



Ethnobotanical importance of Asteraceae plants among Tharu tribe in Udham Singh Nagar, Uttarakhand, India

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Research

Abstract

Background: Uttarakhand, a hilly state of northern India is gifted with unique natural beauty, rich biodiversity and great ethnic diversity. Asteraceae is the largest dicot family in the state and its several species are utilized by Tharu tribes for their livelihood. The present study was aimed to explore and document the ethnobotanical importance of Asteraceae plants used by Tharu community.

Methods: The study area was visited frequently and a total of 104 Tharu informants from 11 villages were interviewed with the help of a semi structured questionnaire. Collected plant specimens were identified and processed for herbarium in the laboratory. Ethnobotanical data were analyzed using Use value (UV) and Factor informant consensus (Fic).

Results: A total of 51 plants belonging to 38 genera under 12 tribes of Asteraceae family were found to be useful among Tharu people. Most of the species (50.98%) were noted to be used for curing various diseases. They use several plants for fodder (33.33%), ornament (27.45%), veterinary medicines (9.80%), social ceremonies (5.88%), and other purposes (13.72%) too. Quantitative analysis of data shows that *Tagetes erecta* has the highest use value (0.9423) followed by *Ageratum houstonianum* (0.4615) and *Eclipta prostrata* (0.3653). Maximum homogeneity was recorded in constipation, earache, eye disorders, heat stroke, infertility, paralysis, fuel and food.

Conclusions: The present study concludes that several Asteraceae plants have high use value and play an important role in Tharu's daily life. The recorded precious ethnobotanical data with UV and Fic analysis will be useful to the future researchers for further phytochemical, pharmacological, conservation and other studies.

Keywords: Asteraceae, Tharu, Ethnobotany, Udham Singh Nagar.

Background

Uttarakhand exhibits unique natural beauty with rich plant diversity ranging from Terai belt in south to high snow zones in the north. Terai is a lowland area lying in Himalayan foothill region which retains super abundance of surface water. The state is also known as "Land of Gods" as several important shrines are located here. Apart from abundant plant resources, Uttarakhand is a reservoir of many tribal communities as well as ethnobotanical heritage. Every district of Uttarakhand has more or less tribal population and about 94.50% of the total tribal population inhabits rural areas and the remaining population are scattered in urban centres (Bisht 2006). There are five notified scheduled tribes in the state, viz. Tharu, Buksa, Bhotia, Jaunsari and Raji which represent a total population of

291903 (Census 2011). Tharu is the largest primitive tribe of Uttarakhand who lives interiorly in the forest sustaining a close association with their ambient environment (Rajpoot *et al.* 2016, Sharma *et al.* 2011). They inhabit mainly in the terai foothills and represent 31.3% ST population in the state (census 2011). Several workers (Bajpai *et al.* 2016, Chaudhary & Roi 2017, Joseph *et al.* 2003, Kumar *et al.* 2008, Kumar *et al.* 2013, Kumar *et al.* 2014, Mishra & Shrivastava 2018, Pandey *et al.* 2012, Sharma *et al.* 2011, Sharma *et al.* 2014, Singh *et al.* 2011, Singh & Hamal 2013) have carried out ethnobotanical studies among Tharu tribe in Uttarakhand and its adjacent areas.

The state has rich plant diversity with varieties of useful plant species having great medicinal and other ethnobotanical values. Asteraceae Berchtold & Presl. (Compositae Giseke, *nom. alt.*) commonly known as daisy, thistle or sunflower family with 134 genera and 370 species represents the largest dicot family in the state (Pusalkar & Shrivastava 2018). It exhibits various life forms viz. herb, shrub, climber and rarely tree. A large number of Asteraceae plants are utilized for medicine, food and other purposes across the world (Dar *et al.* 2015, Hurrell & Puentes 2013, Jan *et al.* 2009, Jan *et al.* 2021 a, Mugendhiran *et al.* 2018, Patel 2012, Rahman 2013, Roy & Kanungo 2016). Asteraceae, the largest dicot family plays a key role in Tharus' livelihood. A perusal of literature shows that there is little information (Bisht & Purohit, 2010) on ethnobotanical study of Asteraceae plants which are growing abundantly in the study area. Tribal communities living in rural areas lack knowledge about modern healthcare and medicinal facilities. They use their senses to identify the common diseases and cure their disorders with the help of various plant species. But this valuable indigenous knowledge is disappearing from generation to generation. Therefore, an attempt was made to investigate and document the ethnobotanical importance of Asteraceae plants among Tharu tribes.

Materials and Methods

Study area

The present ethnobotanical investigation was conducted in Udham Singh Nagar district which lies in Terai belt of Kumaun region of Uttarakhand state. It is also known as the gateway of Kumaun hills of the state. The district is located between 28° 53' N to 29° 23' N latitudes and 78° 45' E to 80° 08' E longitudes at elevation of average 214 m and is spread over an area of 3055 km². It is bounded by Nepal in East and Uttar Pradesh state in South and West. On the North side, it is surrounded by Nainital and Champawat districts of Uttarakhand state. There are seven tehsils in district Udham Singh Nagar i.e. Jaspur, Kashipur Bazpur, Gadarpur, Kichha, Sitarganj and Khatima. The climate is subtropical having rich humidity with average 937.9 mm rainfall during monsoon season. The district harbours luxuriant vegetation as well as a rich tribal population. It is inhabited by two Scheduled tribes, i.e., Tharu and Buksa. Tharu is the largest tribe in this area with a population of 89399 representing 72.66% of total ST population in the district. According to Bisht (2006), Tharus are also residing in Lakhimpur-Kheri, Bahraich, Gonda and Gorakhpur districts of Uttar Pradesh. But sixty percent of total Tharu population is concentrated only in Sitarganj and Khatima tehsils of Udham Singh Nagar. The area with rich Tharu tribes is locally known as "Tharuat". They are divided into several endogamous groups. Tharus of the study area are mainly Rana Tharu, hierarchically they hold a superior social status among all Tharu groups. They consider themselves as descendants of Rana Pratap (Bisht 2006). Their main occupation is agriculture, but they are also engaged in fish catching, animal husbandry, handicraft and other household activities. They depend on plant resources to fulfill their various daily needs such as food, fuel, fodder, medicine, shelter, cultural ceremonies, etc.

