

A Taxonomic Study of Genus *Polygonum*, Section *Polygonum* (*Avicularia*) in Indiana and Wisconsin¹

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Abstract

Study of herbarium specimens and collection of fresh plants reveal that five species of *Polygonum*, sect. *Polygonum*, occur in Indiana and Wisconsin. These species are *P. ramosissimum*, *P. erectum*, *P. arenastrum*, *P. aviculare*, and *P. buxiforme*. *P. tenue* is also found in both states, but evidence indicates that it belongs to sect. *Duravia*. On the basis of distinctive morphological characteristics, *P. buxiforme* should be considered as a taxon separate from *P. arenastrum* and *P. aviculare*, although all three species belong to the *P. aviculare* complex. *P. arenastrum* appears to be the most widely collected species of the *P. aviculare* aggregate in North America. Distribution records for the six species of *Polygonum* dealt with herein were revised and additional county records are reported. The chromosome number for *P. erectum* collected in Porter County, Indiana, was determined to be $2n = ca. 40$. All five species of sect. *Polygonum* occurring in Indiana and Wisconsin produce abnormal, enlarged, olivaceous achenes late in the growing season. This trait should be investigated and its physiology should be determined.

Introduction

The limits of genus *Polygonum*, sect. *Polygonum*, were established on the basis of pollen morphology by Hedberg (4). Excluded from sect. *Polygonum* are most of the species native to North America, which are assigned to sect. *Duravia*. A detailed biosystematic study of sect. *Polygonum* in the British Isles enabled Styles (9) to establish species limits based primarily on flower and achene characteristics. These traits were correlated with plant habit, leaf characteristics, chromosome number, and habitat. The investigations of Hedberg (4) and Styles (9) concerning Old World species of sect. *Polygonum* and a preliminary study of North American representatives of the section by Mertens and Raven (6) serve as the foundation for the present study.

Despite these investigations the taxonomy of this group remains quite confused. There is little agreement among systematists as to what species comprise sect. *Polygonum*, and there is disagreement with species identification itself. The confusion is exemplified by the treatment given sect. *Polygonum* by Fernald (2) and by Gleason (3) (Table 1). Both authors include in sect. *Polygonum*, *P. Douglasii* and *P. tenue*, which have been shown to belong to sect. *Duravia* (4, 6).

This paper summarizes a taxonomic investigation in which both herbarium specimens and newly collected plants of sect. *Polygonum* from Indiana were studied. In addition, herbarium specimens from Wisconsin were investigated. The species found in these states were characterized and records of their distribution were compiled.

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TABLE 1

Treatment of *Polygonum*, section *Polygonum* by two leading taxonomists.
For full discussion, see text.

Fernald (2)	Gleason (3)
1. <i>P. glaucum</i>	1. <i>P. glaucum</i>
2. <i>P. Raii</i>	2. <i>P. Raii</i> (= <i>P. oxyspermum</i>)
3. <i>P. oxyspermum</i>	3. <i>P. Fowleri</i> (= <i>P. allocarpum</i>)
4. <i>P. Fowleri</i>	4. <i>P. prolificum</i>
5. <i>P. allocarpum</i>	5. <i>P. ramosissimum</i> (= <i>P. exsertum</i>)
6. <i>P. exsertum</i>	6. <i>P. erectum</i>
7. <i>P. prolificum</i>	7. <i>P. achoreum</i>
8. <i>P. ramosissimum</i>	8. <i>P. aviculare</i>
9. <i>P. boreale</i>	9. <i>P. tenue</i>
10. <i>P. erectum</i>	10. <i>P. Douglasii</i>
11. <i>P. achoreum</i>	11. <i>P. Bellardi</i>
12. <i>P. aviculare</i>	12. <i>P. arenarium</i>
13. <i>P. tenue</i>	
14. <i>P. Douglasii</i>	

Materials and Methods

Much of the data procured in this study was derived from examination of 126 Indiana specimens of sect. *Polygonum* from the Indiana University Herbarium and 426 Wisconsin specimens from three herbaria in Wisconsin (Table 2). The parameters studied were achene texture,

TABLE 2

A summary of the species identity of the 1102 specimens examined.

