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# CRITICAL TAXA IN *CRATAEGUS* SERIES *MOLLES* (ROSACEAE): TYPIFICATIONS, NEW COMBINATIONS, AND TAXONOMIC REVIEW

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## ABSTRACT

Ten specific or varietal epithets attributed to *Crataegus* series *Molles* are typified or their types commented on. Those typified are *C. arkansana* Sargent, *C. brazoria* Sargent, *C. canadensis* Sargent, *C. coccinea* L. var. *mollis* Torrey & Gray, *C. gravida* Beadle, *C. lanuginosa* Sargent, *C. meridionalis* Sargent, *C. mollis* (Torrey & Gray) Scheele var. *incisifolia* Kruschke, and *C. submollis* Sargent. There is also a minor issue with the type of *Crataegus texana* Buckley, which is commented on. The new combinations **Crataegus mollis** var. **meridionalis** *and* **C. texana** var. **dasyphylla** are made. This is followed by a taxonomic review of ser. *Molles* with emphasis on the 20-stamen taxa.

**KEY WORDS**: *Crataegus* (Rosaceae) series *Molles*, typifications, taxonomic review, *Crataegus arkansana* Sargent, *C. brazoria* Sargent, *C. canadensis* Sargent, *C. coccinea* L. var. *mollis* Torrey & Gray, *C. dasyphylla*, *C. gravida* Beadle, *C. lanuginosa* Sargent, *C. meridionalis* Sargent, *C. mollis* (Torrey & Gray) Scheele, *C. mollis* var. *incisifolia* Kruschke, *C. submollis* Sargent, *C. texana* Buckley, new combinations, *Crataegus mollis* var. *meridionalis* (Sargent) J.B. Phipps, and *C. texana* var. *dasyphylla* (Sargent) J.B. Phipps

Numerous species in *Crataegus* series *Molles* (Sargent ex C.K. Schneider) Rehder were described around a century ago, primarily by Sargent and Ashe and the relevant epithets were collated by Palmer (1925). Many of these names have never been typified and the present paper rectifies this for most of the critical names. I also present a brief review of the taxa accepted with particular attention to the 20-stamen species *C. mollis*, *C. texana*, and *C. brazoria* in order to support the author's forthcoming treatment of *Crataegus* in Flora of North America, Vol. 9. Questions related to the predominantly northern, 10-stamen taxa will be addressed in another paper.

Typification problems are legion and are characteristic of a period when botanists were feeling their way to the more precise notions of holotype and isotype. As most of the names are by Sargent, some familiar issues of interpretation were encountered. For instance, notations of 'type' may be repeated on different specimens, thus they do not automatically imply a holotype. This may even be so when the word 'type' in the protologue is explicitly placed next to a particular date and collection number because duplicates may exist. Likewise the protologue may be ambiguous as to whether a single specimen or 'type tree' is being cited. It is therefore helpful to understand that Sargent's, Beadle's, and even Kruschke's view of 'type' is commonly that of the 'type tree.' In such cases Sargent and his collectors, such as B.F. Bush, often gave the type tree a number separate from the collection number (which varied with date and collector) and this 'type tree' number may be used by various collectors on different dates when collecting from a single marked tree. Beadle, however, usually used different field numbers for collections on different dates and designated 'co-types' commonly from the same tree, while Kruschke used one collection number for all collections of whatever date from the type tree. Label data must be interpreted with this in mind. The type tree concept is very helpful in interpreting these author's taxa, though in the case of Sargent one does need to be aware of occasional apparent discrepancies among specimens having the same number. As

well, Sargent's rather notorious apparent carelessness in citing specimens in the protologue (alternatively viewed as errors in the label) can result in probable syntypes with some element at variance cited with protologue. In addition, there may sometimes be considerable variation among different syntypes, as in *Crataegus gravida* Beadle in this paper. Sargent's protologues are usually more detailed than Beadle's.

A different problem confronting taxonomists of North American *Crataegus* is the difficulty of being absolutely sure of the application of a name, because specimens collected only at one season may not be adequately diagnostic. For this reason, in some cases I designate an epitype collected at another season. The ability to do this is, in fact, aided by the 'type tree' practice as it provides a high level of confidence that flowering and fruiting specimens match.

## ILLUSTRATIONS

This account illustrates all the 20-stamen taxa mentioned plus *Crataegus submollis* and *C. canadensis*. The source materials are herbarium specimens, most of which have been seen by the author. The sources of images are Harvard University (A and GH), Philadelphia Academy of Sciences (PH), Missouri Botanic Garden (MO/Tropicos), New York Botanic Garden (NY), and Royal Ontario Museum (TRT). It should be noted that sometimes only partial sheets are illustrated and thus label data may be omitted from the figures. In such cases, elements are selected are those that are in better condition, that are more typical or to avoid repetition. In doing so composites (from the same sheet) have been created to generate more visually helpful images.

## TYPE DESIGNATIONS

Type designations are arranged alphabetically by species.

**Crataegus arkansana** Sargent, Bot. Gaz. 31: 223. 1901. **LECTOTYPE** (designated here): **USA**. **Massachusetts**. Jamaica Plain (cult.), 18 May1900, *C.S. Sargent* 482-2* (A barcode 18257). Figure 1.

Comment. The lectotype is an entirely characteristic, richly flowering, cultivated specimen of the *C. mollis* group with distinctively shaped leaves. It is selected from the syntypes because of its high quality and similarity to the protologue, critically in leaf shape. The lectotype lacks the seed provenance data on the label but I am assured by J. Damery at the Arnold Aboretum (pers. comm.) that the collection number 482-2 does match one for a Letterman specimen of 1883 Arkansas provenance. On the other hand, the fruiting syntype (MASS, cult., *collector unnamed 4177*, 8.xi.1898, A barcode 18256), although possessing seed provenance data (annotation "from seed lot 484.2 collected by G.W. Letterman, Newport, [Jackson Co.] Ark, in 1883") was rejected as lectotype because it appeared sufficiently different in leaf shape characters, particularly in the lobing, and this casts doubt on it being from the same seed accession. Comparison with Faxon's illustration (tab. 660 in Sargent, 1902) emphasizes this. It is also worth noting that the description of leaf shape in the Silva differs slightly from that in the protologue. Also, according to Damery, 484.2 is not a possible number for a Letterman 1883 Arkansas accession.

*Crataegus arkansana* as interpreted here has leaves of an unusual shape for the 20-stamen, ivory-anthered forms of the *C. mollis* complex, these being of a +/- narrow-ovate to ovate form with cuneate bases and having relatively deep and sharp lobes. However, they are somewhat like var. *incisifolia*. Jennifer Ogle (pers. comm.) was not able to turn up any unambiguous *arkansana* types from the holdings at UARK. Recent material from Arkansas, or elsewhere, for that matter, matching the lectotype would therefore be welcome.

*The label is in Sargent's handwriting but no collector is named, therefore there has to be some doubt as to whether he was the collector.

**Crataegus brazoria** Sargent, Bot. Gaz. 31: 233. 1901. **LECTOTYPE** (designated here): **USA**. **Texas**. Brazoria Co.: Columbia, 25 Mar 1900, *Wm. Canby, C.S. Sargent, Wm. Trelease 102* ("C.n. 3") (DOV 4899; isolectotype: GH 21409). Also on same sheet is *B.F. Bush 911* (tree 3) 25 Sep 1901, DOV 4898, with packaged fruit (latter absent from 'photoshopped' image). Figure 2.

