THE TYPIFICATION OF *CROTALARIA ROTUNDIFOLIA* AND *CROTALARIA MARITIMA* (FABACEAE)

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ABSTRACT

Two species of *Crotalaria* (Fabaceae) native to the American Southeast have been confused in part because of the improper typification of *C. rotundifolia* Walter ex J.F. Gmel. and absence of a type for *C. maritima* Chapm.. A John Fraser specimen currently the neotype for *C. rotundifolia* is here demonstrated to be taxonomically different from the plant known to Thomas Walter, justifying the Fraser specimen be superceded by an appropriate neotype from South Carolina. A specimen from the type locality of *C. maritima* in southern Florida is here selected as neotype for that species.

RESUMEN

Dos especies de *Crotalaria* (Fabaceae) nativas al Sureste de América se han confundido en parte debido a la tipificación incorrecta de *C. rotundifolia* Walter ex J.F. Gmel. y a la ausencia de un tipo para la *C. maritima* Chapm. Un espécimen de John Fraser que es actualmente el neotipo para *C. rotundifolia* se demuestra aquí que es taxonómicamente diferente de la planta conocida por Thomas Walter, justificando que el espécimen de Fraser sea reemplazado por un neotipo apropiado de Carolina del Sur. Un espécimen del lugar tipo de *C. maritima* en el Sur de Florida se selecciona aquí como neotipo para esta especie.

Crotalaria (Fabaceae), section *Alatae*, is represented in the southeastern United States by six species (Windler 1974; Ward 2009). Two taxa in this complex—*C. rotundifolia* Walter ex J.F. Gmel. (1792), and *C. maritima* Chapm. (1878)—have been variously interpreted as one undivided species (Isely 1990; Wunderlin & Hansen 2003), one species of two varieties (Windler 1974; Duncan & Kartesz 1981), or two species (Small 1933; Senn 1939; Ward 2009). Though the variability and occasional intermediacy of individuals of these taxa is obvious, recognition of their populations as worthy of specific status has been hindered by the absence of type specimens that adequately represent their morphology.

The cornerstone of stability in the linkage between a plant and its scientific name is the existence of a single specimen to which each name is permanently fixed. This single specimen—the type—permits later investigators to know with exactness the form of the plant on which the original author based the new name. But an author does not always select a type, or the type may become lost through misfortune, or the type may in one way or another be found to be unrepresentative of the author's original concept. Wherever ambiguity is caused by a missing or defective type, it is helpful to future studies of the characteristics and classification of the plant that a type be determined or a defective type be corrected. The *International Code of Botanical Nomenclature* (McNeill et al. 2006) dictates the rules that govern such selection or correction.

Crotalaria rotundifolia is a familiar name but a poorly understood species. It has been mapped by Windler (1974, as his var. *vulgaris*) as extending from southeastern Virginia, south to central peninsular Florida, and west to southeastern Louisiana. *Crotalaria maritima* was mapped by Windler (1974, as his var. *rotundifolia*) as ranging from southeastern Georgia (one undocumented dot in South Carolina), to southernmost Florida, and sparingly west to southeastern Louisiana. Though these ranges greatly overlap and need adjustment where herbarium materials poorly represent the two entities, Windler's maps well demonstrate that on balance *C. rotundifolia* is northern, while *C. maritima* is significantly more southern.

The present task is to establish types that will assist in separation of the two taxa. No effort is made here to justify this separation; that analysis must await greater understanding of the gross morphology, chromosome counts, DNA morphotypes, and differences in habitat preferences. Though the more southern

population, *Crotalaria maritima*, requires for its typification only selection of a neotype, the more northern population, *C. rotundifolia*, has a record of misinterpretation of its type that can be resolved only by a full review of its taxonomic and nomenclatural history.

