

## On the identity of *Cyperus permacer* (Cyperaceae) in West Africa

Filip VERLOOVE, Jane BROWNING & Attila MESTERHÁZY

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# On the identity of *Cyperus permacer* (Cyperaceae) in West Africa

**Filip VERLOOVE**

Meise Botanic Garden, Nieuwelaan 38, B-1860 Meise (Belgium)  
[filip.verloove@botanicgardenmeise.be](mailto:filip.verloove@botanicgardenmeise.be)

**Jane BROWNING**

Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE (United Kingdom)  
[janebrowning@btinternet.com](mailto:janebrowning@btinternet.com)

**Attila MESTERHÁZY**

Directorate of Hortobágy National Park, Sumen u. 2, H-4024 Debrecen (Hungary)  
[amesterhazy@gmail.com](mailto:amesterhazy@gmail.com)

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## ABSTRACT

*Cyperus permacer sensu* C.B. Clarke is not the same as *C. permacer sensu* Hooper in *Flora of West Tropical Africa*. A thorough study of herbarium specimens proved the latter to be a mere variety of *C. tenuiculmis* Boeckeler. The taxonomic identity of *C. permacer* itself is also unclear, the holotype being a poor specimen. It possibly is only a depauperate form of *C. dilatatus* Schumacher.

## RÉSUMÉ

*Sur l'identité de Cyperus permacer (Cyperaceae) en Afrique de l'Ouest.*

*Cyperus permacer sensu* C.B. Clarke n'est pas le même que *C. permacer sensu* Hooper in *Flora of West Tropical Africa*. Une étude approfondie des spécimens d'herbier a démontré que ce dernier n'est qu'une simple variété de *C. tenuiculmis* Boeckeler. L'identité taxonomique de *C. permacer* lui-même n'est pas claire non plus, l'holotype étant un spécimen de mauvaise qualité. Ce n'est peut-être qu'une forme peu développée de *C. dilatatus* Schumacher.

## KEY WORDS

Cyperaceae,  
*Cyperus*,  
tropical West Africa.

## MOTS CLÉS

Cyperaceae,  
*Cyperus*,  
Afrique de l'Ouest  
tropicale.

## INTRODUCTION

Clarke (1907) described *Cyperus permacer* C.B. Clarke based on a specimen in the Paris herbarium (P; herbarium acronyms hereafter follow Thiers 2019+) collected by Auguste Chevalier in Moyen-Niger (present-day Mali): “de Nyamina à Koulikoro, 05.X.1899, *Aug. Chevalier n°2488*” (MNHN, P[P00569196]; Fig. 1). The new species was said to differ from *C. protractus* T.A. Durand & H. Schinz by its poorly flowered inflorescence, the points of attachment of the glumes being further apart and the non-reddish glumes. Meant was in fact the illegitimate binomial *C. protractus* C.B. Clarke (*in* Durand & Schinz 1895) (syn.: *C. tegetum* C.B. Clarke var. ‘*protracta*’ C.B. Clarke; Clarke 1884), now a synonym of *C. schimperianus* Steud. from the Arabian Peninsula (Govaerts *et al.* 2020). Earlier homonyms were established by Link (1821) and Delile (1813) and now refer to *C. difformis* L. and *C. fuscus* L. respectively (Kükenthal 1935–1936, Govaerts *et al.* 2020). Soon afterwards, Chevalier (1920) provided additional records from (French) Guinea, Ivory Coast and Dahomey (present-day Benin), although not all of them were approved by Kükenthal (1935–1936). Kükenthal (1935–1936) then subsumed this species under *C. zollingeri* Steud. as var. *permacer* (C.B. Clarke) Kük., at that time not knowing that the name *C. zollingeri* had been wrongly applied for the well-known and widely distributed species *C. tenuiculmis* (Kern 1954). By proposing this new combination, Kükenthal explicitly emphasized the close relationship between *C. permacer* and *C. tenuiculmis*. In her revision of *Cyperus* for the Flora of West Tropical Africa Hooper (1972a) reintroduced the name *C. permacer* and reported it from Ghana, Guinea, (southern) Nigeria and Sierra Leone. She found it to be “similar in habit to *C. tenuiculmis* but with cylindrical or oblong spikes of short spikelets with distinctly apiculate glumes”. Interestingly, all of the collections in K of this species are preserved in the folder of *C. tenuiculmis*. One of the inner covers of the folder is labelled “*Cyperus permacer*” (in pencil, probably written by one of the curators) and contains eight of the collections cited by Hooper. However, none of these collections have determination labels by Hooper as *C. permacer*; they all have different determinations. Other authors then followed Hooper and used the name in various West African flora accounts (e.g. Aké Assi 2002; Lisowski 2009). Lowe & Stanfield (1974) reported it from Nigeria saying that it is similar to *C. tenuiculmis* but distinguished by its narrow spikes (i.e. the spikelets are not spreading), and the shorter spikelets. Vanden Berghen (1988) also mentioned it from Senegal and Cape Verde Islands. It is unknown on which source this is based. The species is not cited in a recent catalogue of vascular plants from Cape Verde (Sánchez-Pinto *et al.* 2005), nor was it mentioned by Chevalier (1935) in his flora of the archipelago. The single collection Vanden Berghen (1988) cited (*J. Berhaut 1569*, preserved in BR) represents a depauperate specimen that lacks lower parts and only has a few degenerated inflorescences; Vanden Berghen himself considered

