

WILD RICE GENETIC RESOURCES OF NORTH-EAST INDIA

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The wild relatives of rice assume enough importance for rice improvement work especially when variability in cultivated rice is nearly exhausted for various stress characters. Genes from *Oryza nivara* incorporated in cultivated rice provide resistance to grassy stunt virus and blast disease. Similarly, *O. officinalis* resistant to brown planthopper, white-backed planthopper and green leafhopper. Semi-aquatic *O. rufipogon* species may contribute genes for adaptation to the stagnant flooding and resistant to bacterial blight. Wild species have also provided CMS lines for hybrid rice production in China. In this paper, an attempt has been made to elucidate wild relatives of rice available in north-eastern part of India.

Key words : Rice germplasm, wild *Oryza*, distribution, diversity

There are 22 species of *Oryza* (Vaughan, 1989) of which only two are cultivated. These are *Oryza sativa* L. (Asian rice) and *Oryza glaberrima* Steud. (African rice). Rest of the species occur in wild conditions and hardly a few of them are used as food. In India, *Oryza sativa* is the commonly cultivated species. In addition, 5 wild species including their different forms occur in the country including north-east India.

In the north-eastern parts of India, practically no serious efforts have been made to unravel the present status of wild relatives of rice germplasm. The BSI Herbarium (CAL and ASSAM) however, records the occurrences of the following species in the north-eastern region of the country. The classification of Vaughan (1989) for the genus *Oryza* have been followed in this paper. In the present account, in addition to seven north-eastern states, the adjacent states like Bihar, Orissa, West Bengal, Madhya Pradesh have also been included for better understanding of species distribution.

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WILD SPECIES OF ORYZA

1. *Oryza granulata* Nees et Arn. ex Watt, Dict. Econ. Prod. Ind. 5: 500. 1891: Hook f. Fl. Brit. India 7: 93. 1896. *O. indandamanica* Ellis in Bull. Bot. Surv. India 27: 225. 1985.

Plant erect, tuft with short slender stolon, perennial; spikelet oblong to elliptic-oblong, shorter than 6 mm.; sterile lemma shorter than 1.5 mm, tapered from the base.

Note: The species is photoperiod insensitive; genomic group is diploid. It has got the capacity to thrive in shady forest place and adapted to aerobic red, clay soil.

Distrib. : Sikkim, Khasi hills and Bihar hills.

Exsiccatae : A.S. Rao, 38783 dt. 13.06.1964, Kamrup, Assam; A.C. Chatterjee, 5631 dt. May, 1902, Hathgaon Jungle, Assam; S.K. Mokim, May, 1902, Takreswari hills, Assam; Griffith, 6441, Assam; Sonaimukh Reserve Forest, Nagaon, Assam; R.S. Rao, 8874, 29.08.1952, Tripura; Balakrishnan, 39215, 18.06.1964, Bonaibuchi Reserve Forest, South of Naokhola town (Nagaon); D.B. Deb, 35265 dt. 22.06.1963, Diphu Reserve Forest, Karbi Anglong, Assam; Clarke, 33832, Bihar.

2. *Oryza officinalis* Wall. ex Watt. Dict. Econ. Prod. Ind. 5: 501. 1891. *O. latifolia* Hook. f., Fl. Brit. India 7: 92, 1896. *O. malampuzhaensis* Krishnaswami et Chandrasekharan in Mad. Agric. J. 45: 471-72. 1958. *Oryza minuta* J.S. Presl. ex C.B. Presl. Rel. Haenk. 1: 208. 1830; Bor, Grass. 605, 1960.

Perennial, rhizomatous; spikelet shorter than 6 mm, not inserted near base of lower whorled panicle branches; ligule glabrous or hairy; awn shorter than 2 cm or awnless.

Note: The genome group of the species is CC (diploid) The tetraploid population in southern India is known as *Oryza malampuzhaensis*. The species bears useful traits of multiple pest resistance (Heinrichs *et al.*, 1985).

Distrib. : Assam, Khasi hills and Sikkim Terai.

Exsiccatae : S.K. Sharma, 12319, 15841 dt. 23.09.1935, Nongpoh; G.K. Deka, 39896, Burnihat; R.N. De, s.n., Lakhimpur; Jenkins, 325921, Upper Assam; D.B. Deb, 2582, Lowbipak, 31.08.1954; J.D. Hooker, 525925, Sikkim; Bor, 17159, Dimapur; C.B. Clarke, 36729, Sikkim Terai; GVS Rao, 23188, Bihar (1150 ft.)

3. *Oryza rufipogon* Griff., Notul. Pl. 3: 5. 1851; Bor, Grass., 605. 1960; Sharma and Sastry, Ind. J. Genet. Pl. Breed. 25(2): 157. 1965.

