

Millet

Millets (/ˈmɪlɪts/)^[1] are a highly varied group of small-seeded grasses, widely grown around the world as cereal crops or grains for fodder and human food. Most millets belong to the tribe Paniceae.

Millets are important crops in the semiarid tropics of Asia and Africa, especially in India, Mali, Nigeria, and Niger, with 97% of production in developing countries.^[2] The crop is favoured for its productivity and short growing season under hot dry conditions.^[3] The millets are sometimes understood to include the widely cultivated sorghum,^[4] apart from that, pearl millet is the most commonly cultivated of the millets.^[5] Finger millet, proso millet, barnyard millet, little millet, kodo millet, browntop millet and foxtail millet are other important crop species. Millets may have been consumed by humans for about 7,000 years and potentially had "a pivotal role in the rise of multi-crop agriculture and settled farming societies".^[3]



Pearl millet

Etymology

The word *millet* is derived via Old French *millet*, *millot* from Latin *millium*, 'millet', ultimately from Proto-Indo-European *mele-, 'to crush'.^[6]

Description

Characteristics

Millets are small-grained, annual, warm-weather cereals belonging to the grass family. They are highly tolerant of drought and other extreme weather conditions and have a similar nutrient content to other major cereals.^{[7][8]}



Finger millet in the field



Ripe head of proso millet



Sprouting millet plants

Taxonomic history

In 1753, Carl Linnaeus described foxtail millet as *Panicum italicum*. In 1812, Palisot de Beauvois grouped several taxa into *Setaria italica*.^[9]

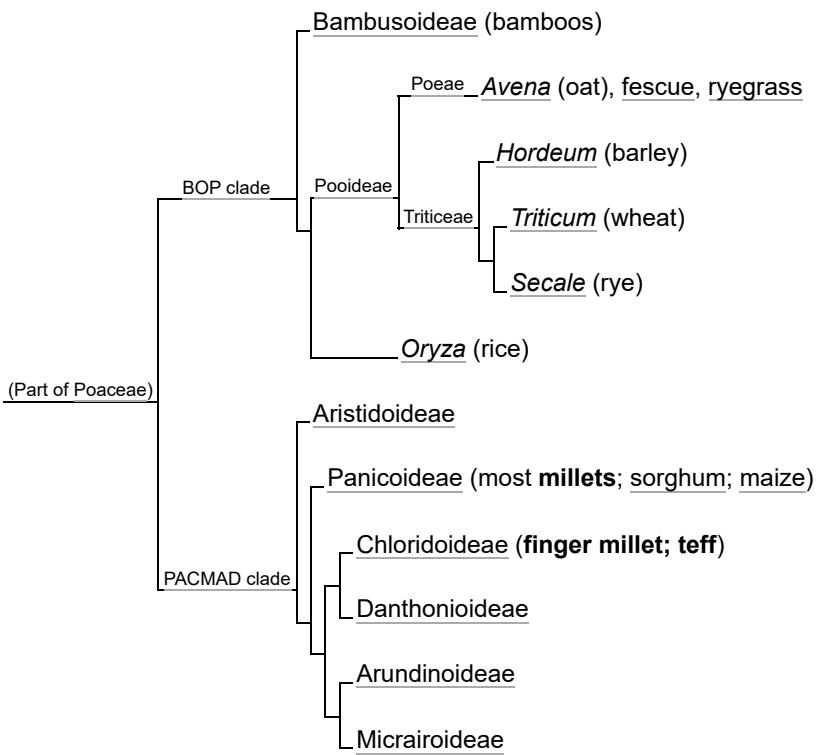
The genus *Pennisetum* was divided by Otto Stapf in 1934 into the section *penicillaria*, with 32 species including all the cultivated ones, and four other sections. In 1977, J. Brunken and colleagues classed the wild *P. violaceum* as part of the cultivated species *P. glaucum* (pearl millet).^[9]

Finger millet was described as *Eleusine coracana* by Joseph Gaertner in 1788.^[10]

Evolution

Phylogeny

The millets are closely related to sorghum and maize within the PACMAD clade of grasses,^[11] and more distantly to the cereals of the BOP clade such as wheat and barley.^[12]



Within the Panicoideae, sorghum (great millet^[4]) is in the tribe *Andropogoneae*, while pearl millet, proso, foxtail, fonio, little millet, sawa, Japanese barnyard millet and kodo are in the tribe *Paniceae*.^{[13][14]} Within the Chloridoideae, finger millet is in the tribe *Cynodonteae*, while teff is in the tribe *Eragrostideae*.^[13]

Taxonomy

The different species of millets are not all closely related. All are members of the family Poaceae (the grasses), but they belong to different tribes and subfamilies. Commonly cultivated millets are:^[15]

Eragrostideae tribe in the subfamily Chloridoideae:

- Eleusine coracana: Finger millet
- Eragrostis tef: Teff; often not considered to be a millet^[16]

Paniceae tribe in the subfamily Panicoideae:

- Genus Panicum:
 - Panicum miliaceum: Proso millet (common millet, broomcorn millet, hog millet, or white millet, also known as baragu in Kannada, panivaragu in Tamil)
 - Panicum sumatrense: Little millet
 - Panicum hirticaule: Sonoran millet, cultivated in the American Southwest
- Cenchrus americanus: Pearl millet
- Setaria italica: Foxtail millet, Italian millet, panic^[17]
- Genus Digitaria: of minor importance as crops^[16]
 - Digitaria exilis: known as white fonio, fonio millet, and hungry rice or acha rice
 - Digitaria iburua: Black fonio
 - Digitaria compacta: Raishan, cultivated in the Khasi Hills of northeast India
 - Digitaria sanguinalis: Polish millet
- Genus Echinochloa: collectively, the members of this genus are called *barnyard grasses* or *barnyard millets*
 - Echinochloa esculenta: Japanese barnyard millet
 - Echinochloa frumentacea: Indian barnyard millet
 - Echinochloa stagnina: Burgu millet
 - Echinochloa crus-galli: Common barnyard grass (or cockspur grass)
- Paspalum scrobiculatum: Kodo millet
- Genus Urochloa (formerly Brachiaria)
 - Urochloa deflexa: Guinea millet



