GSC Biological and Pharmaceutical Sciences, 2019, 08(02), 101–105

Available online at GSC Online Press Directory

GSC Biological and Pharmaceutical Sciences

e-ISSN: 2581-3250, CODEN (USA): GBPSC2

Journal homepage: https://www.gsconlinepress.com/journals/gscbps

(RESEARCH ARTICLE)

Practical identification key of *Digitaria ciliaris* (Retz.) Koeler and *Digitaria horizontalis* Willd. (Poaceae): two harmful weeds of crops in Senegal

Ngom Ablaye *, Mbaye Mame Samba, Gueye Madiop, Camara Abdoul Aziz and Noba Kandioura

Laboratoire de Botanique - Biodiversité, Département de Biologie Végétale, Faculté des Sciences et Techniques, Université Cheikh Anta Diop, BP 5005, Dakar-Fann, Sénégal.

Publication history: Received on 30 July 2019; revised on 09 August 2019; accepted on 20 August 2019

Article DOI: https://doi.org/10.30574/gscbps.2019.8.2.0144

Abstract

Digitaria ciliaris and *D. horizontalis* are among the most common and harmful weed species of crops in Senegal. Their identification by taxonomists and agronomists is not easy because of their close similarity. The objective of this study is to define their morphological differences and to provide a practical identification key. The results of the study show that *Digitaria ciliaris* and *D. horizontalis* are differentiated from three characters in the vegetative and reproductive systems. An illustrated table of these discriminating traits, serving as a key of practical determination, is proposed.

Keywords: Discriminant traits; Key; *Digitaria ciliaris*; *Digitaria horizontalis*; Weeds

1. Introduction

Digitaria ciliaris (Retz.) Koeler and *D. horizontalis* Willd. are considered as highly aggressive and reported as a problem in 60 countries around the world, infesting more than 30 crops economically important [1]. In Senegal, they are found in all phytogeographic zones [2] and remain among the most important weeds in agriculture. Indeed, *D. ciliaris* is one of the most common weeds and the most harmful for many crops such as groundnuts, millet [3] and corn [4]. However, its advantage is that it is usually more nutritious than most other warm-season grasses [5]. As for *D. horizontalis*, it poses a major challenge in favorable environments where it is able to grow vigorously and multiply rapidly [6] despite its strategic role as a livestock feed at the beginning of the rainy season at the time where the dry season straw stock is exhausted [7]. However, on farms, the precise identification of *D. horizontalis* is not easy because it is most often confused with *D. ciliaris*. The two species, so similar vegetatively and reproductively, have often been a source of confusion among taxonomists and agronomists. At the local level, any determination key has been developed. [8]'s work has been of great help in providing identification keys for *Digitaria* species. However, a single character, insufficient, is often used for the discrimination of the two species. The discrimination of these species, potential sources of genes used for the improvement of fonio (*Digitaria exilis* Stapf), the cultivated species, deserves to be made because of their different relationships between *Digitaria exilis*. This present work aims to define the morphological differences between *D. ciliaris* and *D. horizontalis* and to provide a practical key facilitating their identification.

2. Material and methods

The plant material was provided from the Herbaria DAKAR and IFAN and from personal collections. A detailed description of the mature plant was made and completed if necessary with some manuals [8, 9]. A total of 41 morphological characters (qualitative and quantitative) have been described and recorded in Table 1. These characters are derived from culm, leaf (sheath, ligule and limb), racemes, spikelets, glumes, flowers and fruit. All the

* Corresponding author
E-mail address: ngomito@hotmail.com

characters of each species described have been compared in order to obtain the most discriminating characters differentiating at best the two species studied.

