

Assessment Of Current Status Of Medicinal Plants Diversity From Bathinda District, Punjab (India)

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ABSTRACT

Present study aimed to update the current status of medicinal plants diversity in district Bathinda, Punjab (India). In this study, we aimed to explore and document the high-valued plant diversity, both wild and cultivated, and the traditional knowledge associated with these plants. This was accomplished through a participatory approach involving local communities, where we collected data using semi-structured questionnaires. The study highlights the importance of integrating local knowledge with scientific research to enhance conservation efforts and promote sustainable utilization of plant resources. By engaging with the community, we were able to capture valuable insights that reflect the cultural significance and practical applications of these plants in daily life. Moreover, during the biodiversity evaluation, it was noted that various medicinal plants thrived in these villages. Residents of the villages possess extensive knowledge regarding the plants based on traditional healthcare methods, and they consistently opt for local medicinal plants for treating minor ailments in both humans and animals. Predominantly, herb species (173) were utilized in traditional remedies, followed by shrubs (51), trees (50), climbers (14) *etc.* In the current research, it was noted that there is a growing trend of biodiversity in this region, due to the collaborative efforts of local residents, the forest department, and the Punjab Biodiversity Board.

Keywords: Bathinda, residents, remedies, plant species, questionnaires

1. INTRODUCTION

Indigenous and local communities all over the world have fought for years to protect their rights, way of life, culture, and traditional knowledge. Nevertheless, they have survived, adjusting to the effects of globalization and shifting climate conditions. Many of these communities have been able to preserve sustainable use and management of natural resources because of their varied forms of knowledge, which are firmly entrenched in their relationships with the environment as well as in cultural coherence (Ayeeni and Aborisade, 2022). According to WHO reports, the majority of people who live in rural areas rely on medicinal plants to treat common diseases. Many therapeutic plants are found in the wild, and traditional healers frequently clean the plants and prepare medicines from them. It is important to mention that prior to the development of synthetic drugs, individuals relied solely on conventional treatments as their primary form of healthcare. These remedies are more commonly referred to as "home remedies" or "Ghrelu nuskhe" in Indian culture. However, herbal medicines progressively lost its popularity among people due to modernization, changes in cultural traditions, and the establishment of allopathic medical systems. According to the estimate, the herbal medicine business is currently worth \$40 billion and is projected to grow by 16% during the following three to four years (Kumar *et al.*, 2021). Nowadays, almost 50% of the synthetic medicines have roots in medicinal plants, thus attention is being paid to them more than ever. As a result, the plant-based herbal industry is currently expanding rapidly (Chaachouay and Zidane, 2024). The old-age people and traditional healers frequently know more about these indigenous traditions. Due to industrialization, urbanization, and increased usage of synthetic pharmaceuticals, the younger generation has less interest regarding this traditional knowledge. In some households, this traditional knowledge has been passed down orally from generation to generation without any written records throughout the culture (Sidhu and Kaur, 2007; Mahuika, 2019). After a few decades, nobody will be there to explain how to use herbal plants in our daily lives because the elderly will no longer have access to this ancient knowledge. Apart from that, there is an urgent need for documenting the traditional usage of bioresources due to the growing risks to biodiversity and the controversies surrounding biopiracy.

In light of the prevalence of modern diseases, medications, and adverse effects, it is crucial to preserve traditional knowledge and raise public awareness of its critical importance (Okaiyeto and Oguntibeju, 2021). The usage of medicinal plants by indigenous cultures and their traditional benefits extend beyond the realms of drug development and community healthcare, as well as for cultural and biodiversity preservation. Punjab is one of the states in India that is rich in agriculture, with 84% of its area devoted to farming and only six percent designated as forest land. The state has seen an increase in forest cover, growing from 3.72% in 1966 to 6.07% in 2012, due to afforestation and agroforestry (Jerath *et al.*, 2014; Chopra *et al.*, 2023). However, ongoing urbanization and industrialization have had a significant effect on the natural vegetation of the region. In addition, intensive farming practices aimed at supporting the rapidly growing population have led to a reduction in the natural habitats of various plant species. As a result, several new non-native species have been introduced, while many existing native species are now at risk. Keeping these facts into account, the current study has been initiated in the Bathinda region of Punjab to enlist the angiosperms. The Indian government has recently taken a number of actions to preserve medicinal plants and the traditional knowledge that goes with them. State and federal medicinal plant boards have been established to encourage farmers to start growing therapeutic plants. To educate the general public about the rich history of Indian medicine, herbal gardens have been established (Balick and Cox, 2020). Moreover, the National Biodiversity Authority (NBA) has started creating People Biodiversity Registers (PBR) at the local level to record local biological resources and the traditional knowledge that goes with them. As a result, the present study is a modest start in the right direction toward preserving and documenting the plant-based traditional remedies that local people utilize for healthcare and disseminating it with other communities through published literature.

2. MATERIAL AND METHODS

Study area

The area chosen for this study was Bathinda district, Punjab. Bathinda is one of the largest district in Punjab. The municipal council for this area is Talwandi Sabo. It is located between the latitude and longitude of 29.988268° North and 75.078678° East (Figure-1), respectively. Talwandi Sabo Nagar Panchayat has a total size of 17 km². Only a few studies have been done on the medicinal plants used by Punjabi locals in traditional medical practices, despite the fact that many have studied the indigenous medical methods used by Indian aboriginals, tribals, and other folk healers. After reviewing the existing literature, it was discovered that this location had never had a study on traditional medicinal plants, hence this area was chosen.



Figure-1 Location map of selected study area

Study of angiosperm flora

This study of flora involved extensive field trips conducted throughout the year to identify plant species in the study region. Detailed botanical information such as botanical names, family, habits, habitats, locations, dates of collection and other characteristics were meticulously recorded in field notebooks during floristic study. Plant specimens were collected, preferably from fertile individuals bearing fruits or flowers, based on availability, status and specific requirements of each

plant species. Small herbaceous plants, entire plant specimens including roots, stems, leaves, flowers, or fruits were collected, while twigs or branches containing flowers, fruits, or leaves were collected for woody plants. These specimens were carefully labelled and inserted between newspaper folds for preservation. To remove moisture and preserve the specimens, newspapers were frequently replaced until they were completely dry.