Pearl millet (*Cenchrus americanus*)

- *Urochloa ramosa*: Browntop millet, southern India^{[18][19]}
 - *Spodiopogon formosanus*: Taiwan oil millet, endemic to Taiwan^[20]
- Andropogoneae tribe, also in the subfamily Panicoideae:
- *Sorghum bicolor*: Sorghum; usually considered a separate cereal, but sometimes known as *great millet*
 - *Coix lacryma-jobi*: Job's tears, also known as adlay millet^[16]



Kodo millet (*Paspalum scrobiculatum*)

Domestication and spread

The cultivation of common millet as the earliest dry crop in East Asia has been attributed to its resistance to drought,^[21] and this has been suggested to have aided its spread.^[22] Asian varieties of millet made their way from China to the Black Sea region of Europe by 5000 BC.^[22]

Millet was growing wild in Greece as early as 3000 BC, and bulk storage containers for millet have been found from the Late Bronze Age in Macedonia and northern Greece.^[23] Hesiod states that "the beards grow round the millet, which men sow in summer."^{[24][25]} Millet is listed along with wheat in the third century BC by Theophrastus in his *Enquiry into Plants*.^[26]

East Asia

Proso millet (*Panicum miliaceum*) and foxtail millet (*Setaria italica*) were important crops beginning in the Early Neolithic of China. Some of the earliest evidence of millet cultivation in China was found at Cishan (north), where proso millet husk phytoliths and biomolecular components have been identified around 10,300–8,700 years ago in storage pits along with remains of pit-houses, pottery, and stone tools related to millet cultivation.^[21] Evidence at Cishan for foxtail millet dates back to around 8,700 years ago.^[21] Noodles made from these two varieties of millet were found under a 4,000-year-old earthenware bowl containing well-preserved noodles at the Lajia archaeological site in north China; this is the oldest evidence of millet noodles in China.^{[27][28]}

Palaeoethnobotanists have found evidence of the cultivation of millet in the Korean Peninsula dating to the Middle Jeulmun pottery period (around 3500–2000 BC).^{[29][30]} Millet continued to be an important element in the intensive, multicropping agriculture of the Mumun pottery period (about 1500–300 BC) in Korea.^[30] Millets and their wild ancestors, such as barnyard grass and panic grass, were also cultivated in Japan during the Jōmon period sometime after 4000 BC.^{[31][29]}

In the Zhengluo region of China, two millet species (foxtail millet and proso millet) were grown, enabling the people to survive the cooling of the global climate around 2200 BC.^[32] Chinese myths attribute the domestication of millet to Shennong, a legendary Emperor of China, and Hou Ji, whose name means Lord Millet.^[33]

Indian subcontinent

Little millet (*Panicum sumatrense*) is believed to have been domesticated around 3000 BC in Indian subcontinent and Kodo millet (*Paspalum scrobiculatum*) around 3700 BC, also in Indian subcontinent.^{[34][35]} Pearl millet had arrived in the Indian subcontinent by 2000 BC to 1700 BC.^[36] Browntop millet (*Urochloa ramosa*) was likely domesticated in the Deccan near the beginning of the third millennium BCE and spread throughout India though was later superseded by other millets.^[19] Various millets have been mentioned in some of the Yajurveda texts, identifying foxtail millet (*priyangu*), Barnyard millet (*aṇu*) and black finger millet (*śyāmāka*), indicating that millet cultivation was happening around 1200 BC in India.^[37] Upon request by the Indian Government in 2018, the Food and Agriculture Organisation of the United Nations declared 2023 as International Year of Millets.^[38] Cultivation of Finger millet had spread to South India by 1800 BC.^[39]

Africa

Pearl millet (*Pennisetum glaucum*) was domesticated in the Sahel region of West Africa from *Pennisetum violaceum*.^[40] Early archaeological evidence in Africa includes finds at Birimi in northern Ghana (1740 cal BC) and Dhar Tichitt in Mauritania (1936–1683 cal BC) and the lower Tilemsi valley in Mali (2500 to 2000 cal BC).^{[40][36]} Studies of isozymes suggest domestication took place north east of the Senegal River in the far west of the Sahel and tentatively around 6000 BC.^{[40][36]}

Finger millet is native to the highlands of East Africa and was domesticated before the third millennium BC.^[39]

Europe

Broomcorn or proso millet (*Panicum miliaceum*) came to Europe from East Asia as early as the 17th century BC in Vinogradnyi Sad, Ukraine.^{[41][42]} At around 1500 BC it reached Italy and southeastern Europe; around 1400 BC it came to central Europe, and from 1200 BC, it arrived in northern Germany.^{[43][41]}

Agriculture

Cultivation

Pearl millet is one of the two major dryland crops (alongside sorghum^[44]) in the semiarid, impoverished, less fertile agriculture regions of Africa and southeast Asia.^[45] Millets are not only adapted to poor, dry infertile soils, but they are also more reliable under these conditions than most other grain crops.^[45]

Millets, however, do respond to high fertility and moisture. On a per-hectare basis, millet grain production can be 2 to 4 times higher with use of irrigation and soil supplements. Improved varieties of millet with enhanced disease resistance can significantly increase farm yield. There has been cooperation between poor countries to improve millet yields. For example, 'Okashana 1', a variety developed in India from a natural-growing millet variety in Burkina Faso, doubled yields. This variety was selected for trials in Zimbabwe. From there it was taken to Namibia, where it was released in 1990 and enthusiastically adopted by farmers. 'Okashana 1' became the most popular variety in Namibia, the only non-Sahelian country where pearl millet—locally known as *mahangu*—is the dominant food staple for consumers. 'Okashana 1' was then introduced to Chad. The variety has significantly enhanced yields in Mauritania and Benin.^[46]

Pests and diseases

Millets are subject to damage by many insect pests, including corn borers, Stemborers, the caterpillars of numerous moths in the families Erebidae and Noctuidae, the millet midge, many species of flies in the Muscidae, Hemipteran bugs of many families including aphids, and species of thrips, beetles, and grasshoppers.^[47]

