CLARIFICATION OF THE SECTIONAL STATUS OF *CAREX BOELCKEIANA* BARROS (CYPERACEAE) FROM NORTHERN PATAGONIA

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ABSTRACT

Examination of the holotype of *Carex boelckeiana* suggests that this Patagonian species belongs in *Carex* sect. *Junciformes* rather than in sect. *Inflatae*, where it was originally placed. It is then more closely related (i.e., morphologically similar) to carices from southern South America than to *C. breweri* and *C. engelmannii* from western North America, as was previously suggested.

INTRODUCTION

Carex boelckeiana Barros (subg. *Primocarex* Kük., sensu Kükenthal 1909) was originally placed in *Carex* sect. *Inflatae* Kük. (Barros 1969). Recent examination of the holotype suggests that it more properly belongs in sect. *Junciformes* (Boeckeler) Kük. Full citations are given near the end of this report for specimens examined of *C. boelckeiana*.

Barros (1969, p. 70, Fig.58) described and illustrated *Carex boelckeiana* from plants collected in northern Patagonia, citing only the type collection from Neuquén Province, Argentina (*Boelcke 11405* [HOLOTYPE: BAB!]). To date, I have seen only one additional collection of this species (*León 3409* [BAA]), also from Neuquén Province (Fig. 1). *Carex boelckeiana* has been collected at an elevation of 2050 m and apparently grows in dry sites. Mature fruit has been collected in late January and February.

SECTIONAL PLACEMENT AND DISCUSSION

Barros (1969) originally placed *Carex boelckeiana* in sect. *Inflatae* and noted its similarity to the North American *C. breweri* Boott, though in the same paper he also pointed out several features of *C. boelckeiana* that differ from those of the latter species. He writes (p. 70), "...se asemeja a *Carex breweri* Boott de la que difiere por su espiga más pequeña, la porción masculina escondida y pluriflora, la forma de las glumas con su dorso y mucrón verdes, sus utrículos con sólo dos nervios cerca de los bordes en la cara dorsal sobre una línea verde y por último por la forma de la raquilla." Clearly, some of these differences, as well as other features of *C. boelckeiana* pointed out below, make this species an anomaly in sect. *Inflatae*.

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Kükenthal (1909) placed both sect. *Inflatae* and sect. *Junciformes* in subg. *Primocarex* (most present-day authors consider *Primocarex* to be a highly artificial subgenus and use the name primarily for convenience when discussing monoecious species with a solitary spike). In Kükenthal's key (p.69), sect. *Inflatae* is allied with sect. *Leucocephalae* (which contains the single species *C. fraseri* Andr. and upon which Mackenzie (1931) later founded his genus *Cymophyllus*) while sect. *Junciformes* is placed near sects. *Petraeae, Grallatoriae*, and *Psilocarpae*. Nelmes (1952) considered the perigynia of *Carex fraseri* [= *Cymophyllus fraseri* (Andr.) Mackenzie] to resemble those of *C. breweri* and the closely related *C. engelmannii* L. Bailey, but he noted that vegetatively the two member of sect. *Inflatae* are quite distinct from *C. fraseri*. While Nelmes did not comment on the origin of sect. *Inflatae* and also admitted candidly that he was perplexed as to the origin of *C. fraseri*, he was convinced that members of sect. *Junciformes* were reduced species of *Uncinia* (Nelmes 1952, p. 434). It seems very clear that neither Kükenthal (1909) nor Nelmes (1952) considered the two sections in question to be closely related.

In Kükenthal's (1909) key, sect. *Inflatae* and sect. *Junciformes* are differentiated by the following features: the perigynia of the former are very membranaceous (paper-like) and inflated and the achenes do not completely fill the perigynium; by contrast, the perigynia of the latter are neither paper-like nor inflated and the achenes nearly fill the perigynium. Along with differences in perigynium and achene characters, differences in other characters (e.g., rachilla, bract, scale) also serve to distinguish these two sections. A synopsis of each section is given below, but only those characters helpful in sectionally placing *C. boelckeiana* are included in the descriptions.

