



Diversity of *Dichanthium* Willd. in the Satpuda Range of the Khandesh Region, Maharashtra

Tanveer Akhtar Khan

Department of Botany, H. J. Thim College of Arts and Science Mehrun, Jalgaon-425001.

Email: tanveerkhan04@gmail.com

Abstract

Dichanthium Willd. is a highly variable genus in the grass family Poaceae (subfamily Pooideae). *Dichanthium* Willd. is one of the dominant genus of study area. Commonly called as marvel, bluestem or bluegrass. In Maharashtra the genus is represented by 20 species. A taxonomic study of 12 species of the genus *Dichanthium* Willd. in Satpuda range of Khandesh region is here presented. The study was carried out based on fresh collections from various localities of the Khandesh region.

Keywords: *Dichanthium* Willd., Diversity, Satpuda range, Khandesh region.

Introduction

Khandesh lies at the Northwestern corner of the Deccan plateau, in the valley of the Tapti river, and is bound to the north by the Satpuda ranges, to the east by the Berar (Vidarbha) region, to the south by the hills of Ajanta, belonging to the Marathwada region of Maharashtra, and to the west by the Northern most ranges of the Western Ghats, and beyond that the coastal plain of Gujarat. Khandesh includes varied topographical features and landscape. It lies between 20° 8' and 22° 7' North latitude and 73° 42' and 76° 28' East longitude. For administrative purposes, it is distributed over sixteen sub-divisions, with an

average area of 1669.12 sq. km, 215 villages and 64,290 inhabitants. Khandesh covers a total area of 26,703.36 sq. km stretching nearly 257.44 Km along. The river Tapti traverses the length of Khandesh from 112 to 144 Km. Khandesh forms an upland basin of the most northerly section of the Deccan table land. Along the whole northern frontier, the district is bounded by the Satpuda ranges a mountain tract from 48.27-64.36 km wide. The forest of the Khandesh region is of dry deciduous type. The vegetation varies with the changes in altitude, aspect and rainfall. While working on grasses of Khandesh region of Maharashtra we undertook frequent collection tours in every season to study grasses. Khandesh

region though botanically rich in biodiversity have not been explored extensively except a few sporadic reports on floristic of Khandesh region by Patil 2003; Kshirsagar 2008; Khan 2017 and Khan 2019.

The genus *Dichanthium* Willd. (Poaceae) is an important group of perennial and annual grasses distributed predominantly in tropical and subtropical regions of the world. Members of the genus are characterized by their adaptation to a wide range of ecological conditions, particularly grasslands, open forests, wastelands and seasonally dry habitats. Several species of *Dichanthium* Willd. are important components of natural grassland ecosystems and contribute significantly to forage production, soil conservation and maintenance of grassland biodiversity.

The genus *Dichanthium* Willd. belongs to the family Poaceae and is recognized by its distinctive inflorescence, usually consisting of paired racemes bearing sessile and pedicellate spikelets. Species identification within the genus is often challenging because of considerable morphological variation, particularly in vegetative characters, inflorescence structure and spikelet morphology. Accurate identification therefore requires careful examination of diagnostic morphological characters and comparison with authentic taxonomic literature and herbarium specimens.

In India, *Dichanthium* Willd. species occur in different phytogeographical regions and form an important part of the grass flora. The Satpuda range of Khandesh region of Maharashtra provides diverse habitats supporting several grass species. However, systematic information concerning the diversity, distribution, morphological variation and taxonomic relationships of *Dichanthium* Willd. in this region remains comparatively limited. A detailed study of the genus is therefore significant for documenting regional grass diversity and providing reliable identification tools.

The present investigation aims to study the diversity and taxonomy of the genus *Dichanthium* Willd. from the Satpuda range of the Khandesh region of Maharashtra, with emphasis on morphological characterization, identification, distribution and preparation of suitable taxonomic keys. The study will contribute to the documentation of grass diversity in the region and provide baseline information useful for biodiversity assessment, ecological studies, conservation and further taxonomic research.

Materials and Methods

Satpuda ranges, which is one of the major hotspot of plants in Khandesh region of Maharashtra. While working on grasses of Khandesh region of Maharashtra State, frequent collection tours were undertaken in every season for plant collections. The outcome of the collection tour was 12 species of *Dichanthium* Willd. belonging to the family Poaceae. The specimens were collected from wet open grasslands on hill slope and margins of water courses and in moist shady places in forest at high elevations. All taxa have been identified with the help of available literature. Close examination with the help of literature and herbarium specimens revealed that they were not any special survey on *Dichanthium* Willd. recorded earlier from Khandesh region of Maharashtra State. Identification of all taxa was confirmed by Dr. Girish G. Potdar Department of Botany, Yashwantrao Chavan College of Science, Karad, Maharashtra and Shahid Nawaz Khwaja Bhai Landge, The Blatter Herbarium St. Xavier College Mumbai and also by comparing the specimens with those at Botanical Survey of India (BSI) western circle, Pune. The voucher specimens have been deposited at the herbarium of Department of Botany, H. J. Thim College of Arts and Science Mehrun, Jalgaon, Maharashtra. The plants have been described with their Material and Methods: Latin names, followed by author's citations.

Results and Discussion

During the survey of genus *Dichanthium* Willd. from Satpuda range of Khandesh region of Maharashtra all species were identified with the help of pertinent literature Blatt. & McC. (1935), Cooke (1958) (Repr.ed.), Bor (1960), Stapf in Hook (1896), Nair (1991), Laxmi in Sharma *et al.* (1996), Moulik (1997); Yadav & Sardesai (2002), Naik (1998), Kshirsagar and Patil (2008) and Potdar *et al.* (2012) and also consulted to Dr. Girish G. Potdar Department of Botany, Yashwantrao Chavan College of Science, Karad, Maharashtra and Shahid Nawaz Khwaja Bhai Landge, The Blatter Herbarium St. Xavier College Mumbai. The genus *Dichanthium* Willd. about 20 species are found in Maharashtra during the exploration of Khandesh region 12 species are collected out of which *Dichanthium odoratum* (D. Lisboa) Jain & Deshpande is a new distributional records for Khandesh region of Maharashtra. *Dichanthium assimile* (Steud.) Deshpande, *Dichanthium filiculme* (Hook. f.) Jain & Deshpande, *Dichanthium huegelii* (Hack.) Jain & Deshpande, *Dichanthium odoratum* (D. Lisboa) Jain & Deshpande, *Dichanthium tuberculatum* (Hack.) T.A. Cope. are endemic grasses for Satpuda range of Khandesh region of Maharashtra. Detailed descriptions of the taxa, flowering and fruiting period and distributions, precise locations and exsiccate numbers are appended at the end. According to Laxmi in Sharma *et al.* (1996) Intergeneric hybridization has been found to occur and fertile hybrids have been produced between the genera *Dichanthium* Willd., *Capillipedium* Stapf, *Indochloa* Bor *p.p.*, *Eremopogon* Stapf and *Bothriochloa* O. Ktze. Hence, Ohwi (1947), Gardner (1952), de Wet & Harlan (*Amer. J. Bot.* 53: 97. 1966 & *Taxon* 19: 339-340. 1970), Clayton (1977) and Jain and Deshpande (1978) have merged them. The generic epithet, *Dichanthium* Willd. is applicable to the genus as it was the earliest hence the same is followed.