Among the many diseases of millets are serious fungal infections such as anthracnose, blast, charcoal rot, downy mildew, ergot, grain mould, rust, and sheath rot. Bacterial diseases are generally less serious; they include bacterial leaf spot, leaf stripe and leaf streak. Viral diseases are again generally less serious, except for a few diseases such as maize stripe virus, maize mosaic virus, sorghum red stripe virus, and maize streak virus.^[48]

Production

In 2022, global production of millet was 30.9 million tonnes. India is the top millet producer worldwide, with 11.8 million tonnes grown annually – some 38% of the world total and nearly triple its nearest rival. Eight of the remaining nine nations in the top 10 producers are in Africa, ranging from Niger (at 3.7 million tonnes) to Chad (0.7 million tonnes); the sole exception is China, number three in global production, at 2.7 million tonnes.^[49]

Top millet producers in 2022	
Numbers in million tonnes	
1.  <u>India</u>	11.8 (38.19%)
2.  <u>Niger</u>	3.7 (11.97%)
3.  <u>China</u>	2.7 (8.74%)
4.  <u>Nigeria</u>	1.9 (6.15%)
5.  <u>Mali</u>	1.8 (5.83%)
6.  <u>Sudan</u>	1.7 (5.5%)
7.  <u>Ethiopia</u>	1.2 (3.88%)
8.  <u>Senegal</u>	1.1 (3.56%)
9.  <u>Burkina Faso</u>	0.9 (2.91%)
10.  <u>Chad</u>	0.7 (2.27%)
World total	
30.9	

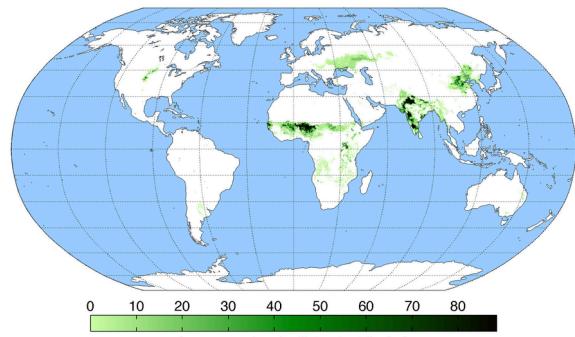
Source: FAOSTAT^[49]



A woman threshing pearl millet in Northern Ghana



Proso millet with bacterial stripe disease



Production of millet (2008) showing major producing regions of the world

Research

Research on millets is carried out by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)^[50]^[51]^[52] and ICAR-Indian Institute of Millets Research^[53] in Telangana, India, and by the United States Department of Agriculture's Agricultural Research Service at Tifton, Georgia, United States.^[54]

Uses

As food

In Ukraine, millet was historically a common ingredient in the diet of the Zaporozhian Cossacks, in the form of a porridge called "kulish". This dish, primarily made with millet, served with stewed vegetables and meat, cooked in a cauldron, remains a part of modern Ukrainian cuisine.^[55] In Germany, it is eaten sweet, for example with milk and berries for breakfast.^[56] In Russia, millet porridge also remains common and is promoted for its health benefits.^[57] Millet porridge made with pumpkin is particularly common. In the Lipetsk Oblast ritual and daily meals from millet include *chichi* (Russian: чичи). These are millet fritters.^[58]

Millet is the main ingredient in *bánh da kê*, a Vietnamese sweet snack. It contains a layer of smashed millet and mungbean topped with sliced dried coconut meat wrapped in a crunchy rice cake.^[59] In parts of Africa millet is mixed with milk to make a drink, *Brukina*.^[60]

Finger millet is made into *ragi rotti* flatbread^[61] and *ragi mudde* dough lumps in Karnataka.^[62] Dough lumps are eaten as *fura* in the Sahel region of West Africa.^[63]



Ragi rotti, finger millet flatbread, Karnataka, India



Ragi mudde, dough lumps of finger millet



Awaokoshi, candied millet puffs, are a specialty of Osaka, Japan.



Bánh da kê, a specialty sweet snack in Hanoi, Vietnam



Tongba, a millet-based alcoholic brew from Nepal and Sikkim

Alcoholic beverages

In the Himalayas, including in Nepal, Sikkim, and Darjeeling, millet is fermented into Tongba, an alcoholic drink.^[64]

In India, alcoholic beverages including *rakshi* are produced from millets.^[65]

As forage

Millet is sometimes used as a forage crop, to produce animal feed. Compared to forage sorghum, animals including lambs gain weight faster on millet, and it has better hay or silage potential, although it produces less dry matter.^[66] Millet does not contain toxic prussic acid, sometimes found in sorghum.^[67] The rapid growth of millet as a grazing crop allows flexibility in its use.

Farmers can wait until sufficient late spring / summer moisture is present and then make use of it. It is ideally suited to irrigation where livestock finishing is required.^{[66][67][68]}

Human consumption

Per capita consumption of millets as food varies in different parts of the world, with consumption being the highest in Western Africa.^[69] In the Sahel region, millet is estimated to account for about 35 percent of total cereal food consumption in Burkina Faso, Chad and the Gambia. In Mali and Senegal, millets constitute roughly 40 percent of total cereal food consumption per capita, while in Niger and arid Namibia it is over 65 percent (see *mahangu*). Other countries in Africa where millets are a significant food source include Ethiopia, Nigeria and Uganda. Millet is also an important food item for the population living in the drier parts of many other countries, especially in eastern and central Africa, and in the northern coastal countries of western Africa. In developing countries outside Africa, millet has local significance as a food in parts of some countries, such as China, India, Burma and North Korea.^[16]

People affected by gluten-related disorders, such as coeliac disease, non-celiac gluten sensitivity and wheat allergy sufferers,^{[70][71][72]} who need a gluten-free diet, can replace gluten-containing cereals in their diets with millet.^[73] There remains a risk of contamination with gluten-containing cereals.^{[74][75]}

Nutrition

The table shows the nutrient content of the grains of different species of millet, raw, compared to other staples.

