

LECTOTYPIFICATION OF *CARDAMINE FLEXUOSA* (BRASSICACEAE)

Angela R. Post¹

Department of Horticultural Science
North Carolina State University
Raleigh North Carolina 27695-7609, U.S.A.

Alexander Krings

Herbarium, Department of Plant Biology
North Carolina State University
Raleigh North Carolina 27695-7612, U.S.A.

Qui-Yun (Jenny) Xiang

Department of Plant Biology
North Carolina State University
Raleigh North Carolina 27695-7612, U.S.A.

Bryon R. Sosinski

Department of Horticultural Science
North Carolina State University
Raleigh North Carolina 27695-7609, U.S.A.

Joseph C. Neal

Department of Horticultural Science
North Carolina State University
Raleigh North Carolina 27695-7609, U.S.A.

In 1796, William Withering (1741–1799) described a new species of Brassicaceae from England as *Cardamine flexuosa* With. The primary set of Withering's collections is held at BM (Stafleu & Cowan 1976), but upon inspection we found no specimens at BM for any taxa of *Cardamine* L. bearing his name or hand. There are also none of his own *Cardamine* specimens or those collected by others that he may have studied in other herbaria also known to house his material: BR, K, LINN, LIV, UPS-Thunb (Stafleu & Cowan 1976). Loss of type material for *C. flexuosa* With. has been previously reported (Marhold 1995; Lihova et al. 2006); however, a lectotype for *C. flexuosa* With. remains undesignated. In the absence of the holotype we refer to illustrations cited in the protologue to lectotypify *Cardamine flexuosa*. Withering cited the following three illustrations which serve as syntypes in the absence of other original material: t. 277 (Curtis 1777); t. 735 (Oeder 1770); *C. hirsuta* (Walcott 1778).

Here we designate one of these illustrations as the lectotype for *Cardamine flexuosa* With.:

Cardamine flexuosa With., Arr. Brit. Pl. ed. 3:578. 1796. (**Fig. 1**). TYPE: "Rookery at Edgebaston" (LECTOTYPE, designated here: Curtis t. 277, 1777).

The lectotype (Fig. 1) is a historical illustration from Curtis' *Flora Londonensis* (1777). This work is a collection of loose or bound plates depending on the copy, and some copies have been hand colored. There are both colored and black and white examples of plate 277. The plate is accompanied by a brief but thorough Latin description and an English translation (Fig. 2). Plate 277 is labeled as the closely related species *C. hirsuta*, but clearly illustrates the siliques angled away from the inflorescence, flexing nodes, and a densely hairy stem more typical of *Cardamine flexuosa* With. This plate undoubtedly refers to the taxon in Withering's original description of the species. Basal leaflets in the illustration are not totally congruent with what we have observed in the field and on herbarium specimens for the taxon, but the description accompanying the plate reads: "Lobes of the radical leaves vary much in shape and are frequently much rounder than the figure represents." The only other caveat to our determination here is that a detailed illustration of the androecium in the bottom right corner of the plate (labeled #3) cannot refer to *C. flexuosa* because it illustrates only four stamens when *C. flexuosa* always has six. Information given in the description accompanying the plate sheds some light on this problem. The main morphological difference between *C. hirsuta* and *C. flexuosa* is stamen number, *C. hirsuta* having four and *C. flexuosa* six. Curtis' illustration shows four stamens and gives the following information in the description: "The same plant, early in the spring, when the weather is cold, has only four stamina; as the summer advances, it has constantly six." We believe that Curtis was encounter-

¹Present address: Department of Plant Biology, Cornell University, Ithaca, NY 14853, arp232@cornell.edu



FIG. 1. Digital image of the lectotype for *Cardamine flexuosa* in W. Curtis' *Flora Londinensis* or, *Plates and descriptions of such plants as grow wild in the environs of London.* t. 277. [Courtesy of Missouri Botanical Garden Library.]

CARDAMINE HIRSUTA. HAIRY LADIES-SMOCK.

CARDAMINE *Lin. Gen. Pl. TETRADYNAMIA SILIQUOSA.*

Siliqua elasticè diffiliens valvulis revolutis. *Stigma* integrum. *Cal.* fubhians.

Raii Syn. Gen. 21. HERBÆ TETRAPETALÆ SILIQUOSÆ ET SILICULOSÆ.

CARDAMINE foliis pinnatis, floribus tetrandris. *Lin. Syst. Vegetab. p.* 497. *Sp. Pl. p.* 915. *Fl. Succ. n.* 587.