	UW-M ¹	MPM ²	UW ³	IU ⁴	BSU ⁵	Total
<i>P. ramosissimum</i>	2	9	27	11	0	49
<i>P. erectum</i>	4	19	42	2	30	97
<i>P. arenastrum</i>	2	24	82	30	216	384
<i>P. aviculare</i>	5	8	21	8	56	98
<i>P. buxiforme</i>	2	16	52	44	172	286
Unidentifiable (No achenes)	1	6	11	0	0	18
Not in section <i>Polygonum</i>						
<i>P. tenue</i>	4	15	73	31	47	170
Total Specimens	20	97	309	126	551	1102

¹UW-M

University of Wisconsin at Milwaukee

²MPM

Milwaukee Public Museum

³UW

University of Wisconsin at Madison

⁴IU

Indiana University

⁵BSU

Ball State University (collections made by A.D. Savage)

color, shape, and size; inflorescence position; and fruiting perianth characteristics, including relative depth of perianth divisions. Measurements of achene size were made with normal, mature achenes, selected at random from each of the specimens studied. Plants without mature achenes are extremely difficult to identify.

In addition to the study of herbarium collections, fresh accessions of sect. *Polygonum* from Indiana were secured and examined. The first collections were made in counties in the southern part of the state where flowering and fruiting occur earlier in the year; subsequent collections were successively more northward. Collection sites were chosen at random, but some regard was paid to habitat; e.g., sites which were similar to those described by Deam (1) for some of the species of sect. *Polygonum* were sought after and more frequently selected than other possible sites.

New maps were prepared of the distribution of each species studied in Indiana. These maps show only the counties in which a certain species of sect. *Polygonum* was positively identified by the investigators. Finally, the newly collected plants provided viable achenes for determination of chromosome numbers.

Data and Discussion

Five species of *Polygonum*, sect. *Polygonum*, were found to occur in both Indiana and Wisconsin. These species are *P. ramosissimum*, *P. erectum*, *P. arenastrum*, *P. aviculare* sensu stricto, and *P. buxiforme*. Another species, *P. tenue*, is also included as a part of this study because it is traditionally placed in sect. *Polygonum* (2, 3).

Most of the species of sect. *Polygonum* are variable in plant habit and are markedly affected by habitat conditions (9), thus making them extremely difficult to differentiate from one another. The most consistent method of identifying these plants is on the basis of achene and perianth characters, which were used extensively in this study.

1. *P. ramosissimum* Michx. is a distinctive species native to North America (5, 6), having inflorescences that appear to be terminal, the flowers being clustered near the ends of stems in the axils of reduced leaves or bracts. The much-branched plant typically has a yellowish-green cast that extends to the perianth. The sharply angled, trigonous achenes are borne on relatively long pedicels which are exerted from the sheathing ocreae. The average achene is 2.87 mm long and 1.98 mm wide and is completely included in the tightly oppressed, persistent perianth.

Herbarium specimens previously identified as *P. atlanticum* (Robinson) Bicknell or *P. exsertum* Small were referred to *P. ramosissimum*. Gleason (3) properly regards *P. exsertum* as a synonym of *P. ramosissimum*. In this species, as in most of the species dealt with herein, enlarged, olivaceous achenes having thin-walled, atypical pericarps may be formed, especially late in the growing season (2, 9). Such achenes are characteristically flattened, wrinkled, and viable (9); they are sufficiently different from the normal fruits borne by the same plant, that they have led to the identification of plants having a predominance

of such achenes as a separate species (*P. exsertum*). Normal achenes of *P. ramosissimum* ranged from 2.33-3.25 mm in length and from 1.50-2.25 mm in width, whereas "late season" fruits tended to be longer (e.g., 3.58 mm) than most typical achenes.

During the present investigation, no new specimens of *P. ramosissimum* were collected in Indiana. Therefore, the data for the distribution of this species are based solely on herbarium specimens from Indiana University, most of which were originally identified as *P. exsertum*. Since very few specimens of this species have been collected in Indiana it seems worthwhile to cite those examined.

Posey Co., Deam 51489. Posey Co., Deam 35171. Fountain Co., Buser 2720. Posey Co., Deam 29112. Warren Co., Deam 9700. Jasper Co., Deam 42253. Greene Co., Deam 24082. Clay Co., Deam 56737. Clay Co., Deam 53217. Warren Co., Buser 3666.

The chromosome number for *P. ramosissimum* is reported to be $2n = 20$ (5).

2. *P. tenue* Michx. is a distinctive and readily identified species. Thirty-one herbarium specimens from Indiana University were all correctly annotated prior to the present study, while only three among 92 Wisconsin herbarium sheets were originally misidentified.

The shiny black achene of this species possesses three concave faces which are smooth and glossy, while the margin of each face is stippled or striated. No species of sect. *Polygonum* is known to these investigators in which this pattern exists. The achenes ranged from 2.00-2.67 mm in length (mean 2.38 mm) and from 1.17-1.75 mm in width (mean 1.49 mm).

