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RISING RAJASTHAN WITH THE GENUS *SENNA* (FABACEAE): THE PROSPECTS AND POTENTIAL OF MEDICINAL HERB IN THAR DESERT OF INDIA

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ABSTRACT

The *Senna* genus comprises perennial plants that are part of the Fabaceae family. Species of *Senna*, which are able to withstand hot, dry and sandy conditions are abundant in Rajasthan's desert terrain. Rajasthan hosts numerous *Senna* species, with *Senna alexandrina* (Indian Senna) being the most economically important. Species such as *Senna italica* and *Senna occidentalis* are also abundant in the region, thriving in arid and sandy environments. This article focuses on the exploration, collection, survey and review of morphological diversity of *Senna* spp. as medicinal plant in Thar desert of India with the aim of revitalizing traditional knowledge for practical applications. Increasing global demand for *Senna* leaves and pods provides an excellent opportunity for farmers to cultivate this crop during the *rabi* and summer. The extensive studies are required to explore the greater number of accessions in view of reported variability of *Senna* spp. as medicinal plants.

Key words : Senna, Medicinal herb, Thar desert.

Introduction

The *Senna* genus consists of perennial plants belonging to the Fabaceae family. The bulk of the world's 250–300 identified species reside in the tropical and subtropical regions of Africa, Asia, Europe, and Latin America. Practitioners of traditional medicine globally have utilised *Senna* spp. for an extended period. Numerous *Senna* species thrive in the arid regions of Rajasthan due to their ability to prosper in hot, dry, and sandy conditions. Rajasthan is home to several *Senna* species, with *Senna alexandrina* (Indian Senna) being the most economically significant. *Senna alexandrina* Mill. has recently been recognised as the correct nomenclature for a plant species that was formerly categorised as two distinct species, *Cassia senna* L. and *Cassia angustifolia* Vahl., which are highly related (Ramchander *et al*., 2017; Jnanesha *et al*., 2021). Species such as *Senna italica* and *Senna occidentalis* are also abundant in the region, thriving in arid and sandy environments. The ecology is hypothermal, defined by low and irregular precipitation and frequent droughts. The region's soils are sandy, deficient in nutrients and organic matter, characterised by undulating topography dominated by sand dunes and interdunal plains. *Senna* spp. is acknowledged for its effectiveness in improving human health and addressing various disorders and infections, such as diabetes, sexually transmitted diseases (STDs), measles, malaria, inflammation, abdominal pain, typhoid, and gonorrhoea (Silva *et al*., 2008). Fruits of *Senna* and hydroxyanthracene derivatives from leaves (dianthrones) have been identified, existing as glycosides (sennosides), with sennidines being the predominant aglycones. Dianthrones are not naturally occurring compounds; rather, they are enzymatically synthesised in the plant during low-temperature drying processes (Jnanesha and Kumar, 2019; Jnanesha *et al*., 2021). The leaves and

pods of the *Senna* plant are being researched globally for its antimutagenic, anti-genotoxic, and antifungal properties. Sennosides A, B, C, D, G, rhein, aloe-amine, Kaempferein, and iso-rhein exist in both free and compound forms in *Senna* leaves and pods (Atzorn *et al*., 1981).India is presently the leading producer of farmed *Senna*, with more than 10,000 acres recorded (Balasankar *et al*., 2013). *Senna* is made out of dried leaves from *C. angustifolia* Vahl. After drying, the leaves turn a light green tint. The plant's pods and roots are also used. The genus *Senna* mostly consists of annual or biennial shrubs distinguished by a distinctive odour. Most *Senna* species thrive in sunny grasslands, coastal areas, and in waste or wet situations (Vashishtha *et al*., 2009). According to morphological data, the majority of *Senna* species demonstrate close relatives despite differences in size and leaf configuration (Waltenbergera *et al*., 2008).