Comment. The lectotype is an extremely fine specimen with elliptic leaves, sharp marginal teeth and acute lobes reduced to apiculi. It is in full flower and has conspicuous bracteoles. Sargent said that only one tree was known, presumably 'tree 3', found on most syntype labels. The isolectotype at Harvard is credited only to Sargent. There is also a vegetative Bush specimen at A (*B.F. Bush 170*, 27 Mar1900).

**Crataegus canadensis** Sargent, Bot. Gaz. 31:7. 1901. **LECTOTYPE** (designated here): **CANADA**: **Quebec**. Chateauguay, 29 May 1887, *J.G. Jack 79* (A18297). Figure 3.

Comment. A flowering specimen was selected for lectotype that clearly showed 20 stamens when imaged. *Crataegus canadensis* has many syntypes.

**Crataegus dasyphylla** Sargent, Ann. Rep. Missouri Bot. Gdn. 22: 80. 1911. **LECTOTYPE**: designated in Phipps et al. (2007). Figure 4.

**Crataegus dumetosa** Sargent, Ann. Rep. Missouri Bot. Gdn. 19: 109. 1908. **LECTOTYPE**: designated in Phipps et al. (2007). Figure 5.

**Crataegus gravida** Beadle, Biltmore Bot. Stud. 1(2): 119. 1902 [30 Apr]. **LECTOTYPE** (designated here): **USA**. **Tennessee**. Davidson Co.: Nashville, flowering specimen, no date but Beadle says 'early May' in protologue, *T.G. Harbison 2142* (A). Possible isolectotype: US 97593, but see comment. Figure 6.

Comment. The lectotype at A (label in Beadle's hand) and the putative syntypes, H2142 and H2736 at US (both on the same sheet), are sufficiently dissimilar as to appear to be from different entities. However, one cannot be sure of this and H2142 at both A and US have the rather small (ca. 15 mm) flowers for the species. Beadle described the leaf margins as 'shallowly incised' which seems a truer reflection of the US specimens though I do not understand his limit to 'shallow.' There are a number of specimens from this area at TRT and they lie between the extremes of the syntypes.

As I have observed it, a tallish *mollis*-group *Crataegus* with smallish (3—5 cm), quite strongly lobed short-shoot leaves, proportionately somewhat narrower than any of the type material but more like the A lectotype in lobing, appears to be a characteristic form of *C. mollis* in southeastern woodlands on limestone.

**Crataegus lanuginosa** Sargent, Trees & Shrubs 1(3): 113, plate 57. 1903. **LECTOTYPE**: designated in Phipps et al. (2007). Figure 7.

**Crataegus meridionalis** Sargent, J. Arnold Arbor. 1: 252. 1920. **LECTOTYPE** (designated here): **USA**. **Alabama**. Hale Co.: Gallion, 17 Apr 1915, *T.G. Harbison 11833* (TENN 3345a; isolectotype: A). Figures 8, 9.

Comment. A possible isotype is *T.G. Harbison 7* (A), same notes as lectotype, except with a tree number rather than a collection number. Also, there are two fruiting syntypes at A.

**Crataegus mollis** (Torrey & Gray) Scheele, Linnaea 21: 569. 1848. *Crataegus coccinea* Linnaeus ε *mollis* Torrey & A. Gray, Fl. N. Amer. 1: 465. 1840. **LECTOTYPE** (designated here): **USA**. **Ohio**. Hamilton Co.: Cincinnati, May, no year, *T.G. Lea s.n.* (NY 532807). Figure 10.

Comment. The lectotype contains a short flowering shoot plus a young extension shoot, plausibly from the same plant. Two syntypes have a mix of fruiting and vegetative shoots apparently also of *Crataegus mollis* but of a different leaf type from the lectotype. The flowering specimen is chosen as lectotype as it is the only specimen reliably referable to the current concept of *C. mollis* var. *mollis* (leaves with shallow subacute to obtuse lobes; ca. 20 stamens in undamaged flowers). The two syntypes, both *A. Clapp s.n.*, have label data "April 20 1839" and "21 May 1839" but are obviously late season and lack provenance.

**Crataegus mollis** var. **incisifolia** Kruschke ex J.B. Phipps, J. Bot. Res. Inst. Texas 1: 1012. 2007. **LECTOTYPE**: designated in Phipps (2007b). Figure 11.

Comment. Figure 11 is a composite from figs. 103-105 in Kruschke (1965), which show specimens made from the type tree at various growth stages. The shape of mature short-shoot leaves (Fig. 11c) is not unlike those of *Crataegus arkansana* (Fig. 1) but the latter lacks the deeply incised extension shoot leaves of the current variety.

**Crataegus submollis** Sargent, Bot. Gaz. 31: 7--9. 1901. **LECTOTYPE** (designated here): **USA**. **Maine**. Penobscot Co.: Orono, 27 May 1887, *M.L. Fernald s.n.* (GH 273975). Figures 12, 13.

Comment. The two flowering specimens on GH 273975 are very similar and display large leaves and flowers, very villous inflorescences, and large herbaceous bracteoles. Both GH fruiting syntypes, collected by J.G. Jack from Gerrish I., Maine, have the accrescent sepals characteristic of the series.

**Crataegus texana** Buckley, Proc. Acad. Nat. Sci. Philadelphia 1861: 454. 1862. **TYPE**: **USA**. **Texas**. Columbia Co.: along Brazos and Columbia Rivers, common, flowering specimen, without date, *S.B. Buckley s.n.* (holotype: part of PH 1020965). Figure 14.

Comment. Lance (2011) has called the holotype *Buckley 161* but this seems dubious as Buckley's little label has no number, nor is there a collection number in the protologue. In fact, the '161' is on a separate label supplied by Gideon Lincecum that comments on fruiting plants and notes that he has not seen the 'large red haw' in flower. Neither does Lincecum's note make any reference to Buckley's specimen. Although only a fragment, the type specimen displays a fine inflorescence at full anthesis surrounded by angular-lobed leaves. The leaf form of the *texana* holotype is quite common in south Texas and matches the prevailing concept of this important species. On the very crowded PH 1020965 sheet there are also two specimens of *Crataegus punctata* Jacquin plus a very large late summer leaf, shown in Fig. 14, possibly belonging to *C. brazoria*.

**Crataegus viburnifolia** Sargent, Trees and Shrubs 2: 145. 1911. **LECTOTYPE (**designated in Phipps 2007a): **USA**. **Texas**. Brazoria Co.: Columbia, *B.F. Bush & C.S. Sargent 11*, 23 Mar. 1909 (A). **EPITYPE** (designated here): **USA**. **Texas**. Brazoria Co.: Columbia, Sep 1909, *B.F. Bush 912 = tree 11*, 25. (A). Figure 15.

Comment. The diagnostic canary yellow color of the fruit is associated with the epitype.

## NEW COMBINATIONS

**Crataegus mollis** (Torrey & Gray) Scheele var. **meridionalis** (Sargent) J.B. Phipps, comb. et var. nov. *Crataegus meridionalis* Sargent, J. Arnold Arbor. 1: 252. 1920. **LECTOTYPE** (designated above): **USA**. **Alabama**. Hale Co.: Gallion, 17 Apr 1915, *T.G. Harbison 11833* (TENN 3345a; isolectotype: A). Figure 8, 9.