this specimen to be doubtful. Eventually, the species was reported from Ghana, Guinea, Nigeria, Senegal and Sierra Leone by Govaerts *et al.* (2020). Mali – despite being the country from where it was described – was omitted from the species’ distribution area.

During our revision of *Cyperus* for an upcoming illustrated revision of Cyperaceae in West tropical Africa (Mesterházy *et al.*, in prep.), we examined collections of alleged *C. permacer*, including the holotype and eight of the collections cited under this species by Hooper (1972a), in order to critically reassess its taxonomic status.

## MATERIAL AND METHODS

Numerous relevant herbarium collections, including several type specimens, were examined from the herbaria BP, BR, K, NU, P, PRE and SRGH. For a few also digitized specimens from online sources such as JSTOR Global Plants (<https://www.jstor.org/>) were studied. In addition, numerous literature references were consulted in order to better understand the distinguishing features used for the separation of the concerned taxa. Floral details and measurements were made from collections. Macro-morphological characters were measured by conventional ruler calibrated in millimeters. Microscopic features were recorded with an Alpha stereomicroscope with graticule at ×40 magnification.

## RESULTS

THE IDENTITY OF *CYPERUS PERMACER*  
SENSU HOOPER (1972A)

In her account of *Cyperus* for the Flora of West Tropical Africa, Hooper (1972a) referred to twelve collections of *C. permacer* that she had seen during her revision. These originated in Guinea, Sierra Leone, Ghana and southern Nigeria. At least eight of these collections are extant and preserved at K, albeit in a folder labelled ‘*Cyperus tenuiculmis*’. They bear names such as *C. zollingeri*, *C. tenuiculmis*, *C. schweinfurthianus* Boeckeler or “*C. solitarius*” (a provisional, unpublished name suggested by J.K. Morton), whereas none is labelled *C. permacer*; nor were any of them annotated by Hooper as belonging to that species, although a label ‘Seen for Revised Edition of F.W.T.A.’ was added.

The type of *Cyperus permacer* (*A.J.B. Chevalier 2488*, Koulikoro, Mali) is preserved in the Paris herbarium. Based on the original description (Clarke 1907) and examination of the type collection, the following diagnostic features become apparent: glumes are *c.* 3.6–3.8 mm long and 1.2–2.3 mm wide, pale green with a darker midrib, an apiculus is not visible; the rachilla is zig-zag and no wings can be seen on this old collection with rachilla from which glumes have been shed; glumes are slightly patent (not closely appressed to the rachilla); spikelets are *c.* 22–24.3 mm long, with the

TABLE 1. — Overview of variables measured on eight extant herbarium collections at K that were considered to be *Cyperus permacer* by Hooper (1972a). Abbreviations: **GUI**, Guinea; **NIG**, Nigeria; **SL**, Sierra Leone; **GHA**, Ghana.