Plants of this species can be identified beyond reasonable doubt, even in the absence of achenes; they are slender with few branches and possess an erect growth habit. Achenes are clustered at the ends of stem tips; leaves are very narrow to linear.

Late in the growing season the five species of sect. *Polygonum* that occur in Indiana and Wisconsin all produce abnormal achenes similar to those described in the discussion of *P. ramosissimum*. In contrast, no such achenes were noted on the 170 specimens of *P. tenue* studied. This fact may further differentiate *P. tenue* from sect.

Polygonum.

The distribution of *P. tenue* in Indiana is shown in Figure 1. *P. tenue* is found in areas where the soil is predominantly sandy and the land is hilly. The chromosome number for this species is reported to be $2n = 20$ (5).

3. *P. erectum* L. A combination of the following characteristics distinguishes this species: (a) Mature fruit color is light brown to tan in contrast to the much darker colors exhibited by mature fruits of other species in sect. *Polygonum*. (b) Fruit texture is characteristically dull and granular. (c) The achene has two more-or-less equal convex sides and one narrow, slightly concave side. Fifty-eight achenes were measured; they ranged from 2.33-2.92 mm in length (mean 2.62 mm) and

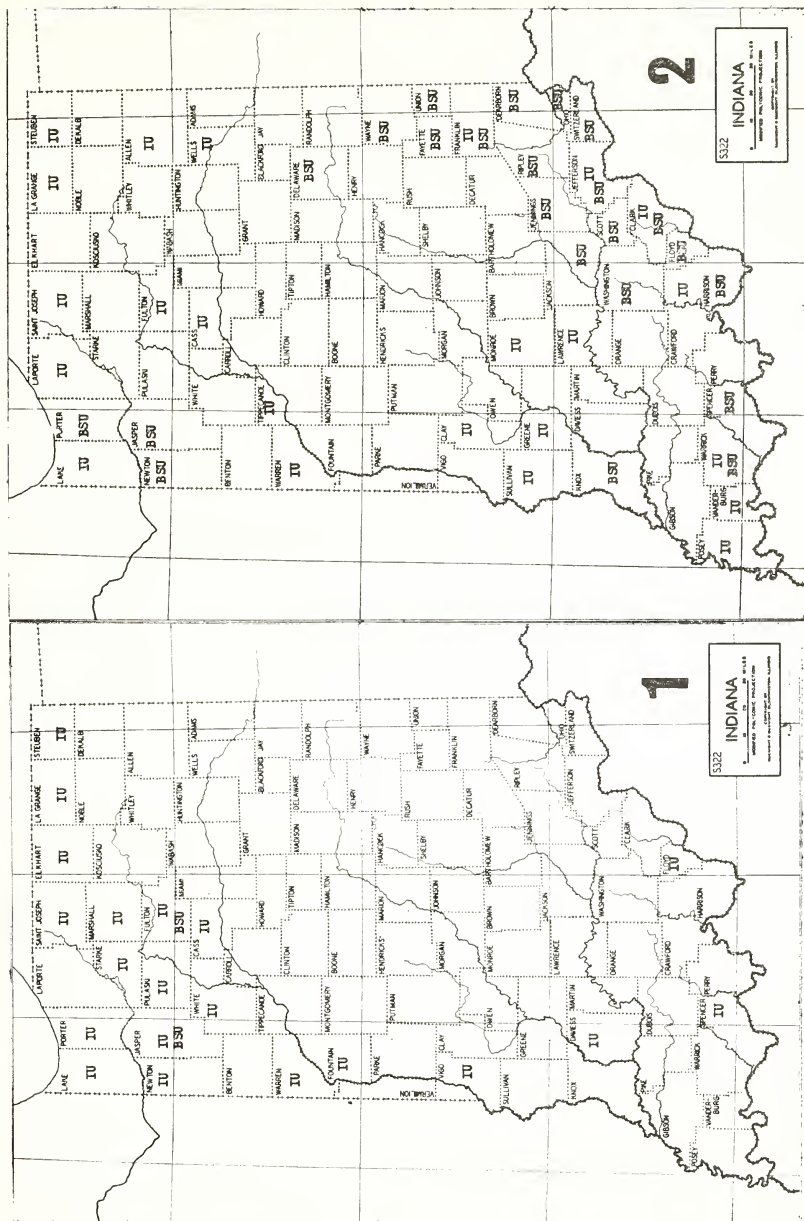


Figure 1. Map of Indiana showing counties in which *P. tenuis* has been collected; IU—collections from Indiana University Herbarium; BSU—collections housed at Ball State University.