Senna alexandrina (*Cassia angustifolia*) – Indian Senna / Tinnevelly Senna

Senna alexandrina Mill, also referred to as Alexandrian *Senna*, is a little perennial shrub or undershrub belonging to the Fabaceae (Leguminosae) family, subfamily Caesalpinioideae, order Fabales, and is cultivated all over tropical counties (Lal *et al*., 1998). *Senna* plants are little perennial shrubs of 60-75 cm height, characterised by peripinnate compound leaves and possess a chromosomal number of 2n = 26. The plants are upright, thin, and somewhat lignified at the base. The branches are angular, ribbed, and either glabrous or slightly pubescent (Fig. 1a & b). The leaves are large, smooth, somewhat leathery, dull green to greyish green, compound, pinnate, comprising 5"8 pairs of leaflets; the leaflets are oval-lanceolate, glabrous, and display a bluish green to pale green colouration; the lamina measures 2.5–6 cm in length and 7–8 mm in width, characterised by an entire margin and an acute apex. Stipules are little, linear and caduceus (Fig. 1c and 1d). It generally flowers within 65 to 70 days. The blooms are vivid yellow, axillary (or sub-terminal), erect and form numerous-flowered racemes that markedly extend to the subtending leaf, accompanied by membranous bracts. The flowers are vibrant yellow, conspicuous, and organised in terminal or axillary racemes, each flower being papilionaceous, approximately 2–3 cm in diameter, consisting of five unequal petals, with the uppermost petal marginally smaller, and featuring 10 stamens, some of which are sterile or exhibit reduced fertility. The flowering season transpires throughout the warm months, generally from summer to early October (Fig. 1e). The pods are somewhat curved, cylindrical, or more frequently, flattened. They are green while unripe

Fig. 1 : *Senna alexandrina* a) whole plant b) branching pattern of *Senna* plant c) adaxial surface of leaflets d) abaxial surface of leaflets e) yellow flowers of *Senna* f) green immature pods of *Senna* g) seeds, dried pods, green pods and leaflet of *Senna.*

and change to brown upon ripening. It has 5–7 obovate, cuneate, compressed, smooth seeds with a yellowish-white colouration. Pods dehisce through one or both sutures. The pods are flat, rectangular, and slightly curved, reaching 3–7 cm in length, bright green when immature, and transitioning to brown or dark brown upon maturation. Each pod comprises 5–10 flattened seeds, which are dark brown to black in colour (Fig. 1f and 1g). The seeds are little, dark brown, silky, and resilient, remaining viable for several years and suitable for propagation (Fig. 1g).

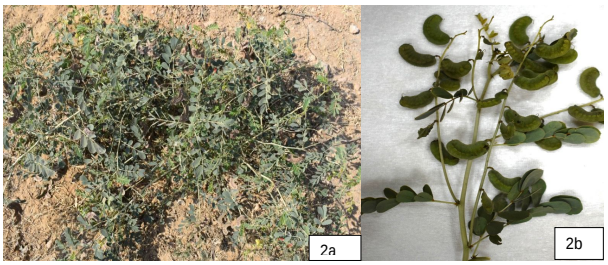
Therapeutic value

Sennosides are anthraquinone glycosides present in significant amounts in the leaves (2.0–3.0%) and pods (3.0–4.0%) of *Senna*. The four sennosides A, B, C and D are present in significant concentrations in the leaves (2.0–3.0%) and pods (3.0–4.0%) of *Senna* (*Senna alexandrina*). Sennosides A and B are two active crystalline glycosides present in *Senna* (Kumar *et al*., 2022). Sennoside B, present in greater quantities, induces laxative effects through two mechanisms: augmented intestinal fluid transfer and heightened intestinal motility. The *Senna* plant is cultivated mostly in for its foliage and immature pods. The leaves and pods contain sennosides,

utilised for their laxative therapeutic effects (Elujoba *et al.*, 1999; Jalwal and Middha, 2017). The sennoside concentration ranges from 1.5% to 3.5% in leaves and pods. The fluctuation in herbal ingredients may result from harvest seasons, plant origins, drying methods, and developmental stages (Hussain *et al.*, 1984; Kumar *et al.*, 2022). The leaves and immature pods of *Senna* alexandrina possess anti-inflammatory, anti-carcinogenic, antioxidant, antibacterial, antimutagenic, hyperglycaemic, and hepatoprotective effects (Kumar *et al.*, 2022). The leaves and unripe pods of *Senna* have been associated with hepatotoxicity (Khan *et al.*, 2020; Srivastava *et al.*, 2006).

