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## Exploration, collection and conservation of *Gymnema sylvestre* germplasm from different parts of India

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**Abstract**

*Gymnema sylvestre* belongs to the family Apocynaceae. It is a high value medicinal plant which is used in Ayurvedic medicine due to its potential source of gymnemagenin. Gymnemagenin is the main active principle found in its leaves. *Gymnema sylvestre* is used to treat the diabetes since ancient times. The present study intensive explorations and collection of *Gymnema sylvestre* germplasm has been carried out from different parts of India to identify the high herbage yield coupled with high gymnemagenin type for sustainable production. The diverse areas are explored in the forest, tribal hilly areas and targeted diverse germplasm has been collected. During exploration, two types of variants were identified as narrow leaf type and broad leaf type. Two types of fruits have been observed in *Gymnema* viz., short length of fruit and longer fruits. Altogether five explorations were carried out and a total of 78 germplasm of *Gymnema sylvestre* has been collected from different areas of Madhya Pradesh, Karnataka and Telangana. These genetic resources of *Gymnema sylvestre* has been maintained in the field gene bank at ICAR-DMAPR, Anand, Gujarat and further need to be characterize the germplasm for growth, yield and quality traits for the selection of elite germplasm for specific trait of interest.

**Keywords:** *Gymnema sylvestre*, germplasm, Western Ghats, genetic diversity, diabetes

**Introduction**

India is a treasure house of medicinal and aromatic plants. India is one of the world's top 12 mega diversity countries with 10 bio-geographic regions. India is having two among the world's eight biodiversity hotspots. World Health Organization (WHO) stated that 21,000 plant species are used for medicinal purposes around the world. About 70 per cent of medicinal plants in the country are spread across the tropical forest of Western Ghats. India is rich in biodiversity due to varied climatic and soils conditions and is suitable to grow various crops by the need of the people and industry. The use of herbal medicine to cure various ailments of human and animal is age old practices in the rural areas. According to WHO about 80% of the world population in the developing countries are rely on traditional medicines for their primary health care needs (Ghosh, 2003) [2]. About 90 per cent of the Indian herbal industries are collecting the raw materials from the wild source. In the forest, 70 per cent of the collection involves indiscriminate over harvesting because of the parts like roots, bark, wood, stem and whole plant in case of herbs irrespective of the stage and maturity of the plant and without following the guidelines of good collection practices leads to the loss of biodiversity and many medicinal plants have rare, threatened, endangered and vulnerable in nature. The red data of book lists 427 Indian medicinal plants are endangered species of which 28 are considered extinct, 124 endangered, 81 rare and 34 insufficiently known (Lakshman, 2016) [3]. The demand for herbal industries is increasing day by day due to the awareness of green therapy from medicinal and aromatic plants and its efficacy in the treatment and side effects of using modern medicine. In India, about 8000 species of medicinal plants are used in the preparation of traditional medicines (Sukumaran and Rajan, 2010) [10]. Among which *Gymnema sylvestre* is one of important botanical widely used in the traditional system of medicine. Its leaves and roots are the economic parts. Gymnemagenin is the bioactive principle extracted from its leaves and used in the treatment of diabetes since 2000 B. C. (Wild *et al.* 2004) [11]. It grows in tropical forest of central and southern part of India up to 600m (Padmapriya *et al.* 2010) [6]. In India, the products of herbal medicine containing *Gymnema* alone in combination with other antidiabetic herbal medicines are sold in the market. *Gymnema* is mainly exported to Unites States, Japan, Belgium, Singapore, Taiwan, and Israel in the form of *Gymnema* leaf powder, leaf extract and as an organic herb. Due to medicinal importance and great demand by the herbal industries, this plant is vulnerable in nature

(Rapini *et al.* 2003)<sup>[9]</sup>. Hence the collection and conservation of *Gymnema sylvestre* from wild areas of different parts of country is our prime need for conservation and multiplication of species and bring to under commercial cultivation. Exploration and collection of *Gymnema sylvestre* genotypes from wild is prerequisite for development of population for selection of genotype with specific trait of interest. Exploration trips could be useful to identify the elite genotype which could be a great use in future breeding programme (Nair and Keshavachandran, 2006)<sup>[5]</sup>. Hence considering the importance of medicinal value of this crop, survey and exploration has been taken place in Karnataka, Madhya Pradesh and Telangana to assess genetic diversity of *Gymnema sylvestre* from different eco-geological region of India.

