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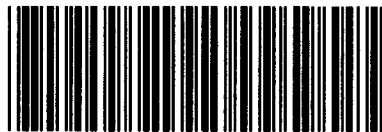
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Clyde K. Brashier

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A revision of *Commelina* (Plum.) L. in the U.S.A.

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BRASHIER, CLYDE K. (Department of Biology, Wisconsin State University, Superior.) A revision of *Commelina* (Plum.) L. in the U.S.A. Bull. Torrey Bot. Club 93: 1-19, 1966.—The genus *Commelina* has five species in the United States—three perennials and two annuals. The perennials comprise three species: (1) *Commelina virginica* forms a distinct group without sufficient variation to warrant subdivisions. Its population center is probably along the lower Mississippi Valley; however, plants in this species are found eastward to the Atlantic Ocean. *Commelina virginica* has broad leaves and is usually found in rich, moist lowland areas. (2) *Commelina dianthifolia* is readily divisible into two varieties—var. *dianthifolia* and var. *longispatha*. The members of this species are found in southwestern United States. They have extremely narrow leaves and are found primarily in sandy areas. (3) *Commelina erecta* is subdivided with difficulty. The author recognizes three overlapping varieties. One of these apparently has diverged into three forms, another into two forms. Although keying to forms in *C. erecta* can be tedious and sometimes not very meaningful, the author feels by using forms he could better show the natural relationships of this group's members. The population center for this species within the United States is presumed to be in Texas. It branches out from there in several directions, the branches constituting the different varieties. The annual species are very closely related, but on most occasions are rapidly distinguished as distinct species—*Commelina communis* and *C. diffusa*. The former usually has larger leaves and spathes, and the spathes are blunt toward the tip. The latter usually has smaller leaves, and spathes that taper toward the tip. The leaves of both are broadly lanceolate. Plants in these two species are found mostly in moist, rich soil in disturbed areas. *Commelina communis* is widespread, ranging from the central United States eastward to the coast, and from central Michigan southward to northern Alabama. *Commelina diffusa* has a similar distribution from west to east; however, the northern boundary of its range is in northern Illinois. It ranges southward to the Gulf of Mexico. Although only that part of its range within the United States was investigated in this research, *C. diffusa* does extend into Central America and probably into South America.

Representatives of the genus *Commelina* (Plum.) L., commonly known as "dayflower," can be found in most of the tropical, subtropical, and temperate countries of the world. Over 250 species have been reported throughout the world (Hooker and Jackson, 1895), about 30 of which were in North America.

Clarke (1881) listed 19 North American species. Pennell (1916) recognized nine species in the United States, seven of which he claimed to be native. The origin of *C. longicaulis* Jacq., he considered questionable; and the other, *C. communis* L., he claimed was not native to the United States.

Matuda (1955) listed nine species of *Commelina* from Mexico, four of which were discovered since Clarke's publication in 1881.

There is an abundance of disagreement on the classification of *Commelina* species in the literature. The "splitters" in taxonomy have divided *Commelina* into many species. A single variable species, *C. erecta* L., has been divided into as many as eight species by some taxonomists. Those who attempted to follow, as closely as possible, a natural classification of the genus have reduced many of the species described by the "splitters" either to synonymy or to a lower rank.

Pennell (1916), in his classification of the Commelinas of the United States, reduced nine published species of this genus, as well as seven species of other genera, to synonymy within the genus *Commelina*. For example, six species of *Commelina* listed by Small in his *Flora of the Southeastern United States* (1903) were reduced by Pennell to the single species *C. erecta*. He also suggested that two species, *C. angustifolia* Michx. and *C. crispa* Wooton, "are probably better considered as geographic varieties of *C. erecta* L."

Fernald (1940) followed Pennell's suggestion and reduced *C. angustifolia* Michx. to a variety of *C. erecta* L. However, he went further with the reduction of *C. crispa* Wooton and included it only as a form of var. *angustifolia*. When finished, Fernald had four varieties and three forms of *C. erecta*, as follows:

- C. erecta* L. var. *typica*
- C. erecta* L. var. *typica* f. *intercursa* Fern.
- C. erecta* L. var. *angustifolia* (Michx.) Fern.
- C. erecta* L. var. *angustifolia* (Michx.) Fern. f. *albina* Fern.
- C. erecta* L. var. *angustifolia* (Michx.) Fern. f. *crispa* (Wooton) Fern.
- C. erecta* L. var. *deamiana* Fern.
- C. erecta* L. var. *hamipila* (Wright) Fern.

Fasset (1943) described *C. erecta* L. var. *greenei* in a new publication subsequent to Fernald's paper, and related it very closely to *C. erecta* var. *deamiana*. The present author feels that var. *greenei* easily fits into var. *deamiana*, and thus the former is relegated to synonymy.

Commelina diffusa Burm. f. is another species that has caused much debate in the literature. For many years it was referred to as *C. nudiflora* L. According to Merrill (1937), Wallich in 1830 transferred the specimens originally published as *C. nudiflora* to the genus *Ancilema*. The dayflower that had been called *C. nudiflora* was transferred to *C. longicaulis* Kunth. by Pennell (1916). Merrill (1937) then discovered that Burman in 1768 had published the earliest description of *C. diffusa* that without doubt fit into this group. Thus, *C. diffusa* Burm. f. had priority and became the correct binomial for this group, and *C. longicaulis* passed into synonymy. Pennell (1938) concurred with this decision one year after Merrill had published his article.

Pennell (1937) reported that the plants representing *Commelina communis* in the United States belonged in two varieties. One year later, Pennell (1938) reappraised the *C. communis* group and this time suggested a division into four varieties, viz., *typica*, *exserta*, *ludens*, and *hortensis*. Most of the characters used to differentiate these varieties necessitate the use of living materials. Almost all the *C. communis* plants used in the present study were herbarium specimens; consequently, no subdivisions of this species were made.

This taxonomic treatment of the genus *Commelina* within the United States includes taxa descriptions, distributions, citations of type specimens, and citations of other selected specimens.

The treatment of the highly complex and controversial species *C. erecta* is dealt with rather extensively and includes theories of origin and divergence of infraspecific taxa.