Figure 2. Map of Indiana showing the distribution of *P. arenastrum*.

from 1.58-2.17 mm in width (mean 1.89 mm). (d) The fruiting perianth is constricted just below the apex, giving it a unique "bottle" shape. (e) The leaves are blunt and rounded in contrast to those of many species of this section, which are to various degrees lanceolate in shape.

P. erectum discussed herein should not be confused with *P. aviculare* L. var. *erectum* Roth (Koch), which is usually considered to be synonymous with *P. aviculare* sensus stricto. Unlike other workers (2, 3, 5), we were unable to find any character by which to consistently distinguish *P. erectum* L. from *P. achoreum* Blake. Gleason's (3) description and illustration of *P. erectum* must, in fact, be *P. aviculare*, while his description and illustration of *P. achoreum* are without question *P. erectum*. Herbarium sheets were encountered which originally were identified as *P. erectum*, but subsequently annotated *P. achoreum*. Such specimens were re-annotated *P. erectum* in the present study.

In the collection at Indiana University, 24 plants were originally labeled *P. erectum*. Only two of these were found to be *P. erectum*; six were either "late season" or immature forms of *P. aviculare*, and the remaining 15 specimens were referred to *P. buxiforme*. Therefore, previously published distribution records for *P. erectum* are practically useless.

P. erectum has rarely been collected in Indiana; therefore, it seems worthwhile to cite the specimens examined in this study.

Fountain Co., Buser 2797 (IU). Nobel Co., Deam 14315 (IU). Porter Co., Savage 58-1 (BSU).

Achenes of *P. erectum* were germinated and root-tip squashes were prepared to determine the chromosome number for this species. Although Löve and Löve (5) report $2n = 20$, in the present investigation the diploid chromosome number was found to be ca. 40; *P. erectum*. Hillcrest Park, just east of Valparaiso, Porter Co., Indiana, along a gravel road, 1966, Savage 58-2 (BSU). $2n =$ ca. 40.

Polygonum aviculare Aggregate

In the British Isles four species comprise the *P. aviculare* aggregate (9): *P. aviculare* L., sensu stricto; *P. arenastrum* Jord. ex Bor.; *P. boreale* Small; and *P. rurivagum* Jord. ex Bor. Mertens and Raven (6) recognized three of these species as constituting the North American representatives of the *P. aviculare* aggregate. *P. rurivagum* was excluded because plants described as belonging to this species by Löve and Löve (5) are not in agreement with those described by Styles (9).

Plants in the *P. aviculare* complex ". . . are characterized by their dull, striate fruits and flowers in axillary fascicles" (6). Separation of the complex into distinct species is based primarily on fruit and perianth characters, although differences in certain plant traits (e.g., presence or absence of heterophylly) and chromosome number were found to correlate positively with particular fruit and perianth characters (9).

Although the distinction between *P. arenastrum* and *P. aviculare* is quite clear in British and European collections (9), Mertens and Raven (6) encountered difficulty in detecting sharp differences in many

cases. Thus, numerous North American collections were referred to *P. arenastrum* “. . . largely on the basis of fruit size . . .” (6), even though the fruits lacked the narrow concave side and the two convex sides that characteristically distinguish *P. arenastrum* from the other species of the aggregate. Similar difficulties were encountered in the present study; however, examination of the *P. aviculare*-like plants led to the conclusion that *P. aviculare*, sensu lato, is represented by still another species in North America—*P. buxiforme* Small.

In the present investigation a concerted attempt has been made to detect differences between *P. aviculare*, *P. arenastrum*, and *P. buxiforme*. Achene and perianth characters afford the most satisfactory means of differentiating these species. Study of over 750 specimens of the aggregate suggests that at least some of the difficulties encountered by Mertens and Raven (6) in dealing with the *P. aviculare* complex could have been resolved by recognizing *P. buxiforme* as a distinct taxon within the aggregate. In all likelihood some collections referred to *P. arenastrum* by Mertens and Raven were, in fact, *P. buxiforme*, especially if the achenes lacked the shape characteristics of *P. arenastrum*.

4. *P. arenastrum* Jord. ex Bor. is the most readily discernible and the most widely collected member of the *P. aviculare* aggregate (Table 2). It is characterized by having trigonous, dark brown achenes, which are striated, but still shiny along the edges. Typically the achenes have two convex sides and one narrow, slightly concave side (9). Achenes ranged in length from 1.58-2.50 mm (mean 2.03 mm) and in width from 1.00-1.75 mm (mean 1.26 mm), and are thus somewhat smaller in size than the fruits of either *P. aviculare* or *P. buxiforme*. The characteristic fruiting perianth of *P. arenastrum* is divided for only slightly more than half of its length (9).