Nutrient content of raw millets compared to other grains (per 100g)^[76]

Crop	Protein (g)	Fibre (g)	Minerals (g)	Iron (mg)	Calcium (mg)
Sorghum	10	4	1.6	2.6	54
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1	4.4	15.2	11
Brown top millet	11.5	12.5	4.2	0.65	0.01
Quinoa	14.1	7	*	4.6	47
Teff	13	8	0.85	7.6	180
Fonio	11	11.3	5.31	84.8	18
Rice	6.8	0.2	0.6	0.7	10
Wheat	11.8	1.2	1.5	5.3	41

See also

- [List of ancient dishes and foods](#)

References

1. "Definition of millet" (<https://www.oxfordlearnersdictionaries.com/definition/english/millet>). Oxford Dictionaries. Oxford University. Retrieved 21 July 2017.
2. McDonough, Cassandra M.; Rooney, Lloyd W.; Serna-Saldivar, Sergio O. (2000). "The Millets". *Food Science and Technology: Handbook of Cereal Science and Technology*. 99 (2nd ed.). CRC Press: 177–210.
3. Cherfas, Jeremy (23 December 2015). "Millet: How A Trendy Ancient Grain Turned Nomads Into Farmers" (<https://www.npr.org/sections/thesalt/2015/12/23/460559052/millet-how-a-trendy-ancient-grain-turned-nomads-into-farmers>). National Public Radio. The Salt. Retrieved 4 May 2018.
4. *BSBI List 2007* (<https://web.archive.org/web/20150626140254/http://www.bsbi.org.uk/BSBIList2007.xls>) (xls). Botanical Society of Britain and Ireland. Archived from the original (<http://bsbi.org/download/3542/>) (xls) on 26 June 2015. Retrieved 14 December 2021.
5. "Annex II: Relative importance of millet species, 1992–94" (<http://www.fao.org/docrep/W1808E/w1808e01.htm>). *The World Sorghum and Millet Economies: Facts, Trends and Outlook*. Food and Agriculture Organization of the United Nations. 1996. ISBN 978-92-5-103861-1.
6. "millet (n.)" (<https://www.etymonline.com/word/millet>). Online Etymology Dictionary. Retrieved 3 January 2025.