Identification of local and regional plants was carried out using diverse sources of information such as floras of China, Pakistan, India (Punjab & Haryana) and North America. Online herbaria like The Janaki Ammal Herbarium and the Herbarium Kerala Forest Research Institute provided high-quality images of plant specimens and additional information on their geographic distribution, habitat and ecology. Various websites such as www.theplantlist.org, www.efloras.org, <https://identify.plantnet.org/> etc, provided extensive information on plant species, including taxonomic classification, morphology and chemical composition. The comprehensive nature of these sources facilitated the gathering of extensive data, ensuring reliability and accuracy of information. Dried and pressed plant specimens were mounted on herbarium sheets (16 x 11 inches), with labels containing detailed information on voucher specimens affixed to the lower right side of the pages. Special care was taken in collecting plant samples, particularly for species restricted to a single site in the research region, to prevent potential extinction. In many cases, multiple field photos of plant species in their natural environment were taken for documentation purposes. Moreover, identification was confirmed by comparing the specimen with the authenticated specimen from herbarium of Panjab University, Chandigarh. The herbarium sheets were prepared and deposited in the PAN herbarium of Botany Department, Panjab University, Chandigarh, India.

3. RESULTS AND DISCUSSION

In the current study, a total of 320 species belonging to 70 families and 242 genera were identified from the selected area. These results represent approximately, 17% of the overall flora recorded in the state of Punjab as shown in Table-1. The Fabaceae family is the most dominant, with 36 species, followed by Asteraceae with 26 species, and both Brassicaceae and Poaceae with 18 species each, then Solanaceae with 13, Cucurbitaceae with 12, Malvaceae with 11, and Amaranthaceae with 10. While the Poaceae family is acknowledged as the largest family in Punjab and Haryana, it ranks third in the Bathinda region. Additionally, the Fabaceae family stands out as the most significant in the study area, securing the third and second positions in the floras of Punjab and Haryana, respectively. The prominence of the Fabaceae family in Punjab may be linked to diverse range of habitats and forms it occupies, which include herbs, shrubs, trees, and climbers. The Asteraceae and Brassicaceae families hold the second and third positions, respectively. Additionally, the genera that contribute to the plant diversity in this area consist of *Brassica* (7 species), *Solanum* (6 species), and both *Citrus* & *Euphorbia* (5 species each), along with *Dahlia*, *Ficus*, and *Rosa* (4 species each). Other genera such as *Ipomoea*, *Terminalia*, *Ziziphus*, *Zephyranthes*, *Portulaca*, and *Senna* have 3 species each, etc (Figure-2). Similar findings were noted by Kumar (2001), who highlighted *Euphorbia* (10 species) and *Ipomoea* (15 species) as the prominent genera in Haryana. Likewise, Kaur *et al.* (2017) pointed out the dominant genera, which include *Euphorbia* (11 species), *Ipomoea* (8 species), and *Solanum*, *Ficus*, & *Brassica* (7 species each), as well as *Trifolium*, *Sida*, *Portulaca*, *Acacia*, & *Alternanthera* (4 species each) in Punjab.

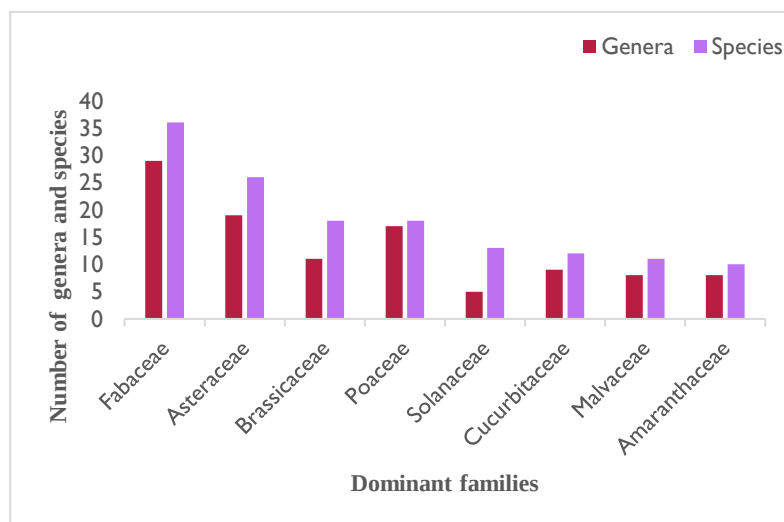


Figure-2 Dominant plant families with number of genera and species

Moreover, amongst all documented species, ornamental species (85), fruit plants (12), timber plants (17), weed (47), medicinal plants (93), crops (62) and aquatic plant species (4) were recorded. Crop plants included sugar yielding crop (1), cereal crops (2), , spices (15), pulses (5), oil crops (4), vegetables (21) and fodder plants (14). In addition to this, 173 were herbs, 51 were shrubs, 50 were trees, 14 were climbers etc (Figure-3). Furthermore, the reported species also include 219

cultivated, 83 wild and 18 both wild as well as cultivated (Figure-4).