Plants of *P. arenastrum* typically are prostrate in growth habit, often forming dense mats close to the soil surface. *P. arenastrum* thrives in places where man treads it underfoot, such as along sidewalks and paths; it is not uncommon as a lawn weed. *P. arenastrum* is further characterized by having branch leaves and main stem leaves which are approximately equal in length and lanceolate in shape (9).

In the present study, many specimens were referred to *P. arenastrum*, which were originally erroneously identified as *P. aviculare* var. *angustissimum* or *P. neglectum* Bess. *P. aviculare* var. *angustissimum* is a synonym of *P. aviculare*, sensu stricto (9). However, in the present study the specimens so identified were without question *P. arenastrum*. *P. neglectum* is a species “. . . hopelessly confused in the literature . . .” (9) and not similar to any form encountered in Western Europe. Thus, this latter taxon would not seem to be identical with *P. arenastrum*. The fact remains, however, that many North American collections identified as *P. neglectum* Bess. are quite probably *P. arenastrum*. Plants identified by Löve and Löve (5) as *P. neglectum* were shown to have $2n = 40$, the chromosome number characteristic of *P. arenastrum* (9).

The distribution of *P. arenastrum* in Indiana is shown in Figure 2. The following collections from the Indiana University Herbarium have been identified as *P. arenastrum*:

Monroe Co., Anderson 3178. Jefferson Co., Young 10399. Clark Co., Deam 65042. Jefferson Co., Young 9947. Lagrange Co., Deam 45243. Lagrange Co., Deam 31294. Wells Co., Deam. Warren Co., Deam 53130. Greene Co., Weatherwax 1039. Laporte Co., Deam 34841. Lake Co., Deam 39450½. Harrison Co., Deam 63716. Monroe Co., Reed 99. Vanderburgh Co., Zeiner. Monroe Co., Gullion 3324. St. Joseph Co., Deam 55577. Lagrange Co., Deam 45242. Clay Co., Deam 53219. Cass Co., Deam 53486. Cass Co., Deam 51245. Warrick Co., Deam 51500. Lawrence Co., Kriebel 902. Posey Co., Deam 37706. Sullivan Co., Deam 51389. Tippecanoe Co., Deam 52873. St. Joseph Co., Deam 51155. Allen Co., Deam 54685. Franklin Co., Deam. Steuben Co., Deam. Fulton Co., Deam 46064.

Collections by Savage, mapped in Figure 2, include the following county records: Newton, Jasper, Delaware, Porter, Wayne, Fayette, Union, Dearborn, Ripley, Jennings, Ohio, Switzerland, Scott, Floyd, Jackson, Washington, Spencer and Knox. All of these collections are housed at Ball State University.

5. *P. aviculare* L., sensu stricto, is a commonly collected entity in Great Britain having quite distinctive characters (9). Earlier investigations (6) and the present study (Table 2) indicate that *P. aviculare* is less commonly encountered in North American collections. Plants referred to *P. aviculare* generally have achenes which are dull and coarsely striated. Occasional exceptions possess fruits in which the edges are mildly shiny and the striations less extreme. Thirty achenes varied from 2.25-3.08 mm in length (mean 2.62 mm) and from 1.42-2.25 mm in width (mean 1.74 mm). Generally the trigonous achene is completely included in the persistent perianth, which is divided for three-fourths or more of its length. *P. aviculare* is characterized by marked heterophylly, branch leaves being notably smaller than those on the main stem (9). Some difficulties are encountered with this characteristic due to the fact that as the plant matures the larger stem leaves tend to drop off, thus destroying all evidence of the trait. The chromosome number for this species is reported to be $2n = 60$ (6, 9).

The distribution of *P. aviculare* in Indiana is given in Figure 3. It is important to note that Deam (1) did not differentiate between *P. arenastrum* and *P. aviculare*. Therefore, his data on the distribution of *P. aviculare* in Indiana are practically useless since they represent *P. aviculare*, sensu lato. In the collection at Indiana University, 37 specimens had been originally referred to *P. aviculare*. After a thorough study of all the specimens in the collection, only eight plants were found to be *P. aviculare*, sensu stricto. Of these eight, six had previously been labeled *P. erectum*. Of the specimens originally annotated *P. aviculare*, only two were found to be *P. aviculare*, sensu stricto; 22 of the specimens were referred to *P. arenastrum* and the remaining 13 were annotated *P. buxiforme*.