***Dichanthium annulatum* (Forssk.) Stapf** in Prain, Fl. Trop Afr. 9: 178. 1917; Blatt. & McC. Bombay Grass. 94. 1935; Bor, Grass. Bur. Cey. Ind. Pak. 133. 1960; Laxmi in Sharma *et al.*

Fl. Maharashtra State Monocot. 452. 1996; Yadav & Sardesai in Fl. Kolhapur Dist. 572. 2002; Potdar *et al.* Grasses of Maharashtra 82.2012. *Andropogon annulatus* Forssk. Fl. Aegypt-Arab. 173. 1775; Hook. f. Fl. Brit. Ind. 7: 196. 1896. "*Marvel, Paunava*" (Plate I).

Perennial. Culms tufted, terete, 50-150 cm tall, erect or geniculately ascending; nodes bearded. Leaves: sheath compressed, 4-10 cm long, glabrous; ligule membranous; blades flat, linear-lanceolate, 5-20 x 0.3-0.6 cm, sparsely hairy or glabrous, acuminate at apex. Racemes 3-10, digitate or subdigitate, 2-8 cm long. Peduncles glabrous, joints 1.5-2 mm long, ciliate. Sessile spikelet obovate, 2.5-4 mm long, awned, callus densely hairy. Lower glume membranous, obovate, 2.5-3.5 x 0.8 -1 mm, 7-9 nerved, 2-keeled, margins scaberulous, obtuse at apex. Upper glume membranous, elliptic-lanceolate, 3-3.5 x 0.8-1 mm, 3-nerved, margins inflexed, ciliate, acute at apex. Lower lemma hyaline, delicate, ovate-lanceolate, 2-2.5 x 0.4- 0.5 mm, nerveless, margins ciliate, acute at apex. Palea absent. Upper lemma stipitate, hyaline base of the awn, 1.3-1.7 x 0.1-0.2 mm, linear, 1- nerved awned, awn geniculate up to 18 mm long. Palea absent. Lodicules 2. Stamens 3; anthers up to 1.5 mm long. Caryopsis elliptic, up to 1 mm long. Pedicel of pedicelled spikelet up to 1.7 mm long, margins hairy. Pedicelled spikelet oblong, 2.5-4 mm long, unawned. Lower glume membranous, obovate, 3-4 x 0.8-1 mm, sparsely hairy on dorsal side, 7-9nerved, 2-keeled, margins inflexed, obtuse at apex. Upper glume membranous, elliptic-lanceolate, 2.5-3 x 0.5-0.6 mm, 5-nerved, margins inflexed, ciliate, acute at apex. Lower lemma hyaline, narrowly obovate, 1.5-1.8 x 0.4-0.6 mm, nerveless, slightly inflexed margins, minutely ciliate.

Fls. & Frts: July to December.

Distribution: In all districts of Khandesh.

Habitat: Common. In open grasslands, abundant along roadside, wastelands.

Specimens examined: Jalgaon Dist. Mehrun lake, TAK135. Jalgaon city, TAK193; Dhule Dist. Morane, TAK2065; Nandurbar Dist. Ukhalwadi talaw, TAK1757. M.J. College Campus, TAK2378.

Note: It can be easily distinguished in the field by the presence of annular hairs at the nodes and narrow raceme.

***Dichanthium assimile* (Steud.)** Deshpande in Fasc. Fl. India 15: 6. 1984; Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot. 453. 1996; Potdar *et al.* Grasses of Maharashtra 84.2012. *Andropogon assimilis* Steud, in Zoll. Verz. 58. 1854. & in Syn. Pl. Glum. 1: 397. 1854; Hook, f. Fl. Brit. India. 7: 179 1896; *Capillipedium assimile* (Steud.) A. Camus in Lecomte, Fl. Gen. Indo-Chine 7: 314. 1922; Bor, Grass. Bur. Cey. Ind. Pak. 110. 1960. **(Plate I)**.

Perennial. Culms terete, tufted, 20-150 cm tall, erect or straggling; nodes villous or glabrous. leaves; sheath compressed, 1.5-6 cm long, glabrous; ligule membranous; blades flat, linear-lanceolate, 5-20 x 0.3- 0.6 cm, margins scaberrulous with tubercle-based hairs in the basal part, acuminate at apex. Panicles 5-15 cm long, open or contracted, axils of racemes long-villous; joints filiform 1-2 mm long, ciliate. Sessile spikelet elliptic-lanceolate, 2-3 x 0.5-0.6 mm, hairy or glabrous, awned, callus bearded. Lower glume chartaceous, ovate-oblong, 2-2.8 x 0.5-0.6 mm, 7-nerved, glabrous or hairy, margins inflexed, truncate at apex. Upper glume chartaceous, ovate-lanceolate, 2-2.8 x 0.4-0.5 mm, 3-nerved, keeled, margins inflexed, obtuse at apex. Lower lemma empty, membranous, elliptic, 1-1.5 x 0.3-0.4 mm, nerveless, obtuse at apex. Upper lemma hyaline to base of awn, linear 1-1.5 x 0.1-0.2 mm, 1-nerved, awned; awn geniculate up to 10 mm long. Palea absent. Lodicules 2. Stamens 3 up to 2 mm long. Caryopsis elliptic, up to 1 mm long, brownish. Pedicel of pedicelled spikelet up to 1.8 mm long, filiform, ciliate. Pedicelled spikelet elliptic-lanceolate, 3-4 x 0.6-0.8 mm, unawned. Lower glume chartaceous, elliptic-lanceolate, 3-3.5 x 0.7 -0.9 mm, 7-9-nerved, margins inflexed, ciliate, obtuse at apex.