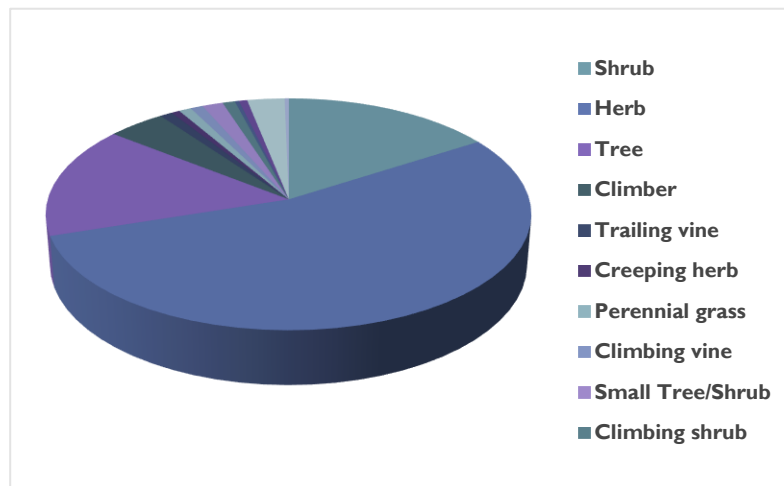


Figure-3 Different life forms of documented plant species from the study area

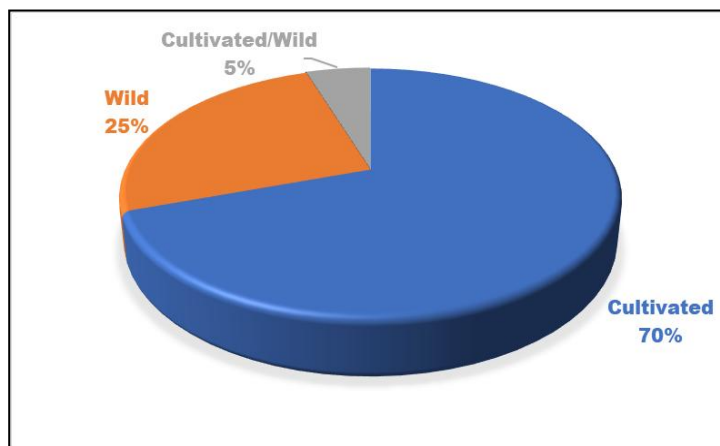


Figure-4 Source % of recorded angiospermic plant species

Previously, similar study was reported by Kaur *et al.* (2017) in Doaba region, Punjab. In their study, they documented 464 angiospermic species belonging to 337 genera and 99 families. Among all species, they reported that 255 were herbs, 65 shrubs, 85 trees and 59 climbers. The documented species also included 273 wild, 111 cultivated, 59 ornamental and 19 both wild as well as cultivated.

The diversity of angiosperms in the selected area has been described for further study, is as follows:

Arid and Sandy Area Plant Species

The vegetation in the Bathinda region varies with the seasons. During floods or waterlogging, aquatic and marshy species dominate the flora, while drought-resistant species are the main vegetation during dry conditions. The species include *Calotropis procera*, *Citrullus colocynthis*, *Argemone mexicana*, *Verbesina encelioides*, *Bougainvillea glabra*, *Nerium oleander*, *Portulaca grandiflora*, *Abutilon indicum* etc.

Aquatic and Marshy Species

The study area contains 2 main aquatic plant species: *Ipomoea aquatica* and *Nymphaea nouchali*. *Nymphaea nouchali* is typically found in shallow water bodies and is characterized by its floating leaves & large purplish-pink flowers that grow from the underside of the leaves. This plant is rare and has only been reported in a few sites within the study area. Previously, these species are reported by Nair (1978), Kumar (2001) and Kaur and Sarangal (2020) from Kurukshetra (Haryana), Ferozepur & Dasuya block of Hoshiarpur district, Punjab, respectively.

Medicinal Plant Species

The angiosperms of Bathinda region contain several plants that have medicinal properties. These plants have been utilized

in home remedies and Ayurvedic formulations to treat various ailments. Notably, the area is home to numerous common species that grow as cultivated/wild, viz., *Achyranthes aspera*, *Aegle marmelos*, *Calotropis procera*, *Azadirachta indica*, *Datura innoxia*, *Eclipta prostrata*, *Euphorbia hirta*, *Justicia adhatoda*, *Phyllanthus emblica*, *Bergera koenigii*, *Ricinus communis*, *Solanum nigrum*, *Tinospora cordifolia*, *Citrus limon*, *Trachyspermum ammi* etc. These plants have been extensively studied for their therapeutic properties and have contributed significantly to the development of herbal practices. The region's rich biodiversity of medicinal plants holds immense potential for the pharmaceutical industry and conventional medicinal practices.

Alien Species

Invasive plant species, also known as non-native, non-indigenous and introduced species, can have serious effects on ecosystems beyond their natural range of dispersal. These plants possess unique traits such as adaptability, aggressiveness and high reproductive capacity, which often leads to outbreak populations in areas where they lack natural enemies. In the study area, *Lantana camara* and *Parthenium hysterophorus* were notably abundant and have been observed to have a detrimental effect on the native flora due to their allelopathic effect. Of the two, *Lantana camara* has a significantly higher negative impact, primarily due to its shrubby and perennating nature. It is worth noting that *Lantana camara* occurs in the form of compact hedges on the roadside and in the Shivalik region, posing a significant threat to the native flora.

Dominant Species

The present study reports the presence and abundance of different species at various sites in the study area. The dominating species identified in the study area are *Achyranthes aspera*, *Cannabis sativa*, *Cynodon dactylon*, *Lantana camara*, *Amaranthus powellii*, *Parthenium hysterophorus* and *Ricinus communis*. These species are ubiquitous throughout the year and spread across the entire study area. In addition, the study area also contains other species such as *Fumaria indica*, *Sisymbrium irio* and *Stellaria media*, which are annual herbs and reported in abundance during their respective growing seasons.

Rare Species

The present category of plant species is comprised of a few plants that are reported to be present in one or two study locations only. This phenomenon can be attributed to various reasons, such as soil shifting, soil texture or seasonal variation. Such species include *Dianella ensifolia*, *Verbena rigida*, *Orobancha cernua*, *Ipomoea aquatica*, *Consolida ajacis*, *Cirsium arvense*, *Lagerstroemia indica*, *Celosia argentea*, *Nymphaea nouchali*, *Kigelia africana*, *Cullen corylifolium* and *Barleria prionitis*. According to the inhabitants of the study area, some of these plant species were once widely distributed, but their numbers have dwindled over time due to over-exploitation for medicinal purposes. There is also a loss of habitat and overall degradation of their environment, with agricultural and developmental activities.

Photography of Plant Species

The conservation of plant species is crucial and keeping this in mind, efforts have been made to document them during the field survey by capturing photographs of the plants at the appropriate stages of growth in their natural habitat. Small quantities of common plant species has been collected for herbarium preparation as a reference for identification while the extensive gathering of rare or endangered plants has been discouraged. The large-scale collection of rare or endangered plant species can result in their extinction or near-extinction, particularly in the case of herbaceous plant species. In such instances, numerous field photographs of plant species with flashy parts (fruits, flower) in their natural habitat has been captured, so that they can easily be identified on drying. However, photographs of some traditionally used plant species in the present study has been recorded (Figure-5).