The two members of sect. *Inflatae* (Kükenthal 1909; Mackenzie 1931), *Carex breweri* and *C. engelmannii*, both grow on rocky slopes and high mountain summits in the western part of North America (Mackenzie 1931; Hermann 1970). The former occurs in the Cascade and Sierra Nevada mountains (California, Oregon, and Washington) and the latter has a somewhat wider distribution from the Rocky Mountains (e.g., Colorado, Montana, and Wyoming) westward to the mountains of the intermontane basin (e.g., Utah) and coastal states (e.g., California and Washington). Based on descriptions given by Mackenzie (1931), as well as from my own observations, sect. *Inflatae* is characterized by: perigynia ovoid to broadly ovoid, very membranaceous, inflated, margins smooth, veinless or sometimes with a few weak veins; perigynium beak 0.5 – 1 mm long, hyaline; achene much narrower than the perigynium and less than one-half of its length, oblong-obovoid, sharply angled, sides concave,

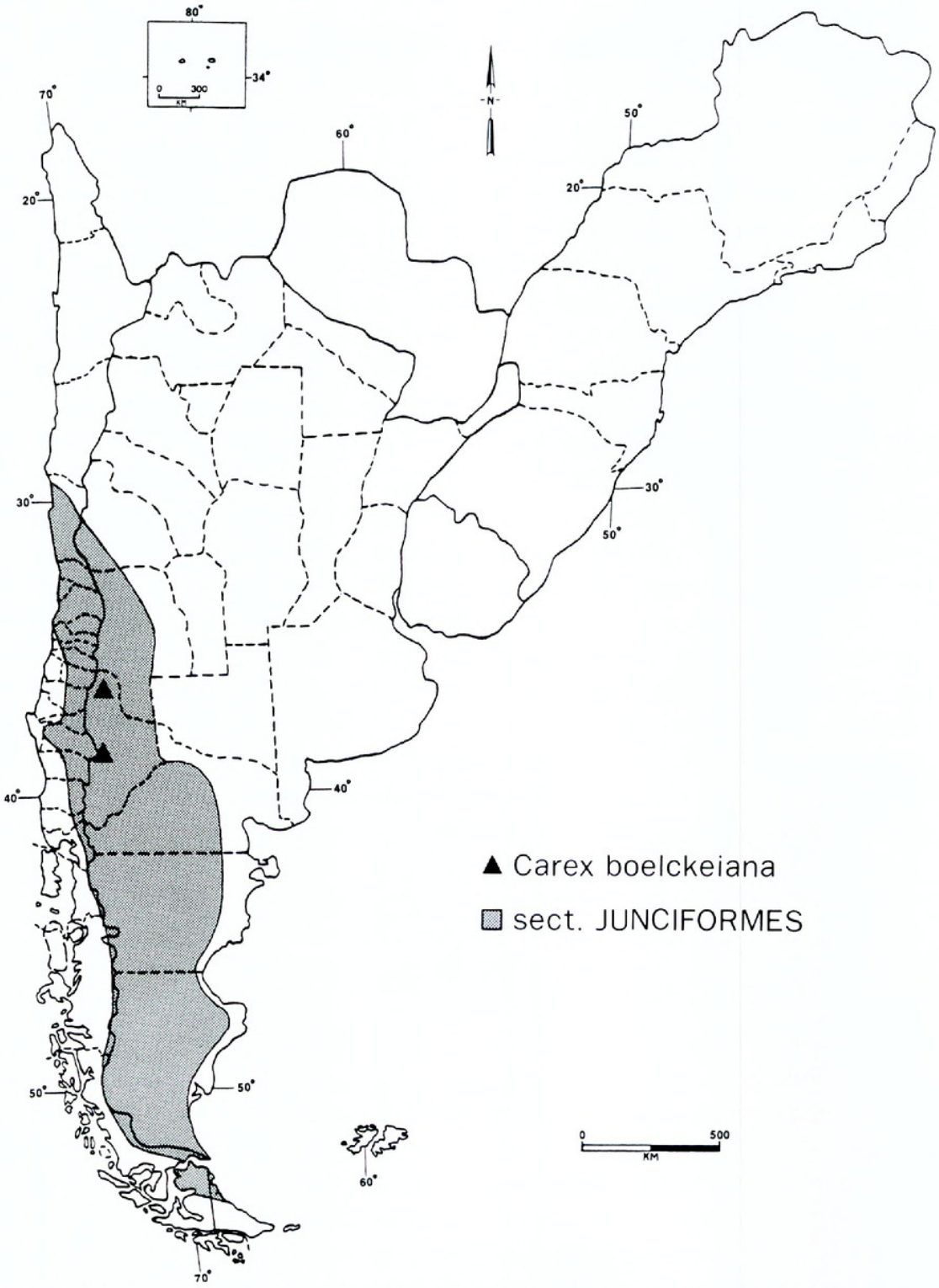

FIG. 1. Map of southern South America showing the distribution of *Carex boelckeiana* and the generalized range of members of *Carex* sect. *Junciformes*. [Stippling denotes the major area of concentration for members of sect. *Junciformes*, but isolated populations do occur outside this demarcation; for example, one species that occurs primarily in Chile is also reported from Peru.]

somewhat stipitate; rachilla setiform, exceeding the achene; stigmas 3; inflorescence bractless; pistillate scales membranaceous, ovate, the apex obtuse to acuminate or slightly cuspidate; leaf sheaths light brown; and rhizomes elongate.

Unlike the two members of sect. *Inflatae*, both of which are endemic to western North America, all known members of sect. *Junciformes* are indigenous to South America (Fig. 1). Kükenthal (1909) placed five species and two varieties in this section, and the remainder have been assigned by Barros (1948, 1957) and Wheeler (1986, in press). Ten of the twelve taxa in the section are tristigmatic, one is strictly bistigmatic, and the remaining one is mostly bistigmatic although it sometimes bears perigynia with three-branched styles (Wheeler in press). Based