Field survey

The present study was carried out during 2018 - 2021 in 11 villages viz. Baruwa Bagh, Bawanpuri, Bidaura, Nakulia, Tharu Tisor and Turka Tisor, Maholiya, Naugawa Thago, Paheniya, Saijana and Jhunkat of Udham Singh Nagar district (Fig. 1). Field visits were conducted regularly in different seasons for plant collection and ethnobotanical interview (Fig. 2 A, B, C, D). During field work, ethnobotanical information and several field characters of plants such as locality, altitude, local name, habit, plant height, specific odor, flower color, flowering and fruiting time were noted in the field book.

Tribal study and data collection

Data on tribal people have been gathered from literature available in different institutions such as Anthropological survey of India, Dehradun; Social Welfare Department, Haldwani, Uttarakhand etc. A semi-structured questionnaire was prepared with the help of Jain and Mudgal (1999) and Martin (2004). First of all, informal visits were made regularly to familiarize with the study area and local people. The Tharu families were located out with the help of literature and personal discussions with native people. The stratified random sampling was taken from the large population and 11 strata were taken in the form of Tharu tribal rich villages. All the informants were told about the purpose of the study and verbal prior consent was taken for their interview. Demographic as well as ethnobotanical

information such as name of the tribe, age, gender, occupation, local name of plant, parts used, method of utilization were recorded in the questionnaire. The information was cross checked also with other informants for proper authentication. Local names of plants were noted as told by more than one informant.

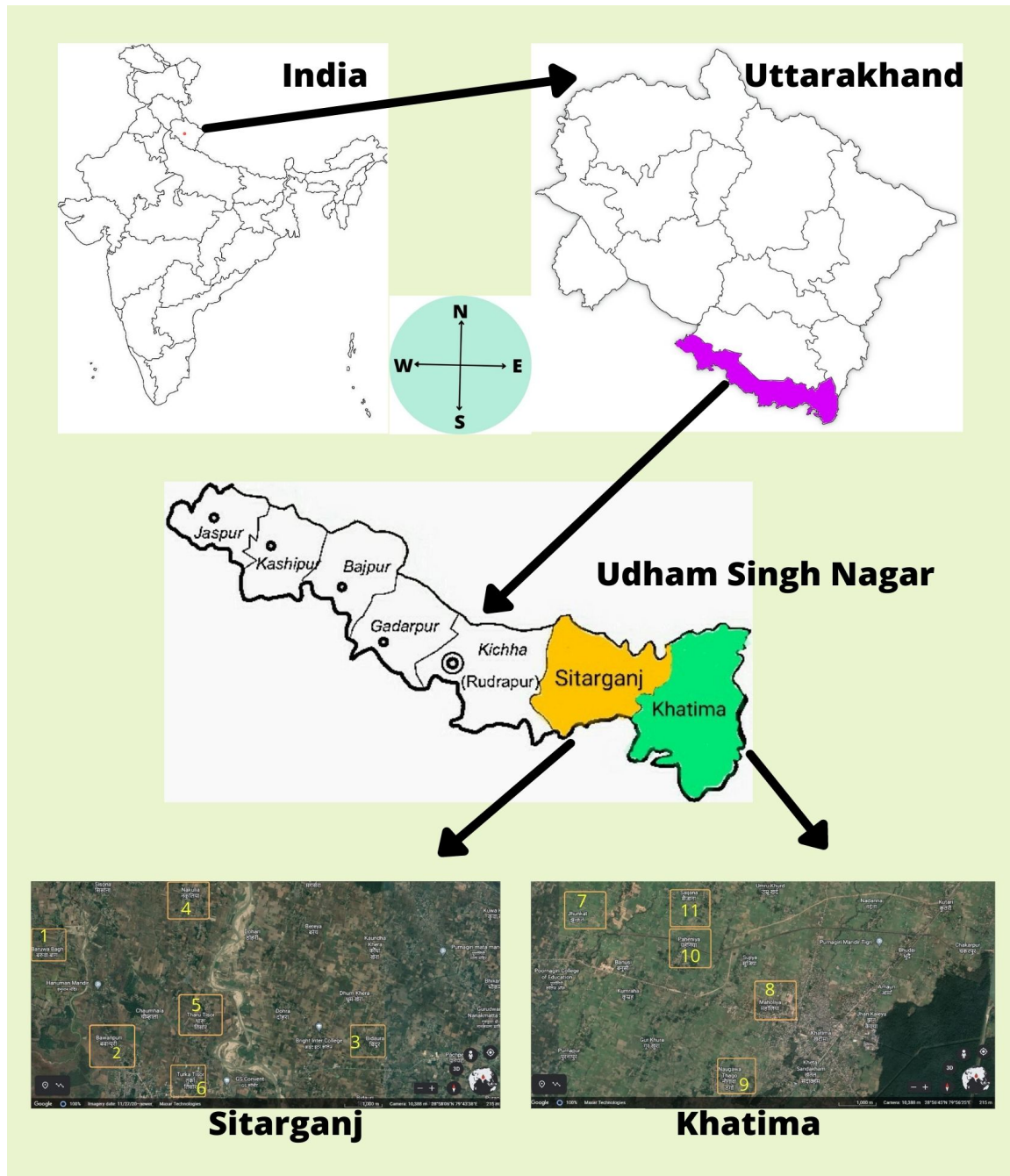


Figure 1. Location of study area. (1-Baruwa Bagh, 2- Bawanpuri, 3- Bidaura, 4- Nakulia, 5- Tharu Tisor, 6-Turka Tisor, 7- Jhunkat, 8- Maholiya, 9- Naugawa Thago, 10- Paheniya, 11- Sajjana)

Plant identification and herbarium preparation

Collected plant specimens were identified with the help of various floras (Babu 1977, Duthie 1903-1929, Gaur 1999, Gupta 1968, Hajra *et al.* 1995 a & b, Kanjilal 1928, Osmaston 1927, Pant 1986, Raizada 1976-1978, Uniyal *et al.* 2007) and compared with specimens deposited in regional herbarium (DD, BSD) and processed for herbarium following Jain and Rao (1977). Botanical names of the plant species were checked and compared with "POWO" Royal Botanical Gardens, Kew. Poisoned herbarium specimens (with 2% mercuric chloride solution) were deposited in the Department of Botany, Radhe Hari Government Post Graduate College Kashipur, Udham Singh Nagar, Uttarakhand.

