina reticulata* or *A. pygmaea*.

How did such species arise? The taxonomic closeness of the two *Deeringothamnus* suggests that there was once, or may still be, a geographical connection between them. Further search for new localities of both species is indicated. One collection by Moldenke (19 June, 1929) from near Bithlo, Orange County, is particularly interesting. This station is approximately 35 miles southwest of any known locality of *D. rugelii* and approximately 100 miles northeast of any

recorded station for *D. pulchellus*. It was identified as *D. rugelii* by the collector, but its petals are too narrow, shaped more like those of *D. pulchellus*. I have therefore, with reservations, annotated this collection as *D. pulchellus* with the hope of visiting the locality later in order to see the plants. Further field study may reveal a series of localities connecting the two now widely separated entities. Should the plants from such localities show intermediate floral morphologies, one might accept the argument of Fries (1939) that *D. pulchellus* and *D. rugelii* should be considered varieties of a single species.

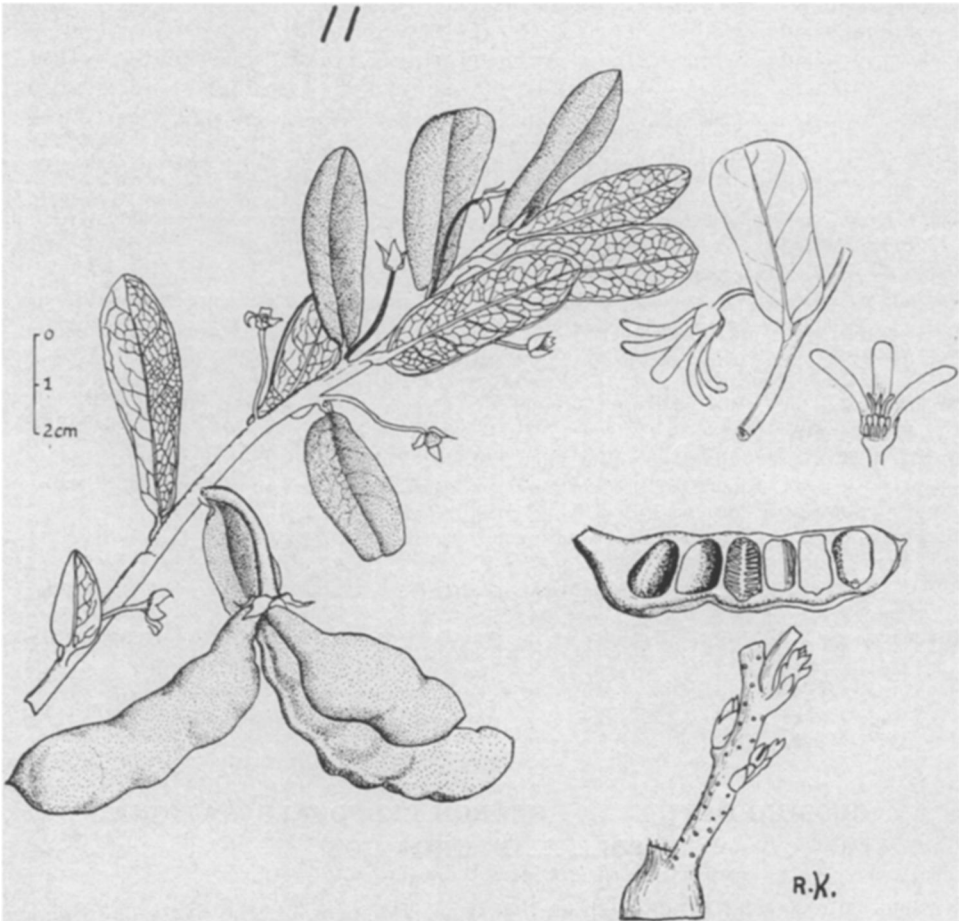


FIG. 11. *Deeringothamnus pulchellus* Small. At left, a fructing twig; upper right, portion of a twig with flower, together with a longisection of a flower; right-center, a longisection of a fruit; lower right, portion of a twig base showing shoot-buds.

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The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the Life Sciences is January 15, 1961. Proposals received before that date will be reviewed at the spring meetings of the Foundation's advisory panels and disposition will be made approximately four months after the closing date. Proposals received after January 15, 1961 will be reviewed after the closing date of May 15, 1961.

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