7. Fahad, Shah; Bajwa, Ali A.; Nazir, Usman; Anjum, Shakeel A.; Farooq, Ayesha; et al. (29 June 2017). "Crop Production under Drought and Heat Stress: Plant Responses and Management Options" (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5489704>). *Frontiers in Plant Science*. **8**: 1147. Bibcode:2017FrPS....8.1147F (<https://ui.adsabs.harvard.edu/abs/2017FrPS....8.1147F>). doi:10.3389/fpls.2017.01147 (<https://doi.org/10.3389%2Ffpls.2017.01147>). PMC 5489704 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5489704>). PMID 28706531 (<https://pubmed.ncbi.nlm.nih.gov/28706531>).
8. Patan, Shaik Sha Valli Khan; Vallepu, Suneetha; Shaik, Khader Basha; Shaik, Naseem; Adi Reddy, Nanja Reddy Yellodu; Terry, Randall G.; Sergeant, Kjell; Hausman, Jean François (2024). "Drought resistance strategies in minor millets: a review" (<https://link.springer.com/10.1007/s00425-024-04427-w>). *Planta*. **260** (1) 29. Bibcode:2024Plant.260...29P (<https://ui.adsabs.harvard.edu/abs/2024Plant.260...29P>). doi:10.1007/s00425-024-04427-w (<https://doi.org/10.1007%2Fs00425-024-04427-w>). ISSN 0032-0935 (<https://search.worldcat.org/issn/0032-0935>). PMID 38879859 (<https://pubmed.ncbi.nlm.nih.gov/38879859>).
9. House, L. R. (1995). "Sorghum and millets: History, taxonomy, and distribution". In Dendy, David A.V. (ed.). *Sorghum and Millets: Chemistry and Technology* (https://oar.icrisat.org/5486/1/Sorghum_%20Millets_Chemistry_and_Technology_1-9.pdf) (PDF). St. Paul, Minnesota: American Association of Cereal Chemists. pp. 1–9.
10. "Eleusine coracana (finger millet)" (<https://www.cabidigitallibrary.org/doi/abs/10.1079/cabicompendium.20674>). CABI. 2019. doi:10.1079/cabicompendium.20674 (<https://doi.org/10.1079%2Fcabicompendium.20674>). Retrieved 3 January 2025.
11. Grass Phylogeny Working Group II (2012). "New grass phylogeny resolves deep evolutionary relationships and discovers C₄ origins". *New Phytologist*. **193** (2): 304–312. Bibcode:2012NewPh.193..304. (<https://ui.adsabs.harvard.edu/abs/2012NewPh.193..304.>). doi:10.1111/j.1469-8137.2011.03972.x (<https://doi.org/10.1111%2Fj.1469-8137.2011.03972.x>). hdl:2262/73271 (<https://hdl.handle.net/2262%2F73271>). ISSN 0028-646X (<https://search.worldcat.org/issn/0028-646X>). PMID 22115274 (<https://pubmed.ncbi.nlm.nih.gov/22115274>). ☀
12. Escobar, Juan S; Scornavacca, Céline; Cenci, Alberto; Guilhaumon, Claire; Santoni, Sylvain; et al. (2011). "Multigenic phylogeny and analysis of tree incongruences in Triticeae (Poaceae)" (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3142523>). *BMC Evolutionary Biology*. **11** (1): 181. Bibcode:2011BMCEE..11..181E (<https://ui.adsabs.harvard.edu/abs/2011BMCEE..11..181E>). doi:10.1186/1471-2148-11-181 (<https://doi.org/10.1186%2F1471-2148-11-181>). PMC 3142523 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3142523>). PMID 21702931 (<https://pubmed.ncbi.nlm.nih.gov/21702931>).
13. Soreng, Robert J.; Peterson, Paul M.; Zuloaga, Fernando O.; Romaschenko, Konstantin; Clark, Lynn G.; et al. (2022). "A worldwide phylogenetic classification of the Poaceae (Gramineae) III: An update". *Journal of Systematics and Evolution*. **60** (3): 476–521. Bibcode:2022JSyEv..60..476S (<https://ui.adsabs.harvard.edu/abs/2022JSyEv..60..476S>). doi:10.1111/jse.12847 (<https://doi.org/10.1111%2Fjse.12847>).
14. Morrone, Osvaldo; Aagesen, Lone; Scataglini, Maria A.; Salariato, Diego L.; Denham, Silvia S.; et al. (2012). "Phylogeny of the Paniceae (Poaceae: Panicoideae): integrating plastid DNA sequences and morphology into a new classification". *Cladistics*. **28** (4): 333–356. doi:10.1111/j.1096-0031.2011.00384.x (<https://doi.org/10.1111%2Fj.1096-0031.2011.00384.x>). PMID 34836451 (<https://pubmed.ncbi.nlm.nih.gov/34836451>).
15. Taylor, John R.N.; Duodu, Kwaku G., eds. (2019). *Sorghum and Millets: Chemistry, Technology, and Nutritional Attributes* (<https://shop.elsevier.com/books/sorghum-and-millets/taylor/978-0-12-811527-5>) (2nd ed.). Elsevier. p. 3. ISBN 978-0-12-811527-5.
16. "Sorghum and millet in human nutrition" (<https://web.archive.org/web/20181001231759/http://www.fao.org/docrep/T0818e/T0818E00.HTM>). Food and Agriculture Organization of the United Nations. 1995. Archived from the original (<http://www.fao.org/docrep/T0818E/T0818E00.htm>) on 1 October 2018. Retrieved 7 January 2012.
17. "panic" (<https://www.oed.com/search/dictionary/?q=panic>). *Oxford English Dictionary* (Online ed.). Oxford University Press. (Subscription or participating institution membership (<https://www.oed.com/public/login/loggingin#withyourlibrary>) required.) from classical Latin *pānicum* (or *pānicum*) Italian millet.
18. "Browntop Millet" (https://plants.usda.gov/plantguide/pdf/pg_urra.pdf) (PDF). United States Department of Agriculture. Archived (https://ghostarchive.org/archive/20221009/https://plants.usda.gov/plantguide/pdf/pg_urra.pdf) (PDF) from the original on 9 October 2022. Retrieved 1 April 2018.
19. Kingwell-Banham, Eleanor; Fuller, Dorian Q. (2014). "Brown Top Millet: Origins and Development" (https://link.springer.com/10.1007/978-1-4419-0465-2_2318). In Smith, Claire (ed.). *Encyclopedia of Global Archaeology*. New York, NY: Springer New York. pp. 1021–1024. doi:10.1007/978-1-4419-0465-2_2318. ISBN 978-1-4419-0426-3. Retrieved 15 January 2025.
20. Takei, Emiko (October 2013). *Millet Culture and Indigenous Cuisine in Taiwan* (https://www.researchgate.net/publication/267747587_Millet_Culture_and_Indigenous_Cuisine_in_Taiwan). The 2013 International Conference on Chinese Food Culture, Kunming, Yunnan, China.
21. Lu, H.; Zhang, J.; Liu, K. B.; Wu, N.; Li, Y.; et al. (2009). "Earliest domestication of common millet (*Panicum miliaceum*) in East Asia extended to 10,000 years ago" (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2678631>). *Proceedings of the National Academy of Sciences of the United States of America*. **106** (18): 7367–7372. Bibcode:2009PNAS..106.7367L (<https://ui.adsabs.harvard.edu/abs/2009PNAS..106.7367L>). doi:10.1073/pnas.0900158106 (<https://doi.org/10.1073%2Fpnas.0900158106>). PMC 2678631 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2678631>). PMID 19383791 (<https://pubmed.ncbi.nlm.nih.gov/19383791>).
22. Lawler, A. (2009). "Bridging East and West: Millet on the move". *Science*. **325** (5943): 942–943. doi:10.1126/science.325_940. PMID 19696328 (<https://pubmed.ncbi.nlm.nih.gov/19696328>).
23. Nesbitt, Mark; Summers, Geoffrey (January 1988). "Some Recent Discoveries of Millet (*Panicum miliaceum* L. and *Setaria italica* (L.) P. Beauv.) at Excavations in Turkey and Iran" (https://www.researchgate.net/figure/Records-of-millet-from-the-Ancient-Near-East-and-Greece_tbl1_234002850). *Anatolian Studies*. **38** (38): 85–97. doi:10.2307/3642844 (<https://doi.org/10.2307%2F3642844>). JSTOR 3642844 (<https://www.jstor.org/stable/3642844>). S2CID 84670275 (<https://api.semanticscholar.org/CorpusID:84670275>). Retrieved 25 February 2019.
24. Hesiod (September 2013). *Hesiod, the Poems and Fragments, Done Into English Prose* (<https://books.google.com/books?id=V9uungEACAAJ>). Theclassics Us. pp. fragments S396–423. ISBN 978-1-230-26344-1.
25. "The Poems and Fragments | Online Library of Liberty" (https://oll.libertyfund.org/titles/1091#Hesiod_0606_290).
26. Theophrastus; Arthur Hort (1916). *Enquiry into plants and minor works on odours and weather signs, with an English translation by Sir Arthur Hort, bart* (<https://archive.org/details/enquiryintoplant01theouoft/page/78>).

