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Taxonomic notes on Some Species of Genus *Urochloa* from Nepal

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Abstract

The purpose of this paper is to study *Urochloa* species and update information on the genus in light of recent changes in the taxonomy of the Poaceae family. *Urochloa* is popularly known as para grass. Disease-free specimens were collected and their morphological features, such as roots, stems, leaves, and floral parts, were studied. Herbarium specimens from KATH were also examined. Five species of *Urochloa*, namely, *Urochloa subquadripara, U. distachya, U. kurzii, U. ramosa, and U. villosa,* were studied. As per observation, taxonomic notes, illustrations, and keys were made.

Keywords: Brachiaria, para grass, poaceae, taxonomy

Introduction

Urochloa P. Beauv. (Synonyms- *Brachiaria* (Trin.) Griseb., *Leucophrys* Rendle, *Pseudobrachiaria* Launert) is a genus of annual and perennial grasses belonging to the sub-tribe Melinidinae, tribe Paniceae, sub-family Panicoideae of the family Poaceae (Soreng *et al*. 2015; POWO 2021). These plants are characterized by often coarse and weedy habit, linear to broadly lanceolate leaf blades, ciliated membranous ligule, inflorescence composed of racemes along a central axis, spikelets single or paired on a flattened or triquetrous rachis (Efloras 2008). Several species of *Urochloa* are known by the name of Para grass which are used as high-quality forage.

Urochloa sensu lato includes more than 100 species distributed mainly in the tropical and subtropical regions of the world (Efloras 2008; POWO 2021). Press *et al.* 2000 have listed four species of *Urochloa* (*Urochloa distachya, U. mutica, U. panicoides, U. supervacua* (syn. of *U. ramosa*)) and, six species and two varieties of *Brachiaria* (included in *Urochloa* at present) (*Brachiaria kurzii, B. ramosa, B. reptans, B. setigera, B. subquadripara, B. villosa; B. villosa* var *villosa* and *B. villosa* var *barbata*) and, National Herbarium and Plant Laboratories (KATH) catalogue lists five species and one variety of *Urochloa* from Nepal (Rajbhandari & Baral 2010). Previously, *Urochloa* and *Brachiaria* were considered separate, however, at present *Brachiaria* is reduced as a synonym of *Urochloa* and all the above-listed species of *Brachiaria* has included under *Urochloa* (POWO 2021) and their names are changed as *Brachiaria kurzii*: *Urochloa kurzii; Brachiaria ramosa*: *Urochloa ramosa; Brachiaria reptans*: *Urochloa reptans; Brachiaria setigera*: *Urochloa setigera; Brachiaria subquadripara*: *Urochloa subquadripara;* and *Brachiaria villosa*: *Urochloa villosa* (POWO 2021). Following the recent change in taxonomy of family Poaceae, this study aimed to update the information about the genus *Urochloa* in Nepal. This work also adds up plant specimens in the herbarium. Nepal is on the way to publishing its national flora and this study may also be useful in the preparation of the Flora of Nepal (Jnawali & Neupane 2020). In this work, we have studied five (*Urochloa subquadripara, U. distachya, U. kurzii, U. villosa, and U. ramosa*) commonly available species of *Urochloa*.

Methods

This research involves the study of freshly collected specimens from Jhapa, Chitwan, and Kailali districts and also the herbarium specimens preserved in the National Herbarium (KATH). Healthy matured plant specimens of the concerned species were collected from different areas of the above-mentioned districts during the field visit in October and November of 2016. Fruiting, disease-free individuals were pressed, dried, mounted on standard herbarium sheets and deposited at the Tribhuvan University Central Herbarium (TUCH) (Forman & Bridson 1989). The collected species were identified using standard literature (Veldkamp 1996; Press *et al.* 2000; Efloras 2008; POWO 2021), herbarium specimens deposited at KATH and TUCH, and expert consultation.

Morphological (both macro and micro) study of the vegetative and reproductive structures of *Urochloa* species was done using, a Loupe magnifier, a stereomicroscope and dissecting microscope. Dissected vegetative and reproductive parts were kept in a paper envelope attached to the herbarium sheet. Following morphological study, illustrations of vegetative and reproductive parts of the studied species were made. Artificial keys were also prepared for the easy identification of species based on observed characters. Keys are arranged in a 'Bracketed format'.

