

## Chapter 2

# Priority Species of Bamboo

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**Abstract** There are over 1,250 species in approximately 75 genera of woody bamboos in the world. Bamboos are native to Africa, the Americas, Asia and Oceania and have been introduced into Europe. This chapter summarizes a revised list of ‘Priority Species of Bamboo and Rattan’, compiled by the International Network for Bamboo and Rattan (INBAR).

**Keywords** *Arundinaria* ssp. • *Bambusa* ssp. • *Cephalostachyum* ssp. • *Chusquea* ssp. • *Dendrocalamus* ssp. • *Gigantochloa* ssp. • *Guadua* ssp. • *Melocanna* ssp. • *Ochlandra* ssp. • *Oxytenanthera* ssp. • *Phyllostachys* ssp. • *Schizostachyum* ssp. • *Thyrsostachys* ssp.

There are over 1,250 species of woody bamboos in the world, in approximately 75 genera. They are native to Africa, the Americas, Asia and Oceania and have been introduced into Europe. Bamboos are naturally found as understorey plants in forests and grow in habitats from the humid tropics, through a range of humid sub-tropical forest types, to temperate regions including northern parts of China, Japan, Korea and the foothills of the Himalayas. They vary in stature from 50 cm (*Sasa borealis* in Japan) to 40 m or more (*Dendrocalamus giganteus* in tropical Asia). Most do not comprise the dominant vegetation unless they are cultivated, such as the huge areas of *Phyllostachys pubescens* in China, but the *Melocanna baccifera* forests of Northeast India, Bangladesh and Myanmar are a major exception, as are the *Guadua* forests of western Amazonia, which cover 120,000 ha (Dransfield and Widjaja 1995; Judziewicz et al. 1999).

With 75 genera of bamboos growing in a wide range of different habitats, it is not surprising that there is much variation in the characteristics they exhibit. Growth habits vary from clump forming to grove forming, culm wall thickness varies from solid in *Chusquea culeo* to just a couple of centimetres in *Bambusa textilis*, internode length between a few centimetres and one metre, and culms may be very straight or zigzag—the latter an important consideration if machine

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**Table 2.1** Bamboo characteristics suitable for various end uses (adapted from Hoogendoorn et al. 2013)

Plant part used	Examples of uses	Characteristics required
Whole plant	Ornamentals	Appearance, growth habit
Whole plant	Environmental services—erosion control and watershed protection	High growth and establishment rate
Whole plant	Environmental services—carbon sequestration	Rapid establishment, high processing value to ensure sustainable management of forest
Round-pole uses	Houses, agricultural implements, etc. (usually lower value uses)	Sturdy, strong (and long) poles
Round-pole uses	Construction	Sturdy and strong, uniformity along the culms
Split pole—slabs	Processing into laminates/lumber (high-value uses)	Straight, thick-walled culms
Split poles—splits	Weaving and stick products (high value—low volume or low value—high volume uses)	Straight culms with long internodes
Shoots	Food	Thick culms with low hydrocyanin content, good flavour
Whole-pole pulping	Paper and rayon	High biomass productivity
Extracts	Tar oil, medicines, ‘beer’	No clear specific requirements

processing. Selection of species for particular uses has been done by communities and producers for centuries, and these days 16 of the 20 most commercially important species are thought to have been domesticated (Rao and Ramanatha Rao 1998). Bamboos have traditionally been used for a wide range of uses from construction to weaving, farm implements to fodder for farm animals, paper making to musical instruments, stick products to tar oil and alcohol. Innovation has been a driving force behind expanding the uses of bamboos, particularly in China, where glued and laminated bamboo products and production systems developed for specific species (usually *Phyllostachys pubescens*) have been developed and contribute hugely to the nation’s bamboo sector (Table 2.1).

Because bamboos are so different, the technologies used for processing them also need to differ—bamboos and the technologies for processing them often fall into species-product groupings (e.g. *Phyllostachys pubescens* for chopsticks and laminates, *Guadua* for construction and *Dendrocalamus asper* and *D. latiflorus* for bamboo shoots), and this has to be taken into account when developing new bamboo businesses (Hoogendoorn et al. 2013).

