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Herb Profile



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Indian Kino Tree Reforestation

Sami-Sabinsa Group Funds Major Conservation Project in India

By Connor Yearsley

The Sami-Sabinsa Group* has committed to fund a 10-year reforestation project that will oversee the planting of more than 166,600 Indian kino (*Pterocarpus marsupium*, Fabaceae) trees on 250 acres in the large central Indian state of Madhya Pradesh.¹ The group expects to spend about \$500,000 on the project, which it claims is the first initiative to conserve this high-value, multipurpose, threatened species in India. The project earned the NutraIngredients-USA Editors Award for Industry Initiative of the Year for 2018.² The Indian kino tree has been used in India's traditional medicine system of Ayurveda, and extracts of the heartwood[†] have demonstrated antidiabetic properties (see "About the Indian Kino Tree" sidebar).

"While there have been some initiatives by Indian forest departments for propagating teak and other timber trees, an initiative for the cultivation of the Indian kino tree has hardly been done by government agencies or private enterprise," wrote Shaheen Majeed, president of Sabinsa Worldwide (email, June 6, 2018). "Natural populations of this tree have been greatly reduced, and often no young saplings can be found in the forest."

The Sami-Sabinsa Group



plants should be protected, but this program illustrates even longerterm thinking, beyond meeting Sabinsa's supply needs."

Suma Tagadur Sureshchandra, a medicinal plants specialist and an assistant professor at the University of Trans-Disciplinary Health Sciences and Technology (TDU)the Foundation for Revitalization of Local Health Traditions (FRLHT), Bengaluru, thinks this initiative should be appreciated and replicated for other Indian botanicals. "Certainly it will reduce pressure on the wild genepool of the species," she wrote, and added that such initiatives should be encouraged by forest departments and the National Medicinal Plants Board of India (email, July 9, 2018). She said that similar programs could be undertaken for other important species in the region, including the ashoka tree (Saraca asoca, Fabaceae), red sandalwood (Pterocarpus santalinus, Fabaceae), and false calumba (Coscinium fenestratum, Menispermaceae). The Indian kino tree is considered Near Threatened according to the Red List criteria of the International Union for Conservation of Nature

produces two proprietary standardized ingredients from the Indian kino tree: Silbinol, a pterostilbeneenriched fraction of the ethanol extract of the heartwood, and pTero-Sol, a C-glycosides-enriched fraction of the aqueous extract of the heartwood.³ The reforestation project was started with the expectation that these products will increase demand for this already-threatened species.

"When Sabinsa looked into supplies with an eye to the future, we found that this tree's population was declining, and it was neglected," wrote Majeed. "The Sami-Sabinsa Group has focused on cultivation, propagation, and conservation of medicinal plants for more than 20 years, and been involved in symposia discussing how traditional Indian



Bark of the Indian kino tree (*Pterocarpus marsupium*) Photo ©2018 Vinayaraj

* Sami Labs, founded in 1991, is a Bengaluru, India-based manufacturer and exporter of herbal extracts and other natural products. It is the parent company of Sabinsa Corporation, which was founded in 1988 and is a manufacturer, supplier, and marketer of herbal extracts, dietary ingredients, and other natural products. Sabinsa has offices around the world with US headquarters in East Windsor, New Jersey. The companies often are referred to as the Sami-Sabinsa Group because they are under the same ownership and both companies contribute to many of the same initiatives.

[†] Heartwood is the older, harder, nonliving inner wood of the trunk that is usually darker, denser, less permeable, and more durable than the surrounding sapwood.

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Map courtesy of Sami-Sabinsa



The Indian kino tree has a wide native range and occurs across much of India and Sri Lanka, as well as in Nepal, Bangladesh, and Taiwan. It grows at elevations up to about 1,200 meters (about 4,000 feet) in moist and dry deciduous forests and in hilly areas. The species prefers deep, well-drained, low-fertility soils and abundant light. The status of populations across the species' range is not fully known, however. The Indian kino tree reportedly is declining in Sri Lanka, and field observations in India suggest that populations there are probably small. Furthermore, the plant's range overlaps with some areas where the Global Forest Watch considers there to have been a 30% loss of tree cover since 2000.4The reforestation project will take place on a 250-acre plot of land, located in the districts of Seoni and Balaghat in the southeastern part of Madhya Pradesh, which was provided and is owned by the government of Madhya Pradesh. According to Majeed, the Madhya Pradesh Forest Department is also concerned about the conservation status of the Indian kino tree, and the Sami-Sabinsa Group's initiative is well-regarded by the government. The project officially began in March 2018 when the Sami-Sabinsa Group entered into a memorandum of understanding with the Forest Department. Seedlings are being grown in nurseries, and planting was done in July 2018, when monsoon season was in full effect. Cultivation will be managed by the reforestation organization Madhya Pradesh Rajya Van Vikas Nigam Ltd., which was incorporated in 1975 and is funded by the state government of Madhya Pradesh and the government of India.