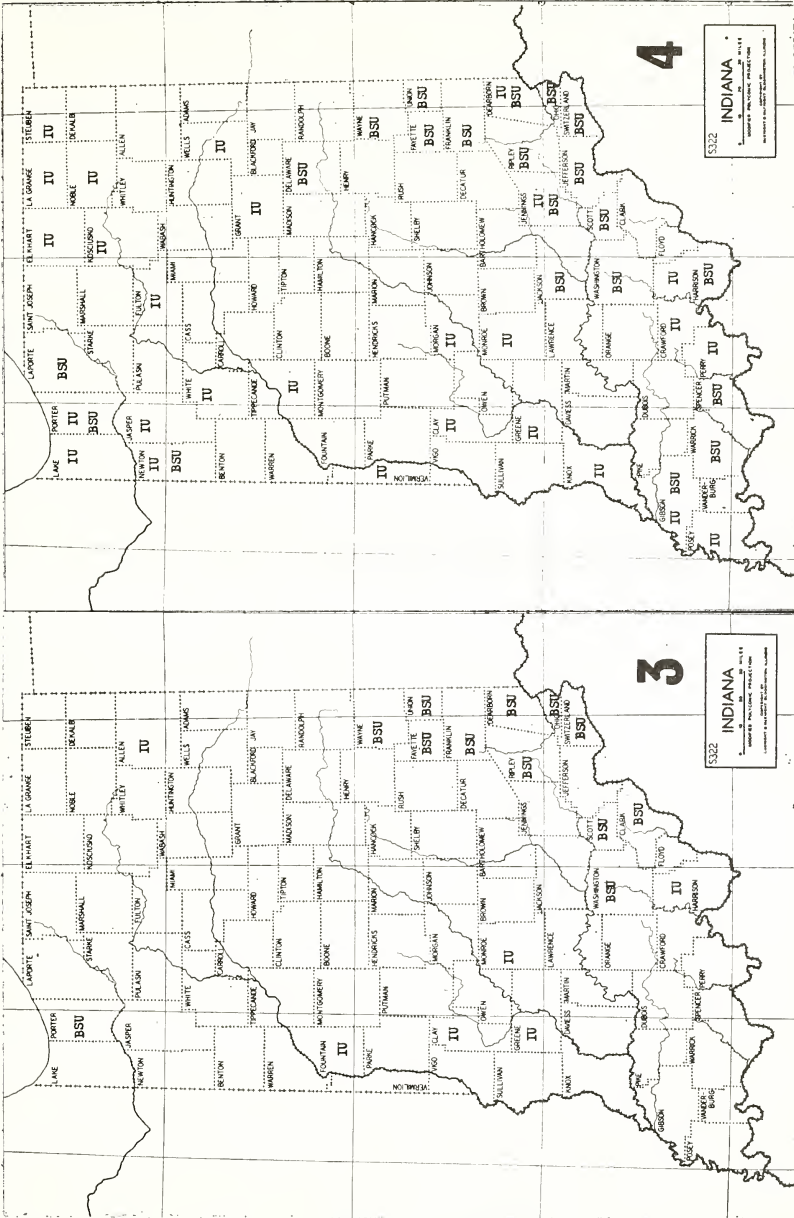


Figure 3. Map of Indiana showing the distribution of *P. avicularie sensu stricto*.

Figure 4. Map of Indiana showing the distribution of *P. buxiforme*.

The following collections from the Indiana University Herbarium have been referred to *P. aviculare*:

Monroe Co., Brooks 1196. Fountain Co., Buser 3273. Harrison Co., Deam 63565. Allen Co., Deam 19236. Clay Co., Deam 56735. Monroe Co., Anderson 3441. Greene Co., Weatherwax 895. Monroe Co., Brooks 973.

Savage obtained the following county records for *P. aviculare* in Indiana: Wayne, Fayette, Union, Franklin, Ripley, Dearborn, Ohio, Switzerland, Clark, Washington, Scott and Porter. These specimens were placed in the Ball State University herbarium.

6. *P. buxiforme* Small. The name, *P. buxiforme*, was first applied by Small (8) to plants, the achenes of which were described as ". . . triquetrous, 2-2.5 mm long, broadly ovoid, usually somewhat constricted and often conspicuously so below the summit, enlarged and rounded at the base, dark brown, more or less granular, mostly dull, sometimes shiny" (7). The persistent perianth covering such achenes was said to be ". . . five-parted to below the middle . . ." and the inflorescence was described as ". . . axillary, consisting of clusters with from two to six flowers . . ." (7).

Many authors (2, 3, 6) have not regarded *P. buxiforme* as a separate taxon. Raven (personal communication, 1966) has suggested that *P. buxiforme* may be a small-fruited form of *P. aviculare*, *sensu stricto*. The achenes of *P. buxiforme* resemble those of *P. aviculare* and to a certain extent those of *P. arenastrum*, and appear to be intermediate between them. The present study indicates that a number of achene and perianth characters consistently distinguish these three entities.