## 2.1 Priority Species of Bamboo

In 1998, the International Network for bamboo and Rattan released a revised list of ‘Priority Species of Bamboo and Rattan’, that included 20 taxa (species and genera) of particular economic importance and a further 18 taxa of importance (Rao and Ramanatha Rao 1998). INBAR has not updated the list since that time, but since then, many more species of bamboos have been trialled and tested under different growing conditions in different countries, and much international germplasm exchange has taken place. In part, this has been enabled by INBAR’s species-to-site matching software, which enables a user in one location to see which bamboo species would be able to grow at their own site with the click of a button, based on climatic conditions and includes information on import/export regulations for such species. Although outside the scope of this short report, it would seem timely to update the priority species list and the software to reflect the current realities.

Selection and, in some cases, breeding of bamboos have been possible. Two examples where selection followed by mass multiplication have reaped commercial benefits are highlighted by Hoogendoorn et al. (2013) and shown below:

### 1. Thick-walled Moso (*Phyllostachys pubescens* cv Pachyloen).

Discovered in southeastern China’s Jiangxi province in 1995, the culm wall is almost twice the thickness of the normal phenotype of the species and yields are correspondingly higher. It has been shown to be a genetic trait and is now grown on thousands of hectares in Jiangxi province (Guo et al. 2003).

### 2. Beema bamboo

Beema bamboo is a selection of *Bambusa balcooa* from Bihar in India discovered over 10 years ago. Its culm walls are very thick and culms weigh three times that of a normal *B. balcooa*, with a reported annual productivity of over 100 tonnes per hectare, three or four times higher than a normal *B. balcooa*. It is produced on a huge scale—200,000 seedlings per annum by micropropagation and currently cultivated commercially in India.

## 2.2 Priority Species of Bamboo: List

Brief introductions to each of the priority taxa are given in the list, as per INBAR’s enumerations (Rao and Ramanatha Rao 1998), with updates and amendments where available.

Note that all species are ‘sympodial’, thereby forming discrete clumps, unless otherwise stated.

Note also that flowering of bamboos often results in the death of the flowered part, particularly if seed is set, but that the flowering habits of most bamboos are poorly understood. In the list, lack of information on gregarious flowering (and therefore subsequent death) indicates only a lack of information rather than a confirmation that such flowering does not happen. Sporadic flowering of a clump or a population of clumps may also result in death. It is thus important for growers

to record, where possible, the date the seed that gave rise to their bamboo plants was produced, in order to enable prediction of possible flowering dates decades to come.

***Bambusa arundinacea (B. bambos)***

*B. bambos* is a tough, vigorous and widespread multipurpose bamboo of South Asia but with limited value for high-value products due to its thick culm internodes that do not enable easy splitting and its thorny nature.

Brief description—thorny bamboo with culms erect up to 30 m tall, to 18 cm in diameter, thick walled up to 15 cm, nodes up to 40 cm long and slightly swollen. Lower branches bear recurved spines, forming dense, often impenetrable, thicket. *B. bambos* clumps are variable with some races almost thorn-less and others very straight culmed.

Native to India, Bangladesh, Myanmar, Thailand and China. Grows at up to about 1,200 m altitude and can tolerate  $-2^{\circ}\text{C}$ .

Introduced to Nepal, Indonesia, Vietnam, Philippines and elsewhere.

Propagation—Seed and offsets.

Lifecycle—clumps can often be found in flower—either whole clumps or a portion of the culms—and produce copious quantities of seeds which exhibit high levels of diversity in the next generation.

Uses—*B. bambos* is planted for land rehabilitation and riverbank stabilisation and is used locally for handicrafts and low-value construction. Culms are often used for pulp and supplies 20 % of India's bamboo pulp demand.

***Bambusa balcooa***

*B. balcooa* is used for construction as well as agricultural implements, round-pole furniture and pulp but is not used for high-value products.

Brief description—culms are up to 24 m tall and 15 cm in diameter; new culms are grey-green to light white bloom, nodes 30–45 cm long and thick walled up to 2.5 cm.

Native to N.E. India and Bangladesh.

Introduced to Indonesia and Australia.

Propagation—offsets and seed.

Uses—construction and farm use.

***Bambusa blumeana***

Large, thorny bamboo with limited commercial value but often used locally.