It should be noted that *Crataegus meridionalis* was not lectotypified by Lance (2011), so his combination is invalid. *Crataegus meridionalis* is a thorny local race of *C. mollis* of blackland soils which has slightly zigzag twigs, elliptic to narrow-ovate, shallowly but acutely lobed, strongly toothed leaves that are very tomentose abaxially at anthesis.

**Crataegus texana** Buckley var. **dasyphylla** (Sargent) J.B. Phipps, comb. et var. nov. *Crataegus dasyphylla* Sargent, Rep. (Annual) Missouri Bot. Gard. 22: 80. 1912. **LECTOTYPE (**designated in Phipps et al. 2007): **USA**. **Missouri**. Jasper Co.: Joplin, 23 Apr. 1909, *E.J. Palmer 34* (A). Figure 4.

*Crataegus dasyphylla* is an ovate-leaved, rose-anthered form. The leaves are shallowly and subacutely or sometimes obtusely lobed and white-tomentose abaxially at anthesis with long marginal teeth. This considerably extends the concept of the *C. texana* complex to include the other southwestern pink-anthered forms except for those of the *brazoria* complex.

## TAXONOMIC REVIEW

*Crataegus* ser. *Molles* is a coherent set of species with a wide range throughout the hawthorn–rich regions of North America to the east of the central Great Plains except for the southeastern piedmont and coastal plain. Series *Molles* are large hawthorns with large leaves, dense indumentum at least in the early stages (often densely white-villous even on the bracteoles), are early-flowering relative to their congeners, have large flowers, and at least the larger bracteoles are large, +/- herbaceous, green, and somewhat persistent. Fruit is commonly large, suborbicular, red, persistently hairy, and commonly with erecto-patent, accrescent sepals.

In the present view there are five species in the series. The primary focus of this review are the *Crataegus mollis* group (two species) and the *C. texana* group (three species), sometimes broadly treated as one species, e.g., Lance (2011), sometimes as several species as here and by Palmer (1950, 1952). They have in common eglandular petioles, 20 stamens, ivory or pink to red anthers, and are trans-Appalachian. They collectively have an extensive synonymy. The other two species are *C. submollis* and *C. pennsylvanica*. This pair have glandular petioles, 5-10 stamens, ivory or palest pink anthers and are nearly perfectly allopatric with the first group, occurring to the north and northeast of them (Wisconsin to Nova Scotia south to North Carolina). A local taxon with 10 stamens, *C. transmississippiensis*, will be evaluated later with the 10-stamen taxa.

I tend to place considerable weight on anther color (basically anthocyanic vs. non-anthocyanic) especially if it can be correlated with other characteristics, even distribution. This derives from discussions with the bee pollination expert, T. Laverty, now deceased, who pointed out the significance of color faithfulness in pollen gathering. This provides a plausible narrative, unfortunately still unchecked as so much else in the adaptive ecology of hawthorns. Anthocyanic anthers in series *Molles* are restricted to a region to the southwest of southern Missouri but non-anthocyanic anthers occur throughout. Other helpful characters in the series are leaf shape and size, thorniness, and in a special case, fruit color. Brilliant yellow fruit is restricted to a few counties of

southeastern Texas while a high level of thorniness, unusual in the eglandular–petiole *Molles*, and is predominantly Ozarkian and in the Gulf states.

## KEY TO TAXA

Occasional interserial hybrids with similarities to the following taxa may normally be distinguished by their lack of larger herbaceous bracteoles.

1. Pomes yellow, gold or orange; se Texas.

2. Most leaves +/- elliptic, not lobed, at maturity abaxially glabrous; anthers rose; pomes 8–10 mm diam. ..... 2. **Crataegus brazoria** (in part)
2. Most leaves +/- broad ovate, evidently lobed, at maturity abaxially rough-hairy; anthers ivory; pomes 15-20 mm diam. ..... 4. **Crataegus mollis** (in part)

1. Pomes reddish; range of series.

3. Stamens 5–10; northern or Ozarkian taxa.

4. Petioles eglandular; styles and nutlets 3–5; Ozarks, ? elsewhere ..... **Crataegus transmississippiensis**
4. Petioles +/- eglandular, at least when young; styles and nutlets 4–5; Great Lakes to Nova Scotia and Maine, south to Pennsylvania and Delaware, ? elsewhere.

5. Anthers white to cream, stamens ca. 10; 2-year-old thorns numerous, shiny black; leaves broadest about one third of the way from the base; usually a bush 5. *Crataegus submollis* (in part)
5. Anthers white to palest pink, stamens 5–10; 2-year-old thorns usually sparse to none, shiny brown; leaves usually broadest near base; commonly tree-like at maturity ..... 6. **Crataegus pennsylvanica**

3. Stamens 20; trans-Appalachian taxa (Minnesota to sw Ontario south to Texas to Alabama).

6. Anthers non-anthocyanic (white to cream).

7. Petioles eglandular ..... 4. **Crataegus mollis** (in part)
7. Petioles glandular ..... 5. **Crataegus submollis** (in part)

6. Anthers anthocyanic (pink to purple).

8. Mature leaf blades broad-ovate to +/- isodiametric, 4–5 cm, lobeless or with few shallow obtuse lobes per side, rather bluish at maturity; bushes 20–40 dm on drier sites (–80) dm, very thorny; sw Missouri, n Arkansas ..... 3. **Crataegus lanuginosa**
8. Mature leaf blades +/- ovate, 4–8 cm, deeply to shallowly 2–4 lobed per side, or +/- elliptic, unlobed or with 1–2 apiculi per side, green at maturity; bushes 40–80 dm, thorns none to few; Missouri to Texas.

9. Mature leaf blades +/-ovate, deeply to shallowly 2–4 lobed per side; Missouri to Texas ..... 1. **Crataegus texana**
9. Mature leaf blades +/- elliptic, 4--8 cm, unlobed or with 1–2 apiculi per side; sc and se Texas ..... 2. **Crataegus brazoria** (in part)

**1. Crataegus texana** Buckley

*Crataegus texana* is the principal pink- to red-anthered member of the series and ranges from southern Misssouri to southeastern Texas. Variation in leaf shape is considerable and may lead to reassessment of this taxonomy.

1. Leaves with 2–4 deep, +/- angular lobes per side ..... 1a. **C. texana var. texana**
1. Leaves with 1–2(–3) shallow, +/- obtuse to subacute lobes per side 1b**. C. texana var. dasyphylla**

**1a. C. texana** var. **texana (**Fig. 14)

This variety is common from the eastern Gulf coast of Texas inland along the I-35 corridor to about halfway to Dallas.

**1b. C. texana** var. **dasyphylla** (Sargent) J.B. Phipps (Fig. 4)

The distribution of this variety is still poorly known but it extends from at least southern Arkansas to southern Missouri. Very similar is *C. brachyphylla* Sargent, with only 3 styles and nutlets, but from dry hills in southwestern Arkansas

**2. Crataegus brazoria** Sargent (Fig. 2)

*Crataegus brazoria* has a similar range to *C. texana* var. *texana* but is maintained as a distinct species primarily on account of its distinct leaf shape and paucity of intermediates. The elliptic, barely lobed, acute-tipped leaves are very distinctive. The type form, which has not been seen in recent years, has bright yellow fruit and comes from the same area as *C. viburnifolia*. By far the most numerous, though unnamed, form has red fruit. The poorly understood, red-fruited *Crataegus dallasiana* may be the same as this. If the typical form is proven to be a hybrid with the *viburnifolia* form of *C. mollis*, which seems possible, the red-fruited from will require naming.