Upper glume chartaceous, elliptic-lanceolate, 3-3.5 x 0.6-0.8 mm, 3-nerved, margins inflexed, ciliate, acute at apex. Lower lemma membranous, elliptic-lanceolate, 2.6-3 x 0.6-0.7 mm, nerveless, margins inflexed, ciliate. Stamens 3; anthers up to 1.5 mm long.

Fls. & Frts: August to December.

Distribution: In all districts of Khandesh.

Habitat: Frequent. Abundant along roadside, and forest margins.

Specimens examined: Jalgaon Dist. Chopda forest, TAK379; Dhule Dist. Charanmal, TAK1582; Nandurbar Dist. Amlibari forest, TAK740. Bilgaon, TAK2789.

Note: It can be identified by its glabrous or shortly hairy nodes and lax panicle.

***Dichanthium caricosum* (L.) A. Camus in Bull.** Mus. Hist. Nat. Paris 27: 549. 1921; Bor, Grass. Bur. Cey. Ind. Pak. 134. 1960; Laxmi in Sharam *et al.* Fl. Maharashtra State Monocot. 453. 1996; Kshirsagar and Patil in Fl. Jalgaon Dist, Maharashtra 353. 2008; Potdar *et al.* Grasses of Maharashtra 86.2012. *Andropogon caricosus* L. Sp. Pl. ed. 2. 1480. 1763; Cooke, Fl. Presi. Bombay 3: 507. 1958 (Repr.ed.) *Dichanthium aristatum* (Poir.) C.E. Hubb. in Kew Bull. 1939:654. 1940. "*Marvel, Jetare*" **(Plate I)**.

Perennial. Culms terete, tufted, 40-170 cm tall, erect or geniculately ascending; nodes bearded or glabrous. Leaves: sheath compressed, 4-12 cm long, glabrous; ligule membranous, ciliate; blades flat, linear-lanceolate, 10-35 x 0.3 -1 cm, glabrous, acuminate at apex. Racemes 2-6, subdigitate, up to 8 cm long, joints 1-2 mm long hairy. Sessile spikelet obovate, 4-5 x 1.7-2 mm, awned, callus short, hairy. Lower glume subcoriaceous, obovate, 4-5 1.7-2 mm, 9-11-nerved, 2-keeled; keel scabrous, margins inflexed, puberulous on dorsal side, obtuse at apex. Upper glume subcoriaceous, elliptic-lanceolate, 4.7- 5 x 1-1.3 cm, 3-nerved, margins inflexed, ciliate, obtuse at apex. Lower lemma

membranous, ovate-lanceolate, 4-4.5 x 0.7-1mm, nerveless, margins inflexed, ciliate, obtuse at apex. Palea absent. Upper lemma hyaline to a base of awn, linear, 2.6-3 x 0.1-0.2 mm, 1-nerved, awned; awn geniculate, up to 25 mm long. Palea hyaline, ovate-lanceolate, 2.7-3 x 0.3-0.5 mm, nerveless, acuminate at apex. Lodicules 2. Stamens 3; anthers up to 3 mm long. Caryopsis linear to fusiform, up to 1.5 mm long. Pedicel of pedicelled spikelet up to 1.5 mm long. Pedicelled spikelets obovate, 3.5-5 x 2-2.5 mm, unawned. Lower glume membranous, obovate, 4-5 x 2-2.5 mm, 15-17 nerved, 2-keeled; keel minutely winged, scabrous, obtuse at apex. Upper glume membranous, elliptic-lanceolate, 4-5 x 1-1.3 mm, 3-nerved, 2-keeled, ciliate, margins inflexed, ciliate, acute at apex. Lower lemma membranous, elliptic-lanceolate, 4-4.5 x 1-1.3 mm, nerveless, margins inflexed, acute at apex. Palea absent. Upper lemma hyaline, elliptic-lanceolate, 4-4.5 x 1-1.3 mm, obtuse at apex. Palea hyaline, linear, 3-3.5 x 0.2-0.3 mm, nerveless, acute at apex. Lodicules 2. stamens 3; anthers up to 3.5 up to 2.5 mm long.

Fls. & Frts: July to January.

Distribution: In all districts of Khandesh.

Habitat: Common. In open grass lands, along road sides, and bunds of fields and riversides.

Specimens examined: Jalgaon Dist. Eklagna forest, TAK155; Dhule Dist. Pimpalner, TAK2230. Sakri, Tanveer A. Khan 2675; Nandurbar city, TAK1692. M.J. College Campus, TAK2221. N. M. U. Campus, TAK 2767.

Note: This species can be distinguished from others in the genus by its peculiar broader, obovate spikelets.

***Dichanthium filiculme* (Hook.f.) Jain & Deshpande** in Bull. Bot. Sur. India 20: 134. (1978) 1979; Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot. 454. 1996; Potdar *et al.* Grasses of Maharashtra 89.2012. *Andropogon filiculmis* Hook. f. Fl. Brit. India. 7: 181. 1896;

Cooke, Fl. Pres. Bombay 3: 502. 1958 (Repr.ed.) *Capillipedium filiculme* (Hook. f.) Stapf in Hook. Ic. Pl. subt. 3085. 1922; Blatt. & McC. Bombay Grass. 82. 1935; Bor, Grass. Bur. Cey. Ind. Pak. 111.1960. **(Plate I).**