Brief description—densely tufted, culms 15–25 m tall, up to 20 cm diameter, internodes 25–60 cm long, green and glabrous with prominent nodes. Young shoots with yellowish-green sheaths and blades.

Distribution—believed to be native to Sumatra, Java, Lesser Sunda Islands and Borneo. Introduced to Papua New Guinea, Peninsular Malaysia, Thailand, Vietnam, Philippines and southern China.

Life cycle—gregarious flowering perhaps once in 20–30 years. Sporadic flowering is also known.

Propagation—culm cuttings, rhizome cuttings, layering and marcotting. Seeds/caryopses are not available.

Uses and value—good for rehabilitating degraded lands and as borders to agricultural areas. Used locally for low-quality furniture, chopsticks, handicrafts and, occasionally, shoots are used after processing.

### ***Bambusa polymorpha***

A medium to large bamboo.

Brief description—densely tufted bamboo with culms 15–25 m tall and up to 15 cm in diameter, relatively thick walls of 1 cm, occasionally solid.

Distribution—native to Myanmar, extending to Bangladesh, India and Thailand. Introduced to germplasm collections elsewhere but not known to be cultivated outside its distribution area.

Life cycle—flowering after 50–60 years.

Propagation—cuttings, rhizome cuttings, branch cuttings, layering and marcotting.

Uses and value—locally used for building and structural uses and for baskets and low-quality furniture. The shoots are edible.

### ***Bambusa textilis***

A delicate thin-walled bamboo ideal for weaving.

Brief description—medium-sized bamboo with straight culms and long internodes. Culms are up to 15 m tall, 3–5 cm in diameter, internodes up to 60 or more cm long and culms are thin walled.

Cultivars and varieties—there are three botanical varieties that are widely grown in China: cv *Albo striata*, var *glabra* and var *gracilis*.

Distribution—southern China.

Introduced to other provinces of China.

Life cycle—not known to flower gregariously.

Propagation—offsets and seed are the two most common methods of propagation.

Uses and value—*Bambusa textilis* culms split easily and very finely, providing high-quality bamboo for woven items. *B. textilis* and some of its varieties are also often used for landscaping. Shoots are edible but small.

### ***Bambusa tulda***

Brief description—culms are up to 30 m tall, usually 20 m, 5–10 cm diameter, internodes 40–70 cm long, culm walls to up to 1 cm thick.

Distribution—India, Bangladesh, Myanmar and Thailand.

Introduced to Nepal, Indonesia, Vietnam and Philippines.

Life cycle—reports of flowering after 25–40 years.

Propagation and cultivation—culm cuttings, marcotting, rhizomes and macroproliferation.

Uses and value—multiple uses. Culms are used structurally, for furniture, pulp and handicrafts.

### ***Bambusa vulgaris***

Brief description—vigorous medium-large bamboo with relatively open clumps. Culms are up to 20 m tall, internodes 25–35 cm long, 5–10 cm diameter, walls up to 1.5 cm thick. Culms are not straight, internodes often zigzagging.

Cultivars and varieties—*B. vulgaris* var *vulgaris* (Yellow culms—very widely grown as an ornamental plant) and *B. vulgaris* cv Wamin (Bhudda's belly bamboo, very widely grown as an ornamental plant).

Distribution—global tropics. *B. vulgaris* is known as the only pan-tropical bamboo.

Life cycle—gregarious flowering not seen, sporadic flowering occurs only very rarely.

Propagation and cultivation—culm cuttings, rhizomes, branch cuttings, layering and marcotting. *B. vulgaris* is one of the easiest bamboos to propagate and is extremely vegetatively vigorous.

Uses and value—widely used for local purposes including construction, furniture and handicrafts, but its non-straight culms limit its uses. Good for pulping. In Brazil, it is grown for pulp in large plantations and harvested mechanically on a 3-year rotation.

### ***Cephalostachyum pergracile***

Brief description—medium-sized bamboo with straight culms that keep the culm sheaths. Up to 30 m tall, thin walled, internodes up to 45 cm.

Distribution—N.E. India, Myanmar, Northern Thailand, Yunnan province and S.W. China. Also cultivated in botanic gardens.

Introduced to southern China, Java.

Life cycle—*C. pergracile* is not known to flower gregariously.