Senna italica – Italian *Senna*/ Neutral Henna

Senna italica Mill, also referred to as Italian *Senna* or Port Royal *Senna*, is a perennial shrub or herb in the Fabaceae (Leguminosae) family. It is prevalent in the tropical and subtropical areas of Africa, India, and the Middle East. It possesses a taproot system complemented by well-developed lateral roots. The roots facilitate soil stabilisation and exhibit tolerance to arid environments. The stem is upright or semi-upright, thin, and woody at the base (Fig. 2a). It can attain a height of 1 to 1.5 meters. The branches are abundant, subtly ribbed, and adorned with tiny hairs (Fig. 2b). The leaves are paripinnate (even-pinnate) compounds consisting of 4–8 pairs of leaflets. The leaflets are elliptical to lanceolate, measuring 1.5–4 cm in length, and are either smooth or somewhat pubescent (Fig. 2c and 2d). They possess a vivid green hue with a subtly lustrous finish. Stipules are little, elongated, and enduring. The flowers are vibrant yellow, conspicuous, and organised in racemes (elongated clusters) (Fig. 2e). Each flower is papillionaceous, measuring 2–3 cm in diameter, consisting of five uneven petals, with the highest petal frequently being somewhat smaller. It possesses 10 stamens, some of which are diminutive. They flower continuously, particularly following precipitation. The pods are flat, rectangular, and slightly curved, with a length of 4 to 7 cm. The pods are pale green in their juvenile stage and transition to a brownish hue during maturation (Fig. 2f). Each pod comprises 6–10 seeds that are dark brown, smooth, and rigid (Fig. 2g and 2h).



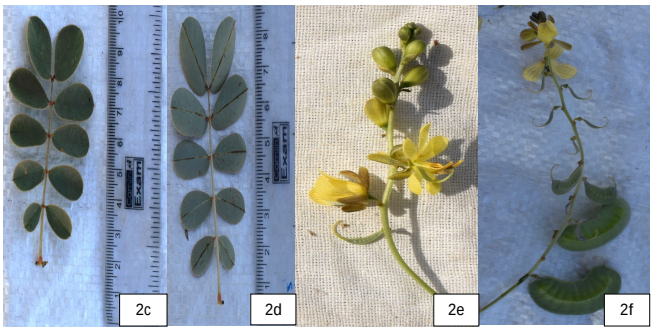


Fig. 2 : a) A mature plant of *Senna italica* b) branching pattern of *Senna italica* plant c) adaxial surface of leaflets d) abaxial surface of leaflets e) yellow flowers of *Senna italica* f) forming pods g) immature and mature pods h) mature pods with seeds.

Therapeutic value

Leaves, root, pods and seeds of *Senna italica* Mill. has been used for various medicinal purposes. *Senna italica* Mill. contains anthraquinone glycosides. The anthraquinone content of the leaves ranges from 1.1 to 3.8. Leaves also contains flavonoids (quercetin, kaempferol, apigenin) and steroids (stigmasterol, α-amyrin, β-sitostamyrinerol (Gololo *et al.*, 2018). Tannins and saponins have also been isolated from the leaves (Yagi *et al.*, 2013). The pods contains not the sennosides but the other bioactive compounds (Mokgoth *et al.*, 2013). The root extracts of *Senna italica* Mill. reported the presence of stilbene resveratrol which is an antioxidant compound (Jain *et al.*, 1997). Leaves, pods and immature seeds serve as purgatives, while decoction and maceration are employed to treat gastrointestinal disorders, fever, jaundice, venereal illnesses, and biliousness. This plant is utilised as an abortifacient and for the treatment of intestinal worms. Fresh, dried, or pulverised leaves are utilised to treat skin ailments, burns, and ulcers. Flowers are brewed into tea and utilised as a purgative and to stimulate labour. Macerated roots are utilised to treat colic and influenza, whereas boiled roots are employed for wound dressing. Root infusion is utilised as eye drops for ocular discomfort and for the management of indigestion, hepatic disorders, gallbladder issues, nausea, emesis, and dysmenorrhea.

Fig. 3 : a) branching pattern in *Senna occidentalis* b) adaxial surface of leaf and leaflets c) abaxial surface of leaf and leaflets d) seeds with dried pods and green pods.