| Collector, number and country | <b>Adam<br/>12554<br/>GUI</b> | <b>Keay<br/>37171<br/>NIG</b>             | <b>Haswell<br/>253<br/>SL</b>                        | <b>Glanville<br/>352<br/>SL</b>                                      | <b>Jordan<br/>808<br/>SL</b> | <b>Morton<br/>2694<br/>SL</b> | <b>Hall<br/>2034<br/>GHA</b> | <b>Morton &amp;<br/>Gledhill 3043<br/>SL</b> |
|-------------------------------|-------------------------------|-------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------|------------------------------|-------------------------------|------------------------------|----------------------------------------------|
| Plant height (cm)             | 53                            | 110                                       | 58                                                   | 78                                                                   | 115                          | 44                            | 103                          | 67                                           |
| Base                          | remains of stolons            | slight swelling; rhizome -fibrous remains | stolons; swollen                                     | ×                                                                    | ×                            | ×                             | bulbous                      | slightly bulbous                             |
| Culm diameter (mm)            | 5                             | 2.5                                       | 2                                                    | 2-3                                                                  | ×                            | 2                             | 1.5                          | 1.5                                          |
| Culm vestiture                | smooth                        | slightly scabrid                          | smooth below inflorescence to slightly scabrid below | smooth to slightly scabrid below inflorescence, the remainder smooth | scabrid below inflorescence  | smooth                        | scabrid                      | scabrid                                      |
| Leaf sheath (cm)              | 5-6                           | 9                                         | 5-6                                                  | ×                                                                    | 9                            | c. 5-6                        | ×                            | ×                                            |
| Leaf blade (cm)               | 23                            | 60+                                       | 40                                                   | 41                                                                   | 84                           | 19                            | 40                           | 35                                           |
| Blade width (mm)              | 5-5.5                         | 5                                         | 3                                                    | 6                                                                    | 2                            | 4-5                           | 5                            | 2                                            |
| Involucral bracts number      | 5-6 (2 long)                  | 4                                         | 3 (1 long)                                           | 3-4 (2 long)                                                         | 3                            | 3                             | 3                            | 3                                            |
| Bract longest (cm)            | cut off                       | 23                                        | 15                                                   | 16                                                                   | 15                           | 15-16                         | 15                           | 15                                           |
| Inflorescence sessile         | 6                             | 5                                         | 3                                                    | 5                                                                    | 3                            | 3-4                           | 3-4                          | 3                                            |
| then number of rays           |                               |                                           |                                                      |                                                                      |                              |                               |                              |                                              |
| Ray length longest (cm)       | 15                            | 18                                        | 4                                                    | 17                                                                   | 7                            | 9                             | 14                           | 4                                            |
| Spikelets per spike           | ×                             | c. 8-12                                   | 3-8                                                  | 20-25                                                                | 13                           | 7-9                           | 7                            | 5                                            |
| Spikelet length (mm)          | ×                             | 15                                        | 10-15                                                | 10-15                                                                | 15                           | 17-20                         | 14-16                        | 15                                           |
| Mucro length (mm)             | 0.4-0.5                       | 0.5-0.6                                   | 0.8                                                  | 0.7-0.8                                                              | 0.5-0.6                      | 0.6-0.8                       | 0.5                          | 0.75                                         |

TABLE 2. — Comparison between two randomly selected collections of *Cyperus permacer sensu* Hooper (1972a) and three varieties of *C. tenuiculmis*.