Propagation—offsets and seed are the two most common methods of propagation. Seedlings can be collected from the forest. Offsets are taken from 1 to 2-year old culms, keeping 1–1.5 m of the culm and planted directly in situ.

Uses and value—light construction, basketry. Outer layer can be split very finely and used for handicrafts. Attractive, ornamental with glaucous culms and brownish sheaths.

### ***Dendrocalamus asper***

Brief description—Large bamboo culms up to 20–30 m tall, internodes 20–45 cm long with a diameter of 8–20 cm and thick walls up to 2 cm.

Distribution—N.E. India, Nepal, Bangladesh, Myanmar, northern Thailand, Laos and Vietnam.

Introduced to southern China, Malaysia, Indonesia and Philippines.

Cultivars—six are known including cv betung wulung, cv Tahi green and cv Phai Tong Dam.

Life cycle—gregarious flowering not known.

Propagation—culm and branch cuttings and offsets.

Uses and value—*D. asper* is a multipurpose bamboo with a wide range of uses. Structural use bamboo with large and strong culms, and a very useful bamboo for construction in rural areas with durable culms. Shoots are edible and are good, tasty and sweet. Plantation for bb shoots established of this bamboo in Thailand. Used for good quality furniture, musical instruments, chopsticks, household utensils and handicrafts.

***Dendrocalamus giganteus***

Brief description—large, sometimes huge bamboo, culms 25–60 m green to dark bluish green, internodes 40–50 cm long, 10–20 cm in diameter and thick walls of 2.5 cm.

Distribution—southern Myanmar and northern Thailand.

Introduced to India, Sri Lanka, Bangladesh, Nepal, Thailand, Vietnam, China, Indonesia, Malay Peninsular, Philippines and Kenya.

Life cycle—not known to flower gregariously.

Propagation—culm cuttings, rhizome planting, branch cuttings, layering, marcotting and macroproliferation.

Uses and value—structural bamboo, strong, for building and for bamboo boards. Also for pulp and for household items. Used for furniture too, and shoots are of good quality.

***Dendrocalamus latiflorus***

Brief description—medium-sized bamboo 14–25 m tall, internodes 20–70 cm long, 8–20 cm diameter and walls 0.5–3 cm.

Cultivars—cv Meimung in China.

Distribution—Myanmar, South China and Taiwan. Like high rainfall.

Introduced to Philippines, Indonesia, Thailand, India, Vietnam and Japan.

Life cycle—*D. latiflorus* is not known to flower gregariously.

Propagation and cultivation—culm cuttings, layering and marcotting.

Uses and value—structural uses of medium quality; very good for shoots, also for high-quality furniture, crafts, baskets, pulp and thatching; leaves are used to wrap rice for cooking.

***Dendrocalamus strictus***

Brief description—medium-sized bamboo culms are 8–20 m tall, internodes 30–45 cm long, 2.5–8 cm diameter, thick walls but slightly zigzag.

Distribution—India, Nepal, Bangladesh, Myanmar and Thailand.

Introduced to many countries in SE Asia but is of limited value outside these regions.

Life cycle—report indicates 20–40 years flowering cycle.

Propagation—culm cuttings, rhizome planting, layering, marcotting and macroproliferation of seedlings.

Uses and value—structural uses, medium to light quality, edible shoots but of poor quality. Pulp use, thick walled and ok for boards, agricultural implements and household utensils.

***Gigantochloa apus***

Brief description—large bamboo 8–30 m, culms 4–13 cm diameter, strongly tufted, internodes 35–45 cm long, wall thickness 1.5 cm and flexible culms.

Distribution—Myanmar, Thailand, Indonesia and Malaysia. Known to survive in drier areas.

Introduced to N.E. India.

Life cycle—not known to flower gregariously.

Propagation—culm cuttings, offsets.

Uses and value—structural uses of medium quality, and for furniture of medium and good quality, also for handicrafts, musical instruments, utensils and baskets. Shoots are edible but are of poor quality, very bitter in taste.

***Gigantochloa levis***

Brief description—large bamboo, culms up to 30 m tall, 5–16 cm in diameter, walls 1–1.2 cm thick and internodes up to 45 cm long.

Distribution—origin unknown, cultivated in Philippines, Eastern Indonesia, Northern and Western Kalimantan, east Malaysia, China and Vietnam. Common in the homesteads and gardens of the Philippines.