Sincere gratitude is expressed for the advice and counsel of Dr. John F. Davidson under whose direction this study was made. Appreciation is also extended to the curators of the following herbaria from which were borrowed the number of specimens designated: Chicago Natural History Museum (1163); Gray Herbarium (5); Missouri Botanical Garden (1176); Smithsonian Institution (80); Southern Methodist University (379); University of California (341); University of Michigan (248); University of Nebraska (102).

The genus *Commelina* (Plum.) L. Plants herbaceous monocots, either annuals or perennials; if perennials, arising from adventitious buds on roots each year; stems at first erect, some species later becoming decumbent; leaves linear to ovate, forming a sheath at the base, margin and throat of sheath often lined with white or reddish trichomes; flower buds borne inside a boat-shaped spathe which is open across the top, 3-5 buds are produced per spathe, buds open in succession 3 or 4 days apart, blue flowers (occasionally paler) emerge above spathe shortly after dawn and remain open until midday when they recede into the spathe in the form of a juicy mass; sepals 3, one subequal to the other two; petals 3, one of which is subequal to others and often paler; stamens 3, staminodia (smaller than stamens) 3; gynoecium made up of three carpels; fruits per spathe usually 1-2, sometimes 3; 1-3 seeds per fruit.

Key to the species of *Commelina* within the United States

1. Plants perennials, growing each spring from adventitious buds on the roots; roots tuberous.
 2. Spathes open across the top, but closed down adaxial side; tip either sharp or blunt, never long and attenuated.
 3. Pubescence along margin and at throat of leaf sheath white; spathes both axillary and terminal, usually single *C. erecta* (1)
 3. Pubescence along margin and at throat of leaf sheath reddish; spathes usually in terminal clusters *C. virginica* (3)
 2. Spathes open across the top and down adaxial side to spathe stalk; spathe tip long and attenuated, often becoming as long as main body of the spathe *C. dianthifolia* (2)

1. Plants annuals; roots fibrous.

4. Leaves 15-40 mm. wide, 50-120 mm. long; leaf sheaths 10-20 mm. long with light pubescence at throat or throat glabrous; spathe stalk 10-70 mm. long; spathe usually tapers rapidly to a blunt point at tip, seldom attenuated *C. communis* (4)
4. Leaves 9-15 (occasionally up to 22) mm. wide, 35-70 (occasionally up to 100) mm. long; leaf sheaths 5-10 mm. long with long white hairs at throat; spathe stalk 10-20 mm. long; spathe gradually tapering at tip becoming very slightly attenuated *C. diffusa* (5)

(1) *COMMELINA ERECTA* Linnaeus, species Plantarum 1:41. 1753.

Plant perennial, overwintering by means of tuberous roots; sprouts by means of adventitious buds on the roots in the spring; stem 2.5-30 dm. in length (often longer under greenhouse conditions), at first erect, later becoming decumbent; leaves linear to lanceolate-ovate, 3-35 mm. wide, 50-150 mm. long, slightly scabrous with fine pubescence above, glabrous beneath; leaf sheath 7-25 mm. long, pubescence white along leaf-sheath opening, becoming denser around the throat of the sheath; spathes 14-35 mm. long, 8-23 mm. high, glabrous to heavily pubescent, hairs often becoming clustered near the base of spathe, adaxial side of spathe closed, top of spathe open, with the abaxial side tapering to a point, giving a somewhat boat-shaped appearance.

Type locality: "Virginia," (Linnaeus)

Distribution: (Fig. 12) This is the most widespread native species of *Commelina* L. in the United States. The western limit of its range is Arizona and Wyoming. The northern boundary is in Wisconsin. It ranges east to the Atlantic Ocean and south to the Gulf of Mexico.

All the characters measured in this species yielded a normal curve when graphed. No characters could be found to separate this group into two or more distinct units. For this reason the entire complex was placed into one species, viz., *C. erecta*. Fernald (1940) stated that this group "is a polymorphous species with pronounced but freely confluent varieties. . . ." The author agrees with him except for the use of the word "pronounced." In the study of about 1000 plants representing this complex, no "pronounced" units could be found. However, single plants selected from different parts of this complex were distinctly different, especially if these were taken from different peripheral areas of the distribution range. It may well be that the present author had more material available than did Fernald. This wide variation probably was the reason for the many specific, varietal, and formal epithets which have been applied to plants within this group. Since most of the variation in *C. erecta* is expressed by quantitative characters, it is practically impossible, when working principally with herbarium specimens, to determine what part of this may be due to genetic differences and how much is due to the environment. There was a large amount of variation in characters on single plants. This may be due either to the position on the plant or to the environmental differences at the times the different parts of the plant were produced. Since this is a perennial group, the environmental

changes from year to year could produce considerable variation in any particular plant. The size of the leaf and spathe can vary from year to year and from one part of the plant to the other. One spathe character, viz., length-width ratio, used by Fernald (1940) in separating two different varieties within *C. erecta* was found to vary enough on one plant, so that one part of the plant could be placed in one taxon and another part in another taxon. He separated *C. erecta* L. var. *hamipila* from *C. erecta* var. *deamiana* and var. *angustifolia* by the following method:

“Mature spathe more than half as high as long, the lower margin only slightly curved; larger leaves 4–20 mm. broad.
 Longer leaves 4–10 cm. long; mature spathes 1–2 (seldom 2.5) cm. long. var. *angustifolia*
 Longer leaves 7–15 cm. long; mature spathes mostly 2.5–3 cm. long. var. *deamiana*
 Mature spathe less than half as high as long, strongly falcate to the prolonged beak, 1.8–2.8 cm. long; larger leaves 3–5 mm. broad. var. *hamipila*.”

Figure 3 shows a plant which has spathes both “more than half as high as long” and “less than half as high as long.” The sizes of leaves, according to Fernald’s key, could have placed it in either var. *hamipila* or var. *angustifolia*. However, to the present author, it appears more closely related to the plants keyed to *C. erecta* var. *hamipila* which is designated in this work as *C. erecta* var. *angustifolia* f. *hamipila*. This is not an isolated case; but one of many that could have been used to illustrate the difficulty of preparing a key set up for this group.

The above is by no means offered as criticism of Fernald’s analysis of this group, but to point out complications arising in attempting an infra-specific classification.

Width of leaves used in combination with spathe characters gives a much better differentiation of plants than does leaf length as predominantly used by Fernald. However, since leaf width is probably controlled by quantitative genes and readily influenced by the environment, this too had to be used with caution and in combination with other characters.