Table 1 Morphological traits studied for the distinction of *D. ciliaris* and *D. horizontalis*

N°	Components	Traits	*D. ciliaris*	*D. horizontalis*
1	Culm	Habit	annual	annual
2		Height	25 cm > x < 200 cm	25 cm > x < 200 cm
3		Nodes pubescence	glabrous	glabrous
4		internodes pubescence	glabrous	glabrous
5	Sheath	Pubescence	glabrous or pubescent	glabrous or pubescent
6	Ligule	Apex	truncate	truncate
7		Length	0.5-3 mm	1-1.5 mm
8		Pubescence	glabrous, presence of long periligular hairs	glabrous, presence of long periligular hairs
9	Limb	Form	linear to lanceolate	linear to lanceolate
10		Apex	attenuated in a peak	attenuated in a peak
11		Base	rounded	rounded
12		Pubescence	glabrous or pubescent	glabrous or pubescent
13		Margin roughness	scabrous	scabrous
14		Margin pubescence	glabrous	glabrous
15	Racemes	Disposition	often digitate	often subdigitate along a central axis
16		Rhachis	triquetrous, not winged	triquetrous, not winged
17	Spikelet	Disposition	by 2	by 2
18		Form	elliptic to lanceolate	lanceolate
19		Pubescence	pubescent	pubescent
20		Type of hairs	apressed	apressed
21		Pedicels roughness	scabrous	scabrous
22		Pedicels pubescence	glabrous	glabrous
23	Lower glume	Form	present and ovate	absent or reduced to scales, ring or membranous
24		Apex	acute	truncate
25	Upper glume	Form	lanceolate to linear	Lanceolate to linear
26		Apex	acute	acute
27		Relative length	½ to ¾ of the spikelet length	≤ ½ of the spikelet length
28		Number of veins	3-veined	3-veined
29		Pubescence	pubescent	pubescent
30	Lower lemme	Form	elliptic	elliptic
31		Relative length	equal to the spikelet length	equal to the spikelet length
32		Apex	acute	acute
33		Number of veins	7- veined	7- veined
34		Pubescence	pubescent	pubescent
35	Upper lemma	Form	lanceolate to oblong	lanceolate
36		Apex	acute	acute
37		Relative length	equal to the spikelet length	equal to the spikelet length
38	Fruit	Form	oblong	oblong
39		Apex	acute	acuminate or acute
40		Length	> 2 mm	1 mm to 2 mm
41		Color	brown	beige

3. Results and discussion

3.1. The discriminating morphological characters

Of the 41 traits studied, thirthy one (31) are common to both species. The remaining ten characters, which are discriminant, are related to the ligule, racemes, spikelet, lower glume, upper glume, upper lemma and fruit. The most diagnostic of these are length and pubescence of the ligule, racemes disposition, shape of the lower glume and the relative length of the upper glume. In species of the genus *Digitaria*, the use of characters from the vegetative system for their distinction is less frequent and uncertain because they are often quite variable within the same species creating transition forms that make identification difficult. However, this study reveals important vegetative characters for the recognition of the two studied species. Indeed, the ligule is most developed in *D. ciliaris* (0.5-3 mm) than *D. horizontalis* (1-1.5 mm).

The spikelet characters are still the most used for distinguishing species and are of great taxonomic importance, making it much easier to identify species of the genus. In this study, the shape of the lower glume and the relative length of the upper glume are the most discriminating characters for distinguishing *D. ciliaris* from *D. horizontalis*. In fact, *D. ciliaris* has a well-developed lower glume ovate and an upper glume equal or longer than half the length of the spikelet. Contrariwise, in *D. horizontalis*, the lower glume is either absent or reduced to scales, ring or membranous; the upper glume not exceeding half the length of the spikelet. As for the upper glume, the great variability of most of its characters makes them highly discriminating. These results are in correlation with those of [10] who states that *D. horizontalis* is distinguished from *D. ciliaris* by the upper glume (1/3 to ½ as long as the spikelet). The upper glume of *D. ciliaris* is ½-¾ as long as the spikelet. The arrangement of the racemes on the main axis is also a character of important value to distinguish these two species [11, 12, 13]. *D. ciliaris* is characterized by its racemes often digitated whereas in *D. horizontalis* they are often digitated or subdigitated and arranged along a common main axis.