Annual. Culms terete, tufted, 40-90 cm tall, creeping or geniculately ascending, slender, weak, usually branched, glabrous; nodes bearded. Leaves: sheath terete, 3-8 cm long, glabrous; ligule membranous; blades flat, linear-lanceolate, 4-20 x 0.5-1 cm, glabrous or hairy, margins scaberrulous, acuminate at apex. Panicles 5-10 cm long, open or contracted; branches capillary; joints up to 2 mm long, with a translucent groove in centre, densely hairy on margins. Sessile spikelets elliptic-lanceolate, 2-3 x 0.8-1 mm, awned, hairy, callus shortly bearded. Lower glume subcoriaceous, oblong or elliptic, 2.5-3 x 0.8-1 mm, 5-7nerved, 2-keeled, sparsely hairy or glabrous, subacute at apex. Upper glume chartaceous, elliptic-lanceolate, 2.5-3x 0.7-0.8mm, 3-nerved, keeled, acute at apex. Lower lemma empty. hyaline, ovate-lanceolate, 1.2-1.5 x 0.5 -0.6 mm, nerveless, obtuse at apex. Palea absent. Upper lemma hyaline to a base of awn, 2-2.7 x 0.2-0.3 mm, 1-nerved, awned; awn geniculate, up to 15 mm long. Palea absent. Lodicules 2. Stamens 3; anthers up to 1.7 mm long. Caryopsis elliptic, up to 1 mm long. Pedicel of pedicelled spikelets up to 2 mm long, capillary, margins ciliate. Pedicelled spikelet elliptic-lanceolate, 3.5-4 x 0.8-1.2 mm, unawned. Lower glume subcoriaceous, elliptic-lanceolate, 3.5-4 x 0.8-1.2 mm, 9-11 nerved, sparsely ciliate, margins inflexed, acute at apex. Upper glume membranous, elliptic-lanceolate, 3.5-4 x 0.8-1.1, 5-7 nerved, margins ciliate, acute at apex. Lower lemma hyaline, 2.7-3 x 0.6-0.8 mm, acute at apex. Stamens 3; anthers up to 2 mm long.

Fls. & Frts: August to December.

Distribution: In all districts of Khandesh.

Habitat: Common. Along hill slopes and rocky places.

Specimens examined: Jalgaon Dist. Yawal, TAK302. Unapdev, TAK 2248; Dhule Dist. Kondaebhari, TAK1866; Nandurbar Dist. Dab, TAK385. Kathi, TAK1492.

Note: This species is quite distinct from others by its peculiar slender, filiform culms which are creeping or trailing over some rocky substratum.

***Dichanthium foveolatum* (Del.)** Roberty in Boissiera 9: 170. 1960; T.A. Cope in Kew Bull. 35: 703. 1980; Laxmi in Sharma *et al.* Fl. Maharashtra State. Monocot. 455. 1996; Yadav & Sardesai in Fl. Kolhapur Dist. 573. 2002; Potdar *et al.* Grasses of Maharashtra 91.2012. *Andropogon foveolatus* Del. Fl. d'Egypte 16, t. 8. f. 2. 1812; Hook, f. Fl. Brit. Ind. 7: 168. 1896. *Eremopogon foveolatus* (Del.) Stapf in Prain, Fl. Trop. Afr. 9: 183. 1917; Blatt. & McC. Bombay Grass. 96. 1935; Bor, Grass. Bur. Cey. Ind. Pak. 148. 1960. "*Kadu marvel, Ghandel*" (Plate I).

Perennial. Culms terete, tufted, 20-80 cm tall, erect or geniculately ascending, simple or sparingly branched, glabrous; nodes bearded leaves: sheath terete, 2-6 cm long, glabrous, shorter than internodes, basal sheath bladeless and silky-villous; ligule membranous, ciliate, truncate; blades flat or convolute, linear, 5-18 x 1-2.5 mm, sparsely hairy or glabrous, acuminate at apex. Racemes solitary, 3-6 cm long, terminal, very slender, reddish or purplish; joints 1.5 -1.8 mm long, densely hairy. Sessile spikelets oblong-lanceolate, 3-3.5 x 0.8 -1 mm, glabrous, pitted, awned, obtuse at apex, callus bearded. Lower glume membranous, elliptic, 2.7-3 x 0.8 -1 mm, 5-nerved, 2-keeled, pitted, margins inflexed, acute at apex. Upper glume membranous, elliptic-lanceolate, 2.7-3 x 0.8-1 mm, 5-nerved, acute at apex. Lower lemma empty, hyaline, elliptic-lanceolate, 2-2.5 x 0.4-0.6 mm, nerveless, acute at apex. Palea absent. Upper lemma hyaline to a base of awn, 1.2-1.5 x 0.1-0.2 mm, awned; awn geniculate, up to 18 mm long. Palea absent. Lodicules 2. Stamens 3; anthers up to 1.3 mm long. Caryopsis oblong, up to 1 mm long. Pedicels of pedicelled spikelets very slender up to 1.5 mm long, margins silky. Pedicelled spikelets

elliptic-lanceolate, 3-3.5 x 0.8 -1 mm, pitted. Lower glume membranous, elliptic-lanceolate, 3-3.3 x 0.6-0.8 mm, 5-nerved, 2-keeled; keels ciliate above the middle, pitted, margins inflexed, acute at apex. Upper glume membranous, elliptic-lanceolate, 3-3.3 x 0.6 -0.8 mm, 3-nerved, keeled, keel ciliate above the middle, acute at apex. Lower lemma empty, hyaline, ovate-lanceolate, 1.8-2 x 0.4-0.6 mm, nerveless, acute at apex. Palea absent. Lodicules 2. Stamens 3; anthers up to 2 mm long.

Fls. & Frts: July to December.

Distribution: In all districts of Khandesh.

Habitat: Common. In open grasslands and margins of fields.

Specimens examined: Jalgaon Dist. Faizpur, TAK17, Pal, TAK 86; Dhule Dist. Dahivel, TAK1535. Laling, TAK 45; Nandurbar Dist. Taloda, TAK1617.

Note: It can be easily distinguished from other grasses by its solitary racemes and pitted lower glume of sessile and pedicelled spikelet.

***Dichanthium glabrum* (Roxb.)** Jain & Deshpande in Bull. Bot. Surv. India. 20:134. (1978) 1979; Deshpande in Fasc. Fl. India 15:13. 1984; Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot. 45. 1996; Potdar *et al.* Grasses of Maharashtra 91.2012. *Andropogon glaber* Roxb. Fl. Ind. 1: 271. 1820. *A. intermedius* R. Br. Prodr. 202 1810; Hook, f. Fl. Brit. India 7: 175. 1896. *Amphilophis glabra* (Roxb.) Stapf in Prain, Fl. Trop. Afr. 9: 172. 1917; Blatt. & McC. Bombay Grass. 87. 1935. *Bothriochloa glabra* (Roxb.) A. Camus in Ann. Soc. Linn. Lyon 1930, n.s. 76: 164. 1931; Bor, Grass. Bur. Cey. Ind. Pak. 107. 1960. "*Ghanya marvel*" (Plate I).