Introggressive hybridization has been shown to be responsible for much variation in the closely related genus *Tradescantia*. Using techniques outlined by Anderson (1949), plant characters within this *C. erecta* complex were checked for correlations that would indicate possible introggressive hybridization. No character correlations were found, and thus introggressive hybridization was ruled out. A free interbreeding was then postulated to explain the variation within this complex.

Greenhouse experimentation showed, however, that *Commelina* flowers normally self before opening. Maheshwari and Baldev (1958) reported *C. forskalaei* Vahl, as being self-pollinated. Other literature indicate that other *Commelinas* are also self-pollinated. No report of effective cross-pollination has yet been found. This suggests that this group is probably not

“freely interbreeding,” but rather that genetic segregations are responsible for the large amount of variation, and natural selection of certain biotypes by different environments has produced divergent populations.

The attempted crossing experiments supported this theory. Even under controlled conditions in the greenhouse, no successful crosses were obtained. However, if the flowers were emasculated and selfed before the pollen was shed in the bud stage, fifty per cent produced seed. Of the flowers that were bagged prior to blooming, seventy per cent selfed and produced seed.

If seed production within *C. erecta* is entirely dependent upon selfing, and all evidence at hand suggests that it is, then any natural groups that have developed would have done so by divergence due to genetic segregations and selection, without crossing. The diversity within the population that would be necessary to allow such a divergence could have been built up by mutation and by genetic segregation in both megasporogenesis and microsporogenesis. Since mutations are randomly occurring events and may be caused by many different environmental factors, in such an extensive and widely distributed species as *C. erecta* relatively large numbers of mutations would be expected. Pure stocks of *Drosophila* under intensive laboratory investigations have produced hundreds of different mutant types.

The genetic segregations during sporogenesis and the resultant combinations during fertilization could be responsible for much of the variation within the species. Not only are these new combinations produced each year, but the parental types can also be maintained since these are perennials. Also any one preferential genetic combination could have been built up since *C. erecta* may be clonal in growth habit.

A gradual divergence of the parts of the *C. erecta* complex is postulated since there are no distinct breaks in these groups. These divergences were controlled by the environment. Any combination of characters or degrees of characters favorable for survival in the existing environment probably produced a population build-up of the plants showing that favorable combination. Other combinations were eliminated by the environment. Other environments would select for different combinations of germ plasm. Very stringent selections of this type eventually resulted in distinct units. In the *C. erecta* complex, this was true in parts of its range, but did not apply to plants in southern Texas which appeared to be the population center. In this area the members of the complex could not be satisfactorily separated into distinct groups. However, as one moves away from this population center, distinct groups become more apparent. As the northern boundary of the range of *Commelina erecta* was approached, definite types were found in any one area. It appears that the environment in southern Texas allowed this complex to produce a large amount of variation, hence, a starting point for divergence. Because natural selection was not strenuous enough to produce distinct groups the environment was conducive to variation. It is the

theory of this author that the plants migrated into more exacting environments, and selections occurred in these areas resulting in the apparent natural units in the northern parts of its range. However, when all these plants were placed together, no distinct taxa could be delimited. The question then arose if these should be taxonomically treated as one unit because they could not be separated, or should these be separated into different taxa to reflect the environmental selection that occurred as the plants migrated away from the population center?

The author feels that, because of the inability to separate these into disjunct units when they were all together, all the plants should definitely be regarded as one species. Inasmuch as Linnaeus first named a member of this group, *Commelina erecta* L. is the appropriate binomial. Because the different environments have selected different variants of this species as the plants migrated in different directions from the population center in Texas, and because of the large amount of variation within the group, the species was subdivided to portray this divergence. One group, var. *angustifolia*, moved northward from Texas into eastern New Mexico and Colorado, and western Oklahoma, Kansas, and Nebraska, where it almost invariably became established in sandy areas. It also became established in the sandy areas along the Gulf Coast. In Florida it became a prominent part of the vegetation. From here it moved along the lower part of the eastern seaboard, reaching as far north as the Carolinas and east to Cuba. There are three forms of this variety—(1) f. *angustifolia*; (2) f. *crispa*; (3) f. *hamipila*. Forma *angustifolia* is apparently the oldest and very probably responsible for producing the other two. Here again, it is difficult to separate the three forms. This, of course, is good argument for combining the three together into one variety without further subdivisions. However, the author found evidence for subdividing the variety into forms. Forma *hamipila* is mainly limited to Florida. Only a few collections have been made in southern Alabama. The theory proposed for this situation is that after var. *angustifolia* became established in Florida, selection by the environment for a particular segregate produced forma *hamipila*. Either the environment west and north of Florida kept it restricted to this area, or it is of rather recent origin and has not moved out of Florida.

Fernald (1940) reduced *C. hamipila* to varietal status. In this work it is felt since its similarities put it so close to the other forms of var. *angustifolia*, and since it probably had been produced from members of this variety, it should still be associated with it as a form.

The other form, *crispa*, was designated as a species by Wootton (1898) and reduced to a form by Fernald after Pennell (1916) had suggested the possibility of reducing it to varietal status. Fernald used the cluster of hairs at the base of the spathe to separate it from the remainder of the variety. Distribution-wise, a grouping based on this character is not valid. This

same type of pubescence in varying degrees is found on plants throughout the variety *angustifolia* as well as in the larger-leaved varieties. However, the plants that fit into this group are all small and tend toward the possession of narrow, linear leaves and small spathes.

The type specimen for this group (Wootton 545!) actually resembles forma *angustifolia* more closely than does the majority of the plants in the forma *crispa*. Of interest is the fact that nearly all the plants in the group that tend toward the small extreme, i.e., the ones with the narrowest leaves, the smallest spathes, and the smallest size, were collected much more recently than were the larger members of this group. Most of the smaller members of forma *crispa* were collected since 1925, while many of the plants in forma *angustifolia*, as well as in forma *crispa*, dated back well into the 1800's. There was a correlation between reduction in size and recency of collecting. This, of course, may have been due to the sampling by the collectors. It may, however, be due to an actual divergence of a smaller form that is occurring at the present time.