Figure-5 (A-T): A) *Catharanthus roseus* B) *Solanum virginianum* C) *Cicer arietinum* D) *Momordica charantia* E) *Abutilon indicum* F) *Passiflora incarnata* G) *Nymphaea nouchali* H) *Clitoria ternatea* I) *Crossandra infundibuliformis* J) *Andrographis paniculata* K) *Ipomoea aquatica* L) *Capsicum annum* M) *Cascabela thevetia* N) *Citrullus lanatus* O) *Justicia brandegeana* P) *Withania somnifera* Q) *Vigna radiata* R) *Polygonum equisetiforme* S) *Papaver rhoeas* T) *Manilkara zapota*

Table-1 List of plant species reported from the selected area

S.No.	Botanical Name	Family	Habit	Source
1.	<i>Abelmoschus esculentus</i> (L.) Moench	Malvaceae	S	C
2.	<i>Abutilon indicum</i> (L.) Sweet	Malvaceae	S	W
3.	<i>Achyranthes aspera</i> L.	Amaranthaceae	H	W
4.	<i>Aegle marmelos</i> (L.) Correa	Rutaceae	ST	C
5.	<i>Aerva javanica</i> (Burm.f.) Schult.	Amaranthaceae	H	W
6.	<i>Agave americana</i> L.	Asparagaceae	H	C
7.	<i>Albizia lebbeck</i> (L.) Benth.	Fabaceae	T	C
8.	<i>Alcea rosea</i> L.	Malvaceae	H	C
9.	<i>Alcea setosa</i> (Boiss.) Alef.	Malvaceae	H	C
10.	<i>Allium cepa</i> L.	Amaryllidaceae	H	C
11.	<i>Allium sativum</i> L.	Amaryllidaceae	H	C
12.	<i>Aloe vera</i> (L.) Burm. f.	Asphodelaceae	H	C
13.	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	T	C
14.	<i>Amaranthus powellii</i> S. Watson	Amaranthaceae	H	W

15.	<i>Amaranthus tricolor</i> L.	Amaranthaceae	H	C
16.	<i>Ammi majus</i> L.	Apiaceae	H	C
17.	<i>Anagallis arvensis</i> L.	Primulaceae	H	W
18.	<i>Andrographis paniculata</i> (Burm.f.) Nees	Acanthaceae	H	C
19.	<i>Anethum graveolens</i> L.	Apiaceae	H	C
20.	<i>Antirrhinum australe</i> Rothm.	Plantaginaceae	H	C
21.	<i>Aralia racemosa</i> L.	Araliaceae	H	W
22.	<i>Areca catechu</i> L.	Arecaceae	T	C
23.	<i>Argemone mexicana</i> L.	Papaveraceae	H	W
24.	<i>Asparagus racemosus</i> Willd.	Asparagaceae	S	C/W
25.	<i>Asphodelus tenuifolius</i> Cav.	Asphodelaceae	H	W
26.	<i>Atocion armeria</i> (L.) Raf.	Caryophyllaceae	H	C
27.	<i>Avena sativa</i> L.	Poaceae	H	C
28.	<i>Azadirachta indica</i> A. Juss.	Meliaceae	T	C
29.	<i>Bacopa monnieri</i> (L.) Pennell	Plantaginaceae	H	W
30.	<i>Bambusa bambos</i> (L.) Voss	Poaceae	H	C
31.	<i>Barbarea stricta</i> Andr. ex Besser	Brassicaceae	H	W
32.	<i>Barleria prionitis</i> L.	Acanthaceae	S	C
33.	<i>Bauhinia purpurea</i> L.	Fabaceae	T	C
34.	<i>Bauhinia tomentosa</i> L.	Fabaceae	ST	C
35.	<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	CH	C
36.	<i>Bergera koenigii</i> (L.)	Rutaceae	ST/S	C
37.	<i>Boerhavia diffusa</i> L. nom. cons.	Nyctaginaceae	H	W
38.	<i>Bougainvillea glabra</i> Choisy	Nyctaginaceae	CS	C
39.	<i>Bougainvillea spectabilis</i> Willd.	Nyctaginaceae	CS	C
40.	<i>Brassica juncea</i> (L.) Czern.	Brassicaceae	H	C
41.	<i>Brassica oleracea</i> var. <i>botrytis</i> L.	Brassicaceae	H	C
42.	<i>Brassica oleracea</i> var. <i>capitata</i> L.	Brassicaceae	H	C
43.	<i>Brassica oleracea</i> var. <i>gongylodes</i> L.	Brassicaceae	H	C
44.	<i>Brassica oleracea</i> var. <i>italica</i> Plenck	Brassicaceae	H	C
45.	<i>Brassica rapa</i> var. <i>chinensis</i> L.	Brassicaceae	H	C
46.	<i>Brassica rapa</i> var. <i>rapa</i> L.	Brassicaceae	H	C
47.	<i>Butea monosperma</i> (Lam.) Taub.	Fabaceae	T	C
48.	<i>Cajanus cajan</i> (L.) Huth	Fabaceae	S	C
49.	<i>Calendula officinalis</i> L.	Asteraceae	H	C