Perennial. Culms tufted, terete, 1-2 m tall, simple or branched; nodes glabrous or hairy. Leaves: sheath terete, glabrous; ligule membranous; blades linear-lanceolate, 10-40 x 0.5 -1 cm, glabrous or sparsely hairy, acuminate at apex. Panicle dense, 10-20 cm long, joint up to 3 mm long

hairy, with a translucent groove in the middle. Sessile spikelet ovate-lanceolate, 4-5 x 1-1.3 mm, awned, callus short, bearded. Lower glume coriaceous, ovate-lanceolate, 4.5-4.8 x 0.8 -1.1 mm, 7-9 nerved, margins inflexed, glabrous, pitted or not, obtuse at apex. Upper glume membranous, ovate-lanceolate, 4.5- 4.8 x 0.5-0.7mm, 3-nerved, margins inflexed, glabrous, acuminate at apex. Lower lemma membranous, elliptic-lanceolate, 2.3- 2.5 x 0.5- 0.7 mm, nerveless, acute at apex. Palea absent. Upper lemma hyaline to a base of geniculate awn, linear, 2.5-3 x 0.1-0.2 mm, 1-nerved, awned; awn geniculate, up to 15 mm long. Palea hyaline, ovate-lanceolate, 0.7-1 x 0.2-0.3 mm, nerveless, acute at apex. Lodicules 2. Stamens 3; anthers up to 1.5 mm long. Caryopsis oblong, upto 1 mm long. Pedicel of pedicelled spikelet upto 2.5 mm long, hairy. Pedicelled spikelet ovate-lanceolate, 4.5 x 0.8 -1 mm, acute at apex. Lower glume coriaceous, elliptic-lanceolate, 4.5 -4.8 x 0.8 -1 mm, 9-11 nerved, glabrous, margins inflexed, acute at apex. Upper glume membranous, ovate-lanceolate, 4-4.5 x 0.4-0.5 mm, 3-nerved, margins inflexed, ciliate, acute at apex. Lower lemma hyaline, lanceolate, 4.5-4.8 x 0.4-0.5 mm, nerveless, margins inflexed, acute at apex. Lodicules 2. Stamens 3; anthers upto 1.5 mm long.

Fls. & Frts: August to January.

Distribution: Jalgaon and Nandurbar districts.

Habitat: Frequent. Along the banks of river, streams.

Specimens examined: Jalgaon Dist. Pal, *TAK*392. Girna river, *TAK* 1846. Haripura, *TAK*2772. Mor river, *TAK*2836; Nandurbar Dist. Taloda, *TAK*961. Legapani, *TAK* 1615. Jamli, *Tanveer A. Khan* 1670.

Note: It can be distinguished by its glabrous sessile spikelets.

***Dichanthium huegelii* (Hack.) Jain & Deshpande** in Bull. Bot. India 20: 135. (1978) 1979; Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot.

456. 1996; Yadav & Sardesai in Fl. Kolhapur Dist. 573. 2002; Potdar *et al.* Grasses of Maharashtra 93.2012. *Andropogon huegelii* Hack. in DC. Monogr. Phan. 6: 492. 1889; Hook, f. Fl. Brit. Ind. 7: 180. 1896. *A. schmidii* Hook. f. *op. cit.* *Capillipedium huegelii* (Hack.) Stapf in Hook. Ic. Pl. subt. 3085. 1922; Blatt. & McC. Bombay Grass. 81. 1935; Bor, Grass. Bur. Cey. Ind. Pak. 111.1960; Moulik, Grass. Bam. India 1: 270. "*Kullus, Podam, Kavala-Sippe*" (Plate II).

Perennial. Culms tufted, terete, 30-150 cm tall, erect or geniculately ascending, slender, glabrous; nodes bearded. Leaves; sheath compressed, upto 15 cm long, glabrous; ligule membranous, ciliate; blades flat, linear-lanceolate, 8-25 x 0.5 -1.5 cm, glabrous or sparsely hairy, margins scabrid, acuminate at apex. Panicles 5-15 cm long, contracted, axils of racemes long-villous; joints capillary, upto 2.5 mm long, ciliate. Sessile spikelet ovate-lanceolate, 3-4 mm long, hairy, awned, callus short bearded. Lower glume subcoriaceous, ovate-lanceolate, 3-4 x 1.4- 1.7 mm, 5-7 nerved, hairy, subacute at apex. Upper glume coriaceous, ovate-lanceolate, 3-4 x 1-1.3 mm, 3-nerved, keeled, margins inflexed, glabrous, acute at apex. Lower lemma empty, hyaline, ovate, 1.6-2 x 0.5- 0.7 mm, nerveless, obtuse at apex. Palea absent. Upper lemma hyaline to the base of awn, 2-2.5 mm long, awned; awn geniculate, up to 20 mm long. Palea absent. Lodicules 2. Stamens 3; anthers upto 2 mm long. Caryopsis elliptic, upto 1 mm long. Pedicel of pedicelled spikelet upto 2.5 mm long, ciliate. Pedicelled spikelets ovate-lanceolate, 3.5 -4.5 mm long, unawned. Lower glume subcoriaceous, ovate-lanceolate, 3.5-4.5 x 1-1.3 mm, 11-13 nerved, hairy, margins inflexed, acute at apex. Upper glume chartaceous, ovate-lanceolate, 3.5-4.5 x 1-1.2 mm, 3-5 nerved, margins inflexed, acute at apex. Lower lemma hyaline, obovate, 2.5-3.5 x 0.8-1.1 mm, nerveless, obtuse at apex. Palea absent. Lodicules 2. Stamens 3; anthers upto 2 mm long.

Fls. & Frts: August to December.

Distribution: In all districts of Khandesh.

Habitat: Occasional. Along the margins of hill slopes.

Specimens examined: Jalgaon Dist. Vagihira, TAK852. Amaner, TAK 2643; Dhule Dist. Charanmal, TAK2034; Nandurbar Dist. Ambi, TAK1803.

Note: This species is closely allied to *C. assimile* but can be differentiated by its contracted panicle and large spikelets.