REPLACEMENT NEOTYPE FOR *CROTALARIA ROTUNDIFOLIA*

Crotalaria rotundifolia, the more northern of the two taxa, was the second species (to *C. sagittalis* L., 1753) of this group to be recognized. The plant was first described by Thomas Walter (1788), using the name *Anonymous rotundifolia*, an impermissible combination (Ward 1962, 2007a; Wilbur 1962). [Walter's use of *Anonymos* has been proscribed (Art. 20.4).] Four years later J.F. Gmelin (1792) validated Walter's epithet, as *Crotalaria rotundifolia*. Gmelin was merely assigning Walter's plant to a familiar Linnaean genus, *Crotalaria*, and his specific description was a restructured and shortened version of the description provided by Walter. *Crotalaria rotundifolia* J.F. Gmel. was thus based on *Anonymos rotundifolia* Walter and whatever materials Walter may have seen and used. [To reflect this origin, authorship of the legitimate name is often cited "Walter ex Gmelin."]

Walter, a plantation owner in rural South Carolina, with no means of long-term dried-plant preservation and surrounded by an abundance of fresh materials, kept no specimens that can now be termed types (Ward 2007b). A folio herbarium at the Natural History Museum, London (BM), gathered by John Fraser, the Scottish plant explorer, contains a specimen of a small *Crotalaria*. The folio was photographed in 1946 by B. G. Schubert and the specimen was believed by M. L. Fernald to be Walter's "type" of *Anonymos rotundifolia* (Fernald & Schubert 1948). Later authors (Ward 1962; Wilbur 1962; Windler 1974) accepted this judgment. Though Fernald used only the term "type," his usage suggests the more precise term "holotype." But since (as described below) Walter could not have based his description on this Fraser specimen, the type designation has been corrected to "neotype," as authorized by the *Code*, Art. 9.8 (Ward 2007a).

The origin and content of the Fraser folio (best termed the Fraser/Walter herbarium) has been studied in detail (Ward 2006). Fraser was in the American Southeast only briefly, with opportunity to collect only during 1787. He gathered plant materials with enthusiasm but with little proficiency; Andre Michaux, who met and briefly traveled with him, spoke disparagingly of Fraser's botanical skills (Ward 2007b). Even so, Fraser returned to England with a collection of 690 mostly small, sometimes fragmentary, specimens from South Carolina and Georgia. Fraser also carried with him Walter's manuscript of the pioneer *Flora Caroliniana* (1788), for publication in London.

Before Fraser returned to England, Walter had opportunity to see and perhaps study Fraser's specimens. Attached slips indicate the specimens had not been named when seen by him (though many bore three-digit numbers assigned by Fraser). Walter's handwriting is now present on 368 of the surviving slips, with 345 representing his identifications and the remainder being his various comments and observations (Ward 2007b). [Fraser's hand is borne by only 230 slips, many merely his assignment of a Walter epithet to a specimen identified by Walter only to genus.]

The specimen that has been believed to be Walter's "type" is now numbered 67-D (Ward 2006). Its photograph has been published (Fernald & Schubert 1948, plate 1107 - an image described as "quite horrible" by John Lewis). A similarly poor image is available on commercial microfiches of the entire herbarium, and a digital image of better quality has been made available by the Museum. [None of these images is sufficient to show pubescence, a critical feature.] The specimen was examined in the 1890s by Britten & Baker (1897), in August 1962 by John Lewis (BM) at the request of the present writer, again in the 1970s by Norman Robson (BM) at the request of Windler (1974: 189), and yet again in July 1984 by the present writer.

Specimen 67-D (BM) is small, but not unrepresentative either of the Fraser specimens or the species itself, consisting of a stem with six branches, perhaps 25 leaves, two crumpled flowers, and a single pod. Its leaves are broadly elliptic to ovate or obovate, apically rounded, the larger ones ±8 mm. long, ±5 mm. broad.