Life cycle—gregarious flowering not known.

Propagation—culm cuttings and offsets.

Uses and value—structural, shoots are edible and of good quality, also for utensils, furniture, craft paper, fencing and other subsistence uses.

***Gigantochloa pseudoarundinacea***

Brief description—culms 7–30 m tall, internodes 35–45 cm, 5–13 cm diameter, medium to thick wall of 2 cm, strong.

Distribution—native to Java, cultivated in Java and Sumatra.

Introduced to China, Malaysia, India and Vietnam.

Life cycle—gregarious flowering not known.

Propagation and cultivation—culm cuttings and branch cuttings.

Uses and value—structural, water pipes, handicrafts, good quality furniture, household articles, chopsticks and toothpicks; good quality edible shoots.

***Guadua angustifolia***

Brief description—large bamboo culms up to 30 m tall, dark green with white bands at the nodes, diameter up to 20 cm.

Distribution—extending from Mexico to Argentina.

Introduced to India, Bangladesh, China and many other countries.

Life cycle—gregarious flowering not known.

Propagation and cultivation—offsets, culm cuttings and seed.

Uses and value—*G. angustifolia* is the most widely used bamboo in Latin America. Culms are large and strong and of superior quality. Excellent for construction, furniture, pulping and laminates.

***Melocanna baccifera* (Grove Forming)**

Brief description—Culms to 10–20 m tall, very open, thin walls of 0.5–1.2 cm, internodes 20–50 cm long, 5–7 cm in diameter, culm tips are pendulous.

Distribution—*M. baccifera* covers huge swathes of northeast India and adjoining parts of Myanmar and Bangladesh.

Introduced to Indonesia and China.

Life cycle—48 years.

Propagation and cultivation—fruits and culm cuttings.

Uses and value—roofing, thatching, matting, pulp, paper and rayon; shoots are locally eaten and used for preparing liquor.



***Phyllostachys pubescens* (Grove Forming)**

Brief description—Medium to large monopodial bamboo with culms 10–20 m tall, approximately 18–20 cm diameter and internodes up to 45 cm long, young culms bearing a noticeable waxy white covering.

Distribution—China.

Introduced to Japan (eighteenth century), Korea, Vietnam, the USA and Europe amongst others.

Life cycle—*P. pubescens* is not known to flower gregariously, though sporadic flowering does occur regularly in pockets.

Propagation and cultivation—offsets and seed.

Uses and value—*P. pubescens* is the most economically valuable bamboo species in the world and contributes the vast majority of the value of the 19bn yuan annual bamboo economy in China.

***Ochlandra* spp.**

Brief description—there are about ten species of *Ochlandra*, all between 5 and 10 m tall with culms up to 5 cm diameter.

Distribution—native to the Western Ghats of southern India and southwestern Sri Lanka.

Introduced to East Africa.

Life cycle—*O. travancorica* is reported as flowering once in every 7 years.

Propagation and cultivation—culm cuttings.

Uses and value—often for pulp and paper, but local uses include non-structural construction uses such as walling and handicrafts.

***Thyrsostachys siamensis***

Brief description—graceful bamboo, densely clumped, culms 8–16 m tall, internodes 15–30 cm long, culm sheaths persistent, white ring below the nodes.

Distribution—Myanmar and Indochina. Naturally in pure or mixed forests in monsoonal areas.

Introduced to many Asian countries where it is cultivated—adaptable to more humid areas on good soils.

Life cycle—both gregarious (48 years) and sporadic.

Propagation and cultivation—seeds, macroproliferation and offsets.

Uses and value—Pulp, shoots, general quality handicrafts, furniture, light construction and for fences and windbreaks, as well as ornamentals.

**2.3 Suggested Other Taxa of Value**

*Arundinaria alpina*—large areas in Ethiopia and forming forests in neighbouring Uganda, Kenya, Rwanda and Burundi, as well as further afield; the ‘highland bamboo’, *A. alpina*, is the foremost bamboo in Africa, where it is used for subsistence uses such as agricultural implements and basic construction.

*Arundinaria amabilis*—*A. amabilis* is also known by its English name of Tonkin cane and has been used for over a century to produce top-quality fly fishing rods in North America and Europe. Cultivation is limited to southwest Guangdong province in China.