Data analysis

Ethnobotanical data collected from all the informants of various age groups of both genders was analyzed through two statistical indices i.e., Use value (UV) and factor informant consensus (Fic) using the following formulae (Phillips and Gentry 1993, Heinrich *et al.* 1998).

Use Value

$$UV = \sum U/N$$

Where, *UV* = The use value of a species; *U* = Total number of uses reported per species; *N* = Total number of informants participated in the interview.

Factor Informant consensus

$$Fic = (Nur - Nt) / (Nur - 1)$$

Where, *Fic* = Factor Informant consensus; *Nur* = Number of uses reported in each category; *Nt* = Total number of taxa used in that particular category



Figure 2 A- F: Ethnobotanical investigation of Asteraceae plants used by Tharu tribe. A- Plant collection, B- Interview with Tharu people, C- Tharu's hut, D- A Tharu lady preparing traditional medicine from *Tagetes erecta*, E- A Tharu lady engaged in animal husbandry, F- Tharu ladies using Asteraceae flowers in marriage ceremonies.

Results and Discussion

Demography of informants

During the present study a total of 104 Tharu people were interviewed out of which 45 (43.26%) informants were male and 59 (56.73%) were female. The age of informants varied from 21 to above 60 years. All the informants are categorized into three age groups i.e., 20-40 years, 41-60 years and 61 above. Maximum informants i.e., 49 (47.11%) were from the first age group followed by the second (40 informants - 38.46%) and third age groups (15 informants-14.42%). About 75% informants were noted to be engaged in Agriculture and animal husbandry as the main occupation (Table 1, Fig. 2E). During the present study, the young people were more interested in the interview and group discussions on the various uses of plants. But older informants have treasure of unique indigenous knowledge. In Terai region, generally women are engaged in collecting plants for food, fodder, fuel and they have more traditional knowledge about ethnobotanical uses of plants (Mathur & Joshi 2013). Most of the agricultural activities are carried out by women folk (Sharma *et al.* 2011). During this study, it was noted that female Tharu informants cooperated more in ethnobotanical data collection.

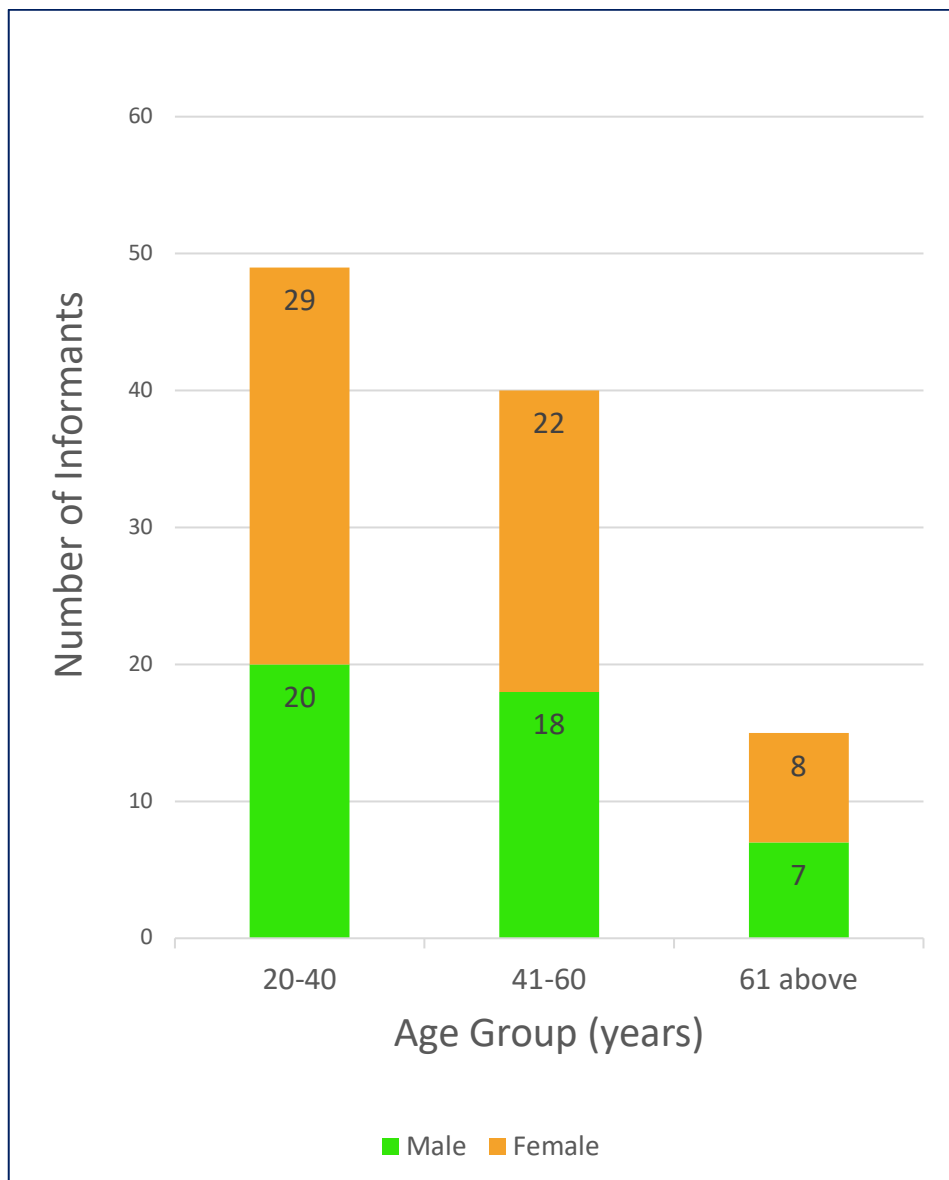


Figure 3. Demographic data of informants

Table 1. Demographic data of the study area.