Probably one of the most distinct varieties of this complex is *C. erecta* var. *deamiana*. Members of this variety migrated from Texas in a north-by-northeast direction through Oklahoma, Arkansas, into Illinois, Indiana, Wisconsin, and the eastern part of Iowa. The range of this group extends farther north than that of any other *Commelina* in the United States. The plants in the northernmost part of the range are usually found growing in sandy areas, as are those in Texas.

The third variety, viz., *C. erecta* var. *erecta*, extended its range from Texas to the east and northeast, covering a much wider area than var. *deamiana*. Variety *erecta* built up a rather large population along the river bottoms in Missouri and Arkansas. It spread through Louisiana, Mississippi, Tennessee, and Kentucky to the east coast, where its northern limit is Maryland and southern Pennsylvania. It apparently has not migrated into Florida. Variety *erecta* is made up of the broadleaved portion of *C. erecta*. These sometimes grow in the sand but are more frequently found on alluvial soil, especially in the Mississippi Valley. On the alluvial soils of Missouri, eastern Kentucky, and southern Illinois a population of this taxon has been built up with extremely large leaves. Scattered patches of this type are found from this area to the Atlantic Coast. Since this is the group into which the first published specimen for this species best fits, it is designated as *C. erecta* L. var. *erecta* f. *erecta*. The plants of var. *erecta* with narrower leaves were first designated as f. *intercurva* by Fernald. According to measurements, Fernald's type specimen for f. *intercurva* fits into the overlap between f. *erecta* and f. *intercurva*. However, the distribution maps show it to fit best into the narrow-leaved form, *intercurva*. Since this is the case, and since it was the first type specimen designated for the group at the rank of form, it is accepted as the type specimen, and the name forma

intercurva Fern. becomes the correct name. The type specimen of *C. saxicola* Small (!) falls about in the middle of this group, according to measurements.

It is appropriate to point out that the author feels that treating this species as three varieties and five forms is not convenient for classification due to the highly variable nature of this group. For a person unfamiliar with this species and using a key in the field, it would be hazardous to attempt to key these plants past the rank of variety. Even to key them to variety will sometimes cause difficulty. However, since in taxonomy we endeavor to show the relationships of the different subordinate taxa in a species, the author feels obliged to separate two of the varieties into forms. For example, the production of a rather distinct form, f. *hamipila*, in Florida without a counterpart in Texas could not have been shown if var. *angustifolia* had not been subdivided. But because it is a segregate of the var. *angustifolia* in Florida, it is properly placed within that variety and given the rank of form.

Key to the varieties and forms of *Commelina erecta* L.

1. Leaves linear to narrowly lanceolate, 4–14 mm. wide, 50–135 mm. long; spathes 14–26 mm. long.
 2. Leaves linear, 5–10 mm. wide; larger spathes 25–30 mm. in length, 12–18 mm. high along adaxial side var. *deamiana*
 2. Leaves linear to narrowly lanceolate, 4–14 mm. wide; larger spathes 15–25 mm. in length, 9–15 mm. high along adaxial side.
 3. Leaves 4–10 mm. wide; spathes pubescent to glabrous.
 4. Leaves linear, 4–7 mm. wide; spathes 14–20 mm. long, straight along lower margin, pubescent var. *angustifolia* f. *crispa*
 4. Leaves linear, 5–10 mm. wide; spathes 22–26 mm. long; tip slightly to strongly decurved; spathes very slightly pubescent to glabrous var. *angustifolia* f. *hamipila*
 3. Leaves linear-lanceolate to narrowly lanceolate, 8–14 mm. wide; spathes pubescent, straight along lower margin.
 - var. *angustifolia* f. *angustifolia*
1. Leaves lanceolate to ovate, 11–35 mm. wide, 60–150 mm. long.
 5. Leaves 11–20 mm. wide var. *erecta* f. *intercurva*
 5. Leaves 20–35 mm. wide var. *erecta* f. *erecta*

COMMELINA ERECTA L. var. DEAMIANA Fern., *Rhodora* 42: 440. 1940. (Fig. 1)
Commelina erecta L. var. *greenii* Fasset, *Bull. Torr. Bot. Club* 70: 398–399. 1943.

Larger leaves 5–10 mm. wide, 90–130 mm. long; mature spathes 24–30 mm. long, 12–18 mm. high, very slightly pubescent to heavily pubescent.

Type locality: Indiana, Newton Co., "roadside sandhill, 4½ mi. NW of Morocco," Deam 31,662 (!) (1920) GH.

Herbarium specimens cited: Illinois: Cass Co. "Beardstown," Benke 3918 (1924) F. Texas: Cass Co. "4 mi. E. of Hughes Springs on Hwy. 11, sandy slope," Whitehouse 21312 (1949) SMU.

Distribution: The greatest concentration is in Indiana and Illinois with more or less localized populations found west and southwest of this area in Iowa, Arkansas, Oklahoma, Texas, New Mexico, and Arizona.

COMMELINA ERECTA L. var. ANGUSTIFOLIA (Michx.) Fern. f. CRISPA (Wooton)
Fern. (Fig. 2)

C. swingleana Nash, Bull. Torr. Bot. Club 22: 160. 1895.

C. crispa Wooton, Bull. Torr. Bot. Club 25: 451. 1898.

C. nashii Small, Flora Southeastern U.S. p. 242. 1903.

C. erecta L. var. *crispa* (Wooton) Palmer & Stey., Rhodora 40: 131. 1938.

C. erecta L. var. *angustifolia* (Michx.) Fern. f. *crispa* (Wooton) Fern.,
Rhodora 42: 440. 1940.

Plant perennial; stem 2.5–25 dm. long, finely pubescent; mature leaves linear to slightly linear-lanceolate, 4–7 mm. wide, 5–12 cm. long; spathes 14–20 mm. long, 9–12 mm. high, pubescent with the white hairs often clustered near base, usually the spathe stalk tends to form a straight line with the adaxial side of the spathe.

Type locality: New Mexico, Dona Ana Co. "Organ Mts. alt. 4800 ft." Wooton 545 (1897) US. (!)

Herbarium specimens cited: Florida: Bay Co. "Dry sandy soil at Lynn Haven," Billington (1921) MICH. Texas: Aransas Co. "Loose Sand, Goose Island State Park," Johnston (1953) SMU.