27. "Oldest noodles unearthed in China" (<https://news.bbc.co.uk/2/hi/science/nature/4335160.stm>). *BBC News*. 12 October 2005.
28. Lu, Houyuan; Yang, Xiaoyan; Ye, Maolin; Liu, Kam-Biu; Xia, Zhengkai; et al. (12 October 2005). "Millet noodles in Late Neolithic China". *Nature*. **437** (7061): 967–968. doi:10.1038/437967a (<https://doi.org/10.1038%2F437967a>). PMID 16222289 (<https://pubmed.ncbi.nlm.nih.gov/16222289/>).
9. S2CID 4385122 (<https://api.semanticscholar.org/CorpusID:4385122>).
29. Crawford, Gary W. (1992). "Prehistoric Plant Domestication in East Asia". In Cowan C.W.; Watson P.J. (eds.). *The Origins of Agriculture: An International Perspective*. Washington: Smithsonian Institution Press. pp. 117–132. ISBN 978-0-87474-990-8.
30. Crawford, Gary W.; Lee, Gyoung-Ah (2003). "Agricultural Origins in the Korean Peninsula". *Antiquity*. **77** (295): 87–95. doi:10.1017/s0003598x00061378 (<https://doi.org/10.1017%2Fs0003598x00061378>). S2CID 163060564 (<https://api.semanticscholar.org/CorpusID:163060564>).
31. Crawford, Gary W. (1983). *Paleoethnobotany of the Kameda Peninsula*. Ann Arbor: Museum of Anthropology, University of Michigan. ISBN 978-0-932206-95-4.
32. An, Jingping; Kirleis, Wiebke; Jin, Guiyun (1 November 2019). "Changing of crop species and agricultural practices from the Late Neolithic to the Bronze Age in the Zhengluo region, China" (<https://link.springer.com/article/10.1007/s12520-019-00915-3>). *Archaeological and Anthropological Sciences*. **11** (11): 6273–6286. Bibcode:2019ArAnS..11.6273A (<https://ui.adsabs.harvard.edu/abs/2019ArAnS..11.6273A>). doi:10.1007/s12520-019-00915-3 (<https://doi.org/10.1007%2Fs12520-019-00915-3>).
33. Yang, Lihui; et al. (2005). *Handbook of Chinese Mythology*. Oxford University Press. pp. 70, 131–135, 198. ISBN 978-0-19-533263-6.
34. Weber, Steven A. (April 1998). "Out of Africa: The Initial Impact of Millets in South Asia". *Current Anthropology*. **39** (2): 267–274. doi:10.1086/204725 (<https://doi.org/10.1086%2F204725>). S2CID 143024704 (<https://api.semanticscholar.org/CorpusID:143024704>).
35. Pokharia, Anil K.; Kharakwal, Jeewan Singh; Srivastava, Alka (February 2014). "Archaeobotanical evidence of millets in the Indian subcontinent with some observations on their role in the Indus civilization". *Journal of Archaeological Science*. **42**: 442–455. Bibcode:2014JArSc..42..442P (<https://ui.adsabs.harvard.edu/abs/2014JArSc..42..442P>). doi:10.1016/j.jas.2013.11.029 (<https://doi.org/10.1016%2Fj.jas.2013.11.029>).
36. Manning, Katie; Pelling, Ruth; Higham, Tom; Schwenniger, Jean-Luc; Fuller, Dorian Q. (2011). "4500-Year old domesticated pearl millet (*Pennisetum glaucum*) from the Tilemsi Valley, Mali: new insights into an alternatives are cereal domestication pathway". *Journal of Archaeological Science*. **38** (2): 312–322. Bibcode:2011JArSc..38..312M (<https://ui.adsabs.harvard.edu/abs/2011JArSc..38..312M>). doi:10.1016/j.jas.2010.09.007 (<https://doi.org/10.1016%2Fj.jas.2010.09.007>).
37. Roy, Mira (2009). "Agriculture in the Vedic Period" (https://www.insa.nic.in/writereaddata/UpLoadedFiles/IJHS/Vol44_4_2_MRoy.pdf) (PDF). *Indian Journal of History of Science*. **44** (4): 497–520. Archived (https://ghostarchive.org/archive/202109/https://www.insa.nic.in/writereaddata/UpLoadedFiles/IJHS/Vol44_4_2_MRoy.pdf) (PDF) from the original on 9 October 2022.
38. "International Year of Millets 2023 - IYM 2023" (<https://www.fao.org/newsroom/detail/international-year-of-millets-unleashing-the-potential-of-millets-for-the-well-being-of-people-and-the-environment>). *Food and Agriculture Organisation*. Retrieved 21 December 2022.
39. Engels, J. M. M.; Hawkes, J. G.; Hawkes, John Gregory; Worede, M. (1991). *Plant Genetic Resources of Ethiopia* (https://books.google.com/books?id=WKj_YqTU4AC&q=finger+millet+domesticated+ethiopia&pg=PA162). Cambridge University Press. ISBN 978-0-521-38456-8.
40. D'Andrea, A. C.; Casey, J. (2002). "Pearl Millet and Kintampo Subsistence" (<https://link.springer.com/article/10.1023/A:1016518919072>). *The African Archaeological Review*. **19** (3): 147–173. doi:10.1023/A:1016518919072 (<https://doi.org/10.1023%2FA%3A1016518919072>). JSTOR 25130746 (<https://www.jstor.org/stable/25130746>). S2CID 162042735 (<https://api.semanticscholar.org/CorpusID:162042735>). Retrieved 18 May 2024.
41. Wiebke Kirleis; Marta Dal Corso; Dragana Filipović, eds. (15 April 2022). *Millet and What Else? The Wider Context of the Adoption of Millet Cultivation in Europe* (<https://www.sidesstone.com/books/millet-and-what-else>). ISBN 978-94-6427-015-0.
42. Dal Corso, Marta; Pashkevych, Galyna; Filipović, Dragana; Liu, Xinyi; Motuzaite Matuzeviciute, Giedre; Stobbe, Astrid; Shatilo, Ludmila; Videiko, Mihail; Kirleis, Wiebke (1 December 2022). "Between Cereal Agriculture and Animal Husbandry: Millet in the Early Economy of the North Pontic Region" (<https://link.springer.com/article/10.1007/s10963-022-09171-1>). *Journal of World Prehistory*. **35** (3): 321–374. doi:10.1007/s10963-022-09171-1 (<https://doi.org/10.1007%2Fs10963-022-09171-1>).
43. "Millet in the Bronze Age: A Superfood conquers the World" (<https://www.uni-kiel.de/en/details/news/081-hirse-superfood>). *Kiel University*. 21 January 2025. Retrieved 21 January 2025.
44. Masaka, Johnson; Chohunoita, Collen; Mupfiga, Elvis (1 January 2021). "Soil moisture, dryland sorghum (*Sorghum bicolor* L.) growth and grain yield responses to in-field rain water harvesting tillage methods" (<https://doi.org/10.1080%2F23311932.2021.1925004>). *Cogent Food & Agriculture*. **7** (1) 1925004. Bibcode:2021CogFA...725004M (<https://ui.adsabs.harvard.edu/abs/2021CogFA...725004M>). doi:10.1080/23311932.2021.1925004 (<https://doi.org/10.1080%2F23311932.2021.1925004>). ISSN 2331-1932 (<https://search.worldcat.org/issn/2331-1932>).
45. Baltensperger, David D. (2002). "Progress with Proso, Pearl and Other Millets". In Janick, J.; Whipkey, A. (eds.). *Trends in New Crops and New Uses* (<http://www.hort.purdue.edu/newcrop/ncnu02/pdf/baltensperger.pdf>) (PDF). Alexandria, Virginia: ASHS Press. Archived (<https://web.archive.org/web/20030421033516/http://www.hort.purdue.edu/newcrop/ncnu02/pdf/baltensperger.pdf>) (PDF) from the original on 21 April 2003.
46. ICRISAT. "A New Generation of Pearl Millet on the Horizon" (<https://web.archive.org/web/20101204142835/http://www.worldbank.org/html/cgiar/newsletter/Oct96/6millet.html>). The World Bank. Archived from the original (<http://www.worldbank.org/html/cgiar/newsletter/Oct96/6millet.html>) on 4 December 2010.
47. Kalaisekar, A. (2017). *Insect pests of millets: systematics, bionomics, and management*. London: Elsevier. ISBN 978-0-12-804243-4. OCLC 967265246 (<https://search.worldcat.org/oclc/967265246>).
48. Das, I.K.; Nagaraja, A.; Tonapi, Vilas A. (March 2016). "Diseases of millets" (<https://www.researchgate.net/publication/361164140>). *Indian Farming*. **12**: 41–45.
49. "FAOSTAT" (<https://www.fao.org/faostat/en/#data/QCL/visualize>). www.fao.org. Retrieved 28 February 2024.
50. "ICRISAT overview" (<https://web.archive.org/web/2021080325819/https://www.icrisat.org/icrisat-strategic-plan/>). ICRISAT. Archived from the original (<https://www.icrisat.org/icrisat-strategic-plan/>) on 3 August 2021. Retrieved 17 September 2021.