Variables	Categories	Number of informants	Percentage
Gender	Male	45	43.26
	Female	59	56.73
Age groups (in years)	20-40	49	47.11
	41-60	40	38.46
	61- above	15	14.42
Occupation	Agriculture and Animal husbandry	79	75.96
	House worker	11	10.57
	Labour	2	1.92
	Service	5	4.80
	Student	2	1.92
	Religious person	1	0.96
	Folk healer	4	3.84

Ethnobotanical uses

During present ethnobotanical study, a total of 51 Asteraceae plant species belonging to 38 genera under 12 tribes were collected which were noted to be useful among Tharu's daily life. Maximum number of ethnobotanically important species were recorded under the tribe Heliantheae (18) followed by Cichorieae (8) Inuleae (6), Anthemideae (4), Eupatorieae (4), Astereae (3), Vernonieae (3), Arctotideae (1), Calenduleae (1), Cardueae (1), Senecioneae (1), Tageteae (1) (Fig. 4). A total of 36 plant species were observed to be growing in wild areas while 15 species were found in cultivated condition (Fig. 5). Figure 6 exhibits that most of the plant species were herbs (47 Spp. - 92%), some were undershrubs (2 Spp. - 04%), shrub (1 Spp. - 02%) and tree (1 Spp. - 02%). Different plant parts used for various purposes are represented by Fig. 7. Leaf (21 Spp.) were the most widely used plant part followed by twig (16 Spp.), flower head (6 Spp.), stem (1 Spp.), root (1 Spp.) and seed (1 Spp.) A total of 21 species were recorded to be used as whole plant. Table 2 shows all the collected plant species, their botanical name, collection number, tribe, habit, local name, parts used and methods of utilization. Most of the plants (26 Spp.) were found to be used for curing various diseases such as dermatological problems, bone fracture & arthritis, constipation, earache, eye disorders, heatstroke, infertility, jaundice, piles, paralysis, tooth & mouth problem etc. (Table 3)