*Bambusa atra*—*B. atra* is up to 10 m tall and native to eastern Indonesia.

*Bambusa heterostachya*—Culms are up to 16 m tall, internodes 30–80 cm in length and walls thick. It is known to be from Malaysia and Indonesia, where it has value as poles for picking oil palm fruit bunches.

*Bambusa nutans*—Culms are up to 15 m tall, internodes up to 45 cm long. *B. nutans* has value as a source of pulp from the lower Himalayas south to Bangladesh south to Thailand. It is also used for furniture and construction.

*Bambusa chungii*—native to China, *B. chungii* is an open-clumped sympodial bamboo that when matures, forms groves with young waxy white culms that are very attractive. It has considerable potential as an ornamental in the tropics and subtropics.

*Bambusa oldhamii* is a medium-sized bamboo up to about 12 m tall. It is native to China, where it is grown as a windbreak and is used as a medium-quality structural bamboo and sometimes for furniture making.

*Bambusa pervariabilis* is a medium-sized bamboo that is native to southern China where it is used for furniture, thatching and weaving, as well as for agricultural implements.

*Chusquea* spp.—the 200 or so species of *Chusquea* are native to Latin America and many are unusual in having solid culms which gives them potential for a huge range of uses.

*Dendrocalamus brandisii* is a large bamboo up to 35 m tall, with culms up to 20 cm in diameter and internodes up to 40 cm. It grows in southern and northeastern India, Myanmar and in adjoining parts of China. It is often used for construction, baskets, furniture and handicrafts. Its shoots are edible.

*Dendrocalamus hamiltonii* grows to 20 m tall, with culms up to 18 cm diameter and internodes up to 50 cm. It is native to Northeast India, Myanmar, Thailand, Laos, Vietnam and Yunnan province in China, where it has much value for construction, baskets, handicrafts, household utensils, fuel, fodder, rafts and edible shoots.

*Dendrocalamus hookeri* grows to 20 m with culms up to 15 cm in diameter. It is distributed in Northeast India, Myanmar and Nepal and is used for construction and simple woven articles.

*Dendrocalamus membranaceous* grows to 25 m tall with thin internodes up to 10 cm diameter. It is native to northeast India, Laos, Thailand, Vietnam and China and has value for construction, furniture, pulp, handicrafts and as edible shoots.

*Gigantochloa albociliata* grows to 10 m tall, in northeast India, Myanmar, Thailand and China, where it is used for its edible shoots, furniture and construction.

*Gigantochloa atrovioleacea* grows up to 15 m tall and is used in its native Java for musical instruments, handicrafts, furniture and edible shoots.

*Gigantochloa balui* grows to 12 m tall with internodes up to 40 cm long. It grows in Thailand, Indochina, Sarawak and parts of Indonesia.

*Gigantochloa hassarkliana* grows to 10 m tall with culms just 6 cm in diameter in its native western Indonesia, where it has value for furniture and for erosion control due to its fast growth and establishment.

*Guadua amplexifolia* and *Guadua chacoensis*—both these bamboos have culms up to 20 m or more tall and are widely used for construction and other uses in Latin America.

*Oxytenanthera abyssinica*—the ‘lowland bamboo of Africa’, grows in drier parts of the continent, where its thick-walled, sometimes solid culms are used for construction, weaving and household utensils.

*Phyllostachys* spp.—there are over 100 species of *Phyllostachys* native to China and Japan, and some have become some of the most widely grown ornamentals in the world. *P. aurea* has been transplanted across the globe, and it is often used for making furniture in places as far afield as Madagascar and Latin America. The shoots of many *Phyllostachys* species are edible, supplying the small shoots industry in China, with shoots of *P. pubescens* shoots used for canned and fresh large shoots.

*Schizostachyum* spp.—Schizostachyums are native to Southeast Asia. A number of species of *Schizostachyum* have local value in Southeast Asia with potential for enhancement. Species including *S. diffusum*, *S. dulooa*, *S. glaucifolium*, *S. lumampao* are small- to medium-sized bamboos with culms up to 15 m tall that are used for construction, weaving, pulping and for bamboo laminates.

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## Bamboo

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