Perennial, semi-aquatic to aquatic grass with decumbent or floating stem; adventitious roots and extravaginal branching at higher nodes; ligule membranous, panicle well-exserted and lax; spikelet laterally compressed; awns more than 4-5 times longer than lemma, scabrid, reddish; caryopsis red, 7-9 mm × 1.9-2.6 mm.

The highly polymorphic species grows well in marshy habitat and edges of forest areas. Tolerant to stagnant flooding and acid sulphate soils.

Note: Genomic group of the species is AA (diploid). A photoperiod sensitive short day plant. The flowering season is between October to February. The species has low seed set and the grains are highly shattered. The species high rate of natural crossing (5-40%) (Chang *et al.*, 1982). The species is resistant to bacterial blight disease (Vaughan and Sitch, 1991). The species can reproduce both vegetatively and sexually.

Exsiccatae : R.K. Basak, 1261 dt. 18.12.1969, Moshmara, Birbhum; R.K. Basak, 1572 dt. 11.01.1971, Daskalgram, Birbhum; S.S.R. Bennet, 1045 dt. 10.11.1964, Panchala, Howrah; S.C. Agarwal, 278 dt. 11.01.1956, Harincghata Farm, Nadia; Bor 13747 (ASSAM); Deka, Jaintiapur, 12538 (ASSAM); Bor 6544, Loktak, Manipur.

4. *Oryza meyeriana* (Zoll. et Mor. ex Steud.) Baill, Hist. Pl. 12: 166. 1894. *Padia meyeriana* Zoll. et Mor. Syst. Verz. 103 1845.

Perennial, *ca.* 1m. tall, plant, rootstalk small, compact, leaves dark green, spikelet narrowly oblong to lanceolate, longer than 6 mm.; awnless sterile lemma shorter than 2 mm, tapered from the base.

Note : The species is photoperiod insensitive; the genomic status is diploid. It can tolerate shade is adapted to aerobic soil. It is found in well drained soils from plains to altitudes upto 1000m, along streams under shade. The grains have a good flavour.

Exsiccatae : S.K. Mokim, *s.n.* dt. 18.08.1902 (ASSAM); I.H. Burkill, 35316 dt. 19.06.1911, Lumding, Assam.

5. *Oryza nivara* Sharma and Sastry, Ind. J. Genet. Pl. Breed. 25: 161. 1965; *O. sativa* var. *fatua* Prain, Beng. Pl. 2: 1184. 1903. *O. sativa* var. *spontanea* Roshev, Bull. Appl. Bot. Pl. Breed 27(4): 37. 1961 (*Proparte*).

Annual, semi-erect to decumbent, intravaginal branching, panicle semi-open at maturity, spikelets usually 6-8 mm long and 2-3 mm wide, 1.2-2 mm thick, awn 4-10 cm long, thick, grain deciduous at maturity.

Note: Essentially self-pollinated plant. Usually insensitive to photoperiod. Genomic constitution of the species is AA (diploid). It has strong seed dormancy. The species can withstand drought and possesses the characteristics traits of virus resistance. One strain of *O. nivara* (IRRI acc. No. - 101 508) has contributed the grassy stunt virus resistance character which has been successfully incorporated and used in breeding purpose.

Distrib : The species has wider distribution which started from Deccan, Madhya Pradesh Bihar and extended to Upper Myanmar (Burma). Thus it indicated that the species may found in N.E. India also if it explored thoroughly because of its trend in continuous distribution.

Exsiccatae: Mokim, 1381, Gaya, Bihar; Kurz, *s. n.*, 1869, Araccan, Myanmar (Burma); S.D. Sharma, 69, Kandagarh, M.P. (CAL); G.K. Deka, 12612, Byrni forest (ASSAM)

OTHER RELATED TAXA OF ORYZA

The closely related wild taxa of *Oryza* that are occurring in north-eastern India are mainly *Hygrorhiza*, *Leersia*, *Porteresia* and *Zizania*. Each genus is represented by a single species in the region.

1. *Hygrorhiza aristata* (Retz.) Nees ex Wight and Arn. in Edimb. New Phil. Jour. 15: 380. 1833; Hook. f. Fl. Brit. India 7: 95. 1896; Bor, Grass 597. 1960 & Fl. Assam 174. 1982 (Rpt.). *Pharus aristatus* Retz. Obs. Bot. 5: 23. 1789.

Perennial, aquatic grass, stem 30-50 cm, roots feathery at nodes; leaves ovate-lanceolate to linear-oblong, rounded both at apex and base or tip acute, base-cordate; leaf sheaths inflated; panicle 5-8 cm, long, slender; spikelet bisexual, 12-15 mm. long; glumes dorsally convex; awn longer than glume; grains narrowly-oblong.