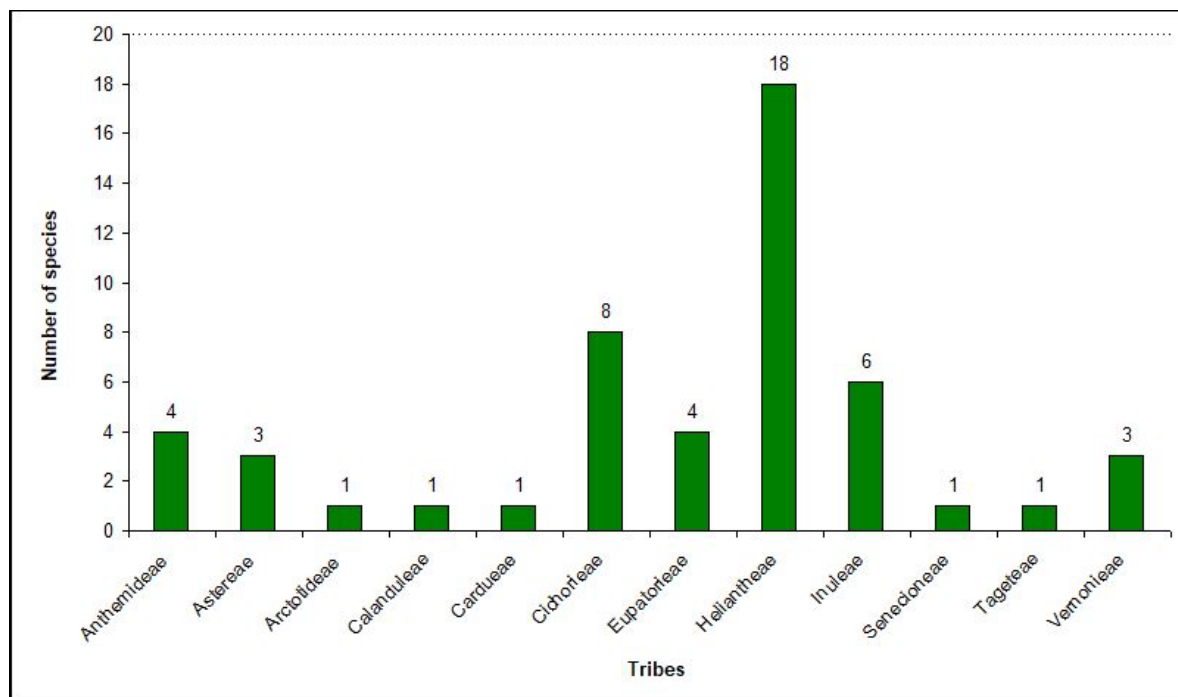


Figure 4. Tribe-wise representation of species

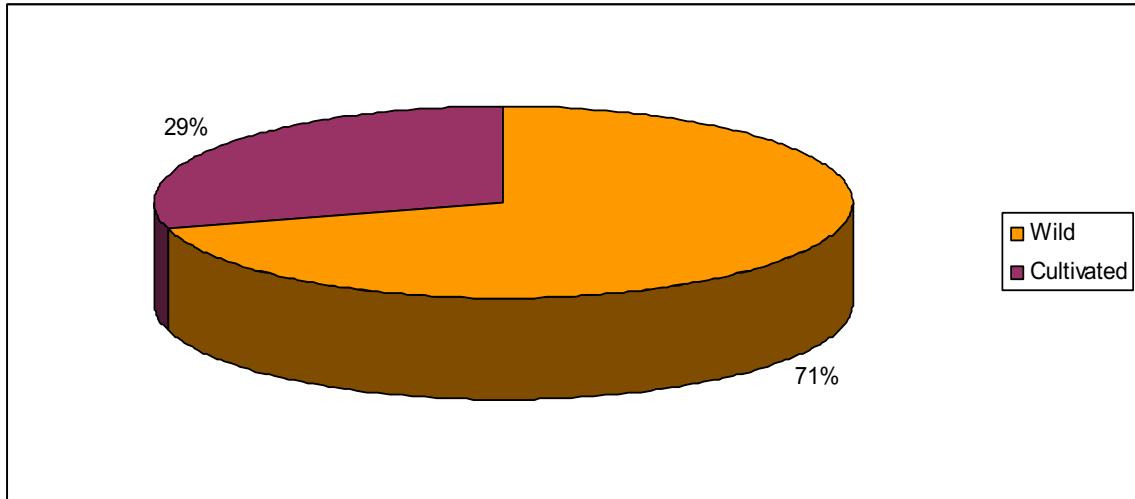


Figure 5. Wild and cultivated species

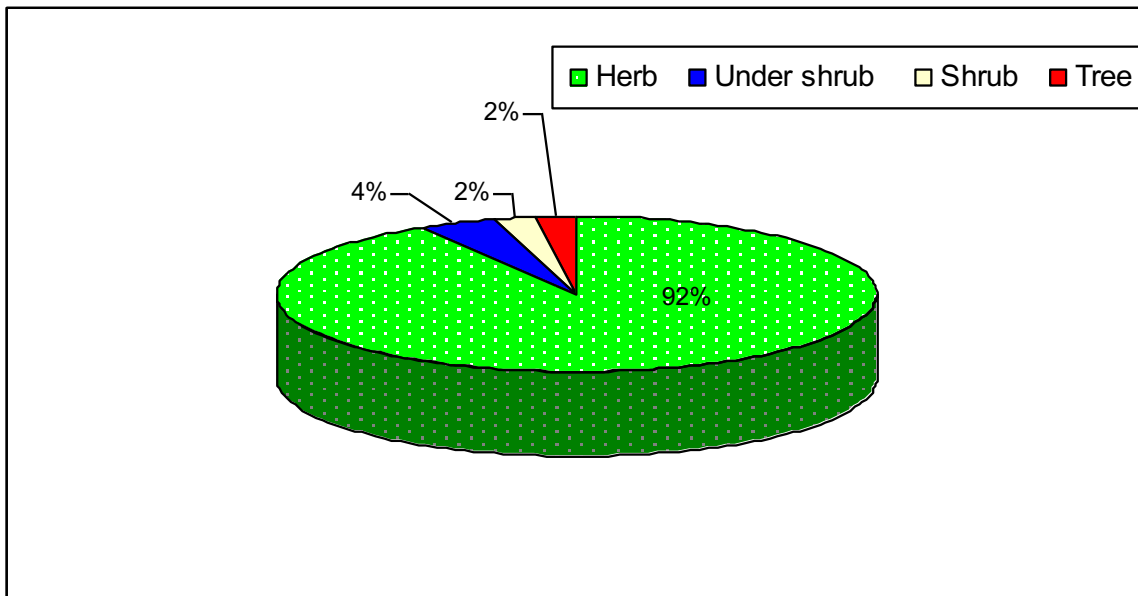


Figure 6. Percentage contribution of habit of collected plant species.

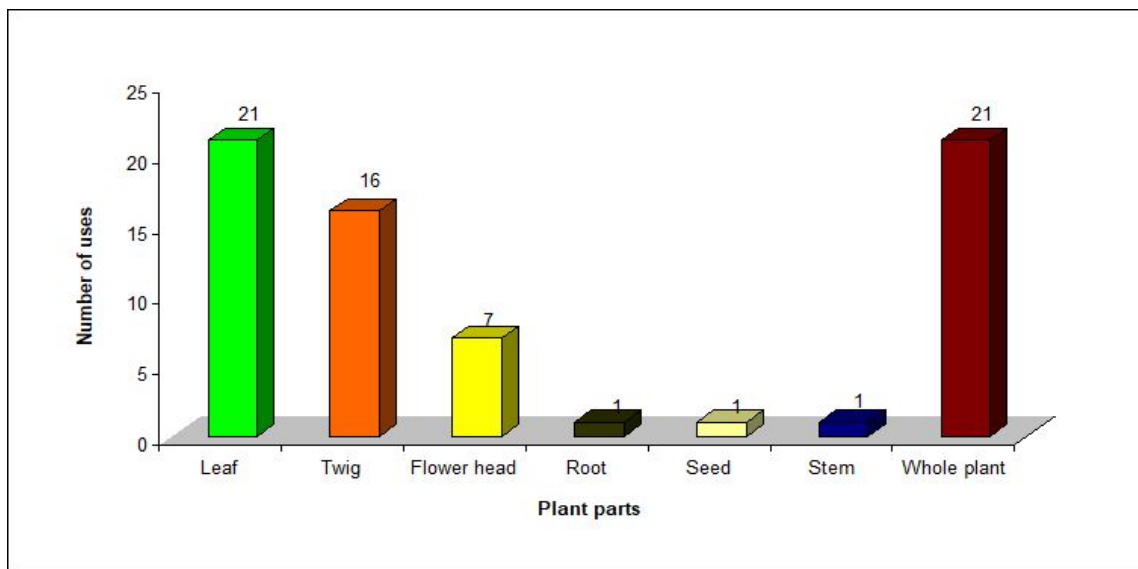


Figure 7. Plant parts used by informants for various uses

Table 2. Ethnobotanical uses of documented plant species

Botanical Name (Collection Number, Accession number)	Tribe	Local Name	Habit	W/C	Parts used	Method of utilization	Use value
<i>Acmella calva</i> (DC.) R.K. Jansen (C. No. 295, GPGCKSP-353)	Heliantheae	Chunchunia, Badi chatpati	H	W	Lf, Tw, FH	Leaves are chewed to cure constipation; twigs are used in jaundice; flower heads are chewed for mouth ulcer and toothache.	0.1923
<i>Acmella ciliata</i> (Kunth) Cass. (C. No. 296, GPGCKSP-354)	Heliantheae	Dantpari	H	W	FH, WP	Flower heads are chewed in toothache; whole plants are used as fodder for oxen.	0.0865
<i>Acmella radicans</i> (Jacq.) R.K. Jansen (C. No. 270, GPGCKSP-348)	Heliantheae	-	H	W	WP	Whole plants are used as fodder.	0.1250
<i>Acmella uliginosa</i> (Sw.) Cass. (C. No. 297, GPGCKSP-355)	Heliantheae	Ghundi, Chatpati	H	W	Lf, FH	Leaves are crushed and put under teeth and mustard oil is poured in the ear to remove cavity from teeth; flower heads are chewed in toothache.	0.1442
<i>Ageratum conyzoides</i> L. (C. No. 311, GPGCKSP-361)	Eupatorieae	Safed gidhauna	H	W	Lf	Leaves are crushed and used in healing cut and wounds.	0.1634
<i>Ageratum houstonianum</i> Mill. (C. No. 332, GPGCKSP-362)	Eupatorieae	Gidhauna	H	W	Lf, Tw	Leaves are used to cure cut and wounds; paste of leaves is applied in bone fracture; twigs are used as fodder with other grasses.	0.4615
<i>Ageratina adenophora</i> (Spreng.) R.M. King & H. Rob. (C. No. 310, GPGCKSP-363)	Eupatorieae	-	H	W	Lf	Juice of leaves is useful for cut and wounds.	0.0192
<i>Artemisia nilagirica</i> (C.B. Clarke) Pamp. (C. No. 307, GPGCKSP-360)	Anthemideae	-	U S	W	Lf	Leaf juice is applied over cut and wounds for proper healing.	0.0192
<i>Bidens biternata</i> (Lour.) Merr. & Sherff (C. No. 298, GPGCKSP-356)	Heliantheae	-	H	W	Lf	Leaves are used as fodder for goat; leaf juice is applied over cuts and wounds.	0.0961
<i>Bidens pilosa</i> L. (C. No. 339, GPGCKSP-364)	Heliantheae	-	H	W	Lf	Leaves are used as fodder for goats; juice of leaves is applied over cut and wounds.	0.0961
<i>Blumea axillaris</i> (Lam.) DC.	Inuleae	Gandha patta	H	W	Lf, Tw	Juice of leaves is applied over cut & wounds; young twigs are used as fodder with other crops.	0.0576