Senna occidentalis (Coffee Senna / Septicweed)

Senna occidentalis, referred to as Coffee *Senna*, Septicweed, or Negro Coffee, is a rapidly growing annual or perennial shrub within the Fabaceae (Leguminosae) family. It is extensively prevalent in tropical and subtropical areas, frequently occurring as a weed in pastures, along roadsides, and in cultivated fields. *Senna occidentalis* is a tall (2-4 ft tall), rapidly growing, drought-resistant shrub characterised by yellow flowers, pinnate leaves, and elongated, dark brown pods (Fig. 3a). The leaves are 6–12 inch long with 4–5 pairs of leaves. Each leaf pair is varied in size and shape. The leaflets range in length from 1.5 to 4 inch. The leaves are paripinnate, compound, about 15–20 cm in length, consisting of 4–6 pairs of alternately placed leaflets. The leaflets are elliptic to lanceolate, measuring 2–6 cm in length and 1–3 cm in width, with a smooth or slightly hairy texture (Fig. 3b and 3c). The plant possesses a taproot system characterised by well-developed lateral roots. The roots can extend deeply into the earth, enabling the plant to withstand drought conditions. The stem is upright, slender, and branching, reaching heights of 1 to 2 meters. Their colouration ranges from green to reddish-brown, transitioning to a woody texture at the base as the plant ages. The surface is either smooth or slightly hairy, featuring noticeable ridges. The leaves exhibit a vibrant green hue on the upper surface, while the underside is of a lighter shade. A diminutive gland is located near the base of the petiole. The unpleasant scent upon crushing differentiates it from other *Senna* species. The blooms are vivid yellow, grouped in little axillary racemes. Each flower measures approximately 2–3 cm in diameter and consists of five asymmetrical petals, with the upper petal being marginally smaller. The flower possesses 10 stamens, some of which are sterile. The blooming period occurs from late summer to autumn in the majority of tropical areas. The pods are elongated, slender, and somewhat curved, ranging 8 to 12 centimetres in length. They are green in their juvenile stage, transitioning to dark brown or black upon maturation. Each pod comprises 20 to 30 seeds, organised in a linear arrangement (Fig. 3d). The seeds are little, dark brown, silky and firm, like coffee beans, therefore the designation “Coffee Senna”.

Therapeutic value

Senna occidentalis (L.) Link serves as a coffee alternative in India. The seeds are utilised to produce a coffee-like beverage for asthma, while a floral infusion is employed to address bronchitis (Al-Snafi, 2015). Traditional assertions indicate that the diverse parts of this plant (seeds, roots, leaves and stems) are extensively utilised as a laxative, analgesic, antipyretic, diuretic, hepatoprotective, vermifuge and for the management of tuberculosis, gonorrhoea, dysmenorrhea, anaemia, dysentery, as well as liver and urinary tract disorders (Issa *et al*., 2020). The roots are used as a febrifuge and diuretic, as well as food supplements. The roots are used to cure menstrual abnormalities, tuberculosis, anaemia, and liver problems. The leaves also used to treat gonorrhoea, fevers, urinary tract infections, and oedema (Manikandaselvi *et al*., 2016).

Climate and Soil requirements for cultivation of *Senna*

Senna thrives in warm, arid areas characterised with moderate precipitation (50-75 cm annually). It

Fig. 4 : *Senna alexandrina* (Sonamukhi) cultivation in Phalodi, Rajasthan.

necessitates direct sunlight and is intolerant of frost or excessive moisture. Optimal soil conditions include well-drained sandy loam or red lateritic soil with a pH range of 7 to 8. Waterlogging must be prevented, as it impairs root development.

Land Preparation

The land should be ploughed 2-3 times to make the soil fine and aerated. Organic manure (like FYM or compost) is applied at 5-10 tons per hectare before sowing. The raised beds or ridges are recommended in areas with heavy rainfall to prevent water stagnation.

Sowing

The seeds may be soaked in water for 12 hours or scarify them to improve germination. The best best sowing time is June-July (*Kharif* season) in western India or September-October in southern states, where crop is grown under residual moisture conditions. The recommended row-to-row distance is 30-45 cm and plant-to-plant distance is 15-30 cm.