50.	<i>Calendula stellata</i> Cav.	Asteraceae	H	C
51.	<i>Calliandra surinamensis</i> Benth.	Fabaceae	ST	C
52.	<i>Callistemon citrinus</i> (Curtis)	Myrtaceae	S	C
53.	<i>Callistemon viminalis</i> (Sol. ex Gaertn.) G. Don	Myrtaceae	ST/S	C
54.	<i>Calotropis gigantea</i> (L.) Dryand.	Apocynaceae	S	W
55.	<i>Calotropis procera</i> (Aiton) W.T. Aiton	Apocynaceae	S	W
56.	<i>Campsis grandiflora</i> (Thunb.) K. Schum.	Bignoniaceae	CL	W
57.	<i>Canna x hybrida</i> Rodigas	Cannaceae	H	C
58.	<i>Cannabis sativa</i> L.	Cannabaceae	H	W
59.	<i>Capsella bursa-pastoris</i> (L.) Medik.	Brassicaceae	H	W
60.	<i>Capsicum annuum</i> L.	Solanaceae	H	C
61.	<i>Capsicum frutescens</i> L.	Solanaceae	S	C
62.	<i>Carica papaya</i> L.	Caricaceae	T	C
63.	<i>Cascabela thevetia</i> (L.) Lippold	Apocynaceae	S	C
64.	<i>Cassia fistula</i> L.	Fabaceae	T	C
65.	<i>Catharanthus roseus</i> (L.) G. Don.	Apocynaceae	S	C
66.	<i>Celosia argentea</i> L.	Amaranthaceae	H	C
67.	<i>Cenchrus purpureus</i> (Schumach.) Morrone	Poaceae	PG	C/W
68.	<i>Centaurea cyanus</i> L.	Asteraceae	H	C
69.	<i>Centaurium tenuiflorum</i> (Hoffmanns. & Link) Fritsch	Gentianaceae	H	C
70.	<i>Chamaedorea seifrizii</i> Burret	Arecaceae	ST	C
71.	<i>Chenopodium album</i> L.	Amaranthaceae	H	W
72.	<i>Chenopodium murale</i> L.	Amaranthaceae	H	W
73.	<i>Chlorophytum borivillianum</i> Santapau & R.R.Fern.	Asparagaceae	H	C
74.	<i>Chlorophytum comosum</i> (Thunb.) Jacques	Asparagaceae	H	C
75.	<i>Chondrilla juncea</i> L.	Asteraceae	H	C
76.	<i>Chrysanthemum indicum</i> L.	Asteraceae	H	C
77.	<i>Chrysopogon zizanioides</i> (L.) Roberty	Poaceae	H	C/W
78.	<i>Cicer arietinum</i> L.	Fabaceae	H	C
79.	<i>Cinnamomum camphora</i> (L.) J. Presl.	Lauraceae	T	C
80.	<i>Cinnamomum verum</i> J. Presl	Lauraceae	T	C
81.	<i>Cirsium arvense</i> (L.) Scop.	Asteraceae	H	W
82.	<i>Citrullus colocynthis</i> (L.) Schrad.	Cucurbitaceae	H	W
83.	<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	Cucurbitaceae	CH	C
84.	<i>Citrus maxima</i> (Burm.) Merr.	Rutaceae	T	C

85.	<i>Citrus pseudolimon</i> Tanaka	Rutaceae	T	C
86.	<i>Citrus reticulata</i> Blanco	Rutaceae	T	C
87.	<i>Citrus x aurantiifolia</i> (Christm.) Swingle	Rutaceae	ST	C
88.	<i>Citrus x limon</i> (L). Osbeck	Rutaceae	ST/S	C
89.	<i>Clitoria ternatea</i> L.	Fabaceae	H	C/W
90.	<i>Coleus scutellarioides</i> (L.) Benth.	Lamiaceae	H	C
91.	<i>Combretum indicum</i> (L.) DeFilipps	Combretaceae	CS	C
92.	<i>Consolida ajacis</i> (L.) Schur	Ranunculaceae	S	C
93.	<i>Convolvulus arvensis</i> L.	Convolvulaceae	TV	W
94.	<i>Cordia myxa</i> L.	Boraginaceae	ST/S	C/W
95.	<i>Coriandrum sativum</i> L.	Apiaceae	H	C
96.	<i>Coronopus didymus</i> (L.) Sm.	Brassicaceae	H	W
97.	<i>Crinum bulbispermum</i> (Burm.f.) Milne-Redh. & Schweick.	Amaryllidaceae	H	C
98.	<i>Crossandra infundibuliformis</i> (L.) Nees	Acanthaceae	SS	C
99.	<i>Crotalaria spectabilis</i> Roth	Fabaceae	H	C/W
100.	<i>Cucumis melo</i> L.	Cucurbitaceae	CL	C
101.	<i>Cucumis sativus</i> L.	Cucurbitaceae	TV	C
102.	<i>Cucurbita ficifolia</i> Bouche	Cucurbitaceae	CL	C
103.	<i>Cullen corylifolium</i> (L.) Medik.	Fabaceae	H	W
104.	<i>Cuminum cyminum</i> L.	Apiaceae	H	C
105.	<i>Curcuma longa</i> L.	Zingiberaceae	H	C
106.	<i>Cuscuta reflexa</i> Roxb.	Convolvulaceae	CL	W
107.	<i>Cyamopsis tetragonoloba</i> (L.) Taub.	Fabaceae	H	C
108.	<i>Cyathula tomentosa</i> (Roth) Moq.	Amaranthaceae	S	W
109.	<i>Cyclospermum leptophyllum</i> (Pers.) Sprague ex Britton & P. Wils.	Apiaceae	H	W
110.	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	H	W
111.	<i>Cyperus rotundus</i> L.	Cyperaceae	H	W
112.	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Poaceae	H	W
113.	<i>Dahlia coccinea</i> Cav.	Asteraceae	H	C
114.	<i>Dahlia pinnata</i> Cav.	Asteraceae	H	C
115.	<i>Dahlia tenuicaulis</i> P.D. Sorensen	Asteraceae	H	C
116.	<i>Dahlia x cultorum</i> Thorsrud & Reisaeter	Asteraceae	H	C
117.	<i>Dalbergia sissoo</i> DC.	Fabaceae	T	C
118.	<i>Datura inoxia</i> Mill.	Solanaceae	H	W
119.	<i>Datura metel</i> L.	Solanaceae	S	W