(C. No. 306, GPGCKSP-359)							
<i>Blumea lacera</i> (Burm. f.) DC. (C. No. 334, GPGCKSP-365)	Inuleae	Korna or Kukronda	H	W	Lf	Juice of leaves is applied on cut & wounds.	0.0480
<i>Blumea sinuata</i> (Lour.) Merr. (C. No. 338, GPGCKSP-366)	Inuleae	Peela gidhauna	H	W	Lf, WP	Juice of leaves is used to cure cut and wounds; leaves are used as fodder for goats; whole plants are used to prepare compost.	0.0961
<i>Caesulia axillaris</i> Roxb. (C. No. 271, GPGCKSP-349)	Inuleae	-	H	W	WP	Whole plants along with other crops are used as fodder; plant juice is applied over cut and wounds.	0.2596
<i>Calendula officinalis</i> L. (C. No. 313, GPGCKSP-368)	Calenduleae	Calendula phool	H	C	WP FH	Tribal people grow it as ornamental plants in their garden; flowers are used in worship.	0.1538
<i>Chromolaena odorata</i> (L.) R.M.King & H.Rob. (C. No. 302, GPGCKSP-358)	Eupatorieae	-	S	W	Lf	Leaf paste is applied to cure bone fracture, cut and wounds.	0.1250
<i>Chrysanthemum morifolium</i> Ramat. (C. No. 335, GPGCKSP-369)	Anthemideae	Guldaudi	H	C	WP	Tribal people grow it as mosquito repellent and ornamental plants in their kitchen garden.	0.2211
<i>Cirsium arvense</i> (L.) Scop. (C. No. 315, GPGCKSP-370)	Cardueae	Gulabi kateela	H	W	Lf, St, Tw	Leaf juice is applied on cut and wounds for healing; stem juice is used in eye disorders; young twigs of plant are used as fodder for goats.	0.1250
<i>Coreopsis auriculata</i> L. (C. No. 322, GPGCKSP-371)	Heliantheae	-	H	C	WP	Plant is grown by tribal as ornamental plants in their garden.	0.0288
<i>Cosmos sulphureus</i> Cav. (C. No. 336, GPGCKSP-372)	Heliantheae	Phool	H	C	WP, FH	Plant is grown by tribal as ornamental plants in garden and flower heads are used in worship.	0.2403
<i>Crassocephalum crepidioides</i> (Benth.) S.Moore (C. No. 309, GPGCKSP-373)	Senecioneae	Chirchida	H	W	Lf	Leaves juice is used for healing cut and wounds.	0.0192
<i>Cyanthillium cinereum</i> (L.) H.Rob. (C. No. 356, GPGCKSP-374)	Vernonieae	-	H	W	Lf	Leaves juice is useful for healing cut and wounds.	0.0480

<i>Dahlia pinnata</i> Cav. (C. No. 314, GPGCKSP-375)	Heliantheae	Dahelia	H	C	WP	Tribal people grow it as ornamental plants in their garden.	0.0384
<i>Eclipta prostrata</i> (L.) L. (C. No. 293, GPGCKSP-252)	Heliantheae	Bhrangraj, Bhangra	H	W	Tw	Juice of twigs is used to cure cut and wounds, fungal infection in toe. Twigs are crushed and used for dandruff control and better hair growth; decoction of twigs is taken orally to cure infertility; fresh twigs are given to cattle as fodder.	0.3653
<i>Elephantopus scaber</i> L. (C. No. 353, GPGCKSP-376)	Vernonieae	-	H	W	Rt	Root juice is used to cure paralysis.	0.0192
<i>Erigeron canadensis</i> L. (C. No. 337, GPGCKSP-377)	Astereae	-	H	W	WP	Whole plant is used to prepare compost.	0.1057
<i>Erigeron bonariensis</i> L. (C. No. 359, GPGCKSP-378)	Astereae	-	H	W	WP	Whole plant is used to prepare compost.	0.1057
<i>Erigeron sumatrensis</i> Retz. (C. No. 300, GPGCKSP-357)	Astereae	Ramasan	H	W	Tw	Twigs of plant are dipped in water in a container and put under sunlight for 4-5 hours. This water is used to take bath in heat stroke.	0.0576
<i>Gaillardia pulchella</i> Foug. (C. No. 226, GPGCKSP-345)	Heliantheae	-	H	C	WP	Plants are grown for ornamental purpose in kitchen garden.	0.0384
<i>Galinsoga parviflora</i> Cav. (C. No. 358, GPGCKSP-379)	Heliantheae	-	H	W	WP	Plants are crushed with fodder and given to cattle for better digestion.	0.0480
<i>Gamochoeta pennsylvanica</i> (Willd.) Cabrera (C. No. 330, GPGCKSP-380)	Inuleae	Kawar	H	W	WP	Plants are used as fodder.	0.1250
<i>Gazania rigens</i> (L.) Gaertn. (C. No. 290, GPGCKSP-350)	Arctotideae	Gazania	H	C	WP	Plants are grown for ornamental purpose in kitchen garden.	0.0288
<i>Glebionis coronaria</i> (L.) Cass. ex Spach (C. No. 333, GPGCKSP-381)	Anthemideae	Ketaki	H	C	WP	Plants are grown for ornamental purpose in kitchen garden.	0.1250
<i>Gymnanthemum amygdalinum</i> (Delile) Sch.Bip. (C. No. 340, GPGCKSP-382)	Vernonieae	Safeda	T	C	Lf, Tw	Leaves and twigs are crushed and its paste is used for arthritis, bone fracture, cut and wounds; garland is prepared from its leaves along with petiole and it is	0.1442