Distribution: The population center of this group appears to be in southeastern Texas. Isolated collections have been made in west Texas, northeastern Texas, the Nebraska Sand Hills, sandy coastal areas of Florida, and sandy areas in New Mexico.

COMMELINA ERECTA L. var. ANGUSTIFOLIA (Michx.) Fern. f. hamipila
(Wright), comb. nov. (Fig. 3)

C. hamipila Wright, in Sauvalle, Flora Cubana p. 157–158. 1873.

C. erecta L. var. *hamipila* (Wright) Fern., Rhodora 42: 440–441. 1940.

Plant perennial; stem finely pubescent; leaves linear to slightly linear-lanceolate; larger leaves 4–10 mm. wide, 85–135 mm. long; spathes glabrous to very slightly pubescent, 22–26 mm. long, usually less than half as wide as long, often purplish, lower margin of spathe slightly to very strongly recurved, spathe tip often falcate.

Type locality: "Cuba," Wright, US. (!)

Herbarium specimens cited: Florida: Alachua Co. "High pine knoll, Gainesville, Murrill (June 22) MO.

Distribution: *Commelina erecta* var. *angustifolia* f. *hamipila* is limited to Florida in its distribution within the United States.

COMMELINA ERECTA L. var. ANGUSTIFOLIA (Michx.) Fern. f. ANGUSTIFOLIA
(Fig. 4)

C. angustifolia Michaux, Flora Boreali-Americana 1: 24. 1803.

C. virginica var. *angustifolia* (Michx.) C. B. Clark in DC. Mon. 3: 183.
1881.

C. erecta L. var. *angustifolia* (Michx.) Fern. Rhodora 42: 439. 1940.

Plant perennial; larger leaves linear-lanceolate to lanceolate, 4–14 mm. wide, 50–120 mm. long; mature spathes 15–25 mm. long, 9–15 mm. high.

Type locality: "Carolinas," (Michaux)

Herbarium specimens cited: Florida: Collier Co. "In sandy soil along road ½ mi. N. of Caxambas," Deam 60535 (1941) SMU. Kansas: Barton Co. "Near Claflin (R.R. 2)," Benke 5124 (1929) F. Oklahoma: Adair Co. "Limestone glades 1 mi. SW of Westville," Moore (1930) SMU. Texas: Armstrong Co. "1 mi. W. of Ashtola, sandy loam ditch," Whitehouse 19140 (1947) SMU, MICH.

Distribution: The population center of *C. erecta* var. *angustifolia* f. *angustifolia* is in Texas. It has a wide range with New Mexico, Colorado, and Wyoming its western limits and Nebraska and Iowa its northern limits in the Midwest. In the East, Tennessee and North Carolina are its northern limits. The Gulf of Mexico is its southern limit within the United States.

COMMELINA ERECTA L. var. ERECTA f. INTERCURSA Fern. (Fig. 5)

C. saxicola Small, Flora of the Southeastern U.S. p. 242. 1903.

C. erecta L. var. *erecta* f. *intercursa* Fernald, Rhodora 42: 439. 1940.

Plant perennial; stem finely pubescent, larger leaves 11–20 (occasionally up to 27) mm. wide, 60–120 mm. long; larger spathes 16–34 mm. long with most 2–34 mm., 12–19 mm. high.

Type locality: Virginia, Prince Co. "Sandy thicket by James River, Jordan Point," Fernald and Long 8643, (1938) GH (!)

Herbarium specimens cited: Arkansas: Benton Co. "Bottoms," Bush 15720 (1936) NEB. Missouri: Barry Co. "Bottoms," Bush 15823 (1936) MO. Texas: Anderson Co. "Sandy ground in Palestine," Eggert (1899) MO.

Distribution: *C. erecta* var. *erecta* f. *intercursa* has its population center in Texas, ranges north to Kansas and east to the Atlantic Ocean. Its northeastern limit is apparently in Pennsylvania. The southern limit in the United States is along the Gulf from Texas to Florida.

COMMELINA ERECTA L. var. ERECTA f. ERECTA (Fig. 6)

C. erecta Linnaeus, Species Plantarum 1: 41. 1753.

Plant perennial; stem finely pubescent, mature internodes 45–110 mm. long; larger leaves 20–35 mm. wide, 75–150 mm. long, broadly lanceolate to lanceolate-ovate; leaf sheaths 15–20 mm. long; spathes 25–35 mm. long, 16–23 mm. high.

Type locality: "Virginia" (Linnaeus)

Herbarium specimens cited: Missouri: Barry Co. "Eagle Rock," Bush 359 (1896) MO. Texas: Bexar Co. "Near San Antonio," Schulz MICH.

Distribution: This form is concentrated in Missouri, Arkansas, and eastern parts of Oklahoma and Texas, but can be found sparsely scattered east to Virginia and north to New Jersey and south to the Gulf of Mexico.

(2) COMMELINA DIANTHIFOLIA Del. in Redoute, Les Liliacees v. 7., t. 390, 1813.

C. stricta Desfontaines, Cat. Hort. Par. p. 388. 1829.

C. linearis Bentham, *Plantas Hartwegianae* p. 26. 1839.

C. graminifolia Pavon ex Clarke, *D.C. Mon. Phan.* 3: 151. 1881.

Plant perennial, erect to suberect; longer internodes of the plant 4–12 (occasionally up to 15) cm. long; leaves linear, finely pubescent to glabrous, 30–80 (occasionally down to 11) mm. wide, leaves 9–15 cm. long, leaf sheaths 15–20 mm. long, often having a purplish tint; spathes open across top and down adaxial side, tapering to a long attenuated tip on abaxial side, often purplish in hue, 7–17 mm. high, 25–62 (occasionally up to 80) mm. long; juncture of adaxial side of spathe and top of spathe forms a smooth curve, not angular as in the other perennial species of *Commelina* in the United States.

Distribution: Southwestern part of the United States—Arizona, New Mexico, Colorado, and Texas.

Type locality: "Mexico, New Mexico, and Arizona" (Delile in Redoute).

This narrow-leaved species of *Commelina* is limited in its range to the western United States, seldom appearing east of western Texas and no farther west than Arizona and New Mexico. Its long linear leaves, and its open spathes with long tapering tips are the most easily recognized distinguishing characters.