### Materials and methods

The intensive survey and exploration trips were carried out during the year 2018-19 to collect *Gymnema sylvestre* germplasm from wild sources to assess the genetic diversity of genotypes for high biomass coupled with high gymnemagenin. A team of scientists, senior research fellow and technical assistant were explored different parts of India for collection of *Gymnema sylvestre* germplasm. First exploration trip was carried out in collaboration with National Bureau of Plant Genetic Resources (NBPGR), Regional Station, Akola as national programme of germplasm collection formulated by NBPGR, New Delhi. The survey and exploration was taken up after had a discussion with traditional healers in the tribal villages, forest range officers, agricultural officers, KVK scientists and local aged persons. The germplasm have been collected from different locations such as farmer's field, tribal hilly areas, traditional healers, forests and wastelands, but among the collections large numbers of genotypes were collected from forest area to capture the genetic diversity. For collection of *Gymnema* germplasm standard practice and procedure developed by NBPGR was followed (Pareek *et al.*, 2000)<sup>[8]</sup>. Passport data of each genotype of *Gymnema sylvestre* has been recorded at the time of collection. Latitude, longitude and altitude of each collection of *Gymnema* genotypes were recorded using Global positioning system (GPS Montana 680 Garmin Taiwan). The team explored in the villages, farmers fields, forest, wastelands, hillocks with the help of local people and forest range officers from different areas such as Madhya Pradesh (Betul, Chhindwara, Seoni, Balaghat, Jabalpur, Damoh and Sagar), Karnataka (Belagavi, Gadag, Uttara Kannada, Udupi, Shivamogga, Tumakuru and Bengaluru) and Telangana (Hyderabad) and collected a total of 78 genotypes and maintained in the field gene bank at ICAR-DMAPR, Anand, Gujarat for further characterization.

### Results and discussions

The intensive exploration trips were made at Madhya Pradesh, Karnataka and Telangana and a total of 78 germplasm of *Gymnema sylvestre* has been collected and germplasm details are presented in the table 1 and distribution was depicted in plate 5. The variability for leaf and fruit (follicle) character was observed among collected genotypes. Similar results have been reported by Dhanani *et al.* (2015)<sup>[1]</sup> significant variation of leaf characters in natural population of *Gymnema sylvestre*. The leaf variability was corroborated with earlier studies reported by Nair and Keshavachandran (2006)<sup>[5]</sup> where the genotypes were collected from Kerala and Pandey and Yadav (2010)<sup>[7]</sup> also reported that the leaf variability of *Gymnema* samples collected from Madhya Pradesh. In the first exploration trip at Betul, Chhindwara, Seoni and Balaghat districts of Madhya

Pradesh a total of 9 genotypes were collected. In the village Belamandi the traditional healer is maintained the few plants of *Gymnema* in the house and also in the field to the preparation of traditional medicines in the name of sugar plant to treat the diabetic patients. Pandervani forest area of Seoni district and Patakot forest in Tamia of Chhindwara district are the two hotspot areas where wild grown *Gymnema* in the top of tendu plants was observed. In this forest woody vines of *Gymnema* are climbed over 'tendu' to the height of 10-15m. Patakot in Chhindwara district is the hotspot for various medicinal and aromatic plants at Madhya Pradesh. In Chhindwara, many herbal industries and traditional healers are collecting the raw material from Patakot. Hence *Gymnema sylvestre* is going to be extinct in the wild areas due to over harvesting and grazing by animals.