***Dichanthium kuntzeana* (Hack.) Jain & Deshpande** in Bull. Bot. India 20: 134. (1978) 1979; Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot. 457. 1996; Potdar *et al.* Grasses of Maharashtra 97.2012. *Andropogon kuntzeanus* Hack. in DC. Monogr. Phan. 6: 478. 1889; Hook f. Fl. Brit. Ind. 7: 175. 1896; Cooke, Fl. Pres. Bombay 3: 498. 1958 (Repr.ed.) *Amphilophis kuntzeana* (Hack.) Hines, Bot. Bih. or. 1031. 1924 [3:1078.1961] (Repair.ed.) Blatt. & McC. Bombay Grass. 86. 1935; *Bothriochloa kuntzeana* (Hack.) Henr. in Blumea 3: 456. 1940; Bor, Grass. Bur. Cey. Ind. Pak. 108. 1960; Kshirsagar and Patil in Fl. Jalgaon Dist, Maharashtra 345. 2008. **(Plate II)**.

Perennial. Culms terete, tufted, 90-140 cm tall, erect or geniculately ascending; nodes bearded. Leaves: sheath compressed, upto 5 cm long, sparsely hairy; ligule membranous, truncate; blades linear, 10-40 cm long, glabrous, scaberulous, along margins, acuminate at apex. Racemes 10-14, subdigitate, upto 7 cm long, silky; joints and pedicels upto 2.5 mm long, with a translucent groove. Sessile spikelet ovate-lanceolate, 4.5-5 x 1-1.3 long, pitted, awned, callus bearded. Lower glume ovate-lanceolate, 4.5-5 x 1-1.3 mm, 7-9 nerved, margins inflexed, acute at apex. Upper glume ovate-lanceolate, 4.5-5 x 0.5-0.7 mm, acute at apex. Lower lemma hyaline, ovate-lanceolate, 3.5-4 x 0.3-0.6mm, acute at apex. Palea absent. Upper lemma hyaline to a base of awn, linear, up to 2.5 mm long, awned awn 12-15 mm long. Palea absent. Lodicules 2. Stamens 3; anthers upto 2 mm long. Pedicelled spikelet ovate-lanceolate, 4.5-5 mm long. Lower glume membranous, ovate-

lanceolate, 4.5-5 x 0.8 -1.2 mm, 9-11-nerved, margins inflexed, hairy, acute at apex. Upper glume membranous, 4-4.5 x 0.3 -0.5 mm, ovate-lanceolate, 3-5 nerved, margins inflexed, acute at apex. Lower lemma hyaline, narrowly obovate, 2-3 x 0.1-0.3 mm, nerveless, margins inflexed, acute at apex. Palea absent. Lodicules 2. Stamens 3; anthers upto 1.8 mm long.

Fls. & Frts: August to November.

Distribution: Dhule district.

Habitat: Occasional. Along the banks of rivers, hill slopes.

Specimens examined: Dhule Dist. Laling, TAK96; Pimpalner, TAK1694. Kondaibari, TAK2013.

Note: It can be identified by translucently gooved joints, glabrous pedicels and pitted sessile spikelets.

***Dichanthium maccannii* Blatt.** in J. Bombay nat. Hist. Soc. 32: 357. 1927; Blatt. & McC. Bombay Grass. 92. 1935; Bor, Grass. Bur. Cey. Ind. Pak. 135. 1960; Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot. 457. 1996; Moulik, Grass. Bam. India 1: 273. 1997; Naik Fl. Marathwada 2: 1018. 1998; Kshirsagar and Patil in Fl. Jalgaon Dist, Maharashtra 353. 2008; Potdar *et al.* Grasses of Maharashtra 100.2012. **(Plate II)**.

Annual. Culms tufted, 30-90 cm tall, erect, slender; nodes densely bearded. Leaves: sheath terete, upto 2 cm long, covered with bulbous based hairs on upper side; ligule hairy; blades linear-lanceolate, 2-10 x 0.2-0.6 cm, covered with bulbous-based hairs, acute at apex. Racemes 1-4, digitate, 2-5 cm long; joint and pedicels glabrous or cillate, hairy on one side. Sessile spikelet ovate-lanceolate or oblong-lanceolate, 3.5-4.3 x 0.8- 1.2 mm, awned; callus bearded. Lower glume membranous, ovate-lanceolate to oblong, 3.5-4x 0.8- 1.2 mm, 7-nerved, margins inflexed, covered with scattered bulbous-based hairs, obtuse at apex. Upper glume ovate-lanceolate, slightly longer than lower, 3.5-4.2 x 0.8- 1.1 mm, hairy,

acuminate at apex. Lower lemma hyaline, oblong-lanceolate, 3.3-3.8 x 0.5-0.8 mm, nerveless, obtuse at apex. Palea absent. Upper lemma hyaline base of geniculate awn, upto 25 mm long, 1-nerved. Palea absent. Pedicelled spikelet oblong-lanceolate, 3-5 mm long, covered with bulbous based hairs on margins, acute at apex. Lower glume membranous, oblong-lanceolate, 4-5 x 1-1.5 mm, 9-nerved, covered with bulbous based hair, on dorsal side, obtuse at apex. Upper glume ovate-lanceolate, 4.8-5.2 x 1-1.5 mm, 3-nerved, margins inflexed, ciliate, acute at apex. Lower lemma hyaline, oblong-lanceolate, margins ciliate, obtuse at apex. Palea hyaline, ovate-lanceolate, acute at apex. Caryopsis linear, up to 2 mm long.

Fls. & Frts: September to December.

Distribution: Jalgaon district.

Habitat: Frequent. Along the riverbanks and open grasslands.

Specimens examined: Jalgaon city, TAK834. N. M. U. Campus, TAK 944. Manudevi forest, TAK527. Haripura, TAK704. Patnadevi forest, TAK2304.

Note: It is distinguished by its lower glume of sessile and pedicelled spikelets not pitted and lower glume of pedicelled spikelets armed with marginal bulbous based hairs.

Dichanthium odoratum (D. Lisboa) Jain & Deshpande in Bull. Bot. Surv. India 20: 134. (1978) 1979; Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot. 458. 1996; Naik, Fl. Marathwada 2: 1018. 1998; Potdar *et al.* Grasses of Maharashtra 100. 2012. *Andropogon odoratus* D. Lisboa in J. Bombay nat. Hist. Soc. 4: 123. 1889; Hook. f. Fl. Brit. India 7: 176. 1896; *Amphilophis odorata* (D. Lisboa) A. Camus in Rev. Bot. Appl. 305. 1921. *Bothriochloa odorata* (D. Lisboa) A. Camus in Ann. Soc. Linn. Lyon. 1930. n.s. 76:164. 1931; Bor, Grass. Bur. Cey. Ind. Pak. 109. 1960. "*Gavatvedi, Usdhana*" (Plate II).