Result

Taxonomic treatments

Urochloa P. Beauv.

Type. *Urochloa panicoides* P. Beauv., Essai d'une Nouvelle Agrostographie 52. t. 11. f. 1. 1812[1812], Neotype: P. Beauv., Ess. Agrost. pl. 11, f. 1. 1812; Neotype designated by Veldkamp, Blumea 41: 433.1996; HT: Commerson in de Jussieu s.n.

Annual or perennial; usually cespitose, sometimes mat-forming, sometimes stoloniferous. Culms 5-500 cm, herbaceous, erect, geniculate or decumbent and rooting from the lower nodes. Leaf sheaths open; auricles rarely present; ligules apparently ciliate. Leaf blades ovate-lanceolate to lanceolate, flat. Inflorescences terminal or terminal and axillary, usually panicles of spikelike primary branches in 2 or more ranks, rachis not concealed by the spikelets. Spikelets solitary, paired or in triplets, subsessile or pedicellate, divergent or appressed, ovoid to ellipsoid, dorsally compressed, in 1-2(4) rows, with 2 florets. Glumes not saccate basally; lower glumes usually very small (1/5-2/3 as long as the spikelet) occasionally equaling the upper florets, (0)1-11-veined. Upper glumes usually more conspicuous than lower glumes and usually 5-13-veined. Lower floret is sterile or staminate whereas upper is fertile or bisexual. Lower lemmas similar to the upper glumes, 5-9 veined, whereas lower lemmas if present, usually hyaline or membranous, 2-veined. Upper lemmas hard, transversely rugose, 5-veined, margins involute, apices round to mucronate, or aristate. Upper paleas rugose, shiny or lustrous. Lodicules 2, cuneate, truncate; anther 3. Caryopses ovoid to elliptic, dorsally compressed.

Key to Studied Species of Urochloa

1a. Culms slender and straggling…….....……*U. subquadripara*
1b. Culms ascending from the prostate base.....…….....…….....2
2a. Leaf blades linear to narrowly lanceolate...…….....…… *U. distachya*
2b. Leaf blades lanceolate to broadly lanceolate.....…….....……..….3
3a. Spikelets distant and glabrous.....…….....*U. kurzii*
3b. Spikelets contiguous and pubescent.....…….....….....4
4a. Lower glume 3-nerved and upper glume 5-nerved …….....….... *U. villosa*

4b. Lower glume 5-nerved and upper glume 5-7 nerved…….....…*U. ramosa*

Taxonomic description

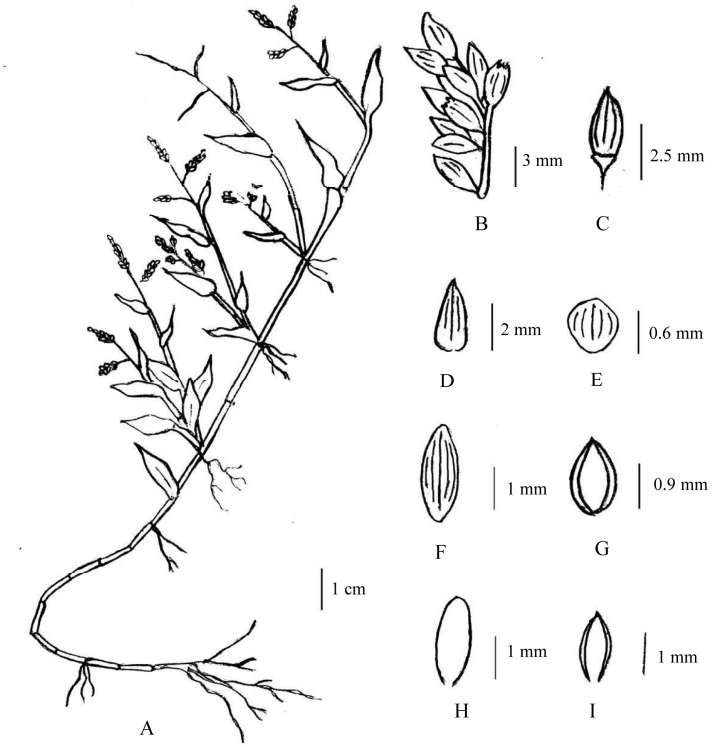
i. ***Urochloa subquadripara*** **(Trin.) R.D. Webster, The Australian Paniceae (Poaceae) 252. 1987.**

Synonyms*: Panicum subquadriparum* Trin., Gram. Panic. [Trinius] 145. 1826; *Panicum miliiforme* J.Presl, Reliq. Haenk. 1(4-5): 300 (-301). 1830; *Brachiaria miliiformis* (J.Presl) Chase, Contr. U.S. Natl. Herb. 22: 35. 1920; *Brachiaria subquadripara* (Trin.) Hitchc., Lingnan Sci. J. 7: 214. 1931.