ALFT-2, a late flowering variety produces higher yield of foliage crop. Tinneyvelley senna, is very popular in Tamil Nadu, a semi-spreading type variety. Sona is another variety identified by CIMAP, Lucknow and also grown in Rajasthan. KKM (Se) 1, it is a selection from Thenkalam local released from Department of Horticulture, Agricultural College and Research Institute, Killikulam.

Irrigation

Senna is drought-tolerant, but requires 3-4 irrigations during the growing season. The first irrigation is given immediately after sowing, followed by subsequent irrigation at 15-20 day intervals. However, overwatering, affects plant growth and alkaloid content.

Harvesting and yield

Leaves are harvested 90-110 days after sowing (when they turn slightly yellowish-green). The pods are harvested 130-150 days after sowing (when fully mature). Leaves are picked manually 2-3 times during the season. The pods are collected separately and dried under shade. Harvested leaves and pods are dispersed in a ventilated room until they attain 10% moisture content. Sun drying is eschewed to avert the degradation of Sennosides.

Post-Harvest Processing and Storage

Grading is essential for determining the quality of *Senna* leaves based on factors like color, size, moisture content, and purity. The grading system varies based on the market (e.g., pharmaceutical, herbal tea, or bulk raw material.

Grading Criteria

Bright green leaves are preferred, while yellowish or brownish leaves are considered lower quality.

Larger, unbroken leaves fetch a higher grade than fragmented or powdered leaves. The Ideal moisture content is below 10% to prevent fungal growth. The leaves should be free from stems, dust, foreign matter, and other plant parts. After grading, the leaves are packed in suitable materials to maintain freshness, prevent contamination, and ensure easy transportation. Jute bags (25–50 kg) or kraft paper bags with inner polyethylene linings are used for large-scale exports.

Exploration and collection of *Senna* spp genetic diversity in Thar Desert of India

Fig. 5 : The route map followed for exploration of *Senna* species in western Rajasthan.

The exploration was carried out in the Jodhpur and Jaisalmer regions of Rajasthan. Jodhpur is located in the western region of Rajasthan, positioned between 26° and 27°31' north latitude and between 72°55' and 73°52' east longitude. It is bordered to the north and west by Jaisalmer district. The western and northwestern regions of the district are distinguished by sand dunes. The district contains a singular significant river, namely the Luni, which enters at Bilara and traverses about 75 kilometers. The Jodhpur district is situated in the arid western plain agro-climatic zone, characterized by desert soils and aeolian sand dunes, with a coarse sand texture and, in certain areas, calcareous properties. The climate in Jodhpur is predominantly hot and arid, with a rainy

Fig. 6 : Morphological variability of different *Senna alexandrina* accessions explored and collected from Thar desert of India.

season occurring from late June to September. The average precipitation is approximately 360 millimeters (14 inches), although it exhibits remarkable variability. The temperature fluctuates from 49 degrees in summer and 1 degree in winter. The Sandstorm (andhi) is a phenomenon that captivates individuals from various parts of India. The annual occurrence of rainy days is capped at 15. Temperatures are extreme from March to October, except when monsoonal rains create dense clouds that slightly reduce them. During these periods of intense rainfall, the often low humidity increases, exacerbating the usual discomfort caused by the heat. The Jaisalmer district is classified within the agro-climatic zone of hyper-arid, slightly irrigated western plain. The average annual precipitation is merely 160 mm and exhibits unpredictable patterns, with elevated temperatures and high wind velocities being characteristic of this region. The soil type consists of desert soils and aeolian sand dunes, characterized by a loamy, coarse texture and calcareous composition.

Table 1 : *Senna* Germplasm collection sites from Thar desert of Rajasthan.