3.2. The proposed determination key

Three determinative characters were retained for the construction of the key (Figure 1). In the proposed key, the first criterion chosen is the relative length of the upper glume. Although the spikelet appears at a late stage and its components delicately appreciable, this key is more reliable. Indeed, according to [14], it is considered as a reliable character by most researchers in the genus but very precise measurements are necessary. By the way, they recommended using relative lengths such as from the upper glume in key construction. As for their study, the present results show that it gave the best indication of the phenetic relationship between D. ciliaris and D. horizontalis. Another character, no less important, to take into account in the distinction of the two species is the presence or not of the lower glume which is absent or reduced to scales, ring or membranous in D. horizontalis while rather developed and ovate in *D. ciliaris.* Thereby, some authors such as [12] and [15] considered this character of some value to distinguish species while [13] indicated a separation of closely related species on the basis of the length of the lower glume.

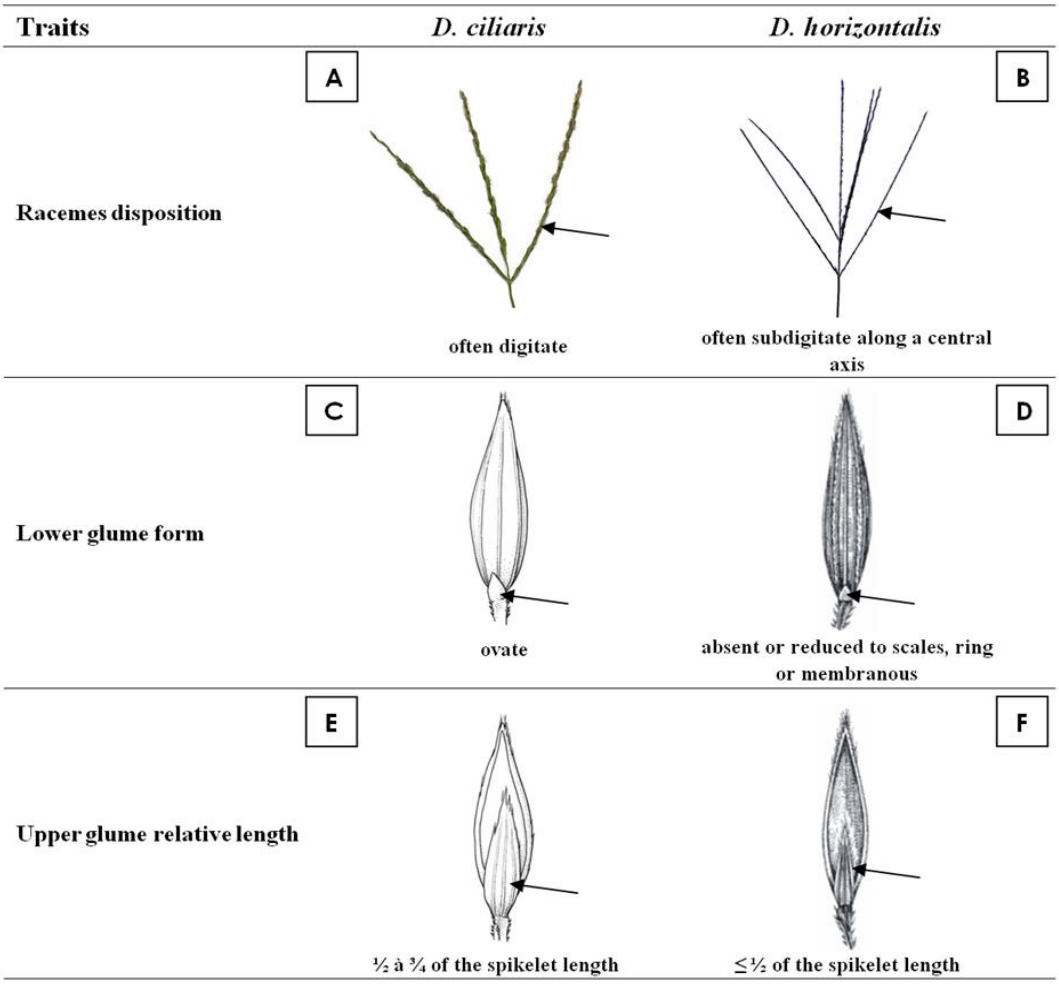

Figure 1 Determinative characters distinguishing *D. ciliaris* from *D. horizontalis*. Sources: A from https://www.eeob.iastate.edu; C and E from [16]; D and F from [8].