on a recent examination of all twelve taxa, sect. *Junciformes* is characterized by: perigynia semi-coriaceous, the body obovate to pyriform or broadly elliptical to subglobose, little if at all inflated, margins smooth or scabrous, two veins prominent, these sometimes bordered by greenish strips, the remaining veins obscure or sometimes a few to several visible; perigynium beak lacking or distinct; achene nearly filling the perigynium, obovoid, blunt on the angles, sides more or less straight, sessile to short-stipitate; rachilla setaceous or relatively broad, much shorter than the achene to greatly exceeding it; inflorescence subtended by one or more bracts or bractless; pistillate scales membranaceous to semi-indurate, ovate to broadly ovate or lanceolate, the apex acute to acuminate to cuspidate or awned; leaf sheaths pale brown to dark brown and sometimes reddish-tinged; and rhizomes short or elongate.

From the descriptions and discussion presented above, it is abundantly clear that sect. *Inflatae* and sect. *Junciformes* differ considerably in regard to morphology. Supported by this knowledge, I will first attempt to show that *C. boelckeiana* is not closely related (i.e., it is not morphologically similar) to *C. breweri* and *C. engelmannii*, and then present a case (based on morphological similarities among taxa) that it more properly belongs in sect. *Junciformes*. Based on an examination of the holotype (Fig. 2), *C. boelckeiana* is characterized by: perigynia broadly elliptical to suborbicular, semi-coriaceous, flattened (except where distended over the trigonous achene); 2 veins prominent, each bordered by a greenish strip; perigynium beak 0.1 − 0.2 mm long, semi-coriaceous, brown; achene slightly narrower than the perigynium and approximately one-half of its length, blunt on the angles, sides more or less straight, subsessile; rachilla ovate, much shorter than the achene; inflorescence subtended by 1 − 3 bracts, the longest sometimes reaching 20 mm; pistillate scales semi-indurate, lanceolate, the apex mucronate; leaf sheaths dark brown; and rhizomes short.

FIG. 2. Holotype specimen of *Carex boelckeiana* Barros *(Boelcke 11405)*. Herb. BAB.