The label of specimen 67-D is unusually ample, with the plant attached near one end by its stem hav-

ing been slipped through parallel cuts in the paper (Fraser's common method of affixing labels). The label is sufficient in size to have received a series of notations extending from (probably) 1787 into the 1960s. Almost hidden by the stem is a partially obscured (and thus readable only as *??6*) three-digit number in Fraser's hand, believed to be his collection number. The label also reads: "*Lupinus affinis*" in Walter's well-formed script; this is one of the 23 specimens in the Fraser collection whose label bears Walter's hand but was not identified by him. [Specimens 67-A, 67-B, and 67-C, mounted across top of the same folio page, were labeled in Fraser's hand as *Lupinus pilosus* (2 spms.) and *L. perennis*.] Alongside the specimen and writings by Fraser and by Walter is a more extended notation: "*confer / Anonymos sagittalis p. 181 / = A. rotundifolia Walt. / = Rhynchosia,*" in the hand of Asa Gray, who examined the Fraser folio in 1839. Below the Gray notation a further entry reads: "*Crotalaria maritima Chapm. / det. John Lewis 1962.*" Still another reads: "*Anonymos rotundifolia Walt. / Fl. Carol.: 181 (1788) / SYNTYPE / of / Crotalaria rotundifolia J. F. Gmel. / in Linn., Syst. Nat., ed 13 2:1095 (1792)*" in an undetermined hand (below and thus subsequent to the 1962 notation of Lewis).

The source of specimen 67-D is unknown. Fraser, unlike Pehr Kalm in the American Northeast and Andre Michaux throughout eastern America, left no account of his travels. But from occasional remarks on labels and from specimens obtainable only in clearly defined locations, it is known Fraser reached (among other more northern and western stations) the Altamaha River in southeastern Georgia (Ward 2006), well within the distribution of the more southern taxon, *Crotalaria maritima*.

Pubescence of the stems and leaves has been long recognized to differ between northern populations typical of *Crotalaria rotundifolia* and more southern populations assignable to *C. maritima*. Lewis (pers. comm., Aug. 1962) directed his analysis primarily to this feature, making comparison with other collections of the two taxa as identified by Senn (1939) and from locations appropriate to the northern and southern populations, respectively. In his words: "The critical difference is that the general level of the top of the indumentum in [*C. rotundifolia*; Lewis used *C. angulata*] is equal in height (from the substratum) to the thickness of the stem, while in *C. maritima* even the few spreading hairs do not reach this height." He found the indumentum of the Fraser specimen to be very worn on the more-mature parts of the stem, but even here "the sparse remnant is wholly appressed." Further, he found the leaf shape "not inconsistent" with that of *C. maritima*. Lewis' conclusion was that Senn would have placed the Fraser specimen in *C. maritima* if he had seen it. The present writer, with opportunity in 1984 to study the Fraser specimen directly, fully agreed with Lewis' conclusions.

Windler (1971, 1974) addressed the judgment of Fernald & Schubert (1948), as well as information given him by Robson and his own examination of a better-quality photo from the British Museum, and his understanding of the approximate ranges of these two taxa. In consideration of the variable and intergrading morphologies of the two populations, he chose to recognize the taxa at varietal level. He was compelled to conclude the "Walter" type was of the more southern population, which obligated him to base *C. rotundifolia* var. *rotundifolia* on Fraser's specimen. He then took the next logical step, by selecting a specimen from the northern population to represent the non-typical variant. He proposed the new name *C. rotundifolia* var. *vulgaris* Windler, and typified it with a specimen from Hampton County, South Carolina.

Windler's acceptance of the Fraser specimen as typical of the southern population and a specimen from the northern population as representing the non-typical variant had the unfortunate consequence of putting in place as type of *C. rotundifolia* a specimen that Walter, the author of that name, would not have recognized. Indeed, Walter (though he died in 1789) has himself had opportunity to speak to this issue. He annotated specimen 67-D as "*Lupinus affinis*," or "allied to *Lupinus*," a comment similar to his many Latin-based remarks throughout the folio (Ward 2007b). This notation well indicates he did not recognize the species, though by later nomenclatural fiat he has now been claimed its author!