Collector's no.	Botanical name	Village	Tehsil/Taluk	District	State	Lat.	Long.
KR/GG-24-1	*Senna alexandrina*	Pal	Basni	Jodhpur	Rajasthan	26.21389	72.99045
KR/GG-24-5	*Senna italica*	Basni pal	Basni	Jophpur	Rajasthan	26.2139	72.90477
KR/GG-24-7	*Senna alexandrina*	Kerwar	Jodhpur	Jodhpur	Rajasthan	26.45007	73.10543
KR/GG-24-8	*Senna occidentalis*	Shikargarh	Jodhpur	Jodhpur	Rajasthan	26.25555	73.03373
KR/GG-24-12	*Senna alexandrina*	Osia	Osia	Jodhpur	Rajasthan	26.49802	73.00688
KR/GG-24-13	*Senna italica*	Osia	Osia	Jodhpur	Rajasthan	26.49794	73.00158
KR/GG-24-15	*Senna alexandrina*	Ugras	Phalodi	Phalodi	Rajasthan	27.02125	72.1144
KR/GG-24-18	*Senna italica*	Ugras	Phalodi	Phalodi	Rajasthan	27.02228	72.11152
KR/GG-24-20	*Senna alexandrina*	Ramdevra	Pokhran	Jaisalmer	Rajasthan	26.99544	71.93088
KR/GG-24-22	*Senna alexandrina*	Parewar	Ramghr	Jaisalmer	Rajasthan	27.16629	70.72955
KR/GG-24-24	*Senna alexandrina*	Kanoi	Jaisalmer	Jaisalmer	Rajasthan	29.87731	70.57911
KR/GG-24-27	*Senna alexandrina*	Jamra	Jaisalmer	Jaisalmer	Rajasthan	26.7189	70.59458
KR/GG-24-29	*Senna alexandrina*	Jaisalmer	Jaisalmer	Jaisalmer	Rajasthan	26.92097	70.9687
KR/GG-24-32	*Senna italica*	Mohangarh	Jaisalmer	Jaisalmer	Rajasthan	27.28224	71.2342
KR/GG-24-33	*Senna alexandrina*	Mohangarh	Jaisalmer	Jaisalmer	Rajasthan	27.29275	71.24669
KR/GG-24-34	*Senna occidentalis*	Jaisalmer	Jaisalmer	Jaisalmer	Rajasthan	26.93226	70.92651
KR/GG-24-35	*Senna alexandrina*	Biramdevgarh	Jodhpur	Jodhpur	Rajasthan	26.61825	72.32935

Fig. 7 : Pods variability in collected accessions of Senna from Thar desert of India.

A total of local diversity/landraces comprising of 36 accessions in targeted medicinal and aromatic plants *viz., Withania coagulens*, *Senna alexandrina*, *Pedalium murex* and *Tribulus terrestris* crops were collected from the explored areas (route map in Fig. 5). Some additional accessions of medicinal plants in rare/threatened category were also collected. The Jodhpur district, located within the Thar Desert, possesses a significant abundance of medicinal plants. The medicinal flora of this region possesses significant potential for application in the pharmaceutical and medicine industries. Local populations, tribal tribes, sellers, and practitioners have utilised these medicinal plants for an extended period in herbal and traditional medicines. Despite the prevailing harsh climatic conditions, the Indian Thar desert comprises richest plant diversity among the other desert of the world. The species diversity in *Senna* was frequently observed. Three common species were reported *viz., S. alexanadrina, S. italica* and *S. occidentalis*. Within each genus variability in plant height, flower, fruit and foliage were observed. However, in the target crop, *Senna alexandrina*, the size of the plant has significantly reduced under the influence of the climate (40-70 cm). *Senna* species were found at the margins of woodlands and forests, natural grassland, shrublands, rail/road sides, on riverbanks and in disturbed habitats such as roadsides and wastelands. However, *S. alexandrina* is also under cultivation in large areas in the Phalodi and adjacent areas on farmer's field. Apart from four targeted crops, other medicinal plants of thar desert such as variants of *Senna viz., S. italica, S. occidentalis*; *Tribulus rajasthanensis* (endemic and threatened species); *Fagonia cretica* (Dhamasha) and *Withania somnifera* (wild), *Blepharis scindica* (Bhangri) an endangered medicinal herb were collected. Jodhpur and Jaisalmer districts are abundant reservoirs of medicinal plants, many of which are reported to be vulnerable. Alongwith *T. terrestris, P. murex, Blepharis scindica,* and *Senna spp* other plants such as *Fagonia critica, Sida cordofolia, Anogeissus coronate* (cancer treatment); *Schweinfurthia papilionacea (*diuretic, antipyretic), *Tephrosia falciformis* (endemic to India with medicinal properties), and *Withania sominifera* could be targeted.