**3. Crataegus lanuginosa** Sargent (Fig. 7)

*Crataegus lanuginosa* comes from the Ozarks, a rich area of endemism for *Crataegus*, at least at the infra-specific level. It resembles *C. texana* var. *dasyphylla* in a general way but has smaller leaves, reported as bluish in summer, and is particularly thorny, an uncommon trait in the 20-stamen group. It occurs on dry hills in which a number of other Ozarkian hawthorn endemics are found.

**4. Crataegus mollis** (Torrey & Gray) Scheele

*Crataegus mollis* is treated as a wide-ranging and very variable species found from South Dakota and Minnesota, east to southwestern Ontario and northwest Pennsylvania thence south to Texas and Alabama. It is a basically a 20-stamen, eglandular-petioled, ivory-anthered species. A significant variant, var. *viburnifolia*, has yellow fruit, two of the varieties are markedly thorny while the whole complex has a considerable variety of leaf shape. *Crataegus transmississippiensis*, an Ozarkian form with 10 stamens, is much like some forms of *C. mollis* and will be evaluated in another paper.

1. Thorns on twigs of mature plants us. few to plentiful; twigs slightly flexuous; blades elliptic to oblong-ovate, lobes, if present, acute, shallow; Mississippi to Tennessee
..... 4e. **C. mollis var. meridionalis**
1. Thorns on twigs of mature plants us. sparse or none; twigs +/- straight or only irregularly or slightly flexuous; leaves +/- ovate to broad-elliptic, lobes, if present, obtuse to acute, shallow to deeper; throughout region of species.

2. Leaves with 4–6 sharp and deep lobes per side (max LII 20-40 %) 4c. **C. mollis** var. **incisifolia**
2. Leaves lobeless or with 2-4 +/- shallow, subacute to obtuse lobes per side (max LII 0-20%).

4. Fruit yellow; south Texas ..... 4d. **C. mollis var. viburnifolia**.
4. Fruit red; throughout.

5. Leaves with 2–4 subacute to obtuse distinct lobes per side, sinuses evident; throughout range of species except northern Minnesota and Manitoba ..... 4a. **C. mollis var. mollis**
5. Leaves with lobes lacking or obscure, sinuses lacking or shallow; n Arkansas to sw Missouri ..... 4b. **C. mollis var. dumetosa**

**4a. C. mollis var. mollis** Figure 10.

This variety is found almost throughout the range of the species. It is thornless to slightly thorny and has shallowly, subacutely to obtusely lobed leaves. *Crataegus gravida* (Fig. 6) is a woodland form from limestone hills in Tennesee and perhaps elsewhere. It is characterized by somewhat small, subacutely lobed leaves and small flowers (ca. 15 mm diam.). If better known it might warrant varietal recognition.

**4b. C. mollis** var. **dumetosa** (Sargent) Kruschke Figure 5.

This variety has unlobed to only slightly lobed leaves, is quite thorny, and is Ozarkian in range. It merges into var. *mollis*.

**4c. C. mollis** var. **incisifolia** Kruschke ex J.B. Phipps Figure 11.

Variety *incisifolia* has deeply and sharply lobed leaves and seems to have a wide distribution but is inadequately documented. The poorly understood *C. arkansana* (Fig. 1), described from cultivated material but lacking the deeply dissected extension shoot leaves of var. *incisifolia*, may well prove to be the same.

**4d. C. mollis** var. **viburnifolia** (Sargent) R.W. Lance Figure 15.
*Crataegus brazoria* var. *viburnifolia* (Sargent) J.B. Phipps

This variety is very similar to var. *mollis* but is restricted to southeast coastal Texas. It has canary-yellow fruit. Yellow-fruited forms with deeply lobed leaves and often slightly anthocyanic anthers are probable hybrids with *C. texana* var. *texana*.

**4e. C. mollis** var. **meridionalis** (Sargent) J.B. Phipps Figures 8, 9.

Variety *meridionali*s is found in several southeastern states on blackland soils. It is characterized by thorniness, somewhat zigzag twigs, and elliptic to narrow-ovate leaves rather chartaceous at maturity. The characteristic narrow leaves of the flowering lectotype show clearly in Fig. 8, but in the fruiting specimen (fig. 9) the leaves are broader.

**5. Crataegus submollis** Sargent Figures 12, 13.

*Crataegus submollis* is characterized by +/- glandular petioles, 10 stamens (except in a local Montreal form), ivory anthers, and a particularly thorny habit. There is some variation in leaf shape. The flowering lectotype (Fig. 12) has broad-based, sometimes subcordate leaves while the fruiting syntype (Fig. 13) has broad-cuneate to subtruncate leaf bases. *Crataegus canadensis*, the 20-stamen form, except for stamen number, is well within the range of variation of *C. submollis*, its leaf shape being very similar to the fruiting syntype (Fig. 13). *Crataegus submollis* has a large northeastern range presently documented as from Wisconsin to Nova Scotia south to northern Ohio and northern Pennsylvania and is particularly common on limestone.

**6. Crataegus pennsylvanica** Ashe

*Crataegus pennsylvanica* is broadly similar to *C. submollis*, differing as indicated in the key. It has a smaller and more southerly range than the latter species, being moderately common only in

southern Ontario, New York, and Pennsylvania and sporadic in Ohio, Delaware, and North Carolina. This species will be typified and illustrated in a forthcoming paper J.A. Macklin and myself.

**Crataegus transmississippiensis** Sargent

*Crataegus transmississippiensis*, an Ozarkian form with10 stamens, is much like some forms of *C. mollis* and will be evaluated in another paper.