Windler's use of varietal status has suppressed the incongruity of a Walter name being applied to a population of which its author had no direct knowledge. Thus persons who interpret the complex as undivided will see no issue, and those who use only varieties will scarcely be alerted. But, in the belief the two populations merit specific rank (Ward 2009), the present writer has long been intrigued of a proper solution.

The *Code* (McNeill et al. 2006) permits any name to be retained by the process of "conservation" (Art. 14). Though there are several subtleties, the usual process would involve a petition to change the type by which a name was determined, thereby changing the name itself. This petition must be of a form acceptable for publication in a specific international journal (*Taxon*). The petition would then be reviewed by a special committee for the appropriate taxonomic group, then by a senior committee, then by a future botanical congress. Disapproval at any level would negate the proposal. Here, a proposal might ask that the type of *Crotalaria rotundifolia* Walter ex J.F. Gmel. be replaced by a specimen more appropriate than the one provided by John Fraser.

A less complex and uncertain pathway exists by which the issue may be resolved. The *Code*, Art. 9.16, states: "A neotype selected under Art. 9.15 [the article permitting selection of a neotype] may be superceded if it can be shown to differ taxonomically from the holotype or lectotype that it replaced." This power does not exist if a holotype or lectotype is involved, for in each of those categories a specimen seen and used by the author would have priority. But a neotype, a replacement selected at a later date by another person, can possibly be an inappropriate choice as a replacement for the missing holotype.

Rejection of the Fraser specimen as the type of *Crotalaria rotundifolia* quite exactly conforms to the requirements of Art. 9.16. All investigators who have examined specimen 67-D or its images, even though in part working independently and without full knowledge of the work of others, have agreed this specimen matches the more southern population. Even its author, Thomas Walter, by his annotation has left testimony of his endorsement. Though it is permissible for an author to consider the variability within the group too slight to permit naming, most authors have recognized the two populations at some taxonomic rank. And there is no dispute that the one taxon is common in the area known to Walter, and the other taxon to be essentially absent. It thus follows that the specimen previously treated as the neotype of *Crotalaria rotundifolia* is taxonomically different from the specimen that Walter must have once held and used as the basis for his new name.

Since the conditions for invoking Art. 9.16 are fully met, it also follows that the Fraser specimen treated as neotype of *Crotalaria rotundifolia* may be superceded by a more appropriate specimen.

Crotalaria rotundifolia J.F. Gmel., Syst. Nat. 2:1095. 1792. TYPE: U.S.A. SOUTH CAROLINA. Hampton Co.: ca. 3 mi NW of Yemassee on SC Hwy 68, sandhill, 23 Jul 1967, *D.R. & B.K. Windler 2769* (NEOTYPE, designated here: NCU). This selection supersedes the previous selection of *J. Fraser 67-D, 1787* (BM) as neotype, as authorized by the Code, Art. 9.16.

The selected specimen is also the holotype chosen by Windler (1974: 193) for *Crotalaria rotundifolia* var. *vulgaris*. Windler's judgment is accepted in his selection of a specimen appropriate for the northern population. Although typification does not apply outside of rank, the use here of the same specimen as the type of *C. rotundifolia* obviates all uncertainty as to application of the name without regard for the rank employed.

NEOTYPE FOR *CROTALARIA MARITIMA*

Crotalaria maritima, the more southern of the two species, is somewhat more variable than its northern analogue, in that the leaves of some plants may range from ovate to linear. This variability has troubled investigators (Windler 1974; Isely 1990), but has then been put aside as a poorly understood property of the southern population. Other workers have separated the more clear-cut linear-leaved plants as *C. linaria* Small (1933) or *C. maritima* var. *linaria* (Small) Senn (1939). Though there is unquestioned intergradation, this linear-leaved population is also separated edaphically along the South Florida coastal dunes, and merits specific rank (Ward 2009).