Second exploration in the area of Belgavi, Gadag, Uttara Kannada, Udupi, Shivamogga has been surveyed during January 2019. Khanapur in Western Ghats of Karnataka is the hotspot for wild grown *Gymnema* at Belagavi. In Kitturu (Belagavi district) the genotypes were shown vigorous growth habit which is having broad leaf and high biomass. The genotypes collected from Uttara Kannada having both narrow and broad leaf types. In Sirsi of Uttara Kannada district *Gymnema* is widely distributed in the tribal hill areas, farmer's fields in the arecanut garden and forest areas. In the plain area of Udupi *Gymnema* is sparsely distributed. In case of Shivamogga it is available in the forest. During the survey and exploration in the Western Ghats of Karnataka a total of 43 genotypes of *Gymnema* have been collected. Similarly survey and collection of various medicinal and aromatic plants was done in Southern Western Ghats of Karnataka. (Manilal, 1988)<sup>[4]</sup>.

Third exploration was made in the area of Jabalpur, Damoh and Sagar districts of Madhya Pradesh. In this survey a total of 11 genotypes have been collected. The village Imaliya in the Damoh district is the hotspot for *Gymnema sylvestre* where it is grown naturally. In this Imaliya hillock the people are visiting from different parts of Madhya Pradesh to worshipping in the 'Hanuman temple' at this hillock and beside this temple they are collecting the *Gymnema* herb in the same hillock (Imaliya) to quickly cure diabetes because of belief in this hillock where Hanuman temple was located in the name of Mandapa. Dhamoni is another hotspot for naturally grown *Gymnema sylvestre* as the same concept of the nearby Hanuman temple at this village. During rainy season over harvesting of *Gymnema sylvestre* leaves by the village people of Dhamoni and sell it to the middleman who is associated with herbal company. The people in the village of Dhamoni are using *Gymnema* leaves as traditional medicine to treat the diabetes and also eye problems with the local name of "Phoolkat".

Survey and collection of *Gymnema* from Tumakuru district of Karnataka has been performed during March 2019. In this survey the main focus was to collect wild grown *Gymnema* genotypes from Siddarabetta. Siddarabetta forest (Religious Hillock) is the hotspot for various medicinal and aromatic plants. In this area 'Namada chilume' and Siddarabetta forest a total of 8 genotypes have been collected, whereas in Hesaraghatta and Bengaluru total 4 genotypes have been collected. In the last exploration at Hyderabad (Telangana) 3 genotypes has been collected from the wild source.

### Conclusion

Genetic diversity is the basic information for any crop breeding programme. The collection of large number of diverse germplasm is a prerequisite for crop improvement. The herbal



industries are collecting the raw materials of *Gymnema* from the wild and collectors are doing over-harvesting in forest or wild source leads to the species is vulnerable in nature. Hence collection of large number of genotypes is the prime need for conservation and multiplication to promote the cultivation of *Gymnema* for sustainable production and supply of the raw materials to meet the demand of herbal industry. Hence in this direction the present effort has been done and 78 germplasm of *Gymnema sylvestre* were collected from Karnataka, Madhya Pradesh and Telangana where this species is predominantly available. Considerable variability has been observed in the

collections of *Gymnema* for major characters. Further the collected germplasm need to be characterizing for growth, yield and quality traits could be highly beneficial for crop improvement of *Gymnema sylvestre*.

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**Plate 1:** Collection of *Gymnema sylvestre* from Madhya Pradesh