(IUCN).[‡] This is based on a 2017 assessment that used version 3.1, the current version, of the Red List Categories and Criteria. According to the IUCN, "a taxon is Near Threatened when it has been evaluated against the criteria but does not qualify for Critically Endangered, Endangered or Vulnerable now, but is close to qualifying for or is likely to qualify for a threatened category in the near future."4,5 Previously, based on a 1998 assessment that used an earlier version of the Red List Categories and Criteria (version 2.3), the Indian kino tree was considered

Vulnerable.⁴ According to Majeed, one of the goals of the Sami-Sabinsa Group's new project is to prevent this autogenic-reproductive-deficient species** from qualifying for one of the IUCN's three threatened categories (i.e., Vulnerable, Endangered, or Critically Endangered) again. Also using version 2.3 of the IUCN

criteria, the FRLHT evaluated Indian kino tree populations in six states in India (Table 1).

The plantation will be monitored constantly for five years, and trees will be replaced if there is any mortality.

Table 1: Threat Status of Pterocarpus marsupium in Six Indian States*

Indian State	Threat Status (Assessment Year)
Chhattisgarh	Vulnerable (2003)
Madhya Pradesh	Vulnerable (2003)
Maharashtra	Vulnerable (2001)
Odisha	Endangered (2007)
Rajasthan	Critically Endangered (2007)
West Bengal	Endangered (2007)
*Based on the FRLHT's assessments using IUCN criteria. ⁶	

[‡] The IUCN's Red List of Threatened Species is the world's most comprehensive information source on the conservation status of plant, animal, and fungal species. Red List Categories and Criteria provides an explicit, objective framework for classifying species at high risk of global extinction, based on parameters such as population reduction and restricted geographic range.

** An autogenic-reproductive-deficient species is one in which "reproduction is low due to self-generated and biotic factors," according to Majeed. The Indian kino tree has a low germination rate (14-20%) and "early development of seedlings is hampered" by various factors, such as competition from weeds or thick grass. Also, young roots are vulnerable to rot, and most of the tree's pods fall during the hot season and may be damaged by fire.

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After five years, the trees will be self-sustaining. It was determined that 166,600 trees is the maximum number that the 250-acre plot can support. Since Indian kino trees are deciduous trees that usually have straight boles, the trees initially should be able to thrive in the allotted space, according to Majeed, but thinning will be required after 10 years. After 15 to 20 years, the Forest Department may decide about the harvesting of selected trees. "For each hectare of land, it is estimated that 999 man-days will be required for plantation and maintenance of the trees for a period of five years," Majeed wrote. "The clearing of undergrowth in the forest land, while preserving fruit-bearing and other desirable trees on the five



meters around the periphery, has been done. The trees will be monitored regularly to make sure they are taking root and starting to thrive."

According to Majeed, many initial challenges associated with the project have been overcome already, such as finding the cultivation partner and getting the government to provide the land. "While there is concern that the trees may be poached before they are mature, the area has been wire-fenced and will be under supervision," Majeed wrote. "Unwanted interference and/or forest devastation should not occur to disturb this ongoing project. Any soil concerns and potential pathogens will be strictly observed by our scientists, botanists, and agro-specialists, and remedied immediately."

Indian kino tree Pterocarpus marsupium Photo ©2018 Sami-Sabinsa

About the Indian Kino Tree

A'Multipurpose Forest Tree'

The Indian kino tree, also called vijayasar in Hindi and asan in Sanskrit, is a perennial, tropical, deciduous tree in the legume family (Fabaceae) that can grow to 30 meters (98 feet) tall. Its elliptic-ovate or oblong leaflets are arranged alternately on the rachis, and there is one unpaired terminal leaflet. From about June to August, the tree produces showy golden yellow flowers in panicles (loose, branching flower clusters). Its pods are orbicular, flat, and winged, each with one or two seeds.⁷⁻⁹ The tree's timber can be used for plywood, veneer, poles, tools, furniture, containers, boats, musical instruments, and more.¹⁰ In fact, the species has been described as one of the most "multipurpose forest trees."⁴ However, unlike species that are valued primarily for their fruit, leaves, or flowers, which can be harvested without killing the entire plant, the Indian kino tree mostly is valued for different parts of its trunk (e.g., the heartwood), so human use usually requires harvesting the entire tree. This creates concerns about the sustainability of the species. It has been proposed that a population census be conducted across the Indian kino tree's range, its international trade be monitored, and harvest quotas be introduced.⁴ According to Majeed, the sustainable management of valuable trees, including this species, requires longer-term thinking than for other plants, because trees typically have longer life cycles.

of mango (*Mangifera indica*, Anacardiaceae), sal tree (*Shorea robusta*, Dipterocarpaceae), and *Spondias pinnata* (Anacardiaceae) to treat dysentery. In addition, the Kannada people reportedly have made wooden tumblers (drinking vessels) from the yellowish-brown heartwood of the tree. The tumblers are then filled with water that is allowed to sit overnight, which creates an extract of the heartwood that is drunk the next morning to treat diabetes.⁷