|                                 | <b><i>Cyperus permacer sensu</i> Hooper (1972a)<br/>Keay 37171 (K)</b> | <b><i>Cyperus permacer sensu</i> Hooper (1972a)<br/>Morton 2694 (K)</b> | <b><i>Cyperus tenuiculmis</i> var.<br/><i>tenuiculmis</i></b> | <b><i>Cyperus tenuiculmis</i> var.<br/><i>guineensis</i></b> | <b><i>Cyperus tenuiculmis</i> var.<br/><i>schweinfurthianus</i></b> |
|---------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------|---------------------------------------------------------------|--------------------------------------------------------------|---------------------------------------------------------------------|
| Spikelets digitate or spicate   | spicate                                                                | spicate                                                                 | spicate                                                       | spicate                                                      | spicate                                                             |
| Spikelet length (mm)            | 15                                                                     | 17-20                                                                   | 15-46                                                         | 15-46                                                        | 15-46                                                               |
| Spikelet width (mm)             | 2-2.5                                                                  | 3.5                                                                     | 1.6-2.2                                                       | 1.6-2.2                                                      | 1.6-2.2                                                             |
| Rachilla wing                   | winged                                                                 | winged                                                                  | winged                                                        | winged                                                       | winged                                                              |
| Rachilla zig-zag                | rachilla zig-zag                                                       | rachilla zig-zag                                                        | rachilla zig-zag                                              | rachilla zig-zag                                             | rachilla zig-zag                                                    |
| Glume number                    | 12                                                                     | 14                                                                      | ×                                                             | ×                                                            | ×                                                                   |
| Glume length (incl. mucro) (mm) | 4                                                                      | 4.3-4.5                                                                 | 2.7-4.1                                                       | 2.7-4.1                                                      | 2.7-4.1                                                             |
| Mucro length (mm)               | 0.5-0.6                                                                | 0.6-0.8                                                                 | without or with very short mucro                              | without or with very short mucro                             | with clearly excurrent mucro                                        |
| Glume width (mm)                | 2                                                                      | 2.25                                                                    | ×                                                             | ×                                                            | ×                                                                   |
| Veins on glume flanks           | 3                                                                      | 3                                                                       | ×                                                             | ×                                                            | ×                                                                   |
| Stamen number                   | 3                                                                      | 3                                                                       | 3                                                             | 3                                                            | 3                                                                   |
| Anther length (mm)              | 1                                                                      | ×                                                                       | 0.6-1.4                                                       | 0.6-1.4                                                      | 0.6-1.4                                                             |
| Nutlet shape                    | ×                                                                      | ovoid to obovoid                                                        | obovoid to ellipsoid                                          | obovoid to ellipsoid                                         | obovoid to ellipsoid                                                |
| Nutlet length                   | ×                                                                      | 1.5-1.6                                                                 | 1.6-1.9                                                       | 1.9-2                                                        | 1.6-1.9                                                             |

distance between the glumes 1.45 mm (measured at mid-length); the nutlet is ellipsoid.

In Table 1, an overview is presented of variables measured on eight extant herbarium collections at K that were considered to be *Cyperus permacer* by Hooper (1972a). The following details were assessed: plant height, culm base (form, absence or presence of stolons and/or rhizomes), culm diameter, culm vestiture, leaf sheath length, leaf blade length, leaf blade width, number of involucral bracts, length of longest bract, number of inflorescence rays (if

any), length of longest ray, number of spikelets per spike, spikelet length and mucro length.

Based on the above, it becomes obvious that plants named *Cyperus permacer* by Hooper (1972a) do not correspond with the concept of that species as described by Clarke (1907). Hooper's plants mainly differ in the following respect: the rachillas are definitely winged, the glumes are darker and have a very distinct mucro and the nutlets are shorter and wider (ovoid to obovoid). Also, glumes are tightly appressed to the rachilla. The specimens of alleged *C. permacer* that



FIG. 1. — Specimen used by Clarke (1907) to describe *Cyperus permacer* C.B. Clarke (Paris herbarium, Aug. Chevalier n°2488, P00569196).

were examined are quite variable (see Table 2) but none is genuine *C. permacer* as understood by Clarke.

In Table 2, measurements of features of the inflorescence and nutlet found in the collections examined are presented: two randomly selected collections of *Cyperus permacer sensu* Hooper are compared with three varieties of *C. tenuiculmis*, a widespread and very variable species that much resembles *C. permacer* (see Kükenthal 1935-1936).

Hooper (1972a) emphasized the resemblance of her *Cyperus permacer* with *C. tenuiculmis*. She suggested it mostly differed in quantitative characters such as form and length of spikes and spikelets. In addition, it was said to have distinctly apiculate glumes. However, the type of *C. permacer* clearly has glumes without a mucro. Our contention is that the specimens referred by Hooper to *C. permacer* are in fact part of the variation of *C. tenuiculmis* as can be deduced from the measurements presented in Tables 1 and 2. There obviously is a lack of clear-cut characters that separate *C. permacer sensu* Hooper from *C. tenuiculmis* and its varieties since both overlap in nearly all characters. Even in case of slight divergence measurements are still in line with other flora accounts for *C. tenuiculmis* (e.g. Haines & Lye 1983). Glume mucros appear to be slightly longer than in most material seen of *C. tenuiculmis* (up to 0.8 mm in some specimens; see Table 1). However, mucro length often varies even in a single individual and some forms of *C. tenuiculmis* (especially in var. *schweinfurthianus* (Boeckeler) S.S. Hooper) tend to have glumes with longer mucros. Since in other characters these specimens do not seem to differ, we refrain from describing them as (yet) another variety and consider *C. permacer sensu* Hooper (1972a) to be conspecific with *C. tenuiculmis*.