The achenes of *P. buxiforme* are dark brown and striated, usually with smooth, shiny edges. Typically, the achenes are broad relative to their length, giving them a characteristic "heart shape." The achenes of *P. buxiforme* resemble those of *P. aviculare* in that in both species the achenes have two more-or-less equal, concave sides and one broader, flat or slightly concave side. The 60 achenes measured varied from 1.92-2.75 mm (mean 2.26 mm) in length and from 1.33-2.00 mm (mean 1.64 mm) in width. In mean length, the fruits are intermediate between those of *P. aviculare* and *P. arenastrum*.

The perianth of plants referred to *P. buxiforme* is especially unique due to the characteristic "flange" or border located at the base of the calyx. The fruiting perianth is divided for nearly two-thirds of its length, thus resembling Small's description (7). Therefore, a characteristic combination of fruit size, shape and texture traits along with the typical perianth features permit the separation of *P. buxiforme* from both *P. aviculare* and *P. arenastrum*.

In many respects *P. buxiforme* appears as an intermediate between *P. arenastrum* and *P. aviculare* with reference to achene and perianth characters. These observations may lead one to the conclusion that *P. buxiforme* is the product of interspecific hybridization. However, species belonging to the *P. aviculare* aggregate, like other species of this section of the genus, are cleistogamous (9). Styles attempted to

obtain hybrids among the species belonging to the aggregate in British Isles, but he never encountered an artificial or natural hybrid (9).

The problem of the identity of *P. buxiforme* definitely necessitates further investigation. Although Löve and Löve (5) report the chromosome number as $2n = 20$, confirmation of this count in a number of plants from different populations should be made. It has been further suggested that *P. buxiforme* is indigenous to North America (5); this is hardly to be expected since other members of the *P. aviculare* aggregate in North America are Eurasian introductions. Also, a careful biosystematic study of the entire *P. aviculare* complex would seem to be in order. The constancy of the apparently unique and identifying characters of each species must be ascertained if the present species designations are to be at all meaningful and useful. To determine the constancy of these characters, cultivation of populations of *P. arenastrum*, *P. aviculare*, and *P. buxiforme* under controlled environmental conditions is necessary.

The distribution of *P. buxiforme* in Indiana is shown in Figure 4.

Our study of sect. *Polygonum* confirms Deam's (1) prediction that *P. buxiforme* would be found throughout the state. In addition to new records collected by Savage from Laporte, Delaware, Wayne, Fayette, Union, Franklin, Ohio, Switzerland, Jefferson, Ripley, Scott, Jackson, Spencer, Washington, and Warrick Counties, the following collections from Indiana University have been determined as *P. buxiforme*:

Grant Co., Deam 43592. Crawford Co., Deam 53396. Jasper Co., Deam 59111. Wells Co., Deam 57536. White Co., Deam 51258. Knox Co., Deam 55681. Steuben Co., Deam 58421. Elkhart Co., Deam 57535. Porter Co., Deam 55551. Noble Co., Deam 6775. Greene Co., Weatherwax 2431. Wells Co., Deam 58549. Dearborn Co., Deam 48512. Wells Co., Deam 59365. Porter Co., Deam 45449. Steuben Co., Deam 58422. Steuben Co., Deam 45859. Fulton Co., Deam 57912. Wells Co., Deam 63013. Jennings Co., Deam 52540. Newton Co., Deam 49191. Lagrange Co., Deam 61468. Noble Co., Deam 54496. Kosciusko Co., Deam. Posey Co., Deam 59273. Lake Co., Deam 55508. Morgan Co., Willis 106. Clay Co., Deam 53228. Knox Co., Deam 53278. Knox Co., Deam 51471. Gibson Co., Deam 45581. Gibson Co., Deam 35127. Crawford Co., Deam 53395. Monroe Co., Price 3880. Monroe Co., Deam 12354. Perry Co., Deam 51587. Posey Co., Deam 24279. Posey Co., Deam 51495. Tippecanoe Co., Young 10398. Vermillion Co., Deam 53174. Wells Co., Deam. Wells Co., Deam 61979. Harrison Co., Deam 63717.

The parameters measured in this study were used to construct a key to the species of sect. *Polygonum* which occur in Indiana and Wisconsin. For convenience, *P. tenue* is also included in the key.

**Key to the Species of *Polygonum* Traditionally Referred
to Sect. *Polygonum* Occurring in Indiana and Wisconsin**

Achene surface predominantly smooth and shiny but may have stippled or striated edges; inflorescences appear to be terminal, the flowers

being more-or-less clustered at the ends of stems among reduced leaves or bracts; perianth tightly oppressed to the achene, which has three equal concave sides.