51. "Pearl Millet" (<https://web.archive.org/web/20190529043747/http://exploreit.icrisat.org/profile/Pearl%2520Millet/178>). ICRISAT. Archived from the original (<http://exploreit.icrisat.org/profile/Pearl%20Millet/178>) on 29 May 2019. Retrieved 17 September 2021.
52. "Small Millets" (<https://web.archive.org/web/20190529043858/http://exploreit.icrisat.org/profile/Small%2520millets/187>). ICRISAT. Archived from the original (<http://exploreit.icrisat.org/profile/Small%20millets/187>) on 29 May 2019. Retrieved 17 September 2021.
53. "Indian Institute of Millets Research" (<https://millets.res.in/>). millets.res.in. Retrieved 17 September 2021.
54. Hanna, W.; Wilson, J. "Pearl Millet Hybrids for Grain" (<https://www.ars.usda.gov/southeast-area/tifton-ga/crop-genetics-and-breeding-research/docs/pearl-millet-hybrids-for-grain/>). USDA-ARS. Retrieved 30 July 2021.
55. "Kulish" (<https://ukrainefood.info/recipes/soups/28-kulish>). Discover Ukraine. Retrieved 2 January 2025.
56. "Süßer Hirsebrei mit Milch und Beeren" (<https://eat.de/rezept/suesser-hirsebrei/>) [Sweet Millet Porridge with Milk and Berries]. eat.de (in German). Retrieved 2 January 2025.
57. "Пшеничная каша (4 секрета приготовления рассыпчатой каши) — Пошаговый рецепт приготовления с фото 2025 | Простые и вкусные рецепты в домашних условиях" (<https://www.edimdoma.ru/retsepty/42638-pshennaya-kasha-4-sekreta-prigotovleniya-rassypchatoy-kashi>) [Millet porridge (4 secrets of making crumbly porridge) - Step-by-step recipe with photos 2025 | Simple and delicious recipes at home]. EdimDoma.ru. 14 September 2009.
58. "Рязанские чичи, сыроги и калинники" (<https://rv-ryazan.ru/ryazanskie-chichi-syroegi-i-kalinniki/>) [Ryazan chichi, syroggi and viburnum]. Рязанские ведомости (Ryazan News) (in Russian). 4 April 2019.
59. "Bánh da kê - món quà vặt của người Hà Nội" (<https://dulich.vnexpress.net/tin-tuc/dau-chan/ba-nh-da-ke-mo-n-qua-va-t-cu-a-nguo-i-ha-no-i-3467611.html>) [Rice paper rolls - a snack of Hanoi people] (in Vietnamese). Retrieved 7 December 2018.
60. "Burkina: Latest millet smoothie in town" (<https://web.archive.org/web/20190622103555/https://www.ghanaweb.com/GhanaHomePage/business/Burkina-Latest-millet-smoothie-in-town-278294>). www.ghanaweb.com. Archived from the original (<https://www.ghanaweb.com/GhanaHomePage/business/Burkina-Latest-millet-smoothie-in-town-278294>) on 22 June 2019. Retrieved 22 June 2019.
61. "Ragi Roti Recipe" (<https://recipes.timesofindia.com/recipes/ragi-roti/rs57534900.cms>). Times of India. 4 December 2018. Retrieved 2 January 2025.
62. "Ragi Sangati" (<http://www.thehindu.com/todays-paper/tp-features/tp-metroplus/article1419117.ece>). The Hindu. 21 June 2008. Retrieved 25 March 2016.
63. "Relish The Fulani's fura" (<https://tribuneonlineng.com/relish-the-fulanis-fura/>). Tribune Online. 11 September 2020. Retrieved 22 June 2022.
64. Easen, Nick (1 March 2004). "Mountain High" (<https://web.archive.org/web/20091015071154/http://www.time.com/time/magazine/article/0,9171,596307,00.html>). Time. Archived from the original (<http://www.time.com/time/magazine/article/0,9171,596307,00.html>) on 15 October 2009. Retrieved 29 August 2009.
65. Kumar, Ashwani; Tomer, Vidisha; Kaur, Amarjeet; Kumar, Vikas; Gupta, Kritika (27 April 2018). "Millets: a solution to agrarian and nutritional challenges" (<https://doi.org/10.1186/s40066-018-0183-3>). Agriculture & Food Security. 7 (1): 31. Bibcode:2018AgFS....7...31K (<https://ui.adsabs.harvard.edu/abs/2018AgFS....7...31K>). doi:10.1186/s40066-018-0183-3 (<https://doi.org/10.1186/s40066-018-0183-3>).
66. Collett, Ian J. "Forage Sorghum and Millet" (http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0006/146616/forage-sorghum-and-millet.pdf) (PDF). District Agronomist, Tamworth. NSW Department of Primary Industries. Archived (https://web.archive.org/web/20080822230144/http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0006/146616/forage-sorghum-and-millet.pdf) (PDF) from the original on 22 August 2008. Retrieved 7 November 2013.