**Plate 2:** Collection of *Gymnema sylvestre* from Western Ghats of India



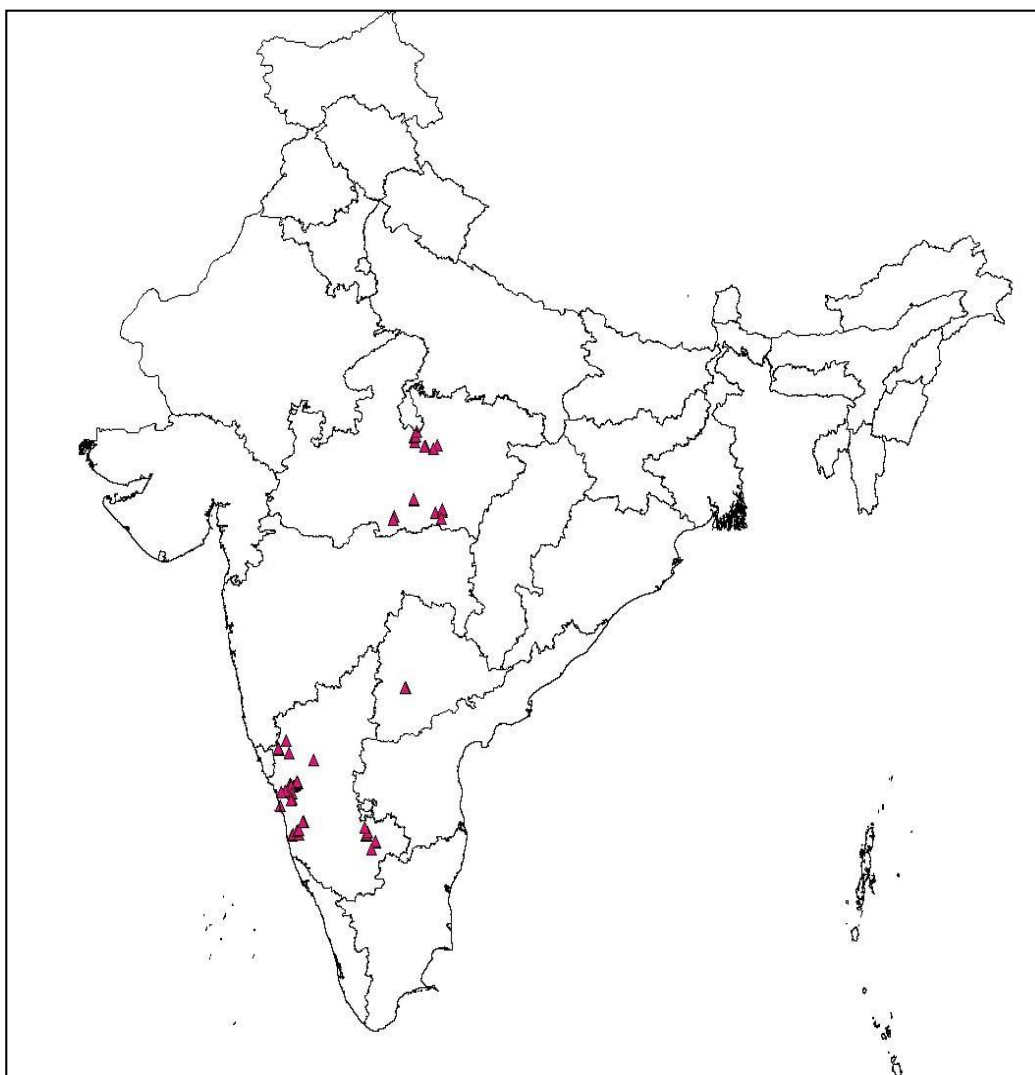


**Plate 3:** Collection of *Gymnema sylvestre* from Western Ghats of India





**Plate 4:** Over view of Western Ghats of Karnataka



**Plate 5:** Distribution of *Gymnema sylvestre* in India

**Table 1:** List of *Gymnema sylvestre* germplasm collected during explorations

S. No.	Place of collection	Tehsil/Taluk	District	State	Latitude (°N)	Longitude (°E)	Altitude (m)
1.	Belamandi	Multai	Betul	Madhya Pradesh	21°55.55	78°04.21	779
2.	Ambada	Amla	Betul	Madhya Pradesh	21°51.31	78°03.05	786
3.	Forest colony, Tamia	Tamia	Chhindwara	Madhya Pradesh	22°20.70	78.40.76	937
4.	Tamia forest, Patakot	Tamia	Chhindwara	Madhya Pradesh	22°23.40	78°40.80	620
5.	Hardua nursery, Range-Chourai, East Van Mandal	Chhindwara	Chhindwara	Madhya Pradesh	22°00.88	79°21.70	585
6.	Bamahan Dehi Nursery, Part -2	Seoni	Seoni	Madhya Pradesh	22°02.92	79°34.75	635
7.	Bamahan Dehi Rest House Jungle area	Seoni	Seoni	Madhya Pradesh	22°02.84	79°34.64	649
8.	Pandervani jungle near Bamahan Dehi Forest Nursery	Seoni	Seoni	Madhya Pradesh	22°05.73	79°35.14	642
9.	Rukhad forest, Near Pench National park	Seoni	Seoni	Madhya Pradesh	21°52.27	79°31.75	563
10.	Ramaguruwadi	Khanapura	Belagavi	Karnataka	15°39.93	74°28.15	699
11.	Jamboti	Khanapura	Belagavi	Karnataka	15°40.76	74°25.91	725
12.	Hanumanahatti	Bailahongal	Belagavi	Karnataka	15°53.32	74°41.52	906
13.	Kolawalli	Kittur	Belagavi	Karnataka	15°34.10	74°47.15	730
14.	Kolawalli	Kittur	Belagavi	Karnataka	15°34.09	74°47.13	722
15.	Kolawalli	Kittur	Belagavi	Karnataka	15°34.04	74°47.11	727
16.	Kolawalli	Kittur	Belagavi	Karnataka	15°34.00	74°47.09	723
17.	Kolawalli	Kittur	Belagavi	Karnataka	15°34.13	74°47.15	410
18.	Kurthikoti	Gadag	Gadag	Karnataka	15°21.85	75°32.60	664
19.	Kalaspura	Gadag	Gadag	Karnataka	15°21.86	75°32.60	663
20.	Sadashivalli	Sirsi	Uttara Kannada (UK)	Karnataka	14°39.97	74°51.16	557
21.	Dasanagadde	Sirsi	UK	Karnataka	14°39.57	74°50.52	537
22.	Dasanahalligadde	Sirsi	UK	Karnataka	14°40.10	74°50.00	530
23.	Dodduru	Sirsi	UK	Karnataka	14°41.11	74°54.09	636
24.	Malagi	Mundgod	UK	Karnataka	14°42.23	74°56.73	648
25.	Malagi	Mundgod	UK	Karnataka	14°44.41	74°59.86	616
26.	Paladoddakere	Mundgod	UK	Karnataka	14°46.21	75°01.95	611
27.	Paladoddakere	Mundgod	UK	Karnataka	14°47.39	75°02.10	600