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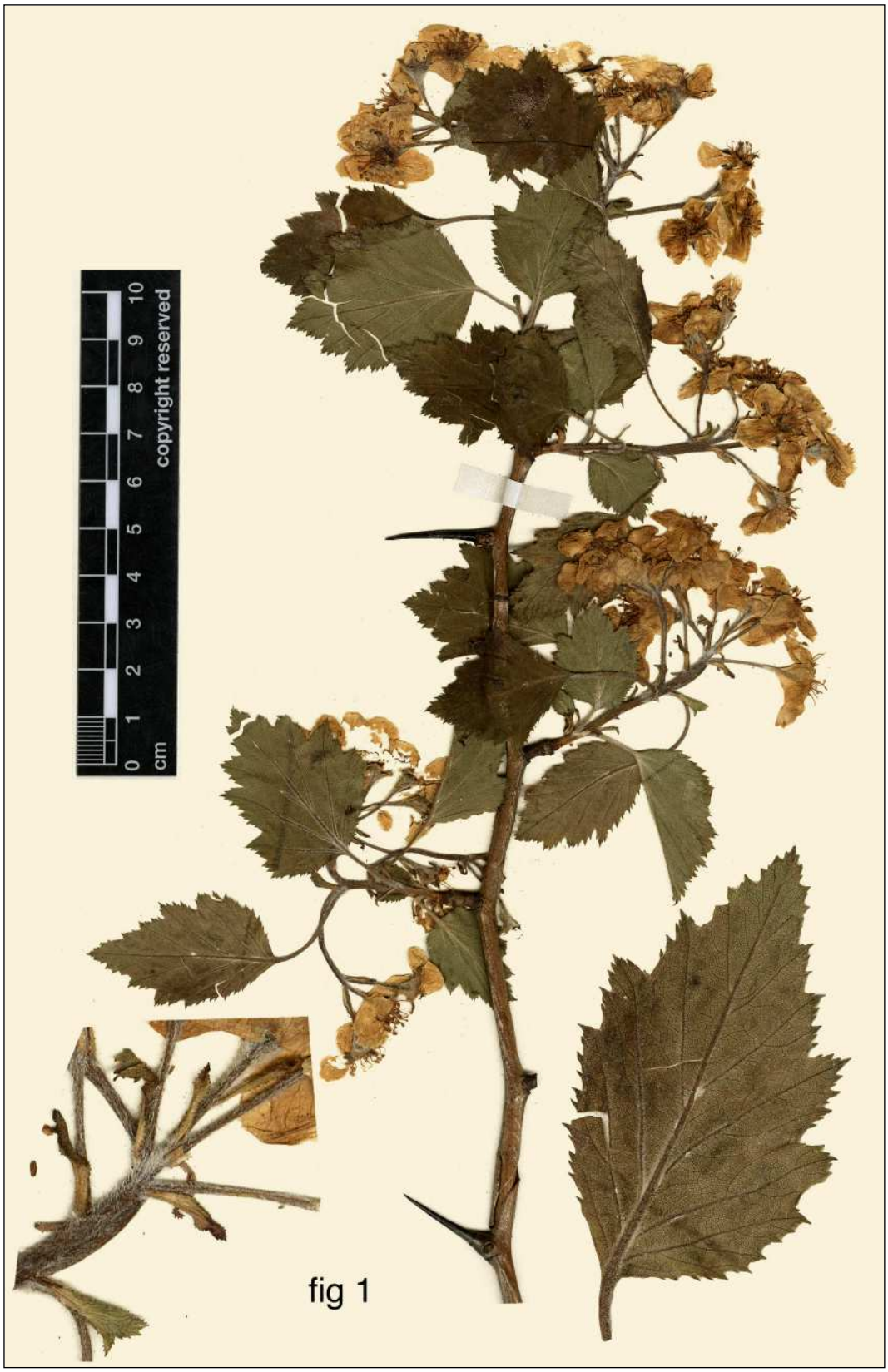


Figure 1. *Crataegus arkansana*. Flowering lectotype. Massachussets: Arnold Arboretum, cult., 18 May 1900, *C.S. Sargent(?) 482-2* (A barcode 18257).


Figure 2. *Crataegus brazoria.* Flowering isolectotype. Texas: Brazoria Co., Columbia, 25 Mar 1900, *Wm. Canby, C.S. Sargent, Wm. Trelease 102* (DOV 4899). There is also a sterile specimen on the same sheet.

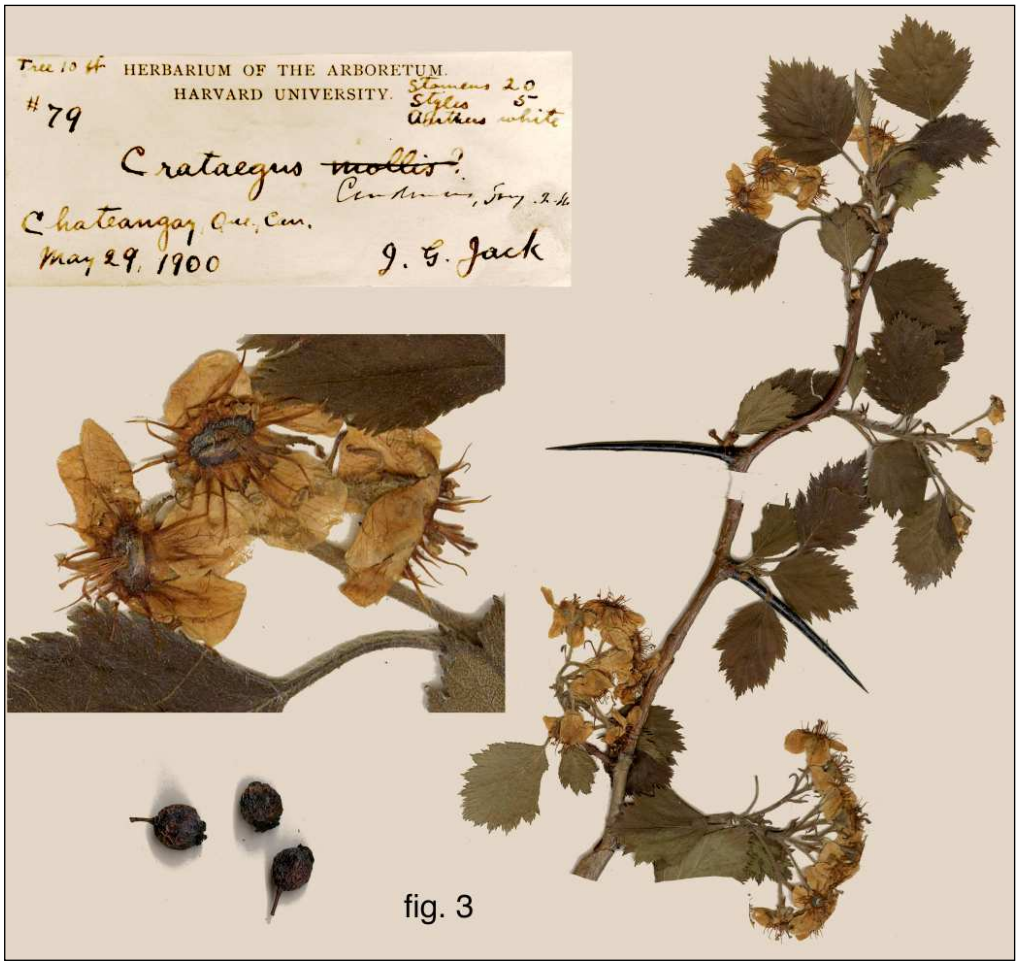


Figure 3. *Crataegus canadensis.* Flowering lectotype. Quebec: Chateauguay, 29 May 1900, *J.G. Jack 79* (A 18297).

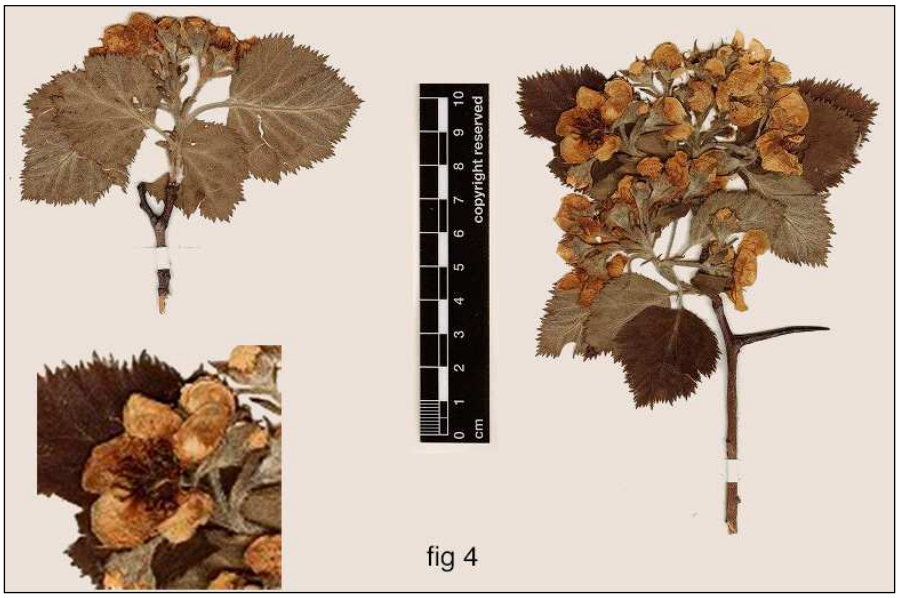


Figure 4. *Crataegus dasyphylla.* Flowering lectotype. Missouri: Jasper Co., 23 Apr 1909, *E.J. Palmer 34* (A 3132).