120.	<i>Daucus carota</i> subsp. <i>sativus</i> (Hoffm.) Schubl. & G. Martens	Apiaceae	H	C
121.	<i>Delonix regia</i> (Boj. ex Hook.) Raf.	Fabaceae	T	C
122.	<i>Delphinium ajacis</i> L.	Ranunculaceae	H	C
123.	<i>Delphinium pentagynum</i> Lam.	Ranunculaceae	H	C
124.	<i>Dendranthema grandiflorum</i> (Ramat.) Kitam.	Asteraceae	H	C
125.	<i>Dianella ensifolia</i> (L.) DC.	Xanthorrhoeaceae	H	C/W
126.	<i>Dianthus chinensis</i> L.	Caryophyllaceae	H	C
127.	<i>Dianthus seguieri</i> Vill.	Caryophyllaceae	H	C
128.	<i>Digera muricata</i> (L.) Mart.	Amaranthaceae	H	W
129.	<i>Digitaria longiflora</i> (Retz.) Pers.	Poaceae	H	W
130.	<i>Diplotaxis muralis</i> (L.) DC.	Brassicaceae	S	W
131.	<i>Dombeya acutangula</i> Cav.	Malvaceae	S	C
132.	<i>Duranta erecta</i> L.	Verbenaceae	S	C
133.	<i>Eclipta prostrata</i> (L.) L.	Asteraceae	H	C/W
134.	<i>Elettaria cardamomum</i> (L.) Maton	Zingiberaceae	H	C
135.	<i>Erigeron bonariensis</i> L.	Asteraceae	H	W
136.	<i>Eruca vesicaria</i> (L.) Cav.	Brassicaceae	H	C
137.	<i>Eschscholzia californica</i> Cham.	Papaveraceae	H	C
138.	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	T	C
139.	<i>Eucalyptus</i> sp.	Myrtaceae	T	C/W
140.	<i>Euphorbia heterophylla</i> L.	Euphorbiaceae	H	C
141.	<i>Euphorbia hirta</i> L.	Euphorbiaceae	H	W
142.	<i>Euphorbia lophogona</i> Lam.	Euphorbiaceae	S	C
143.	<i>Euphorbia milii</i> Des Moul.	Euphorbiaceae	S	C
144.	<i>Euphorbia pulcherrima</i> Willd. ex Klotzsch	Euphorbiaceae	S	C
145.	<i>Ficus benghalensis</i> L.	Moraceae	T	C
146.	<i>Ficus citrifolia</i> Mill.	Moraceae	T	C
147.	<i>Ficus religiosa</i> L.	Moraceae	T	C/W
148.	<i>Ficus retusa</i> L.	Moraceae	T	C
149.	<i>Foeniculum vulgare</i> Mill.	Apiaceae	H	C
150.	<i>Fumaria indica</i> (Hausskn.) Pugsley	Papaveraceae	H	W
151.	<i>Geranium rotundifolium</i> L.	Geraniaceae	H	C/W
152.	<i>Gerbera leandrii</i> Humbert	Asteraceae	H	C
153.	<i>Glycyrrhiza glabra</i> L.	Fabaceae	H	C
154.	<i>Gnaphalium indicum</i> L.	Asteraceae	H	C

155.	<i>Gnaphalium uliginosum</i> L.	Asteraceae	H	C
156.	<i>Gomphrena globosa</i> L.	Amaranthaceae	H	C
157.	<i>Gossypium hirsutum</i> L.	Malvaceae	S	C
158.	<i>Hamelia patens</i> Jacq.	Rubiaceae	S	W
159.	<i>Helianthus annuus</i> L.	Asteraceae	H	C
160.	<i>Heliotropium bacciferum</i> Forssk.	Boraginaceae	H	W
161.	<i>Heliotropium indicum</i> L.	Boraginaceae	H	W
162.	<i>Hibiscus fragilis</i> DC.	Malvaceae	S	C
163.	<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	S	C
164.	<i>Hippeastrum correiense</i> (Bury) Worsley	Amaryllidaceae	H	C
165.	<i>Hordeum vulgare</i> L.	Poaceae	H	C
166.	<i>Ipomoea aquatica</i> Forssk.	Convolvulaceae	TV	C
167.	<i>Ipomoea purpurea</i> (L.) Roth	Convolvulaceae	CL	C
168.	<i>Ipomoea tiliacea</i> (Willd.) Choisy	Convolvulaceae	CV	W
169.	<i>Ixora javanica</i> (Blume) DC.	Rubiaceae	S	W
170.	<i>Jacaranda caucana</i> Pittier	Bignoniaceae	T	C
171.	<i>Jacquemontia pentanthos</i> (Jacq.) G.Don	Convolvulaceae	CV	W
172.	<i>Jasminum multiflorum</i> (Burm.f.) Andrews	Oleaceae	S	C
173.	<i>Jasminum sambac</i> (L.) Aiton	Oleaceae	S	C
174.	<i>Jatropha integerrima</i> Jacq.	Euphorbiaceae	S	C
175.	<i>Justicia adhatoda</i> L.	Acanthaceae	S	C
176.	<i>Justicia brandegeana</i> Wassh. & L.B.Sm.	Acanthaceae	S	C
177.	<i>Kalanchoe pinnata</i> (Lam.) Pers.	Crassulaceae	H	C
178.	<i>Kigelia africana</i> (Lam.) Benth.	Bignoniaceae	T	C
179.	<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	CL	C
180.	<i>Lagerstroemia indica</i> L.	Lythraceae	T	W
181.	<i>Lantana camara</i> L.	Verbenaceae	S	C/W
182.	<i>Lawsonia inermis</i> L.	Lythraceae	ST	C
183.	<i>Lepidium didymium</i> L.	Brassicaceae	H	W
184.	<i>Lepidium sativum</i> L.	Brassicaceae	H	C
185.	<i>Leucaena leucocephala</i> (Lam.) de Wit	Fabaceae	T	C
186.	<i>Linum usitatissimum</i> L.	Linaceae	H	C
187.	<i>Lobularia maritima</i> (L.) Desv.	Brassicaceae	H	C
188.	<i>Lonchocarpus sericeus</i> (Poir.) Kunth ex DC.	Fabaceae	T	C
189.	<i>Luffa acutangula</i> (L.) Roxb.	Cucurbitaceae	CL	C