There are two distinct groups within this species, both found mainly in Arizona and New Mexico. One, *C. dianthifolia* var. *longispatha* appears farther north, having been collected in Colorado. The other, *C. dianthifolia* var. *dianthifolia*, ranges farther to the southeast and has been collected in the western half of Texas.

Commelina dianthifolia var. *longispatha* is primarily a strict, erect plant, branching very little with relatively small angles between branches and main stem. *Commelina dianthifolia* var. *dianthifolia* is erect at first, becoming prostrate later due to its profuse, often dichotomous type of branching.

There were plants within this species that at first appeared to be intermediate between the two above varieties. Upon closer examination it was found that these plants tended toward one group or another. The author found no plants within the collections examined that could not eventually be satisfactorily placed. However, because of these plants that tended toward intermediacy, because of the strong affinities of these two groups, and because the two together formed a group easily distinguished from any other species of North American *Commelina*, it was felt they should both be placed in the same species and subdivided as two distinct varieties.

Key to the varieties of *Commelina dianthifolia* Del. in Red.

Plant erect; branch angles 15° and under; longer internodes 8–15 cm. long; spathe tip attenuated, consistently narrow, and as long or longer than main body (see Fig. 7), spathe length (mm.) × spathe width (at widest point in mm.) usually a numerical value of 50–110

..... *C. dianthifolia* var. *longispatha*

Plant suberect; branch angles usually 25°–85°; longer internodes 4–6

(occasionally up to 8) cm. long; spathe tip gradually tapering to a point, spathe length (mm.) \times spathe width (at widest point in mm. usually gives a numerical value of 20-50

..... *C. dianthifolia* var. *dianthifolia*

COMMELINA DIANTHIFOLIA Del. in Red. var. *longispatha* (Torr.) comb. nov.
(Fig. 7)

C. linearis var. *longispatha* Torr., Rep. U.S. and Mex. Bound. (Bot.): 224. 1859.

C. dianthifolia var. *filliformis* M. E. Jones, Contri. Western Bot. No. 12, p. 80. 1908.

Plant erect; branching little; branching angles seldom over 15 degrees; longest internodes 8-12 (occasionally up to 15) cm. long; spathes bulbous, narrowing rapidly to form a long attenuated tip; tip of spathe consistently narrow and usually about as long as bulbous part of spathe; largest spathes 9-17 mm. high at widest point and 34-80, usually 38-62, mm. long; spathe length (in mm.) \times spathe width (in mm.) (at widest point) gives a numerical value of 30-110, the majority having a value between 55-100.

Type locality: Arizona.

Herbarium specimens cited: Arizona: Coconino Co. "Flagstaff," Hanson A 923 (1923) F, MO. New Mexico: Lincoln Co. "White Mt." Wooton 311 (1897) MO, UC.

Distribution: (Fig. 13) Arizona, New Mexico, Colorado.

COMMELINA DIANTHIFOLIA Del. in Red. var. DIANTHIFOLIA (Fig. 8)

C. dianthifolia Del. in Redoute, Les Liliacees. v. 7, t. 390. 1813.

Plant erect when young, becoming suberect to decumbent in age; branching profusely with angle of branching 25°-85°; longest internodes 4-6 (seldom 8) cm. long; spathes 25-45 mm. long, 7-13 mm. high at widest point tapering very gradually to a tip, so that narrowest point is at tip only, spathe length (mm.) \times spathe width at widest point (mm.) gives a numerical value of 20-50, as opposed to var. *longispatha* which has numerical values for this same character that fall mainly between 55-100.

Herbarium specimens cited: New Mexico: Dona Ana Co. "Organ Mts." Wooton (1894) MO; Grant Co. Holzinger (1911) MO. Texas: Brewster Co. "Chisos Mts." Mueller 7956 (1931) UC, MICH, MO.

Distribution: (Fig. 13) Arizona, New Mexico, Texas.

(3) COMMELINA VIRGINICA Linnaeus, Species Plantarum ed II p. 61 1762.
(Fig. 9)

C. longifolia Michaux, Flora Boreali-Americana 1: 23. 1803.

C. hirtella Vahl, Enumeratio Plantarum V. ', p. 116. 1806.

C. elegans Kunth, Nov. Gen. et Sp. 1: 259. 1816.

C. deficiens Hook., Curtis's Bot. Mag. v. 53, t. 2644. 1826.

Plant perennial, overwintering by a tuberous root system; stem erect to decumbent, longest internodes usually 80-180 mm., stem at base 3-6 mm. in diameter; leaves broadly lanceolate, mature ones usually 20-65 mm. wide, 100-200 mm. wide, finely pubescent, especially scabrous to the touch when rubbed from the tip toward the sheath, leaf sheaths heavily pubescent at

throat and down open edge, the hairs sandy red to dark red in color; spathes terminal and usually clustered, occasionally produced single at top; larger spathes usually 25–35 mm. long, 12–20 mm. high; closed down adaxial side, open across the top, tapering to a point on abaxial side, spathes glabrous to very finely pubescent; long, prostrate rhizomes turn up at the ends, producing a new plant.

Type locality: "Virginia," (Linnaeus).

Herbarium specimens cited: Arkansas: Benton Co. "Boston Mts. foothills, 5 mi. N. of Bentonville," Demaree (1928) SMU. Missouri: Barry Co. "Along White River E. of Shreiner Ferry," Steyermark 19585 (1935) MO. Texas: Harrison Co. "Marshall, swamps" Blush 989 (1901) MO.

Distribution: (Fig. 14) This species is limited in its distribution chiefly to states east of the Mississippi River and to those states immediately bordering it on the west. A few collections have been made in eastern Texas and Oklahoma. Its northern borders are Illinois in the West and Maryland in the East.

Commelina virginica, a very distinct species with broad leaves, was usually easily distinguished from the other species of *Commelina*. It was closer in appearance to the large-leaved variety of *C. erecta*, i.e., var. *erecta*, than any other group. Specimens of *C. virginica* have occasionally been mistaken for *C. erecta*. However, its over-all coarse appearance and its distinctly reddish hairs at the throat of the leaf sheath easily distinguish it from *C. erecta* or any other group. It apparently thrives in low wetlands, since it was mostly collected from rich alluvial soils along streams. Although it ranges from eastern Oklahoma to the Atlantic seaboard, it is most prominent in the lower Mississippi Valley from northern Missouri to Louisiana.