						worn by patients to cure jaundice.	
<i>Helianthus annuus</i> L. (C. No. 263, GPGCKSP-346)	Heliantheae	Surajmukhi	H	C	WP, Sd	Plants are grown for ornamental purposes in gardens; seeds are used for making oil for various purposes.	0.0865
<i>Helianthus debilis</i> Nutt. (C. No. 331, GPGCKSP-383)	Heliantheae	Surajmukhi jangali	H	C	Lf	Leaf juice is used in cut and wounds; plants are grown for ornamental purposes in gardens.	0.0961
<i>Helichrysum luteoalbum</i> (L.) Rchb. (C. No. 312, GPGCKSP-385)	Inuleae	Jhol	H	W	FH, Tw	Dried flower heads catch fire easily and therefore used along with other fuel; twigs of plant are used with fodder for better milk production.	0.0865
<i>Ixeris polycephala</i> Cass. (C. No. 303, GPGCKSP-386)	Cichorieae	-	H	W	Tw	Twigs of plants are used with fodder for better milk production.	0.0480
<i>Lactuca sativa</i> L. (C. No. 323, GPGCKSP-387)	Cichorieae	Letuce	H	C	WP	Plants are grown for ornamental purposes in gardens.	0.0192
<i>Launaea aspleniifolia</i> (Willd.) Hook. f. (C. No. 292, GPGCKSP-351)	Cichorieae	-	H	W	Tw	Twigs of plants are crushed and extract is mixed with buttermilk and it is taken orally to cure piles.	0.1250
<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal (C. No. 321, GPGCKSP-389)	Cichorieae	-	H	W	Tw	Twigs are used as fodder for cattle.	0.1057
<i>Soliva anthemifolia</i> (Juss.) R.Br. (C. No. 305, GPGCKSP-390)	Anthemideae	-	H	W	Tw	Twigs are used as fodder for cattle.	0.1250
<i>Sonchus asper</i> (L.) Hill (C. No. 325, GPGCKSP-394)	Cichorieae	Peela kateela	H	W	Tw	Young twigs are used as fodder for goats.	0.0769
<i>Sonchus oleraceus</i> L. (C. No. 329, GPGCKSP-396)	Cichorieae	Unt kateela	H	W	Tw	Twigs are used as fodder for better milk production in domestic animals.	0.1250
<i>Sonchus wightianus</i> DC. (C. No. 326, GPGCKSP-397)	Cichorieae	Chirchira	H	W	Tw	Twigs are used as fodder for goats.	0.1057
<i>Sphagneticola trilobata</i> (L.) Pruski (C. No. 360, GPGCKSP-398)	Heliantheae	-	H	C	WP	Tribal people grow plants in their garden for ornamental purpose and to prevent soil erosion.	0.0192

<i>Tagetes erecta</i> L. (C. No. 269, GPGCKSP-347)	Tageteae	Genda	H	C	Lf, FH, WP	Leaf juice is used in eczema, earache; flower heads are used to cure boils in nostrils, ringworm; decoction of either leaves or flower heads are taken orally to cure piles; plants are grown by tribal for ornamental purpose and to repel mosquito; debris of plant is used to prepare compost; flower heads are used in worship and various social ceremonies.	0.9423
<i>Tridax procumbens</i> L. (C. No. 354, GPGCKSP-399)	Heliantheae	Mundi	H	W	Lf, Tw	Leaf juice is applied on cut and wounds to stop bleeding; twigs are used as fodder for cattle.	0.1057
<i>Xanthium strumarium</i> L. (C. No. 355, GPGCKSP-400)	Heliantheae	Kateela	U S	W	Lf	Leaves are crushed and its juice is applied to cure eczema and cut and wounds.	0.0769
<i>Youngia japonica</i> (L.) DC. (C. No. 327, GPGCKSP-401)	Cichorieae	Palak ghass	H	W	Lf	Leaves are given to cattle along with other fodder crops for better milk production.	0.0480
<i>Zinnia elegans</i> Jacq. (C. No. 357, GPGCKSP-403)	Heliantheae	Zeenia	H	C	WP	Plants are grown for ornamental purpose.	0.0384

Table 3. Factor informant consensus for different use categories

Categories	Nt	Nur	Fic
Dermatological problems	20	164	0.883
Bone fracture & arthritis	3	14	0.846
Constipation	1	2	1.000
Earache	1	4	1.000
Eye disorder	1	2	1.000
Heat stroke	1	6	1.000
Infertility	1	2	1.000
Jaundice	2	3	0.500
Paralysis	1	2	1.000
Piles	2	4	0.666
Tooth & mouth problems	3	37	0.944
Compost preparation	4	31	0.900
Fodder	17	151	0.893
Food	1	5	1.000
Fuel	1	5	1.000
Mosquito repellent	2	9	0.875
Ornamental plant	14	131	0.900
Veterinary problems	5	32	0.870
Worship and social ceremonies	3	47	0.956

The Tharu families of the study area are still engaged in various traditional occupations such as agriculture, animal husbandry, fish keeping, poultry farming for their daily livelihoods. They use several Asteraceae plants also for compost preparation, as fodder and treating veterinary diseases. Seventeen plant species were recorded to be used as fodder with other crops for the cattle. During field work, some Tharu ceremonies were also attended and three

plant species viz. *Calendula officinalis* L., *Cosmos sulphureus* Cav., *Tagetes erecta* L. were observed to be used on several occasions (Fig. 2F) Informants mentioned that some Asteraceae plants are easy to catch fire and thus these plants are used with other fuel. Some ethnobotanical uses of *Acmella calva* (DC.) R.K. Jansen (Leaf in constipation), *Chromolaena odorata* (L.) R.M.King & H.Rob. (Leaf for bone fracture), *Cirsium arvense* (L.) Scop. (stem in eye disorder), *Crassocephalum crepidioides* (Benth.) S.Moore. (Leaf for cut and wound), *Eclipta prostrata* (L.) L. (twig for infertility), *Elephantopus scaber* L. (root for paralysis), *Gymnanthemum amygdalinum* (Delile) Sch.Bip. (Leaf and twig for bone fracture, arthritis and leaf for jaundice) are new reports in the study area.

The Tharu tribe lives in Terai region where outbreak of mosquito and other insects are prevalent. Therefore, they have to deal with many insects. To avoid them, these people cultivate some Asteraceae plants e.g., *Tagetes erecta* L., *Chrysanthemum morifolium* Ramat. as mosquito repellent. Some chemical study reveals that Pyrethrin is an important chemical compound present in the flowers of *Tagetes erecta* L. which has insecticidal properties; due to the unique smell emanating from these plants, the insects are reduced to some extent (Ponkiya *et al.* 2018). Burlec *et al.* 2017 have reported presence of various alkaloids, phenols and other chemicals in ornamental plants of family Asteraceae.