Perennial, aromatic herbs. Culms terete, 20-180 cm tall, erect, tufted, geniculately ascending; nodes bearded. Leaves; sheath compressed, 5-20 cm long, glabrous; ligule ciliate; blades linear-lanceolate, 15-60 x 0.4-1 cm, glabrous, scaberulous along margins, acuminate at apex. Racemes whorled or subwhorled, 8-18 cm long. Joints and pedicels 2-3 mm long, densely silky. Sessile spikelet ovate-elliptic, 3-3.5 x 0.7-1 mm, awned, callus bearded. Lower glume membranous, ovate-elliptic, 3-3.5 x 0.7-1 mm, 9-11 nerved, margins inflexed, hairy on dorsal side, truncate at apex. Upper glume membranous, ovate-lanceolate, 3.2-3.5 x 0.7-1, 3-nerved, 1-keeled, margins inflexed, glabrous, acute at apex. Lower lemma hyaline, ovate-lanceolate, 2.7-3 x 0.7-1 mm, nerveless, obtuse at apex. Palea absent. Upper lemma hyaline, linear, 1.4-1.6 x 0.1-0.2 mm, bearing geniculate awn at apex. awn up to 1.5 cm long, 1-nerved. Palea hyaline, minute, 0.3-0.5 x 0.2-0.3 mm, acute at apex. Lodicules 2. Stamens 3; anthers upto 1.7 mm long. Caryopsis 1.7-2 x 0.7-1 mm, obovate. Pedicel of pedicelled spikelets upto 2 mm long, hairy. Pedicelled spikelet elliptic-lanceolate, 3-3.5 x 0.7-1 mm unawned. Lower glume membranous, ovate-lanceolate, 2.7-3 x 0.7-1 mm, 9-11 nerved, margins inflexed, sparsely hairy, obtuse at apex. Upper glume membranous, elliptic-lanceolate, 2.7-3 x 0.7-1.1 mm, 3-5 nerved, margins inflexed, acute at apex. Lower lemma hyaline, obovate, 2.2-2.5 x 0.7-0.9 mm, nerveless, margins ciliate, cleft at apex. Palea absent. Lodicules 2. Stamens 3; anthers up to 2 mm long.

Fls. & Frts: September to December.

Distribution: Nandurbar district.

Habitat: Occasional. Along the hills slopes, banks of streams.

Specimens examined: Nandurbar Dist. Dab, TAK1726. Legapani, TAK1997. Bhagdhari, TAK1565.

Note: Whole plant is aromatic.

Uses: For aromatic oil.

***Dichanthium pertusum* (L.)** W.D. Clayton in Kew Bull. 32: 4. 1977; Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot. 459. 1996; Naik. Fl. Marathwada 2: 1019. 1998; Yadav & Sardesai in Fl. Kolhapur Dist. 575. 2002; Potdar *et al.* Grasses of Maharashtra 110. 2012. *Holcus pertusus* L. Mant. 2: 301. 1771. *Andropogon pertusus* (L.) Willd Sp. Pl. 4: 922. 1806; Hook. f. Fl. Brit. India 7: 173. 1896. *Amphilophis pertusa* (L.) Nash ex Stapf in Agr. News W. India 15: 179. 1916; Blatt. & McC. Bombay Grass. 84. 1935. *Bothriochloa pertusa* (L.) A. Camus in Ann. Soc. Linn. Lyon. 1930. n. s. 76: 164. 1931; Bor, Grass. Bur. Cey. Ind. Pak. 109. 1960; Moulik, Grass. Bam. India 1: 267. 1997. "*Kathora, Palva*" (Plate II).

Perennial. Culms tufted, terete, 15-80 cm tall, erect, creeping or geniculate; nodes bearded. Leaves; sheath compressed, 3-7 cm long, glabrous or hairy, bearded at mouth; ligule membranous; blades flat, linear, 2-15 x 0.2 -0.5 cm, hairy or glabrous, acuminate at apex. Racemes 3-10, digitate or subdigitate, upto 5 cm long, shortly pedunculate, densely villous; joints linear, up to 2 mm long, densely villous at margins, translucent groove in the centre. Sessile spikelets elliptic-lanceolate, 3-4 mm long, awned, acute at apex, callus short, bearded. Lower glume coriaceous, elliptic-lanceolate, 3-4 x 1-1.3 mm, faintly 7-9 nerved, densely hairy below the middle, with a deep circular pit above the middle, sometimes 2-pitted, keeled, shortly 2-fid at apex. Upper glume subcoriaceous, boat-shaped or oblong-lanceolate, 3-4 x 1-1.2 mm, faintly 3-5 nerved, acute at apex. Lower lemma empty, hyaline, ovate-lanceolate, 2.4-3 x 0.8-1 mm, nerveless, subacute at apex. Palea absent. Upper lemma reduced to a hyaline stipe of a geniculate awn up to 18 mm long. Palea absent. Lodicules 2. Stamens 3; anthers up to 1.6 mm long. Caryopsis oblong. Pedicels of pedicelled spikelets up to 2.5 mm long, linear villous along the margins, translucent groove in the center. Pedicelled spikelet elliptic-lanceolate, 3-4 mm long, acute at apex. Lower glume chartaceous, elliptic-lanceolate, 3-4 x 1-1.4 mm, 9-11 nerved, keeled, with or without pit, acute at apex. Upper glume elliptic-lanceolate, 3-4 x 0.8-1.2 mm, 3-5-nerved, margins hyaline, villous, acute at apex. Lemma hyaline, narrowly obouate, 2.5-3.5 x 0.5 -0.8 mm, nerveless, truncate at apex.

Palea absent. Lodicules 2. Stamens 3; anthers up to 1.5 mm long.

Fls. & Frts: August to December.

Distribution: In all districts of Khandesh.

Habitat: Common. Along the bunds of fields, wetlands and in open grasslands.

Specimens examined: Jalgaon Dist. Hatnoor Dam, TAK1688. Dhule Dist. Kondaibari, TAK1458; Nandurbar Dist. Tapi river, TAK2146. Jamner forest, TAK2465.