With *Crotalaria linaria* removed, the remaining plants of the southern population are appreciably more uniform. A rare, recently described endemic, *C. avonensis* Delaney & Wunderlin (1989), with succulent leaves and loosely appressed pubescence, from near the southern end of the Lake Wales Ridge in central peninsular Florida, appears to be a local derivative. An erect species with leaves glabrous above, *C. purshii* DC., is known to hybridize with the southern population (Windler 1974: 202). An erect, usually annual

Fig. 1. Neotype for *Crotalaria maritima* Chapm., Bot. Gaz. 3:4. 1878. From: open dry sandy swale behind low coastal shell ridge, Middle Cape ("Palm Cape" of Chapman 1878, 1883), Cape Sable, Everglades National Park, Monroe County, Florida. Bulls-eye scale = 3 cm diameter.

species, *C. sagittalis* L., may hybridize with the northern plants here called *C. rotundifolia* (Windler 1974: 202), but appears not to overlap in range with the southern population.

The earliest name for the southern population is *Crotalaria maritima* Chapm. (1878, 1883). Chapman described his plant with elements unique to the southern population: "Stem low, much branched, pubescent with short appressed hairs; leaves simple, small, oblong, sub-sessile, very thick and succulent; stipules minute and narrowly decurrent, or none; raceme 2-flowered; legume smooth; ... Stem 6 in. high. Leaves 1 in. long. Flowers not seen" (slightly rephrased in 1883). He gave the place of collection, perhaps well known to Florida travelers in the 19th century, though now far from obvious, as "Sandy beach at Palm Cape, South Florida." His notation of "Flowers not seen" suggests the plant was not overly familiar to him. Windler (1974) did not trace this station; he noted Chapman's type only as "not located."

Chapman's home was in Apalachicola, in the central Florida panhandle. At least once he is known to have visited another early botanist, Dr. John Blodgett of Key West (who died in 1853). He made this journey by taking a small boat along the western Florida coast, stopping and apparently collecting along the way. He may have done so more than once, at least for part of the distance, in that along with the new *Crotalaria* he reported many other plants newly discovered in South Florida (Chapman 1878). The careful account of Florida botanical exploration by R.P. Wunderlin, B.F. Hansen & J. Beckner (in Wunderlin & Hansen 2000) reported no documentation of these journeys.

Old late-19th century maps of Florida, however, do record "Palm Cape" as the middle point of Cape Sable, on the southwestern tip of peninsular Florida. The Palm Cape beach is an obvious stopping-point for shallow-draft vessels moving along the southern shore. This location is now within the Everglades National Park, Monroe County, though it is still quite as remote—and perhaps less visited—as in Chapman's day. In April 1964 the writer, accompanied by a graduate student and two rangers, was able to reach the Cape. *Crotalaria maritima* was immediately obvious, broadly spreading in a dry sandy depression behind the front beach. Specimens were collected, and one has been selected as typical of *C. maritima* Chapm..

Crotalaria maritima Chapm., Bot. Gaz. 3:4. 1878. (**Fig. 1**). TYPE: U.S.A. FLORIDA. Monroe Co.: Middle Cape ("Palm Cape" of Chapman 1878), Cape Sable, Everglades National Park, open dry sandy swale behind low coastal shell ridge, 18 Apr 1964, *D.B. Ward 3939* (NEOTYPE (and topotype), designated here: FLAS).

With recognition of the types selected here, *Crotalaria rotundifolia* Walter ex J.F. Gmel. again becomes the round-leaved, non-succulent, spreading-pubescent plant of the Carolina coastal plain and northern Florida, and *Crotalaria maritima* Chapm. again is recognized as the ovate-leaved, succulent, appressed-pubescent plant of peninsular Florida. These points of nomenclatural stability will serve as clearly understood data-points for further work addressing the morphological subtleties of these and related taxa.

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