To prevent possible confusion to the reader, as well as to clarify a discrepancy between what is reported in the literature and what is written in this paper, two perigynium characteristics (i.e., texture, veination) of *Carex boelckeiana* will be discussed here in more detail. Barros (1969, p.70) described the perigynia of *Carex boelckeiana* as "papiráceos" and reported them to be similar to those of the North American members of sect. *Inflatae*. However, I have found the texture of the perigynium in *C. boelckeiana* to be quite unlike that of the perigynia in *C. breweri* and *C. engelmannii*. For example, transmitted light passes readily through the diaphanous perigynium of both members of sect. *Inflatae* (i.e., the enclosed achene and rachilla are distinctly visible), whereas the same type of light passes with much more difficulty through the semi-opaque perigynium of *C. boelckeiana* (i.e., the rachilla is not visible and the achene only indistinctly so). Furthermore, the perigynium of both members of sect. *Inflatae* is easily ruptured when teased, whereas the comparatively "harder" perigynium of *C. boelckeiana* is not easily torn.

In regard to veination, while the ventral face of the perigynium in *Carex boelckeiana* is veinless, 2 prominent veins run down the dorsal face (the rest obscure), these widely separated and situated near opposite edges of the body and each bordered by a greenish strip. It is suggested here that the 2 prominent "dorsal" veins are actually lateral (or marginal) veins that have been displaced due to stretching of the perigynium walls, which in turn is the result of pronounced flattening of the perigynium. In *C. vallicola* Dewey and its var. *hidalgensis* F.J. Herm. (sect. *Bracteosae*) the lateral veins are also displaced, but in that North American species the 2 prominent veins run down the ventral face as a result of pronounced dorsal bulging of the perigynium (Hermann 1974, p. 28). In contrast to the veination in *C. boelckeiana*, the lateral veins of the perigynium in both member of sect. *Inflatae* are only slightly thickened and are never bordered by greenish strips; furthermore, in both species a few additional weak veins are sometimes visible on one or both faces of the perigynium.

Some of the other differences between *Carex boelckeiana* and the two members of sect. *Inflatae* are also briefly discussed here. The small achenes in both members of sect. *Inflatae* are stipitate and are rather loosely enveloped by the more or less inflated perigynia, and the accompanying rachilla is setaceous and generally exceeds the achene. By contrast, in *C. boelckeiana* the comparatively larger achenes are subsessile and are tightly enveloped by the pronouncedly flattened perigynia, and the rachilla is ovate and usually much shorter than the achene. The relatively broad rachilla and rather large achenes of *C. boelckeiana* are features difficult to reconcile in sect. *Inflatae*. Also, the semi-indurate scales and bracts

subtending the inflorescence are features of *C. boelckeiana* that do not fit easily into sect. *Inflatae*.

Taking into account all of the features of *Carex boelckeiana* that are anomalous in sect. *Inflatae*, retaining the species in the *Inflatae* group is untenable. Also, with the exception of (1) the size and general shape of the perigynia and (2) the achene being narrower and shorter than the perigynium, *C. boelckeiana* shares few other features in common with the two members of sect. *Inflatae*.

Physiognomically, *Carex boelckeiana* closely resembles some members of sect. *Junciformes*, particularly *C. andina* Philippi. Features shared in common by these two species are: spike androgynous, hemispherical to subglobose, pistillate part several- to many-flowered, staminate part inconspicuous, subtended by 1 – 3 bracts; perigynia with 2 prominent veins, each bordered by a greenish strip, the remaining veins obscure; perigynium beak very short; achenes obovate, trigonous, blunt on the angles, the sides more or less straight, subsessile; rachilla relatively broad, shorter than the achene; pistillate scales semi-indurate, lanceolate, cuspidate; culms terete, smooth, striate, stiff; leaves generally shorter than the culms, mostly basal, the blades linear, canaliculate proximally, more or less flattened distally, the margins scaberulent to scabrous (at least distally); leaf sheaths glabrous, dark brown, the inner band hyaline or pale brown, smooth at the mouth; plants cespitose, with short rhizomes; and stigmas 3.