Achene surface completely smooth, achenes dark reddish brown, sharp angled; calyx yellowish green; plant large, much branched 1. *P. ramosissimum*

Each face of black, trigonous achene is smooth and shiny but bordered with striated or stippled margin; plant slender, stiff or wiry; leaves linear 2. *P. tenue*

Achenes normally stippled, striated, or granular, achene surface usually dull but edges may be smooth and shiny; inflorescences axillary and scattered along stem.

Achenes light brown to tan, dull and characteristically granular, having two equal convex and one narrow, slightly concave side; perianth uniquely bottle-shaped, i.e. constricted just below apex; persistent perianth often has a border or "flange" where the calyx is flattened along the margin; fruiting perianth divided for less than half its length; plant erect with rounded or blunt leaves 3. *P. erectum*

Achenes striated or stippled, dull to somewhat shiny but not granular, dark brown in color when mature; leaves lanceolate; plants typically prostrate in growth habit *P. aviculare* aggregate

Achenes with two equal convex and one narrow, slightly concave side, 1.58 to 2.50 mm long; fruiting perianth divided for only slightly more than half its length . . . 4. *P. arenastrum*

Achenes with two more-or-less equal concave sides and one broader, flat to slightly concave side; fruiting perianth divided $\frac{2}{3}$ to $\frac{3}{4}$ of its length.

Achenes typically extremely dull with coarse striations, 2.25-3.08 mm long, 1.42-2.25 mm wide; fruiting perianth divided nearly to the base; well grown plants exhibit heterophylly 5. *P. aviculare*, sensu stricto

Achenes striated with shiny edges, relatively broad and heart-shaped, 1.92 to 2.75 mm long and 1.33 to 2.00 mm wide; fruiting perianth divided for about $\frac{2}{3}$ its length, perianth typically has a border or "flange" where the calyx is flattened along the margin 6. *P. buxiforme*

Conclusions

1. Five species of *Polygonum*, sect. *Polygonum* occur in both Indiana and Wisconsin. The species are *P. ramosissimum*, *P. erectum*, *P. arenastrum*, *P. aviculare*, *P. buxiforme*.

2. *P. tenue* is also present in both Indiana and Wisconsin, but there is evidence that it belongs to sect. *Duravia*.

3. On the basis of distinctive morphological characteristics it would appear that *P. buxiforme* should be considered as a taxon separate from *P. arenastrum* and *P. aviculare*, although all three species belong to the *P. aviculare* complex.

4. This study supports previous investigations which indicate that *P. arenastrum* is the most widely collected species in the *P. aviculare* aggregate in North America.

5. The distribution records for species of sect. *Polygonum* are quite inaccurate and therefore need to be prepared anew. Preliminary remapping of these species has been initiated in this investigation.

6. The diploid chromosome number for *P. erectum* was determined to be *circa* 40. The chromosome numbers for *P. ramosissimum*, *P. tenue*, and *P. buxiforme* are still questionable and should be ascertained.

7. All five species of sect. *Polygonum* occurring in Indiana and Wisconsin produce abnormal achenes late in the growing season. This trait should be investigated thoroughly and the physiology of this phenomenon determined.

Literature Cited

1. DEAM, C. C. 1940. Flora of Indiana. Indiana Department of Conservation, Indianapolis.
2. FERNALD, M. L. 1950. Gray's Manual of Botany. Ed. 8. American Book Co., New York.
3. GLEASON, H. A. 1952. Illustrated Flora of the Northeastern United States and Adjacent Canada. Vol. 2. New York Botanical Garden.
4. HEDBERG, O. 1946. Pollen morphology in the genus *Polygonum* L. s. lat. and its taxonomical significance. Svensk. Botan. Tidskr. **40**:371-404.
5. LÖVE, A., and D. LÖVE. 1956. Chromosomes and taxonomy of eastern North American *Polygonum*. Can. Jour. Botan. **34**:501-521.
6. MERTENS, T. R., and P. RAVEN. 1965. Taxonomy of *Polygonum*, section *Polygonum* (*Avicularia*) in North America. Madroño **18**(3):85-92.
7. SMALL, J. K. 1895. Mem. Dept. Bot. Columbia College **1**:102.
8. SMALL, J. K. 1906. Studies in North American *Polygonaceae*-II. Bull. Torrey Bot. Club **33**:51-57.
9. STYLES, B. T. 1962. The taxonomy of *Polygonum aviculare* and its allies in Britain. Watsonia **5**:177-214.