There was some variation within this group, mainly in size, and probably mostly attributable to environmental conditions. However, *C. virginica* was far more constant than *C. erecta* and did not warrant subdivision.

(4) *COMMELINA COMMUNIS* Linnaeus, Species Plantarum 1: 40 1753. (Fig. 10)

C. Wildenowii Kunth, Enum. Pl. 4: 37. 1843.

Plant an annual, with fibrous root system; shoot erect at first, becoming prostrate and spreading out due to later profuse branching, longer internodes vary from 60 mm. on some plants to 160 mm. on others; stem between 1 and 4 mm. in diameter; leaves broadly lanceolate, smooth on lower surface, scabrous on upper surface, larger leaves 15–40 mm. wide, 50–120 mm. long with throat of sheath either with or without pubescence; spathes glabrous to very slightly pubescent, if pubescent, long white hairs are very sparsely scattered over spathe (similar situation on upper surface of leaves), larger spathes 20–30 mm. long, 8–13 mm. high, spathes open across top and down the side to the spathe stalk, spathe tapers to a blunt tip on abaxial end, bottom of spathe forms a straight line, while top is curved, spathe stalks 10–70 mm. long.

Type locality: "America," (Linnaeus).

Herbarium specimens cited: Missouri: Cooper Co. "Moniteau Creek, 8 mi. SE of Bunceton," Steyermark 21654 (1938) F. Pennsylvania: Allegheny Co. "Pittsburgh," Dubois 332 (1937) UC.

Distribution: (Fig. 15) *Commelina communis* ranges farther north than any other species of *Commelina*. Its western limit lies along a line from South Dakota to Texas. It ranges from there east to the Atlantic Ocean. Although it is found in the northern part of the Gulf states with the exception of Florida, its southern boundary is a line about two hundred miles south of the Gulf of Mexico.

Commelina communis according to Pennell (1916) was native to eastern Asia and had been introduced into the United States, since the record of Linnaeus' collection of it in America was published in 1753. The present author feels that Pennell's statement of origin was probably correct, since it is apparently restricted to disturbed areas within the United States. Geographically, however, it has become as widespread as most of the native species.

Pennell (1938) subdivided *C. communis* L. into as many as four varieties, basing this mainly on different shades of the blue color of the petals, petal size, and degrees of pubescence of different parts of the plant. This work was done mostly on the basis of living material. On only a few of the better herbarium specimens can such characters be dealt with and then with much difficulty. Without at least some living representatives of each of such groups to use as a guide, the author feels it better not to deal with such characters.

Commelina communis most closely resembles *C. diffusa*, another annual. The habits of the two species are similar, the opening of the spathe, the shape of the leaves, the type of branching are very close. Usually *C. communis* has larger leaves and spathes and a larger over-all size. The size of the leaves and spathes, as well as the shape of the spathe, were the most noticeable characters that distinguished the two species. Occasionally, plants were noted that were difficult, upon a superficial examination, to place in the proper species. It was felt by the author that these two species were more closely related than any of the perennial species in the United States.

(5) COMMELINA DIFFUSA Burm. f., Fl. Ind. 18, t. 7 f. 2. 1768. (Fig. 11)

C. caroliniana Walt., Fl. Carol. p. 68. 1788.

C. longicaulis Jacq., Coll. 3: 234. 1789.

C. pacifica Vahl. Enum. 2: 168. 1806.

C. cespitosa Roxb., F. Ind. 1: 178. 1820.

C. ochreatea Schauer, Nova Acta Acad. Leop.-Carol. Nat. Cur. 19: Suppl. 1: 447. 1843.

Plant an annual with fibrous root system; plant at first erect, later becoming decumbent with profuse branching and layering, larger internodes 3-10 cm. long; stem diameter seldom greater than 1.5 mm., usually less than



Fig. 1-6. Members of the genus *Commelina* within the United States.—Fig. 1. *Commelina erecta* L. var. *deamiana* Fern.;—Fig. 2. *Commelina erecta* L. var. *angustifolia* (Michx.) Fern. f. *crispa* (Wooton) Fern.;—Fig. 3. *Commelina erecta* L. var. *angustifolia* (Michx.) Fern. f. *hampilia* (Wright) comb. nov.;—Fig. 4. *Commelina erecta* L. var. *angustifolia* (Michx.) Fern. f. *angustifolia*;—Fig. 5. *Commelina erecta* L. var. *erecta* f. *intercourse* Fern.;—Fig. 6. *Commelina erecta* L. var. *erecta* f. *erecta*.