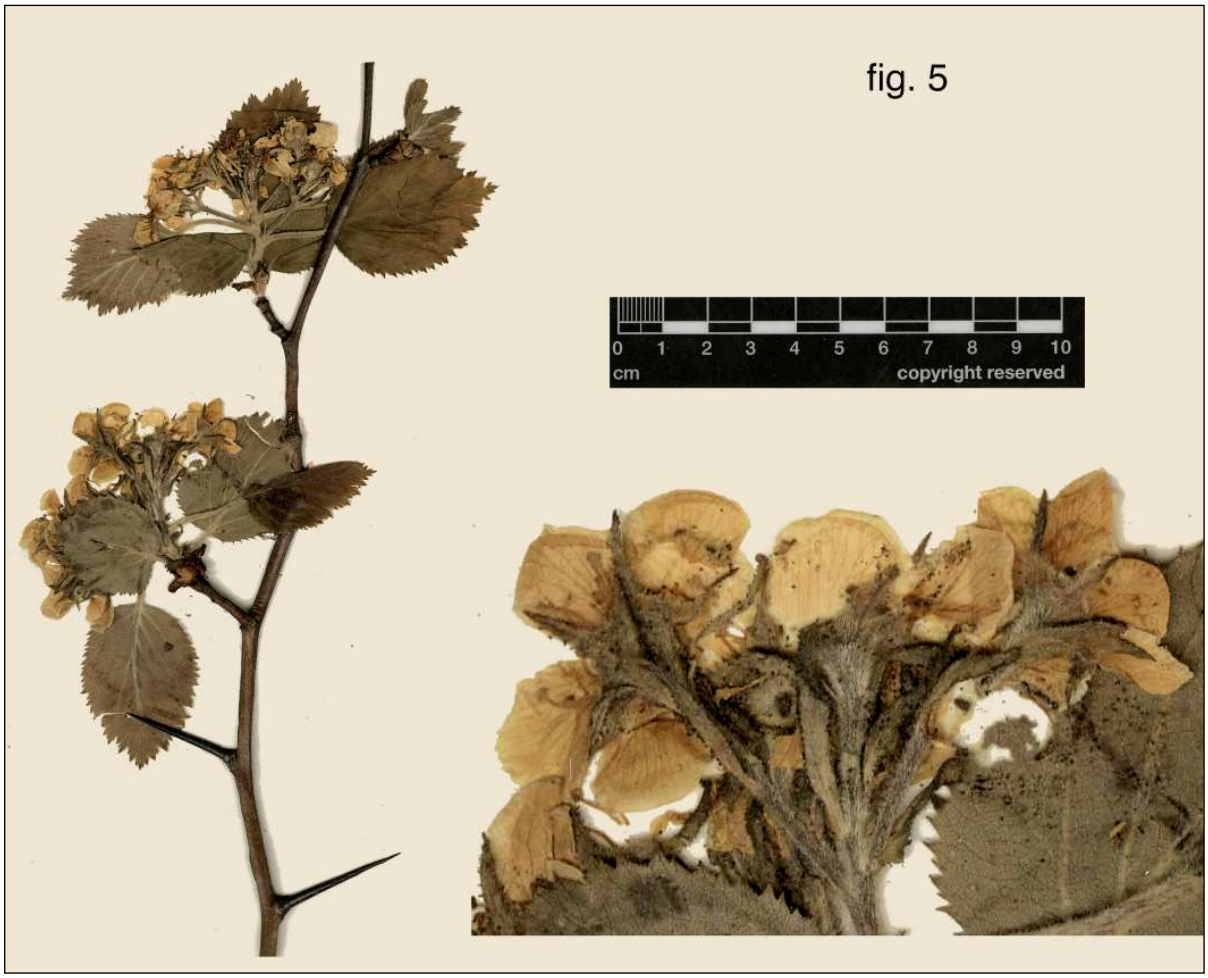


Figure 5. *Crataegus dumetosa.* Flowering lectotype. Missouri: Neck City, 31 Mar 1907, *Palmer 2* (A 16331).


Figure 6. *Crataegus gravida.* Flowering lectotype. Tennessee: Davidson Co., 'early May' no year, *T.G. Harbison 2142* (A 214400).


Figure 7. *Crataegus lanuginosa.* Fruiting syntype. Missouri: Jasper Co., nr. Webb City, *C.S. Sargent 4*, 2 Oct. 1901 (A16746). Flowering **?**syntype. Missouri: Jasper Co., nr. Carterville, 26 Apr 1903, *E.J. Palmer 1239* (MO 747738).


Figure 8. *Crataegus meridionalis.* Possible isolectotype. Alabama: Hale Co., 17 Apr 1915, *T.G. Harbison tree 7* (A 16920).


Figure 9. *Crataegus meridionalis.* Fruiting specimen. Alabama: Hale Co., 24 Sep 1999, *O'Kennon 14465 & Lance* (TRT).


Figure 10. *Crataegus coccinea* var. *mollis.* Flowering lectotype. Ohio: Hamilton Co., Cincinnati, May, no year, *T.G. Lea s.n.* (NY 532807).