CARDAMINE foliis pinnatis hirsutis, pinnis subrotundis, flaminibus quaternis. *Haller Hist.* 472.

CARDAMINE *hirsuta.* *Scopoli Fl. Carn. n.* 817. *t.* 38.

NASTURTIIUM aquaticum minus. *Bauh. Pin.* 104.

CARDAMINE impatiens altera hirsutior. *Raii Syn. p.* 300. The lesser Hairy, impatient Cuckow-Flower or Ladies-Smock.

CARDAMINE foliis pinnatis, foliolis radicalibus subrotundo-cordatis; caulinis ovatis dentatis petiolatis. *Hudson. Fl. Ang. ed. 2. p.* 295. *Lightfoot Fl. Scot. p.* 348.

<p>RADIX annua, fibrosa, fibris albidis.</p> <p>CAULIS spithameus, et ultra pro ratione loci, in fossis humidis reperitur etiam sesquipederalis, solidus, erectus, flexuosus, fulcato-angulosus, prope basin purpureus, et sæpius hirsutissimus, superne fere glaber, ramosus, ramosissimus etiam occurrit.</p> <p>FOLIA radicalia plurima, in orbem posita, pinnata, foliolis petiolatis, rotundato angulatis, plerumque quinque lobatis, hirsutis, punctis prominulis scabriusculis, lobis inæqualibus, nunc obtusis, nunc acutis, caulina angustiora et magis profunde incisa, lobis paucioribus.</p> <p>FLORES parvi, albi, primo vere tantum, tetrandri.</p> <p>CALYX: PERIANTHIUM tetraphyllum, foliolis ovato-oblongis, obtusis, concavis, deciduis, pilis paucis albidis instructis, <i>fig. 1.</i></p> <p>COROLLA: PETALA quatuor, alba, calyce duplo fere longiora, patentia, integerrima, obtusa, <i>fig. 2.</i></p> <p>STAMINA: FILAMENTA plerumque sex, quorum duo, breviora, alba. ANTHERÆ minimæ, lutescentes, <i>fig. 3.</i></p> <p>PISTILLUM: GERMEN oblongum, tenue, flaminibus paulo brevior. STIGMA capitatum, <i>fig. 4.</i></p> <p>PERICARPIUM: <i>Siliqua</i> erecta, uncialis, subcompressa, bivalvis, elasticè diffiliens, valvulis revolutis, <i>fig. 5.</i></p> <p>SEMINA duodecim circiter, suborbiculata, compressa, glabra, e flavo fusca, <i>fig. 6.</i></p>	<p>◇ ROOT annual and fibrous, the fibres whitish.</p> <p>◇ STALK about a span high, or more, according to the situation in which it grows; in wet ditches it is sometimes found even a foot and a half in height, solid, upright, crooked, grooved or angular, purple near the base, and most commonly very hairy, above nearly smooth, branched, sometimes very much so.</p> <p>◇ LEAVES next the root numerous, forming a circle, pinnated, the small leaves standing on foot-stalks, round yet angular, generally divided into five lobes, hirsute, roughish with little prominent points, the lobes unequal, sometimes blunt and sometimes pointed; those of the stalk narrower, and more deeply indented, with fewer lobes.</p> <p>◇ FLOWERS small, and white, early in the spring having only four stamina.</p> <p>◇ CALYX: a PERIANTHIUM of four leaves, of an ovate, oblong shape, obtuse, hollow, deciduous, furnished with a few white hairs, <i>fig. 1.</i></p> <p>◇ COROLLA: four white PETALS, almost twice the length of the calyx, spreading, entire and obtuse, <i>fig. 2.</i></p> <p>◇ STAMINA: for the most part six FILAMENTS, of which two are shorter than the rest, of a white colour. ANTHERÆ very small and yellowish, <i>fig. 3.</i></p> <p>◇ PISTILLUM: GERMEN oblong, slender, a little shorter than the stamina. STIGMA forming a small head, <i>fig. 4.</i></p> <p>◇ SEED-VESSEL: an upright <i>Pod.</i>, about an inch in length, somewhat flattened, of two valves, which burst with an elastic force, and roll back, <i>fig. 5.</i></p> <p>◇ SEEDS about twelve in number, nearly round and flattened, smooth, and of a yellowish-brown colour, <i>fig. 6.</i></p>
---	--

We were inclined to believe with our ingenious friend Mr. LIGHTFOOT, that the *Cardamine hirsuta* and *parviflora* were distinct species; but repeated observation and culture have convinced us, that they are both the same, varying only in size, in hairiness, and in the number of their stamina.