190.	<i>Magnolia champaca</i> (L.) Baill. ex Pierre	Magnoliaceae	S	C
191.	<i>Mangifera indica</i> L.	Anacardiaceae	T	C
192.	<i>Manilkara zapota</i> (L.) P.Royen	Sapotaceae	T	C
193.	<i>Medicago polyceratia</i> (L.) Sauvages ex Trautv.	Fabaceae	H	W
194.	<i>Medicago polymorpha</i> L.	Fabaceae	H	W
195.	<i>Melaleuca viminalis</i> (Sol. ex Gaertn.) Byrnes	Myrtaceae	T	C
196.	<i>Melia azedarach</i> L.	Meliaceae	T	C
197.	<i>Melilotus indicus</i> (L.) All.	Fabaceae	H	W
198.	<i>Melilotus sulcatus</i> Desf.	Fabaceae	S	W
199.	<i>Melothria pendula</i> L.	Cucurbitaceae	CL	C
200.	<i>Mentha arvensis</i> L.	Lamiaceae	H	C
201.	<i>Mesembryanthemum crystallinum</i> L.	Aizoaceae	H	C
202.	<i>Mimusops elengi</i> L.	Sapotaceae	T	C
203.	<i>Mirabilis jalapa</i> L.	Nyctaginaceae	H	C
204.	<i>Modiola caroliniana</i> (L.) G.Don	Malvaceae	H	C
205.	<i>Momordica charantia</i> L.	Cucurbitaceae	CL	C
206.	<i>Momordica dioica</i> Roxb. ex Willd.	Cucurbitaceae	CL	W
207.	<i>Moringa oleifera</i> Lam.	Moringaceae	T	C
208.	<i>Morus alba</i> L.	Moraceae	T	C
209.	<i>Musa x paradisiaca</i> L.	Musaceae	H	C
210.	<i>Neolamarckia cadamba</i> (Roxb.) Bosser	Rubiaceae	T	C
211.	<i>Nerium oleander</i> L.	Apocynaceae	S	C
212.	<i>Nyctanthes arbor-tristis</i> L.	Oleaceae	ST	C
213.	<i>Nymphaea nouchali</i> Burm.f.	Nymphaeaceae	FH	C
214.	<i>Ocimum basilicum</i> L.	Lamiaceae	H	C
215.	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	H	C
216.	<i>Orlaya grandiflora</i> (L.) Hoffm.	Apiaceae	H	C
217.	<i>Orobanche cernua</i> Loebl.	Orobanchaceae	H	W
218.	<i>Oryza sativa</i> L.	Poaceae	H	C
219.	<i>Oxalis corniculata</i> L.	Oxalidaceae	H	W
220.	<i>Oxalis violacea</i> L.	Oxalidaceae	H	C
221.	<i>Panicum virgatum</i> L.	Poaceae	PG	W
222.	<i>Papaver rhoeas</i> L.	Papaveraceae	H	W
223.	<i>Parthenium hysterophorus</i> L.	Asteraceae	H	W
224.	<i>Passiflora incarnata</i> L.	Passifloraceae	CL	C

225.	<i>Pennisetum typhoides</i> (Burm.f.) Stapf et C.E.Hubb.	Poaceae	H	W
226.	<i>Pericallis echinata</i> (L.f.) B.Nord.	Asteraceae	H	C
227.	<i>Petunia axillaris</i> (Lam.) Britton, Sterns & Poggenb.	Solanaceae	H	C
228.	<i>Petunia x atkinsiana</i> (Sweet) D. Don ex W.H. Baxter	Solanaceae	H	C
229.	<i>Phyla nodiflora</i> (L.) Greene	Verbenaceae	H	W
230.	<i>Phyllanthus emblica</i> L.	Phyllanthaceae	T	C
231.	<i>Phyllanthus niruri</i> L.	Phyllanthaceae	H	C/W
232.	<i>Piper nigrum</i> L.	Piperaceae	CV	C
233.	<i>Pisum sativum</i> L.	Fabaceae	CL	C
234.	<i>Plumbago zeylanica</i> L.	Plumbaginaceae	H	C
235.	<i>Plumeria alba</i> L.	Apocynaceae	T	C
236.	<i>Poa annua</i> L.	Poaceae	H	W
237.	<i>Poa trivialis</i> L.	Poaceae	H	W
238.	<i>Polianthes tuberosa</i> L.	Asparagaceae	H	C
239.	<i>Polyalthia longifolia</i> (Sonn.) Thwaites	Annonaceae	T	C
240.	<i>Polygonum equisetiforme</i> Sm.	Polygonaceae	S	W
241.	<i>Polypogon monspeliensis</i> (L.) Desf.	Poaceae	G	W
242.	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae	T	C/W
243.	<i>Populus angustifolia</i> James	Salicaceae	T	C
244.	<i>Portulaca grandiflora</i> Hook.	Portulacaceae	H	C
245.	<i>Portulaca oleracea</i> L.	Portulacaceae	H	C
246.	<i>Portulaca quadrifida</i> L.	Portulacaceae	H	W
247.	<i>Prosopis cineraria</i> (L.) Druce	Fabaceae	T	C
248.	<i>Psidium guajava</i> L.	Myrtaceae	ST	C
249.	<i>Punica granatum</i> L.	Lythraceae	S	C
250.	<i>Raphanus raphanistrum</i> L.	Brassicaceae	H	W
251.	<i>Raphanus sativus</i> L.	Brassicaceae	H	C
252.	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	Apocynaceae	S	W
253.	<i>Ricinus communis</i> L.	Euphorbiaceae	S	W
254.	<i>Rosa abietina</i> Gren. ex Christ	Rosaceae	S	C
255.	<i>Rosa foetida</i> Herrm.	Rosaceae	S	C
256.	<i>Rosa gallica</i> L.	Rosaceae	S	C
257.	<i>Rosa indica</i> L.	Rosaceae	S	C
258.	<i>Rumex dentatus</i> L.	Polygonaceae	H	W
259.	<i>Saccharum officinarum</i> L.	Poaceae	PG	C