Moreover, an extensive revision of the *Cyperus tenuiculmis* complex is needed, preferably based on modern techniques. Morphologically, the subspecies that are currently accepted appear to be poorly separated and establishing subspecies as did Hooper (1972b) was probably premature.

#### THE IDENTITY OF *CYPERUS PERMACER* *SENSU* CLARKE (1907)

The holotype of *Cyperus permacer* is a rather poor collection. It consists of a complete specimen and two additional stems, all with poorly developed inflorescences. The material was apparently collected late in the season and most spikes only have a few spikelets with only some glumes left, exposing the slightly zigzag rachis. The stems are thin and flexuous, hence the Latin epithet 'permacer', meaning exceedingly thin.

*Cyperus permacer*, *C. dilatatus* Schumach. and *C. tenuiculmis* are morphologically similar species. They all belong to Kükenthal's former section *Subquadrangulares* Kük. (Kükenthal 1935-1936), for which the nomenclaturally correct name is section *Subimbricati* C.B. Clarke (Larridon *et al.* 2011). Vanden Berghen (1988) distinguished them in consecutive leads in his identification key, based on rather faint characters such as glume color and robustness of stems. 'Typical' for *C. permacer* appears

to be the thin, flexuous (wavy) stems, which is reflected in its name ('permacer'). Also, it is said to have greenish glumes but this is hard to assess in older specimens. The flexible stems are seen in both the type and a specimen collected by Berhaut and preserved in BR (*J. Berhaut* 1569). *Cyperus dilatatus*, in turn, is a coarser species with usually erect, straight stems. It has spicate inflorescences, with large glumes (c. 4 mm long) and ellipsoid nutlets. The position of the glumes is scattered and the glumes are mucous (a mucro is lacking). It is a weed and occurs in rice fields but also in other agricultural fields, roadsides, less frequently in clearings, etc. It certainly shows a lot of resemblance to *C. tenuiculmis* and allies. *A fortiori*, in BR several specimens were first named *C. tenuiculmis*, then corrected to *C. dilatatus* (or vice versa).

One of our collections from Senegal (Casamance, Bouyouye, degraded gallery forest near the path, alt. 12 m, 12°26'59"N, 16°44'42"W, 13.IX.2014, A. Mesterházy SEN 81, preserved in BP) agrees well with *C. permacer* in glume and nutlet characters. However, it was collected in a shady habitat and otherwise did not seem to differ from shade-forms of *C. dilatatus*. In BR several specimens identified as *C. dilatatus* (and confirmed as such by famous cyperologists like J. Raynal) are preserved that represent such depauperate specimens, e.g. *J. Andreu* 1129 from Chad, *R. Boutique* 86 bis and *J.M. Warlet s.n.* from Democratic Republic of Congo; all are available online at: <http://www.botanicalcollections.be>. These specimens have thin and wiry stems and/or leaves and spicate inflorescences with few spikelets. Closer examination of glumes and nutlets show that they are exactly the same in these characters as the type of *C. permacer*.

We think it is possible or even likely that *Cyperus permacer* is nothing else than a depauperate, shade-form of the widespread species *C. dilatatus*.

#### CONCLUSION

It was shown that there is a lot of confusion with regard to the name *Cyperus permacer*. This binomial has been widely misapplied in tropical West Africa, not in the least by Hooper (1972a) in the Cyperaceae treatment in the Flora of West Tropical Africa. Specimens cited in that account all proved to belong to the exceedingly variable species *C. tenuiculmis*. The type collection of 'genuine' *C. permacer* is a poor specimen and difficult to judge correctly. However, it shows a certain resemblance to the widespread *C. dilatatus* and may be a mere shade-form of the latter.

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