Statistical analysis

The collected ethnobotanical data was analyzed for Use value (UV) and Factor informant consensus (Fic).

Use value (UV)

The Use value (UV) determines the relative importance of plant species known locally (Akhtar *et al.* 2021, Bano *et al.* 2014). It is helpful in revealing the particular plant with the highest use in a specific area. As far as use value is concerned, quantitative data analysis reveals that *Tagetes erecta* L. has the highest use value (UV= 0.9423) followed by *Ageratum houstonianum* Mill. (UV= 0.4615) and *Eclipta prostrata* (L.) L. (UV= 0.3653) with respect to different ethnobotanical uses. Highest use value of *Tagetes erecta* L. represents that it is relatively the most important species as compared to other Asteraceae plants among Tharu. However, these plant species are not reported as threatened plant taxa in ENVIS database of Botanical Survey of India, Kolkata. For various purposes, *Tagetes erecta* L. is cultivated in the gardens of almost all Tharu people (Lata *et al.* 2022). Six plant species viz. *Artemisia nilagirica* (C.B. Clarke) Pamp., *Ageratina adenophora* (Spreng.) R.M.King & H.Rob., *Crassocephalum crepidioides* (Benth.) S.Moore, *Elephantopus scaber* L., *Lactuca sativa* L. and *Sphagneticola trilobata* (L.) Pruski have less use value (UV=0.0192) which denotes that these species are not commonly used but lesser known among them (Table 2). Sharma *et al.* (2014) have reported few Asteraceae plants along with other ethnomedicinal plants used by Tharu tribes in U. S. Nagar. They have also calculated use value of *Ageratum conyzoides* (L.) L. (0.541), *Caesulia axillaris* Roxb. (0.180), *Eclipta prostrata* (L.) L. (0.344), *Tridax procumbens* (L.) L. (0.623).

Factor informant consensus (Fic)

Factor informant consensus was calculated on the basis of the informants' responses on the number of plants used for a particular use category. It represents the homogeneity of the informant's knowledge for the particular category (Trotter & Logan 1986).

A total of 51 plant species were collected and 104 people were interviewed. During the entire study, a total 651 uses were recorded which were distributed conveniently under 19 different categories i.e., dermatological problems, bone fracture & arthritis, constipation, earache, eye disorder, heatstroke, infertility, jaundice, paralysis, piles, tooth & mouth problem, compost preparation, fuel, fodder, food, mosquito repellent, ornamental, veterinary problems, worship and social ceremonies. Maximum numbers of species (20) were recorded for dermatological disorders for which a total number of 164 uses were reported followed by fodder category in which 17 species were reported with a total number of 151 uses. The factor informant consensus shows the homogeneity and heterogeneity of knowledge among informants, and it ranges between 0.0 to 1.0. Maximum homogeneity was seen in constipation, earache, eye disorders, heat stroke, infertility, paralysis, food, fuel (Fic= 1.000) while minimum homogeneity was found in the knowledge of information among the informant in the treatment of jaundice (Fic = 0.500) (Table 3). However, several authors (Singh *et al.* 2019, Jan *et al.* 2021 b, Mir *et al.* 2021, Wani *et al.* 2021) have calculated Fic for various disease categories in Himalayan region such as constipation, wound, skin diseases, Jaundice etc but these reports lack of information on Asteraceous plants.

Conclusions

The Asteraceae family and Tharu tribe, both are the most dominant ones in the study area. The present study concludes that out of 51 Asteraceae plants, several plant species have high use value and play important role in Tharu's daily life. The informants of study area are engaged in several activities such as agriculture, handicraft and animal husbandry. Some female informants continue practicing traditional knowledge and also try to understand

effects and side effects of particular plant species. Due to urbanization and modernization the great tribal's indigenous knowledge is depleting day by day. There is an urgent need to document their unique traditional knowledge to conserve biodiversity as well as cultural diversity. Available literature shows that there is scarcity of detailed ethnobotanical study on Asteraceae- the largest dicot family. For further phytochemical study, it is required to pay attention to those species which have high use value, and more investigation is needed in future for species having low use value. The present study will provide precious ethnobotanical data to the future researchers for further phytochemical analysis, pharmacological studies and conservation strategies for commercial utilization.

Declarations

List of Abbreviations: BSD - Herbarium of Botanical Survey of India, Dehradun, Uttarakhand, India; DD- Herbarium of Forest Research Institute, Dehradun, Uttarakhand, India; ENVIS- Environmental Information System POWO- Plants of the World Online; ST- Scheduled Tribe; C- Cultivated, FH- Flower head, H- Herb, Lf- Leaf, Rt- Root, S- Shrub, S. No. Serial Number, Sd- Seed, St-Stem, T-Tree, Tw- Twig, US- Under Shrub, W- Wild, WP- Whole plant.

Ethics approval and consent to participate: Oral consent was taken from local informants prior to interviews. Their photographs were also clicked with their permission.

Consent for publication: This paper does not include any individual personal's data. Informants agreed that their photographs and interview data may be published for research purposes.

Availability of data and materials: The voucher specimens were deposited at the Department of Botany, R.H. Govt. PG College, Kashipur, U. S. Nagar, Uttarakhand.

Competing interest: Authors have no competing interest.

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Authors' contributions: Both the authors have contributed equally.

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Semi structured Questionnaire

Date-

Place-

Name of tribe-

Name of informant-

Age-

Gender-

Occupation-

Q.1 Do you know this plant? Yes/No.

Q.2 What is the local name of this plant?

Q.3 Do you use this plant as medicine to cure any disease? Yes/No

Q.4 Which part of the plant is useful?

a. Leaf, b. stem, c. root, d. flower, e. bud, f. bark, g. twig, h. whole, i. other

Q.5 How do you utilize the plant to cure a particular disease?

Q.6 Do you use this plant in any religious and social ceremonies? Yes/No

Q.7 Any other purpose, in which this plant is useful in your daily life.

a. Food b. compost c. handicrafts d. household item e. fodder f. fibre g. insecticide h. fuel i. veterinary problems j. others

Q.8 Any other information of plant

a-..... b-c-