28.	Bommanalli	Sirsi	UK	Karnataka	14°40.04	74°49.98	546
29.	Bommanalli	Sirsi	UK	Karnataka	14°40.28	74°49.82	552
30.	Sahasralinga road	Sirsi	UK	Karnataka	14°43.12	74°48.63	473
31.	Sahasralinga	Sirsi	UK	Karnataka	14°43.23	74°48.44	462
32.	Hulagola	Sirsi	UK	Karnataka	14°43.22	74°48.46	466
33.	Byrumbe	Sirsi	UK	Karnataka	14°40.94	74°49.70	535
34.	Kallali Farm House, Targoda	Sirsi	UK	Karnataka	14°40.13	74°49.94	532
35.	Tyagali	Siddapur	UK	Karnataka	14°30.32	74°51.74	503
36.	Tyagali	Siddapur	UK	Karnataka	14°30.31	74°51.73	492
37.	Tyagali	Siddapur	UK	Karnataka	14°29.53	74°51.89	516
38.	Kodthikoppa	Joga	Shimoga	Karnataka	14°18.86	74°51.39	568
39.	Joga road	Joga	Shimoga	Karnataka	14°16.86	74°49.58	572
40.	Ammanalli	Sirsi	UK	Karnataka	14°32.81	74°44.08	519
41.	Bandal	Sirsi	UK	Karnataka	14°31.95	74°39.67	56
42.	Masthahalli	Kumta	UK	Karnataka	14°30.80	74°32.30	57
43.	Kodambali	Kumta	UK	Karnataka	14°30.62	74°31.72	31
44.	Bailuru	Bhatkal	UK	Karnataka	14°07.98	74°30.25	26
45.	Hireadka	Udupi	Udupi	Karnataka	13°20.96	74°51.49	69
46.	Pedroor	Udupi	Udupi	Karnataka	13°23.56	74°54.71	48
47.	Pedroor	Udupi	Udupi	Karnataka	13°23.56	74°54.78	46
48.	Hebri	Hebri	Udupi	Karnataka	13°28.29	75°00.37	65
49.	Hebri	Hebri	Udupi	Karnataka	13°28.54	75°01.28	70
50.	Agumbe ghat road	Thirthahalli	Shimoga	Karnataka	13°29.63	75°04.26	161
51.	Thirthahalli	Thirthahalli	Shimoga	Karnataka	13°42.51	75°13.90	629
52.	Arga	Thirthahalli	Shimoga	Karnataka	13°43.75	75°12.99	619
53.	Malayamill	Damoh	Damoh	Madhya Pradesh	23°50.45	79°25.26	539
54.	Imaliya	Damoh	Damoh	Madhya Pradesh	23°44.83	79°19.05	384
55.	Chenuvva	Garhakota	Sagar	Madhya Pradesh	23°47.56	79°03.68	407
56.	Barpani	Sagar	Sagar	Madhya Pradesh	23°48.51	79°00.47	555
57.	Gadpehra	Sagar	Sagar	Madhya Pradesh	23°54.94	78°42.75	512
58.	Imaliya	Korani	Sagar	Madhya Pradesh	24°02.89	78°41.14	470
59.	Imaliya	Korani	Sagar	Madhya Pradesh	24°02.89	78°41.12	470
60.	Behrol	Bandri	Sagar	Madhya Pradesh	24°03.75	78°44.87	460
61.	Dhamoni road, Behrol	Bandri	Sagar	Madhya Pradesh	24°04.58	78°44.51	477
62.	Dhamoni road, Behrol	Bandri	Sagar	Madhya Pradesh	24°04.57	78°44.50	474
63.	Salampur, Dhamoni	Bandri	Sagar	Madhya Pradesh	24°12.43	78°46.07	566
64.	Siddarabetta road	Tumkur	Tumkur	Karnataka	13°20.57	77°09.58	877
65.	Siddarabetta road	Tumkur	Tumkur	Karnataka	13°20.59	77°09.60	875
66.	Siddarabetta road	Tumkur	Tumkur	Karnataka	13°21.34	77°10.93	890