Traditional Uses

Modern Research

Epicatechin, found in the bark and heartwood of the tree, is chemically similar to insulin but reportedly works through a different mechanism of action.¹⁴ In diabetic rats, epicatechin has been shown to be able to regenerate pancreatic beta cells, which release insulin.¹² In addition, in one study, marsupin and pterostilbene from the heartwood of the tree performed comparably to the conventional diabetes drug metformin in reducing blood glucose levels in hyperglycemic rats.⁸ In another study, the Sami-Sabinsa Group's pTeroSol extract lowered blood glucose and HbA1c levels and increased insulin levels in diabetic rats. Oxidative stress and inflammatory markers also were reduced in this study.¹⁵

Multiple studies have investigated the Indian kino tree's effects in human subjects. At least two of these were conducted by the Indian Council of Medical Research (ICMR). In the first, 67 (69%) of 97 patients with newly diagnosed or untreated diabetes and who took the Indian kino tree preparation (a dried aqueous decoction of the bark) achieved blood glucose control by week 12. The majority of those achieved control with a daily dose of two grams. No adverse side effects were reported.¹⁶ In the second study, patients with newly diagnosed or untreated type 2 diabetes were randomly assigned to receive either the Indian kino tree preparation (a dried aqueous decoction of the heartwood) or the standard antidiabetic medication tolbutamide. After 36 weeks of treatment, 86% of 172 patients in the Indian kino tree group and 94% of 177 patients in the tolbutamide group achieved blood glucose control. The study authors concluded that the Indian kino tree performed comparably to tolbutamide and without any significant adverse side effects.¹⁷

According to the *Indian Materia Medica* (1908): "Kino is a simple astringent, administered in diarrhea; somewhat milder in action than catechu, therefore better adapted for females and children. Gum is used for toothache."¹¹ The red exudate, called kino gum, which is yielded when incisions are made through the bark up to the cambium layer, contains kino tannic acid and has astringent properties.¹²

The stem bark of the Indian kino tree is used in ethnomedicines in India for diabetes, anemia, asthma, body pain, digestive disorders, diarrhea, dysentery, herpes, skin diseases, toothache, leukorrhea, and dysmenorrhea.¹³

Kol tribes in Odisha, India, reportedly have made a paste mixture from the bark of the Indian kino tree and the barks

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Majeed hopes this effort, which is unusual because it intends to proactively prevent shortfalls in supplies of this species ahead of anticipated future demand, will serve as a model. "There are declining species around the world, and the effects of climate change are already exacerbating vulnerabilities created by exploitation without replanting," he wrote. "As far as we know, this venture is the first of its kind in the dietary supplements industry. It goes beyond farms and into the forest. We hope that it will inspire other similar programs. We have already had other government entities in India take notice of our efforts, and we are in discussions for greater conservation efforts for this species as well as other threatened species in and around India. This collaboration model can be replicated by other companies and in other countries. We hope it will be." HG

Planting of Indian kino trees Pterocarpus marsupium Photo ©2018 Sami-Sabinsa

The plot is located near forests where the Indian kino tree currently grows. A variety of other medium-sized and large tree species also grow in these areas, including Butea monosperma (Fabaceae), Dalbergia spp. (Fabaceae), Ficus religiosa (Moraceae), Lagerstroemia spp. (Lythraceae), Schleichera oleosa (Sapindaceae), Syzygium cumini (Myrtaceae), and Terminalia spp. (Combretaceae). According to Majeed, tinsa (Desmodium oojeinense, Fabaceae) and sheesham (Dalbergia sissoo) often are found as key associates of the Indian kino tree. In Madhya Pradesh, the Indian kino tree has been used primarily as a source of timber, according to Majeed. "Our focus is also on the better availability of the compound of our interest," he wrote. "Considering the species' low germination rate, Sami-Sabinsa with the Forest Department is identifying pterostilbene-rich chemotypes of *Pterocarpus* marsupium. After evaluation, the selected chemotypes will be taken up for micropropagation. We expect this value addition will have a great impact on the conservation of the species in general and the elite chemotypes in particular." This project is part of the Sami-Sabinsa Group's larger commitment to sustainability. "The industry, or parts of it, has struggled to address growing challenges in sourcing of botanical ingredients in the face of increased demand, climate change, inadequate protection of indigenous species, and sometimes questionable agricultural practices," Majeed wrote. "Sabinsa's well-established cultivation program contracts directly with farmers in rural India, ensuring income for the small farmers, supporting schools, and improving rural infrastructure. Sabinsa is replicating this successful program in other countries, because the impact of climate change on weather patterns will create the necessity of sourcing in different regions."

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Botanical illustration of *Pterocarpus* marsupium from Köhler's Medizinal-*Pflanzen* by Franz Eugen Köhler (1897).

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