Specimen examined: Tokla Tea Estate, Mechinagar, Jhapa, 26.65075° N, 88.13794° E, 124 m, 12 Nov 2016, *A. Neupane 002* (TUCH); Pikhute, Sure Dovan, Dolakha, 1020 m, 28 Aug 1983, *K.R. Rajbhandari 9382* (KATH); Chisapani to Lamahi, 22 Aug 1979, *K.R. Rajbhandari and B. Roy 4931* (KATH).

Annual or short-lived perennial, Culms slender and straggling, 10- 45 cm long. Roots from the lower nodes. Leaf blades 1-2.9 × 0.2-0.7 cm, lanceolate, apex acuminate, margin hairy and wavy, long hairs at the leaf base, surface hairy; Leaf sheath loose, pilose with ciliate margin; Ligule ciliate, cilia ca 1.5 mm. Inflorescence axis 3- 5 cm; racemes 2-4, 1- 2.5 cm; Peduncle 0.4-3.4 cm; spikelets elliptic to narrowly obvate, borne singly, alternate, 2-3 × 0.6-1 mm, glabrous. Lower glume 0.8-1 × 0.9-1 mm, broadly ovate, bluntly acuminate, 5- veined, margin smooth; upper glume 2-2.5 mm, narrowly elliptic, acuminate, 7-veined, margin involute. Lower lemma 2-2.5 mm, oblong-elliptic, 5-veined, acuminate, margin involute; Upper lemma 1-1.5 mm, finely rugose, apex subacute, margin inrolled. Lower palea 1.5-1.7 mm, oblong, hyaline, Upper palea 1-1.5, elliptic, rugose.

Figure 1 *Urochloa subquadripara*. A. Habit B. A branch of spike C. A spikelet D. Upper glume E. Lower glume F. Lower lemma G. Upper lemma H. Lower palea I. Upper palea.



ii. ***Urochloa distachya* (L.) T.Q. Nguyen, Novosti Sistematiki Vysshchikh Rastenii 3: 13. 1966.**

Synonyms: *Digitaria distachyos* (L.) Pers., Syn. Pl. [Persoon] 1: 85 .1805; *Panicum paspaloides* Pers., Syn. Pl. [Persoon] 1: 81. 1805; *Brachiaria distachya* (L.) Stapf, Fl. Trop. Afr. [Oliver et al.] 9(3): 565 .1919; *Brachiaria hybrida* Basappa & Muniy., Proc. Indian Natl. Sci. Acad., B 49(4): 379 .1983.

Specimen examined: Aayabari, Mechinagar, Jhapa, 118 m, 26.646890° N, 88.134634° E, 12 Nov 2016, *A. Neupane 003* (TUCH); Ratnanagar, Tandi, Chitwan, 27.620346° N, 84.519302° E, 196 m, 13 Oct 2016, *S. Sharma 010SS* (TUCH); Arundada, Sindhuli, 3100 ft, 24 Dec 1975, *P.R. Shakya & K.R. Rajbhandari 3315* (KATH).

Annual, Culms 20-65 cm tall, ascending from a prostate base. Roots from the lower nodes of prostate base. Leaf blades 3-14 × 0.4-0.7 cm, linear to narrowly lanceolate, apex acuminate, midrib distinct, margin rough to touch; Leaf sheath loose, pilose with ciliate margin; Ligule ciliate, cilia ca 1 mm. Inflorescence axis 3- 7 cm; racemes 2-4, 2.5- 5 cm; Peduncle 1.5-10 cm, scrabid; spikelets elliptic to narrowly ovate, borne singly, 3-4.5 × 0.8-1 mm, glabrous. Lower glume 0.8-1.5 × 0.5-0.9 mm, ovate, apex obtuse, 5-7 veined, margin smooth; upper glume 2-3.5 mm, narrowly oblong, acute, 7-veined. Lower lemma 3-4.5 mm, oblong-elliptic, 5-veined, acute, margin involute; Upper lemma 1.5-2.5 mm, rugose, apex subacute, margin involute. Lower palea 2.5-4 mm, oblong, hyaline, Upper palea 1.5-2.5, elliptic, rugose.