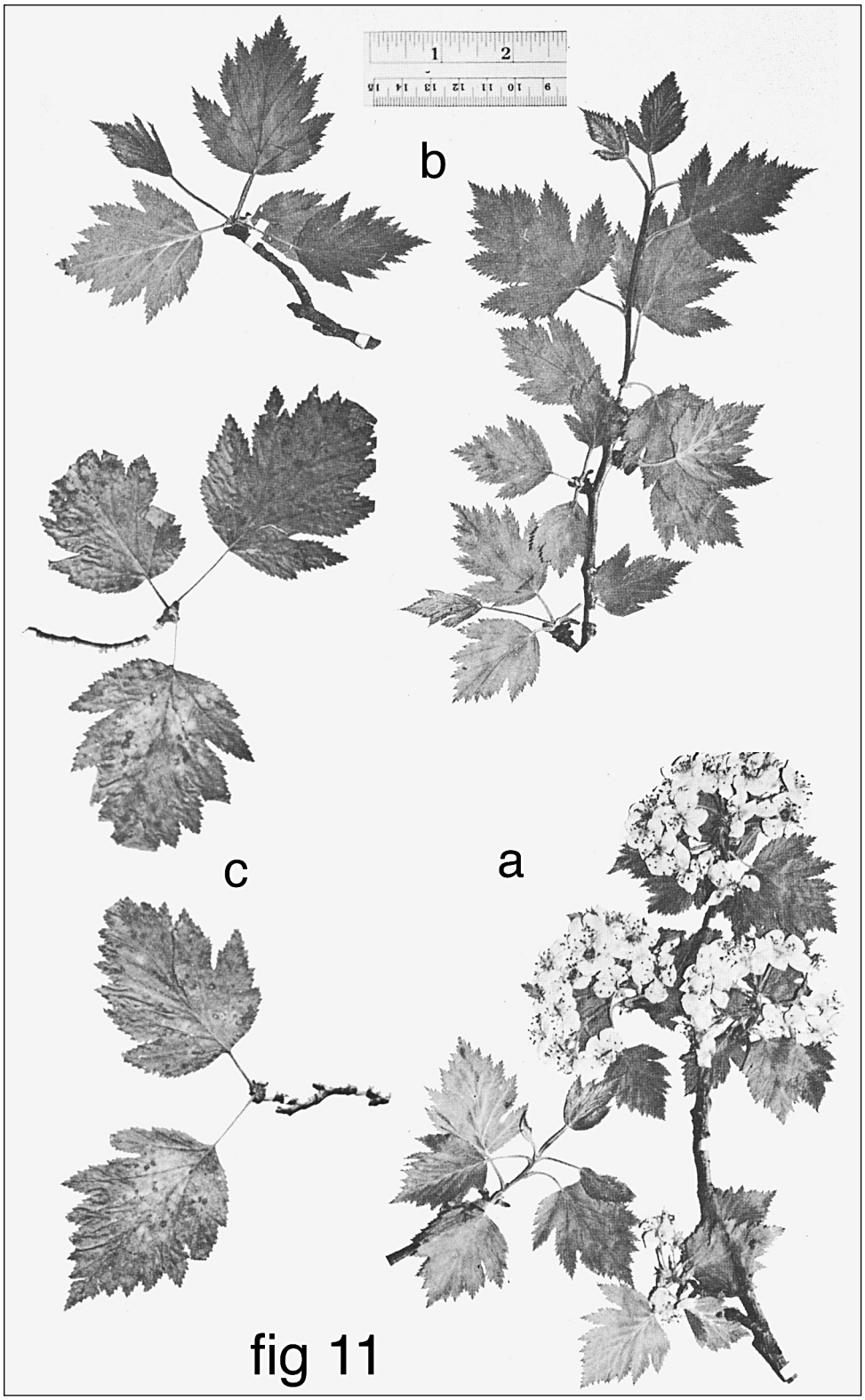


Figure 11. *Crataegus mollis* var. *incisifolia*.. Fragments from type tree (Wisconsin: Rock Co., *Kruschke K-47-8*). Collage from figs 103-105 in Kruschke (1965): (a) flowering specimen; (b) vegetative specimen at about anthesis; (c) mature short-shoot leaves (September).

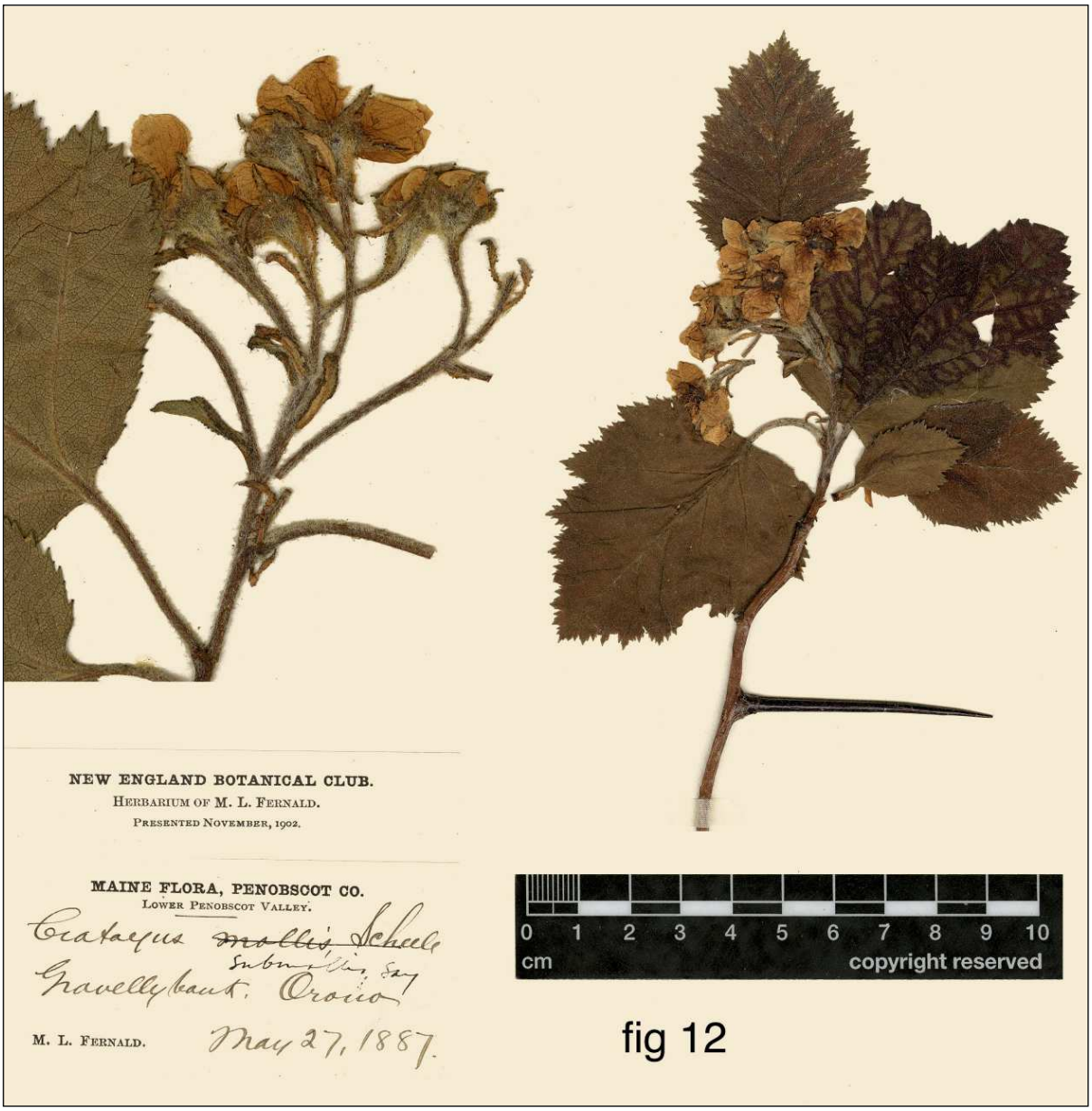


Figure 12. *Crataegus submollis.* Flowering lectotype. Maine: Penobscot Co., Orono, 27 May 1887 *M.L. Fernald s.n.* (GH 273975).


Figure 13. *Crataegus submollis.* Fruiting syntype. Maine: York Co., Gerrish I., 17 Sep 1899, *J.G. Jack 2* (A 58615).