Note: Monotypic genus having chromosome number $2n=24$. In north-eastern region, it has been collected from Bengal, Assam, Meghalaya and Tripura. The species is found in slow moving streams and yields a good fodder.

Exsiccatae: Bengal, Griffith, 6442; Anon, 21554 dt. 20.10.1960. Diphu Reserve Forest, Assam; Anon, 525762 dt. April, 1891, Nongpoh, Meghalaya; Deb. 569, 581, Agartala, Tripura.

2. *Leersia hexandra* Swartz, Prod. Veg. Ind. Occ. 21. 1788; Hook. f., Fl. Brit. India 7; 94. 1896; Bor, Grass, 599. 1960 and Fl. Assam 5: 173. 1982 (rpt.); Deb, Fl. Tripura 520. 1983.

Perennial bisexual, aquatic grass, extensively creeping runners, rhizome leafy; stem ca 1 m, weak; nodes hairy; leaves erect, rigid, acuminate; ligule truncate panicle branched, 5-10 cm. long; few flowered; empty glume 0, flowering glume thin, awnless.

Note: The species occurs in swampy and marshy area from sea level to 2100 m altitude. The species having different chromosome numbers $2n=48, 60$ and 96 .

Exsiccatae: Meebold, 6446, Manipur; D.C. Mukherjee 38, Assam; Naskar, 1234, Bengal; Deb, 100, 477, Agartala, Tripura.

3. *Porteresia coarctata* (Roxb.) Takeoka in Bull. Nat. Sci. Mus. Tokyo 8: 406. 1965. *Oryza coarctata* Fl. Ind. ed. 2(2): 206. 1832; Hook. f. Fl. Brit. India 7: 93. 1896.

Aquatic bisexual, robust grass; leaves caudate-acuminate spinous-serrate; ligule short; panicles piniform, few flowered; spikelet ca 1 cm; anthers long, slender; ovary narrow, elongate.

Note: The species grows in brackish water, tidal swamps and is adapted to salinity in the soil. The grains resemble wheat and are said to be edible. This monotypic species bears the chromosome number $2n=48$. Common in delta region of Sunderban (West Bengal), Mahanadi (Orissa and Godavari (Andhra Pradesh).

Exsiccatae: Bengal, s.n. Kakdwip, 24 Parganas; Sunderban, West Bengal; R.S. Rao, 20749 (ASSAM).

4. *Zizania latifolia* (Griseb.) Stapf. in Kew Bull. 385. 1909; Bor., Fl. Assam 5; 175. 1982 (Rpt.). *Hydropyrum latifolia* Griseb. in Ledeb. Fl. Ross. 4 : 466. 1853.

Perennial, aquatic, tall grass with well developed stolons and rhizomes. Culms 0.9-1.8m high, erect, glabrous, very thick but spongy below, leaves flat, 30-100 x 2-3 cm; inflorescence 30-50 cm. long; flower unisexual; female spikelet 5-17 mm long produced at upper branches while male spikelet 8-12 mm long and occur in lower branches; caryopsis cylindrical, ca. 1.5 cm long.

Note : Rhizomes and grains are eaten. The seeds are recalcitrant and hence propagated vegetatively. Well adapted to aquatic or marshy habitats. The chromosome number of the species reported as $2n = 30$ and 34 .

Exsiccatae : Manipur, Loktak, Meebold, 6448.

DISCUSSION

This review is entirely based on literature and herbarium records. The present status of occurrence of wild *Oryza* spp. and its close relatives in the north-eastern region of India is not well known. The Rice Germplasm Conservation Workshop (sponsored by IRRI and IBPGR (now named as IPGRI)) was held at IRRI, Manila (Philippines) in 1983. Resolution of collection programme conceived in the Workshop is still to be implemented for this country in general and north-eastern India in particular. The importance of wild species of rice is now well established due to their various stress tolerant characters.

The species of *Oryza granulata* and *O. meyeriana* usually grow in aerobic soil, shady forest places or edges and hence they are well adapted to low light intensity. The latter species can grow even up to 1000 m altitude and may have genes for low temperature tolerance. *O. officinalis* has genes for multiple pest resistance, while *O. rufipogon* possesses the resistance to bacterial blight. *O. nicara* can withstand drought situation and also has the gene to protect from the grassy stunt virus and from the blast disease. *Leersia hexandra* can thrive well in varied ecological conditions (0-2100 m altitude). This character may be useful in producing high altitude/cold tolerant variety. *Porteresia coarctata* has got the capacity to grow well in saline soils. Therefore, salt tolerant traits may be located in this. Likewise, the unisexual flower of *Zizania latifolia* also can offer unique opportunity to develop male and female lines separately for easy hybridization. The basic need is to obtain the materials through collection and a recourse to successive stages (i.e. maintenance, evaluation, cytological and crossing relationships) for its establishment before a rational enhancement programme can be undertaken.

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