iii. ***Urochloa kurzii* (Hook. f.) T.Q. Nguyen, Novosti Sistematiki Vysshchikh Rastenii 3: 13. 1966.**

Synonyms: *Panicum kurzii* Hook.f., Fl. Brit. India [J. D. Hooker] 7(21): 38. 1896; *Brachiaria kurzii* A.Camus, Fl. Indo-Chine [P.H. Lecomte et al.] 7: 438. 1922; *Brachiaria lanceata* Ohwi, in Bull. Tokyo Sci. Mus. No. 18, 4. 1947; *Brachiaria timorensis* Ohwi, in Bull. Tokyo Sci. Mus. No. 18, 4. 1947.

Specimen examined: Tokla Tea Estate, Mechinagar, Jhapa, 26.65075° N, 88.13794° E, 124 m, 12 Nov 2016, *A. Neupane 005* (TUCH); Babichor, Myagdi, 960 m, 3 Sep 1996, *M. Mikage, R. Hirano, N. Kondo, R. Caoul, C. Mohri, A. Takahasi & K. Yonekura 9682148* (KATH)

Annual. Culms decumbent, rooting from the lower nodes, 15-40 cm long, nodes pubescent. Leaf blades 4-7 × 0.3-0.7 cm, lanceolate, apex acuminate, sparsely pilose, margin thickened, midrib distinct; Leaf sheath pilose with ciliate margin. Inflorescence axis 2.5- 7 cm; racemes 3-8, 2.5- 4 cm; Peduncle 2-6 cm, scrabid; spikelets single, distant, elliptic, 2-3.5 × 0.8-1 mm, glabrous. Lower glume ovate, 3-5 veined; upper glume 7-veined. Lower lemma 7-veined acute apex, upper lemma rugose.

Figure 3 *Urochloa distachya*. A. Habit B. A branch of spike C. A spikelet D. Upper glume E. Lower glume F. Lower lemma G. Upper lemma H. Lower palea I. Upper palea.

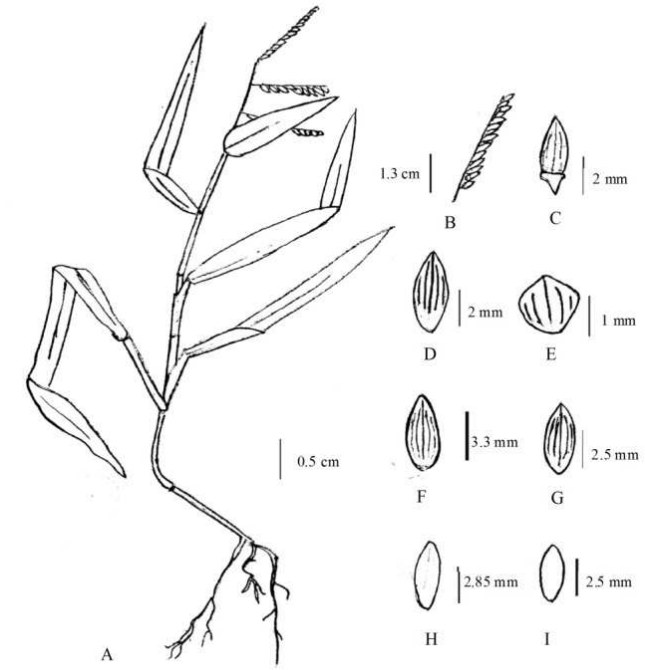
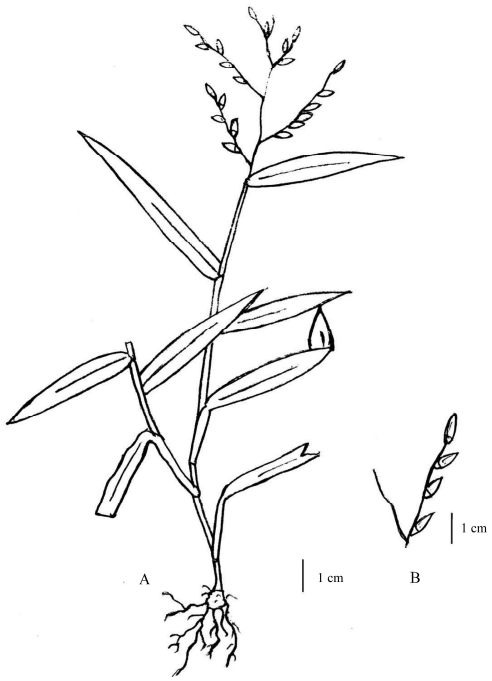