In wet situations, where the soil is luxuriant, it grows a foot or two in height, and loses in a great degree its hairiness; in exposed places it seldom reaches more than six or eight inches, and is generally much more hairy; and, when it grows singly, much more branched. The same plant, early in the spring, when the weather is cold, has only four stamina; as the summer advances, it has constantly six. The lobes of the radical leaves vary much in shape, and are frequently much rounder than the figure represents.

This species is by no means general about London, but abounds in particular places; as by *Chelsea* water-works, in wet ditches about *Hamstead*, *Highgate*, and elsewhere.

It flowers in *April* and *May*. In the garden, if the situation in which it is sown be shady, and the season not uncommonly dry, it continues flowering and seeding during the whole of the summer.

According to Mr. LIGHTFOOT, the young leaves are a good ingredient in a salad, and may easily be obtained in the spring, when Mustard and Cress are not to be had.

Fig. 2. Digital image of the description accompanying type illustration for *Cardamine flexuosa* in Curtis' *Flora Londinensis* or, *Plates and descriptions of such plants as grow wild in the environs of London*. Page previous to t. 277. [Courtesy of Missouri Botanical Garden Library.]

ing two different taxa during the course of the growing season. Our personal observations suggest that *C. hirsuta* has a winter annual life cycle and is only encountered in flower during the cooler months of spring. *Cardamine flexuosa*, on the other hand, does not have such a set life cycle in the landscape and can be seen flowering later in the year. We thus suggest that in the early Spring, Curtis was likely observing *C. hirsuta* with four stamens and later, when he observed six stamens, he almost certainly was observing *C. flexuosa* which is only subtly different in vegetative morphology compared with *C. hirsuta*.

The two remaining illustrations cited in the protologue (Walc. *C. hirsuta* and Fl. Dan.735) are poor representations of the taxon in question. The Walcott illustration labeled *C. hirsuta* (1778) depicts a plant with six stamens in the flower which could refer to *C. flexuosa*; however, a very straight stem and four stamens in the detailed drawing of the androecium suggest *C. hirsuta* rather than *C. flexuosa*. Table 735 (Oeder 1770) labeled *C. impatiens* exhibits a flexing stem, but the stem and rachis are very thick compared to *C. flexuosa* and there are numerous cauline leaves with leaflet shapes more typical of *C. impatiens*, though Kučera et al. (2006) excluded this as an accurate depiction of *C. impatiens* citing the lack of auriculate leaf bases. Compared to this illustration, *Cardamine flexuosa* has sparser cauline leaves which exhibit fewer leaflets per leaf than the basal leaves.

ACKNOWLEDGMENTS

We would like to thank the curators of BM, K, and LINN for the courtesies extended during herbarium visits, the curators at BR, LIV, and UPS-Thunb. for their assistance in searching for holotype material of this taxon, and those at MO for providing high resolution images of the designated lectotype. Reviews of Jeffery M. Saarela and Karol Marhold are greatly appreciated.

REFERENCES

- CURTIS, W. 1777. Flora Londinensis or, plates and descriptions of such plants as grow wild in the environs of London. t. 277. Britain.
- LIHOVÁ, J., K. MARHOLD, H. KUDOH, AND M. KOCH. 2006. Worldwide phylogeny and biogeography of *Cardamine flexuosa* (Brassicaceae) and its relatives. Amer. J. Bot. 93:1206–1221.
- KUČERA, J., J. LIHOVÁ, AND K. MARHOLD. 2006. Taxonomy and phylogeography of *Cardamine impatiens* and *C. pectinata* (Brassicaceae). Bot. J. Linn. Soc. 152:169–195.
- MARHOLD, K. 1995. Taxonomy of the genus *Cardamine* L. (Cruciferae) in the Carpathians and Pannonia. III. Folia Geobot. Phytotax. 30:397–434.
- OEDER, G.C. 1770. Enumeratio plantarum florum Danicae. t. 735, Hafniae, Sumptibus Heineck & Faber.
- STAFLEU, F.A. AND R.S.COWAN. 1976. Taxonomic literature: a selective guide to botanical publications and collections with dates commentaries and types Vol. II. Bohn, Scheltema, and Holkema, Utrecht.
- WALCOTT, J. 1778. Flora Britannica Indigena: or plates of the indigenous plants of Great Britain. S. Hazard, Bath.
- WITHERING, W. 1796. Arrangement of British plants. Ed. 3 Swinney and Walker, Birmingham. P. 578.