260.	<i>Salvia splendens</i> Sellow ex Schult.	Lamiaceae	H	C
261.	<i>Saraca asoca</i> (Roxb.) Willd.	Fabaceae	T	C
262.	<i>Senegalia catechu</i> (L.f.) P.J.H. Hurter & Mabb.	Fabaceae	T	C/W
263.	<i>Senna occidentalis</i> (L.) Link	Fabaceae	S	C
264.	<i>Senna siamea</i> (Lam.) Irwin et Barneby	Fabaceae	S	C
265.	<i>Senna surattensis</i> (Burm.f.) H.S.Irwin & Barneby	Fabaceae	ST/S	C
266.	<i>Setaria viridis</i> (L.) P.Beauv.	Poaceae	G	W
267.	<i>Sida cordifolia</i> L.	Malvaceae	S	W
268.	<i>Sida ovata</i> Forssk.	Malvaceae	H	W
269.	<i>Sisymbrium irio</i> L.	Brassicaceae	H	W
270.	<i>Solanum lycopersicum</i> L.	Solanaceae	H	C
271.	<i>Solanum melongena</i> L.	Solanaceae	H	C
272.	<i>Solanum nigrum</i> L.	Solanaceae	H	W
273.	<i>Solanum sisymbriifolium</i> Lam.	Solanaceae	H	W
274.	<i>Solanum tuberosum</i> L.	Solanaceae	H	C
275.	<i>Solanum virginianum</i> L.	Solanaceae	H	W
276.	<i>Sonchus asper</i> (L.) Hill	Asteraceae	H	W
277.	<i>Sonchus oleraceus</i> L.	Asteraceae	H	W
278.	<i>Spergula arvensis</i> L.	Caryophyllaceae	H	W
279.	<i>Sphagneticola trilobata</i> (L.) Pruski	Asteraceae	H	C/W
280.	<i>Stachys annua</i> (L.) L.	Lamiaceae	H	W
281.	<i>Stellaria media</i> (L.) Vill	Caryophyllaceae	H	W
282.	<i>Syzygium aromaticum</i> (L.) Merr. & L.M. Perry	Myrtaceae	T	C
283.	<i>Syzygium cumini</i> (L.) Skeels	Myrtaceae	T	C
284.	<i>Tabernaemontana divaricate</i> (L.) R.Br. ex Roem. & Schult.	Apocynaceae	S	C
285.	<i>Tagetes erecta</i> L.	Asteraceae	H	C
286.	<i>Tagetes lunulata</i> Ortega	Asteraceae	H	C
287.	<i>Tecoma stans</i> (L.) Juss. ex Kunth	Bignoniaceae	ST	C
288.	<i>Tectona grandis</i> L.f.	Lamiaceae	T	C
289.	<i>Tephrosia purpurea</i> (L.) Pers.	Fabaceae	H	C/W
290.	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Combretaceae	T	C
291.	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	T	C
292.	<i>Terminalia chebula</i> Retz.	Combretaceae	T	C
293.	<i>Tinospora cordifolia</i> (Thunb.) Miers	Menispermaceae	CL	C/W
294.	<i>Trachyspermum ammi</i> (L.) Sprague ex Turrill	Apiaceae	H	C

295.	<i>Tradescantia pallida</i> (Rose) D.R. Hunt	Commelinaceae	H	C
296.	<i>Tribulus terrestris</i> L.	Zygophyllaceae	H	W
297.	<i>Trichosanthes dioica</i> Roxb.	Cucurbitaceae	H	C
298.	<i>Trifolium alexandrinum</i> L.	Fabaceae	H	C
299.	<i>Trigonella balansae</i> Boiss. & Reut.	Fabaceae	H	C
300.	<i>Trigonella foenum-graecum</i> L.	Fabaceae	H	C
301.	<i>Triticum aestivum</i> L.	Poaceae	H	C
302.	<i>Vachellia nilotica</i> (L.) P.J.H. Hurter & Mabb.	Fabaceae	T	C
303.	<i>Verbena rigida</i> Spreng.	Verbenaceae	H	C
304.	<i>Verbena x hybrida</i> Groenland & Rumpler	Verbenaceae	H	C
305.	<i>Verbesina encelioides</i> (Cav.) Benth. & Hook. f. ex A. Gray	Asteraceae	H	W
306.	<i>Vigna radiata</i> (L.) R. Wilczek	Fabaceae	H	C
307.	<i>Vigna unguiculata</i> (L.) Walp.	Fabaceae	H	C
308.	<i>Vitex negundo</i> L.	Lamiaceae	S	C
309.	<i>Vitis vinifera</i> L.	Vitaceae	CL	C
310.	<i>Volkameria inermis</i> L.	Lamiaceae	S	C
311.	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	H	W
312.	<i>Youngia japonica</i> (L.) DC.	Asteraceae	H	W
313.	<i>Zea mays</i> L.	Poaceae	S	C
314.	<i>Zephyranthes candida</i> (Lindl.) Herb.	Amaryllidaceae	H	C
315.	<i>Zephyranthes carinata</i> Herb.	Amaryllidaceae	H	C
316.	<i>Zephyranthes minuta</i> (Kunth) D.Dietr.	Amaryllidaceae	H	C
317.	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	H	C
318.	<i>Ziziphus jujuba</i> Mill.	Rhamnaceae	T	C
319.	<i>Ziziphus lotus</i> (L.) Lam.	Rhamnaceae	S	W
320.	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	S	C

H- Herb, **S-** Shrub, **CS-** Climbing Shrub, **CL-** Climber, **T-** Tree, **ST-** Small Tree, **TV-** Trailing Vine, **SS-** Sub-Shrub, **FH-** Floating Herb, **CV-** Climbing Vine, **PG-** Perennial grass, **G-** Grass, **CH-** Creeping Herb, **C-** Cultivated, **W-** Wild

4. CONCLUSION

In the current study, a total of 320 angiosperm species from 242 genera and 70 families have been documented and identified. The Fabaceae family has the highest number of species (36), followed by Asteraceae with 26, and Brassicaceae and Poaceae, each with 18 species. Other families include Solanaceae (13), Cucurbitaceae (12), Malvaceae (11), and Amaranthaceae (10). Over half of the documented species (173) are herbs, while the remaining include shrubs (51), trees (50), climbers (14), etc. Furthermore, all four tehsils (Rampura Phul, Talwandi Sabo, Maur, Bathinda) in the Bathinda region of Punjab exhibit minimal variation in angiosperm diversity. This lack of diversity is likely influenced by the geographical variations present in these areas. Moreover, factors contributing to the variation in diversity within the Bathinda districts may include increased urbanization, industrialization, and land leveling for various purposes. *Lantana* and *Parthenium* are invasive weeds that require urgent attention, to protect the region's floral diversity. Certain species, such as *Kigelia africana*, *Orobancha cernua*, and *Polianthes tuberosa*, are also need to be conserved. This study emphasizes issues that need immediate attention to

conserve the region's floral diversity.

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