Figure 2 *Urochloa kurzii*. A. Habit, B. A branch of spike.



iv. ***Urochloa villosa*** **(L.) T.Q. Nguyen, Novosti Sistematiki Vysshchikh Rastenii 3: 14. 1966.**

Synonyms: *Panicum villosum* Lam., Tabl. Encycl. 1:173. 1791**;** *Brachiaria distichophylla* Stapf, Fl. Trop. Afr. [Oliver et al.] 9(3): 557. 1919; *Brachiaria villosa* (Lam.) A.Camus, Fl. Indo-Chine [P.H. Lecomte et al.] 7: 433. 1922.

Specimen examined: Rautela Mandir, Bhimdatta, Kailali, 29.013938° N, 80.215098° E, 339 m, 21 Oct 2016, *B. Bhatta BB07* (TUCH); Launtada, Bajhang, 17 Jul 1976, *H. Tabata, K.R. Rajbhandari & K. Tschuiya 192* (KATH); Bijauri, Dang, 680 m, 20 Aug 1979, *K.R. Rajbhandari & B. Roy 4888* (KATH);**:** Sundarijal, 1400 m, 29 Aug 1971 *J.F. Dobremez 867* (KATH).

Annual, Culms 30-65 cm tall loosely tufted. Leaf blades 4-9 × 0.4-2 cm, broadly lanceolate, apex acute, both surfaces densely pubescent, base rounded, margin rough to touch; Leaf sheath pilose, longs hairs in collar region; Ligule ciliate, cilia ca 2 mm. Inflorescence axis 8- 11 cm; racemes 8-12, 2.5- 5 cm; Peduncle 2-5 cm, scrabid; spikelets elliptic, borne singly, 2-3 × 0.8-1.3 mm, glabrous or pubescent. Lower glume 1-1.5 × 0.70.9 mm, ovate, apex obtuse, 3 veined, margin smooth; upper glume 2-3 mm, narrowly elliptic, acute, 5-veined. Lower lemma 2-2.5 mm, elliptic, 5-veined, acute, margin involute; Upper lemma 1.5-2 mm, rugose, apex acute, margin involute. Lower palea 1.32 mm, oblong, hyaline, Upper palea 1.5-2 mm, elliptic, rugose.

v. **Urochloa ramosa (L.) T.Q. Nguyen, Novosti Sistematiki Vysshchikh Rastenii 3: 13. 1966**

Synonyms: *Panicum ramosum* L., Mant. Pl. 29. 1767; *Brachiaria ramosa* Stapf, Fl. Trop. Afr. [Oliver et al.] 9(3): 542. 1919; *Echinochloa ramosa* (L.) Roberty, Fl. Ouest-Afr. 398. 1954; *Urochloa supervacua* (C.B.Clarke) Noltie, Edinburgh J. Bot. 56(3): 394. 1999.

Specimen examined: Itabhatta, Mechinagar, Jhapa, 26.64689° N, 88.127849° E, 123 m, 03 Nov 2016, *A. Neupane 001* (TUCH); Aithpur, Bhimdatta, Kailali, 28.9873762° N, 80.165172° E, 229 m, 20 Oct 2016, *B. Bhatta, 006* (TUCH); Garhwa, Dang, 250 m, 28 Aug 1982, *N.P. Manandhar & N.R. Bhattarai 8502* (KATH); Rajarani, Morang 570 m, 4 Jun 1974, *P. Pradhan, M.M. Amatya & R. Shrestha 65/74* (KATH); Nepalgunj, 200 ft, 17 Jul 1975, *K.J. Malla 83* (KATH).