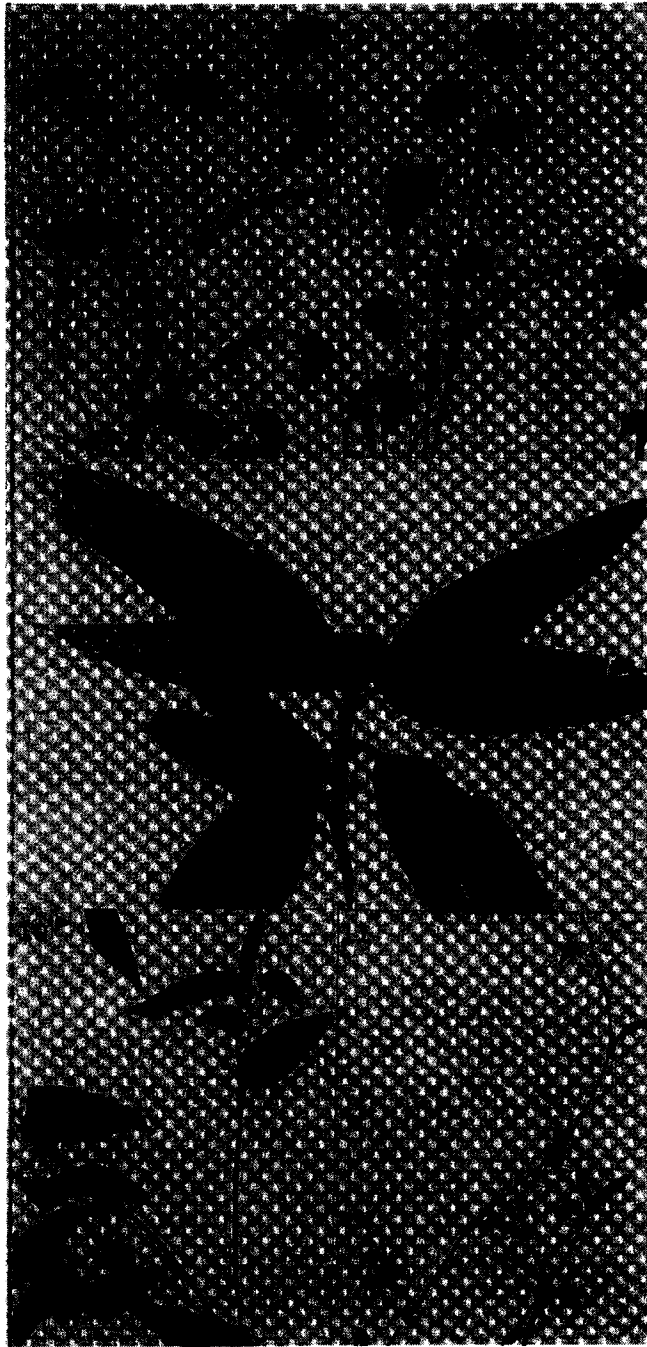


Fig. 7-11. Members of the genus *Commelina* within the United States.—Fig. 7. *Commelina dianthifolia* Del. in Red. var. *longispatha* (Torr.) comb. nov.;—Fig. 8. *Commelina dianthifolia* Del. in Red. var. *dianthifolia*;—Fig. 9. *Commelina virginica* L.;—Fig. 10. *Commelina communis* L.;—Fig. 11. *Commelina diffusa* Burm. f.

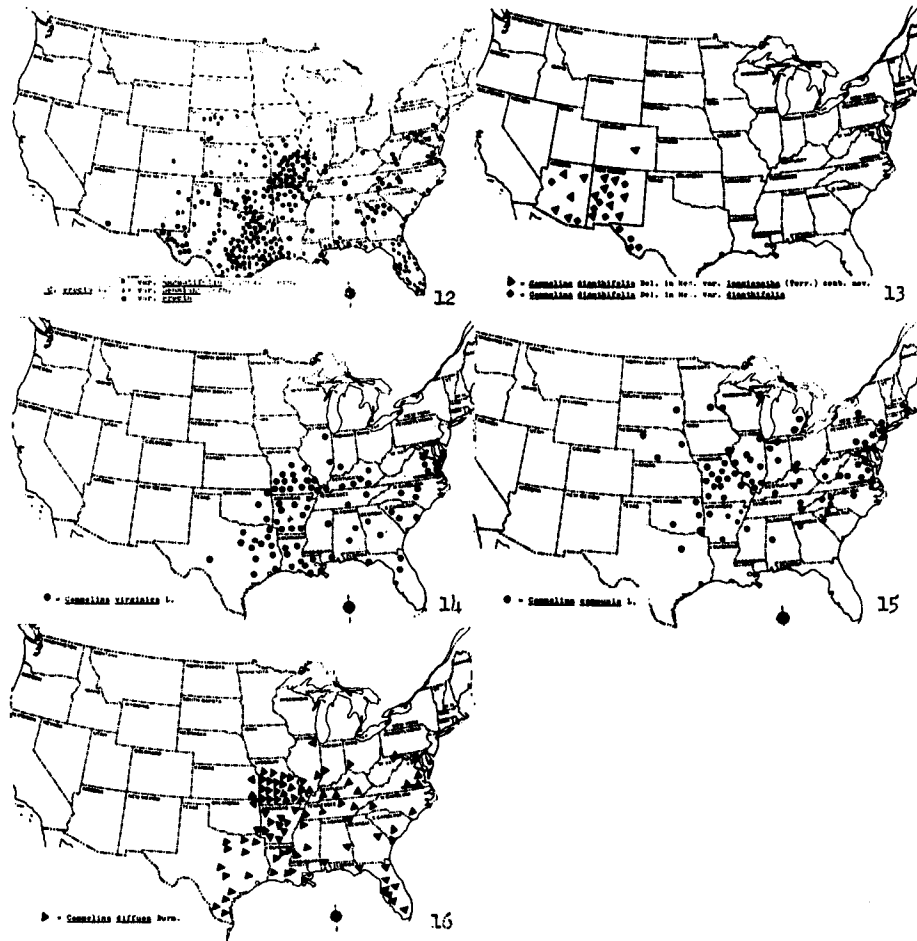


Fig. 12-16. The distribution of the species and varieties of *Commelina* within the U. S.—Fig. 12. *C. erecta* L.: ■ = *C. erecta* L. var. *angustifolia* (Michx.) Fern.; ► = *C. erecta* L. var. *deamiana* Fern.; ● = *C. erecta* L. var. *erecta*.—Fig. 13. *C. dianthifolia* Del. in Red.: ► = *C. dianthifolia* Del. in Red. var. *longispatha* (Torr.) comb. nov.; ◆ = *C. dianthifolia* Del. in Red. var. *dianthifolia*.—Fig. 14. ● = *C. virginica* L.—Fig. 15. ● = *C. communis* L.—Fig. 16. ► = *C. diffusa* Burm.

1 mm.; leaves broadly lanceolate, glabrous beneath, glabrous to slightly scabrous above, larger leaves on plant usually 9–15 mm. wide, and 35–70 mm. long; some leaves, however, grow as large as 22 mm. in width and up to 110 mm. in length, leaf sheaths 5–10 mm. long; leaf sheath throats usually lined with long white hairs, but may have only very short ones; spathe stalk usually 10–20 mm. long, spathe open across top, tapering to a slightly attenuated tip at the abaxial end and open down adaxial side to point of attachment of the spathe stalk, bottom of spathe usually decurved at the tip, spathe glabrous.

Type locality: India.

Herbarium specimens cited: Florida: Dade Co. "Field NW of 79th St. and 30th Ave., Miami," Jarish 599 (1948) MO. Missouri: Barry Co. "Eagle Rock," Bush 356 (1896) MO.

Distribution: (Fig. 16) In North America this species is limited to the southeastern one-third of the United States. The eastern parts of Texas, Oklahoma, and Kansas are its western limit. It ranges east from here through Missouri and Illinois to the Atlantic Ocean and south to the Gulf of Mexico.

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