67. Robson, Sarah. "Dr" (http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0013/111190/prussic-acid-poisoning-in-livestock.pdf) (PDF). primefact 417, Prussic Acid Poisoning in Livestock. NSW Department of Primary Industries. Archived (https://ghostarchive.org/archive/20221009/http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0013/111190/prussic-acid-poisoning-in-livestock.pdf) (PDF) from the original on 9 October 2022. Retrieved 7 November 2013.
68. Lonewood Trust. "Shirohie Millet Growing Guide" (http://aussiesapphire.com/documents/SHIROHIE_MILLET_GROWING_GUIDE.pdf) (PDF). Archived (https://ghostarchive.org/archive/20221009/http://aussiesapphire.com/documents/SHIROHIE_MILLET_GROWING_GUIDE.pdf) (PDF) from the original on 9 October 2022. Retrieved 7 November 2013.
69. "Millet Industry Statistics in Africa | SME Blue Pages" (<http://smebluepages.com/millet-industry-statistics-in-africa/>). Retrieved 21 August 2024.
70. Ludvigsson, Jonas F; Leffler, Daniel A; Bai, Julio C; Biagi, Federico; Fasano, Alessio; et al. (2013). "The Oslo definitions for coeliac disease and related terms" (<https://gut.bmjjournals.org/content/gutjnl/62/1/43.full.pdf>) (PDF). Gut. 62 (1): 43–52. doi:10.1136/gutjnl-2011-301346 (<https://doi.org/10.1136/gutjnl-2011-301346>). PMC 3440559 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3440559>). PMID 22345659 (<https://pubmed.ncbi.nlm.nih.gov/22345659>). Retrieved 3 January 2025.
71. Mulder, Chris J.J.; van Wanrooij, R.L.J.; Bakker, S.F.; Wierdsma, N.; Bouma, G. (2013). "Gluten-Free Diet in Gluten-Related Disorders". Digestive Diseases. 31 (1): 57–62. doi:10.1159/000347180 (<https://doi.org/10.1159/000347180>). PMID 23797124 (<https://pubmed.ncbi.nlm.nih.gov/23797124>).
72. Volta, Umberto; Caio, Giacomo; De Giorgio, Roberto; Henriksen, Christine; Skodje, Gry; Lundin, Knut E. (2015). "Non-celiac gluten sensitivity: A work-in-progress entity in the spectrum of wheat-related disorders". Best Practice & Research Clinical Gastroenterology. 29 (3): 477–491. doi:10.1016/j.bpg.2015.04.006 (<https://doi.org/10.1016/j.bpg.2015.04.006>).
73. Rai, Sweta; Kaur, Amarjeet; Singh, Baljit (2014). "Quality characteristics of gluten free cookies prepared from different flour combinations" (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3982011>). Journal of Food Science and Technology. 51 (4): 785–789. doi:10.1007/s13197-011-0547-1 (<https://doi.org/10.1007/s13197-011-0547-1>). PMC 3982011 (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3982011>). PMID 24741176 (<https://pubmed.ncbi.nlm.nih.gov/24741176>).
74. Saturni, Letizia; Ferretti, Gianna; Bacchetti, Tiziana (14 January 2010). "The Gluten-Free Diet: Safety and Nutritional Quality" (<https://doi.org/10.3390%2Fnut2010016>). Nutrients. 2 (1): 16–34. doi:10.3390/nu2010016 (<https://doi.org/10.3390/nu2010016>). ISSN 2072-6643 (<https://search.worldcat.org/issn/2072-6643>).
75. Koerner, Terence B.; Cleroux, Chantal; Poirier, Christine; Cantin, Isabelle; La Vieille, Sébastien; Hayward, Stephen; Dubois, Sheila (2013). "Gluten contamination of naturally gluten-free flours and starches used by Canadians with celiac disease". Food Additives & Contaminants: Part A. 30 (12): 2017–2021. doi:10.1080/19440049.2013.840744 (<https://doi.org/10.1080/19440049.2013.840744>). PMID 24124879 (<https://pubmed.ncbi.nlm.nih.gov/24124879>).

76. *Millets 2009* (https://milletindia.org/wp-content/uploads/2015/07/II_National_Consulate.pdf) (PDF). India: National Forum for Policy Dialogues. p. 4. Archived (https://web.archive.org/web/20210917051422/https://milletindia.org/wp-content/uploads/2015/07/II_National_Consulate.pdf) (PDF) from the original on 17 September 2021. Retrieved 17 September 2021.

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- "Millets" (<http://www.hort.purdue.edu/newcrop/afcm/millet.html>). *Alternative Field Crops Manual*.
 - Digital exhibition of European prehistory of Millet (<https://www.allesbleibtanders.com/en/modules/rispenhirse/>)
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