Annual. Culms 30-65 cm tall, tufted, loosely ascending. Leaf blades 5-11 × 1-1.5 cm, lanceolate, apex acute, surface pilose, margin thickened, midrib distinct; Leaf sheath glaborous to pubescent. Inflorescence axis 5-15 cm; racemes 3-8, 3- 5 cm; Peduncle 2-3 cm, scrabid; spikelets borne in pairs, elliptic, 2-3.5 × 0.8-1 mm, glabrous. Lower glume 5-veined and ovate; upper glume 5-7 veined. Upper lemma rugose, actue apex.

Figure 4 *Urochloa villosa*. A. Habit B. A branch of spike C. A spikelet D. Upper glume & Lower glume E. Lower lemma &. Upper lemma F. Upper Palae & Lower Palea

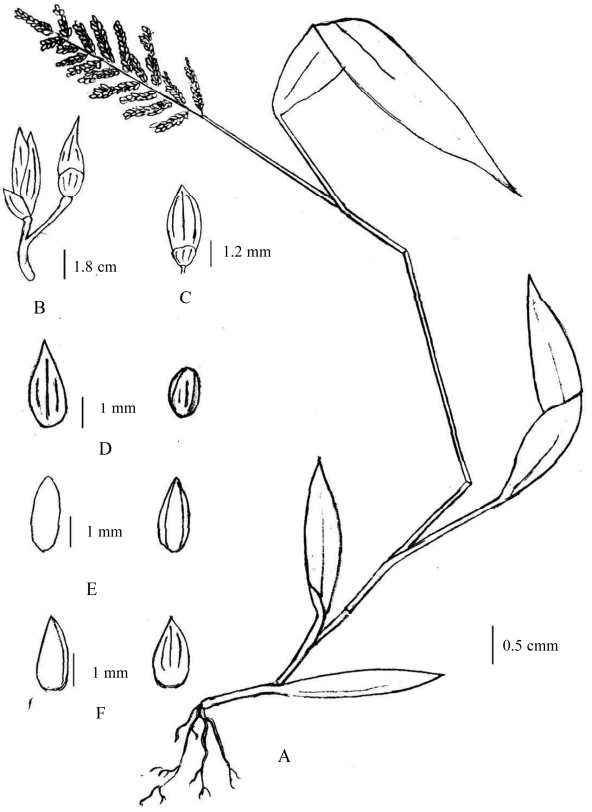
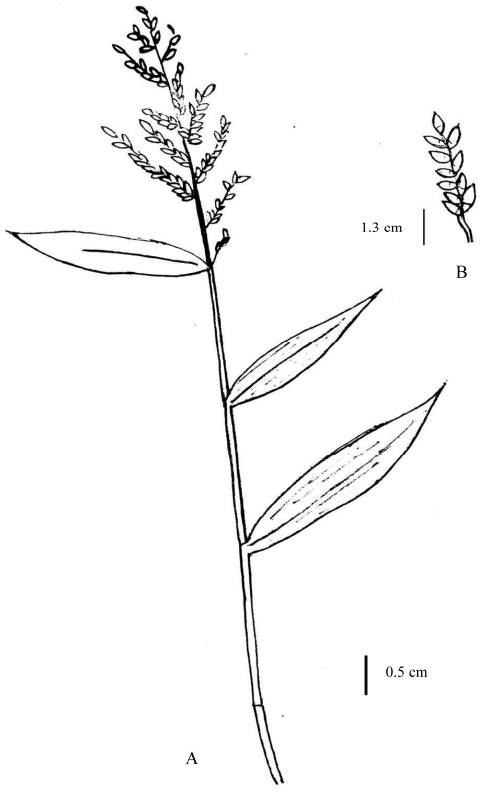


Figure 5 *Urochloa ramosa*. A. Habit B. A branch of spike.



Conclusion

Urochloa is a widely distributed genus in Nepal. Herbarium specimens of *Urochloa* deposited in the KATH were collected from 100 m up to 2800 m and from Maikhola in East Nepal to Ghodaghodi tal in West Nepal. This research work included the study of only five species of the genus. However, considering recent changes in the taxonomy of the family Poaceae and available information regarding the genus, *Urochloa* includes a total of nine species

(*Urochloa distachya, U. kurzii, U. mutica, U. panicoides, U. ramosa, U. reptans, U. setigera, U. subquadripara, and U. villosa*) in Nepal.

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