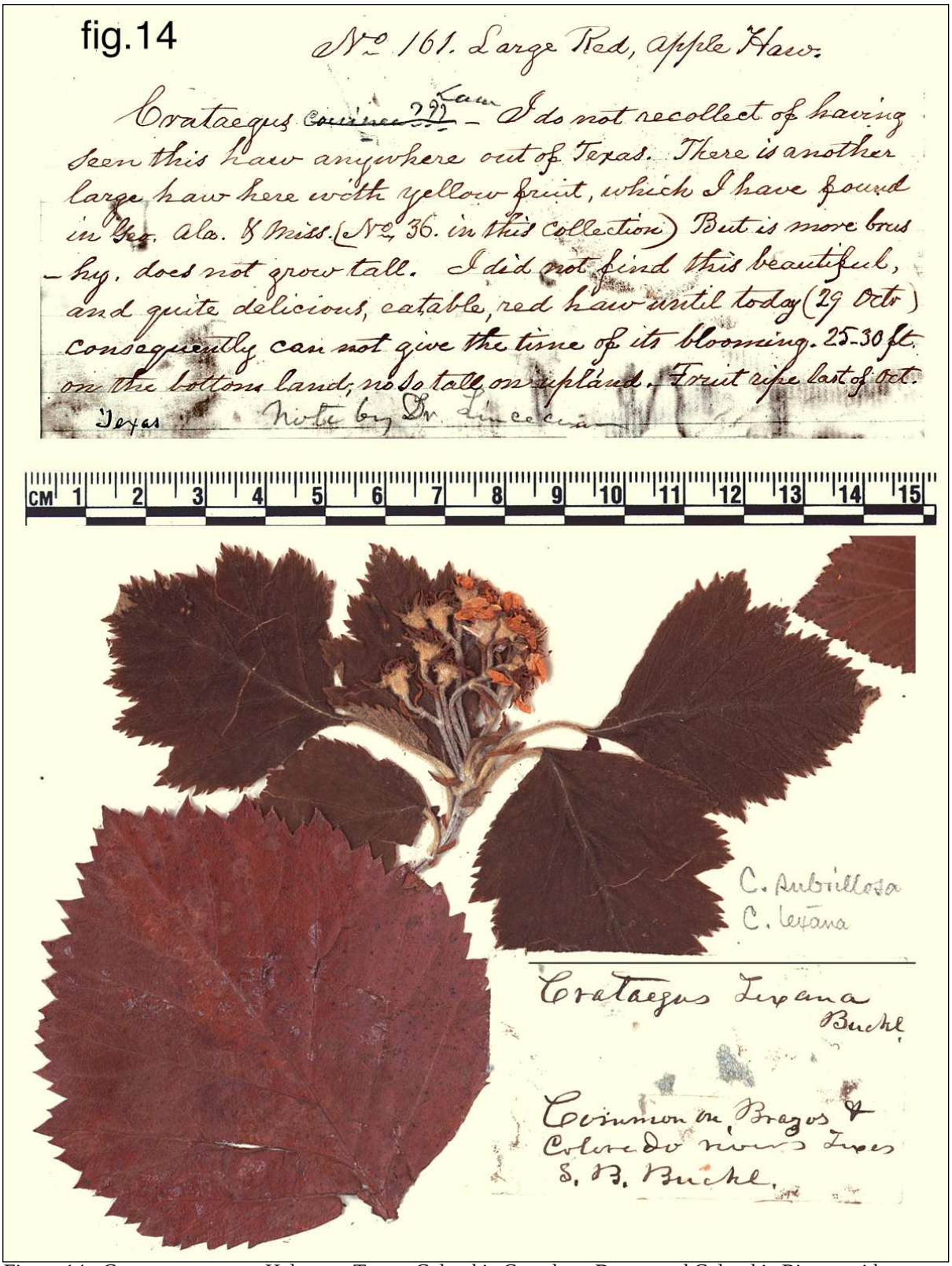


Figure 14. *Crataegus texana*. Holotype. Texas: Columbia Co., along Brazos and Columbia Rivers, without date, *S.B. Buckley s.n.*, flowering specimen (PH 1020965).

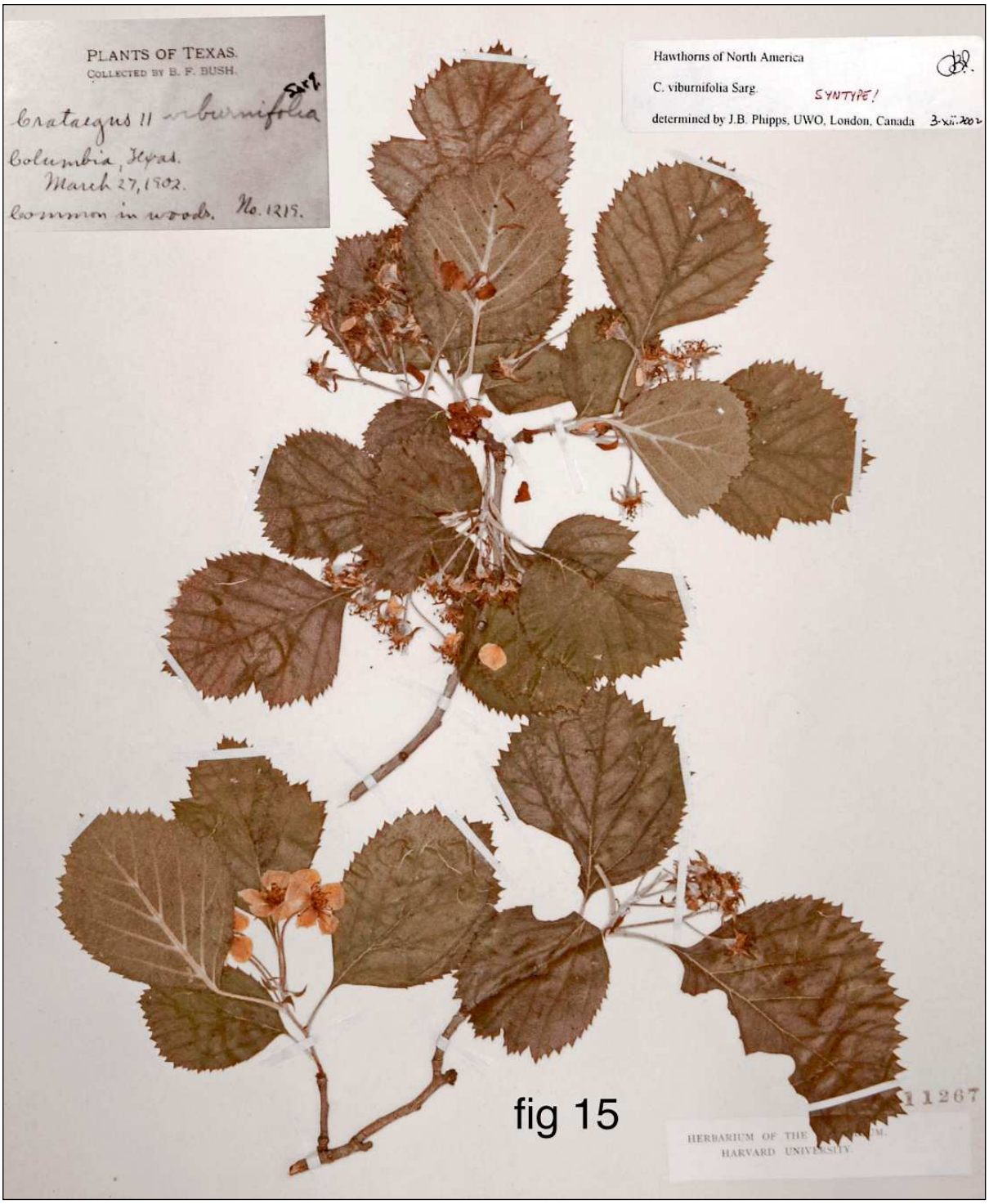


Figure 15. *Crataegus viburnifolia.* Flowering syntype. Texas: Brazoria Co., Columbia, 27 Mar 1902 *B.F. Bush 1219, tree11* (TRT, CM 245998).