67.	Siddarabetta road	Tumkur	Tumkur	Karnataka	13°21.35	77°10.91	892
68.	Siddarabetta road	Tumkur	Tumkur	Karnataka	13°22.15	77°11.64	860
69.	Irakasandra colony	Tumkur	Tumkur	Karnataka	13°26.13	77°14.18	808
70.	Siddarabetta	Koratagere	Tumkur	Karnataka	13°34.12	77°08.50	871
71.	Siddarabetta	Koratagere	Tumkur	Karnataka	13°33.93	77°08.39	892
72.	Hesaraghatta	Bengaluru	Bengaluru	Karnataka	13°09.45	77°28.59	869
73.	Byatha	Doddaballapur	Bengaluru	Karnataka	13°11.41	77°28.46	818
74.	Madhure	Doddaballapur	Bengaluru	Karnataka	13°11.50	77°27.92	872
75.	Thippakondanalli dam	Nelamangala	Bengaluru	Karnataka	12°59.21	77°20.79	787
76.	MANAGE Road, Rajendranagar	Hyderabad	Hyderabad	Telangana	17°18.72	78°24.87	529
77.	MANAGE Road, Rajendranagar	Hyderabad	Hyderabad	Telangana	17°18.78	78°24.88	538
78.	NAARM, Rajendranagar	Hyderabad	Hyderabad	Telangana	17°18.97	78°24.69	533

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