The features of *Carex boelckeiana* fit reasonably well into sect. *Junciformes*, but two characters that appear (at least superficially) to be anomalous in this section are (1) the pronounced flattened perigynia and (2) the achene being smaller than the perigynium (i.e., it is slightly narrower than the perigynium and it fills only about one-half of the body). Is it possible that due to severe flattening the perigynia of *C. boelckeiana* look quite unlike those of its closest related congeners (which is here believed to be members of sect. *Junciformes*)? It is hypothesized that stretching of the perigynium walls in *C. boelckeiana* has resulted in (1) the 2 prominent lateral veins being displaced abaxially, (2) the broadly elliptical to suborbicular shape of the perigynium, and (3) the fact that the perigynium is somewhat larger than the achene. Some support for this hypothesis comes from the structures enclosed within the perigynium. Stretching of the perigynium walls presumably would have little (if any) affect on the enclosed achene and rachilla, and, indeed, both of these structures in *C. boelckeiana* are very similar to those in members of sect. *Junciformes*.

In conclusion, the features of *Carex boelckeiana* that "appear to be anomalous" in sect. *Junciformes* do not deter the author from suggesting placement for this species in the *Junciformes* group, and particularly since all other

observable features of the plant seem to indicate close relationship with the members of this section. Wood (1972) and Raven (1972) stressed that an accurate taxonomic framework is a prerequisite in the study of plant disjunctions. Although Barros (1969) claimed that *C. boelckeiana* is related (i.e., morphologically similar) to the North American members of sect. *Inflatae*, this study shows that it is an anomaly in sect. *Inflatae*, thus negating Barros' claim that the *Inflatae* group is represented in South America. Finally, with *C. boelckeiana* placed in sect. *Junciformes*, one is pleasantly saved from having to postulate long-distance dispersal or complicated orographic migration to explain the occurrence of this species on the South American continent.

Specimens examined: *Carex boelckeiana*. ARGENTINA. PROV. NEUQUÉN: **Dpto. Minas**, Piedra del Gallo, 36°42′30″S, 70°30′W, 2050 m, 30 – Jan – 1964, *Boelcke 11405* (HOLOTYPE: BAB); **Dpto. Picunches**, Pino Hachado, Portezuelo Sanguileo, 20 – Feb – 1983, *León 3409* (BAA).

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Review

ARONSON, J. K. 1985. An account of the foxglove and its medical uses, 1785 – 1985. 399 pp. Oxford University Press, New York. ISBN 0-19-261501-7. Hardbound, $45.00.

The first part of the book is a facsimile of William Withering's monograph *An Account of the Foxglove and some of its Medical Uses: with Practical Remarks on Dropsy, and other Diseases* to which the author has added annotations that help to elucidate certain aspects of that time period in relation to current conditions.

The second half of the book is an account of the history of the use of the digitalis glycosides and related compounds over the last 200 years. "I have hoped thereby to learn something about how modern practice has been influenced and about what we can learn about our own practices through a knowledge of the previous habits of others." (Preface)

The second half is divided into Part I, II, & III. Part I is the Introduction with Chapter 1 entitled "The Foxglove as Flower and Herb." Sections within Chapter 1 are: The Botany of Foxgloves, Terminology, Naming the Flower, The Foxglove in Literature, The Cardiac Glycosides in *Digitalis* Plants, The Pharmacology of Digitoxin and its influence on Withering's Methods of Treatment with the Foxglove, and Digitalis Toxicity. Chapter 2, "Uses of the Foxglove before Withering," includes topics on: Use of the Foxglove in Tuberculosis, Use of the Foxglove in Epilepsy, and Use of the Foxglove in Dropsies.

Part II, "William Withering of Birmingham", begins with Chapter 3 by the same title with a biographical sketch. The next section discusses "Withering's Other Scientific Activities" followed by "Withering's Character" and a "Chronology of Withering's Life and Publications." Chapter 4: "Withering's Discovery and Use of the Foxglove," Chapter 5: "Attitudes to the Use of the Foxglove in Withering's Lifetime".