No accessions of *Senna* spp (*S. alexandrina, S. italica* and *S. occidentalis* from the western parts of India were conserved in the National Genebank, ICAR-NBPGR, New Delhi (accessed PGR portal, 2025). In the present exploration, a total of 17 accessions of *Senna* (*S. alexandrina* (11), *S.italica* (4) and *S. occidentalis* (2) species were explored and collected based on morphological variability (Table 1). The diversity and distribution of these accessions across the areas of study

Table 2 : Characteristics of some senna accessions.

	Plant height (cm)	Primary branches (No./plant)	Leaflet length (cm)	Leaf let width (cm)	Pod length (cm)	Pod width (cm)	No of seeds/pod	100 seed weight (gm)
***Senna alexandrina* accessions**								
KR/GG-24-1 (Pal rural)	74	7	4.8	1.6	6.2	2.1	7	2.32
KR/GG-24-7 (Mandor)	104	9	4.3	1	5.2	2.7	8	2.39
KR/GG-24-12 (Osia)	94	9	4.7	1.5	5.4	2.8	6	2.33
KR/GG-24-15 (Ugras)	78	6	3.8	0.8	4.2	2.1	5	2.36
KR/GG-24-20 (Ramdevra)	81	7	3.9	1.6	5.4	3.1	6	2.33
KR/GG-24-22 (Ramgarh)	85	7	3.8	1.7	5.3	3.3	5	2.43
KR/GG-24-24 (Kanoi, Jaisalmer)	15	8	3.9	1.8	5.5	3.1	6	2.70
KR/GG-24-27 (Jamra DNP, Jaisalmer)	98	8	4.3	1.3	5.8	2.3	5	2.32
KR/GG-24-29 (KVK , Jaisalmer)	112	9	4.6	1.6	5.8	3.1	5	2.76
KR/GG-24-33 (Mohangarh)	68	6	4.1	0.7	6	1.7	5	2.63
KR/GG-24-35 (Biramdevgarh, Jodhpur)	75	8	3.8	1.1	5.8	2.9	5	2.55

and methods of use by the communities were also recorded. *Senna* species has large cultivated area in farmer's field in Phalodi and adjoining villages. During the year, two to three harvests of Sonamukhi-March, September and November-December is done. About 30-40 factories in Phalodi, 5-8 in Pokhron, 35-40 in Bap and 15-20 in Sojat are planted for post-harvest processing, packaging and export of *Senna* leaves. Leaves are sold at about Rs. 35-40/kg, and pods for Rs. 22/kg. *Senna alexandrina* or sonamukhi is cultivated as SONA in these villages with very less inputs. The field view of *S. alexandrina* cultivated in Phalodi district of Rajasthan is given in the Fig. 4. The passport data of 17 collected *Senna* accessions were given in the Table 1. The variability in *Senna alexandrina* accessions is given in the Figs. 6 and 7. In general, they fetch a good income generation from export to different countries which fetch Rs.300-350 /kg of graded dried leaves. Sometimes farmers sell their produce to local venders in markets @ Rs. 40-80/kg of dried leaves to avoid the transport charges.

Conclusion

The research findings emphasized the prevalent preference for *Senna* species as therapeutic plants in the Jodhpur and Jaisalmer regions of Rajasthan, India. The conventional application of *Senna* as a medicinal plant establishes a basis for the advancement of research, policies, and strategies to encourage *Senna* growth. The increasing global demand for *Senna* leaves and pods offers a substantial potential for farmers to cultivate this crop in the rabi and summer seasons. *Senna* leaves and pods are produced in India at a volume of 10,000 to 12,000 tonnes, with 85% of the yield being exported. The extensive studies are required to explore the greater number of accessions in view of reported use as medicinal plants. The exploratory traits, cultivation technology, package of practices to be developed for this medicinal plants. High yielding varieties with superior medicinal values can be a boon for farmers of Western India. A smart value addition and processing technology, strengthening the linkage can also help in, promoting and upliftment of this crop.

Conflict of interest

Authors declare that they have no conflict of interest on the content of the manuscript and study undertaken.

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