4. Conclusion

In this study, 10 discriminant characters was identified among which three (racemes disposition, lower glume form and relative length of the upper glume) can be used for the distinction of *D. ciliaris* and *D. horizontalis*. However, it would be more prudent to use simultaneously these three characters.

Compliance with ethical standards

Acknowledgments

We are thankful to the Curators of the Herbaria DAKAR and IFAN for providing herbarium materials.

Disclosure of conflict of interest

The authors hereby declare that there is no conflict of interest.

References

[1] Souza RC, Dias AC, Figueiredo MRA, Obara FEB and Christoffoleti PJ. (2012). Growth of the crabgrass species *Digitaria ciliaris* and *Digitaria nuda*. Planta Daninha, 30 (2), 317-325.

[2] Ngom A, Mbaye MS, Barnaud A, Gueye MC, Camara AA, Gueye M, Diop BM and Noba K. (2019). Ecological distribution, diversity and use of the genus *Digitaria* Haller (Poaceae) in Senegal. International Journal of Biodiversity and Conservation, 11(1), 8-17.

[3] Noba K. (2002). Weed flora in the southern Groundnut Basin (Senegal): structure, dynamics and impact on the production of millet and groundnuts. State Doctorate Thesis, Cheikh Anta Diop University of Dakar, Senegal, 64-102.

[4] Bassene C, Mbaye MS, Kane A, Diangar S and Noba K. (2012). Weed flora of maize (*Zea mays* L.) in the southern groundnut basin (Senegal): structure and harmfulness of species. Journal of Applied Biosciences, 59, 4307-4320.

[5] Dalrymple RL, Mitchell R, Flatt B, Dobbs W, Ingram S and Coleman SW. (1999). Crabgrass for Forage: management from the 1990s. The Noble Foundation, Ardmore, OK.

[6] Johnson DE and Kent RJ. (2002). The impact of cropping on weed species composition in rice after fallow across a hydrological gradient in West Africa. Weed Research 42, 89-99.

[7] Sanou KF, Ouedraogo S, Nacro S, Ouedraogo M and Kaboré-Zoungrana C. (2016). Sustainability of supply and nutritional value of marketed fodder in urban areas of Bobo-Dioulasso, Burkina Faso. Cahiers Agricultures, 25, 15002.

[8] Poilecot P. (1999). Poaceae of Niger. Boissiera, 56, 448-469.

[9] Berhaut J. (1967). Flora of Senegal, Second edition. Clairafrique, Dakar, Senegal.

[10] Clayton WD. (1974). Notes on the Genus *Digitaria* Haller Studies in the Gramineae: XXXVI. Kew Bulletin, 29 (3), 517-525.

[11] Henrard JT. (1950). Monograph of the genus *Digitaria*.: Universitaire Pers Leiden, Leiden.

[12] Veldkamp JF. (1973). A revision of *Digitaria* in Malesia. Blumea, 21, 1-80.

[13] Webster RD. (1983). A revision of the genus *Digitaria* Haller (Paniceae: Poaceae) in Australia. Brunonia, 6, 131-216.

[14] Kok PDF, Robbertse PJ and van Wyk AE. (1988). Systematic study of *Digitaria* section *Digitaria* (Poaceae) in southern Africa. South African Journal of Botany, 55(2), 141-153.

[15] Bor NL. (1955). The genus *Digitaria* Heist in India and Burma. Webbia, 2, 301-367.

[16] Verloove F. (2008). Studies within the genus *Digitaria* Haller (Poaceae, Panicoideae) in southwestern Europe. Candollea, 63, 227-233.

How to cite this article

Ngom A, Mbaye MS, Gueye M, Camara AA and Noba K. (2019). Practical identification key of *Digitaria* ciliaris (Retz.) Koeler and *Digitaria horizontalis* Willd. (Poaceae): two harmful weeds of crops in Senegal. GSC Biological and Pharmaceutical Sciences, 8(2), 101-105.