Note: This species can easily be distinguished by its hairy racemes and lower glumes with 1-2 peculiar deep circular pits.

***Dichanthium tuberculatum* (Hack.)** T.A. Cope. in Kew Bull. 35: 703. 1980. Laxmi in Sharma *et al.* Fl. Maharashtra State Monocot. 460. 1996; Moulik, Grass. Bam. India 1: 274. 1997; Potdar *et al.* Grasses of Maharashtra 112. 2012. *Andropogon tuberculatus* Hack. in DC. Mongr. Phan. 6: 404. 1889; Hook. f. Fl. Brit. India 7: 168. 1896. *Eremopogon tuberculatus* (Hack.) A. Camus in Ann. Soc. Linn. Lyon, n.s. 68: 208. 1922; Bor, Grass. Bur. Cey. Ind. Pak. 149. 1960; Deshpande & Singh in J. Bombay nat. Hist. Soc. 76: 204. (1979) 1980. (Plate II).

Perennial. Culms tufted, terete, 100-150 cm tall, erect or geniculately ascending, glabrous, simple or sparingly branched; nodes glabrous. Leaves; sheath terete, 2-5 cm long, glabrous; ligule membranous, ciliated, auricled; blades flat, linear, 30-60 x 0.2-0.5 cm, rigid, glabrous, scabrous at margins, acuminate at apex. Racemes solitary 2-5 cm long, subtended by spatheole. Sessile spikelets ovate-lanceolate, 4-5 x 1-1.5 mm, glabrous, awned, callus densely bearded. Lower glume membranous, linear-lanceolate, 4-5 x 1-1.5 mm long, margins inflexed, 5-nerved, 2-keeled, without a pit, with strong tuberculate nerves, acute at apex. Upper glume membranous, elliptic-lanceolate, 4-5 x 0.8-1.2 mm, glabrous, 3-5 nerved, acute at apex. Lower lemma empty hyaline, ovate-lanceolate, 3.5- 4.5 x 0.6 -0.8 mm, nerveless, acute at apex. Palea absent. Upper lemma hyaline to geniculate awn, 2-2.5 x 0.1- 0.2 mm, awned, awn geniculate, 20-25 mm long.

Palea absent. Lodicules 2. Stamens 3; anthers upto 2 mm long. Pedicels of pedicelled spikelets upto 2 mm long, densely hairy. Pedicelled spikelets ovate-lanceolate, 4-6 x 0.8 -1.2 mm, without a pit, acute at apex. Lower glume ovate-lanceolate, 4-6 x 0.8- 1.2 mm, 7-9 nerved, margins inflexed, scabrid, acute at apex. Upper glume membranous, ovate-lanceolate, 4-6 x 0.8 - 1.2 mm, 5-nerved, margins inflexed, acute at apex. Lower lemma empty, hyaline, ovate-lanceolate, 4-5 x 0.8-1 mm, faintly 1-nerved, acute at apex. Palea absent. Lodicules not seen. Stamens 3; anthers upto 2 mm long.

Fls. & Frts: October to December.

Distribution: Jalgaon district.

Habitat: Frequent. Weed in cultivated fields.

Specimens examined: Jalgaon Dist. Jamner forest, TAK196.Neri, TAK 226. Bodwad, TAK1537.

Note: This species is distinguished by its lower glume having tuberculate nerves and lower lemma not cleft at apex.

DICHANTHIUM Willd.

- 1a. Joints and pedicels solid, not grooved; racemes digitate or subdigitate, not paniced..... 2
 - 2a. Raceme solitary.....3
 - 3a. Upper lemma usually 2-cleft at apex, nerve smooth, lower glume pitted.....*D. foveolatum*
 - 3b. Upper lemma not cleft at apex, nerve tuberculate, lower glume not pitted..... *D. tuberculatum*
 - 2b. Racemes 2-many..... 4
 - 4a. Lower glume of pedicelled spikelets not armed with marginal bulbous based hairs..... 5
 - 4b. Lower glume of pedicelled spikelets armed with marginal bulbous based bristles.....*D. maccannii*
 - 5a. Lower glume of sessile spikelets obovate; sessile spikelets 3-4 mm long*D. annulatum*
 - 5b. Lower glume of sessile spikelets elliptic; sessile spikelets 4-5 mm long..... *D. caricosum*
- 1b. Joints and pedicels with a translucent groove, if not grooved then racemes in panicles..... 6
 - 6a. Branches of panicles capillary, bearing a few spikelets near apex only..... 7
 - 7a. Culms weak, decumbent and trailing, much geniculately branched..... *D. filiculme*
 - 7b. Culms erect, robust, simple or branched.....8
 - 8a. Nodes glabrous or shortly hairy, panicle lax..... *D. assimile*
 - 8b. Nodes densely bearded, panicle contracted*D. huegelii*
 - 6b. Branches of panicles stout, bearing number of spikelets from a little above base to apex.....9
 - 9a. Lower racemes shorter than main rhachis.....10
 - 10a. Plants aromatic; racemes silky.....*D. odoratum*
 - 10b. Plants not aromatic; racemes not very silky.....*D. glabrum*
 - 9b. Lower racemes longer than main rhachis..... 11
 - 11a. Lower glume of sessile spikelets hairy below middle; lower glume of pedicelled spikelets 0-1 pitted.....
.....*D. pertusum*
 - 11b. Lower glume of sessile spikelets glabrous; 1-2 pitted.....*D. kuntzeana*



Dichanthium annulatum (Forssk.) Stapf



Dichanthium assimile (Steud.) Deshpande



Dichanthium caricolum (L.) A. Camus



Dichanthium filiculme (Hook.) Jain & Deshpande



Dichanthium foveolatum (Del.) Roberty



Dichanthium glabrum (Roxb.) Jain & Deshpande

Plate: I



Dicanthium huegelii (Hack.) Jain & Deshpande *Dicanthium kuntzeana* (Hack.) Jain & Deshpande



Dicanthium maccannii Blatt.

Dicanthium odoratum (D.Lisboa) Jain & Deshpande



Dicanthium pertusum (L.) W.D. Clayton *Dicanthium tuberculatum* (Hack.) T.A. Cope

Plate - II

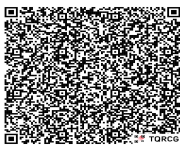
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