

Ethno-ecological survey on medicinal plants for the treatment of Cancer in Hamirpur district, Himachal Pradesh, India

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Abstract

One of the most terrible diseases and a major medical problem in the world, cancer has an unacceptable death rate and is becoming increasingly prevalent every day. Despite the advancement of modern hygiene systems, medicinal plants still serve a significant therapeutic role. In the research area, an ethnobotanical survey was carried out to learn more about the use of herbs in traditional cancer treatment. According to the study, cancer is treated with 35 medicinal plants from 24 botanical families and 33 genera. Four species each from the Fabaceae and Solanaceae families, three from the Rutaceae, Apocynaceae, Asclepiadaceae, and Verbenaceae. The most common plant portion employed by the population under study as cancer preventative was leaves. The most popular technique for making remedies was the combination of Powder and decoction. According to public citations, the most significant plants for battling cancer include *Vitex negundo*, *Tinospora cordifolia*, *Aloe vera*, *Achyranthes aspera*, *Withania somnifera*, *Azadirachta indica*, *Premna latifolia*, *Cynodon dactylon*, *Datura innoxia*, and *Dalbergia sissoo*. More research should be explored to find practical phytochemical components and active ingredients that could be helpful for the treatment of cancer.

Introduction

Cancer is a dreadful disease that has caused enormous deaths over the years despite advancements in medical science and technology [21, 1], which has generated approximately 9.5-10 million deaths globally in 2020. In India, it is estimated to be 19 to 20

lakh incidences of cancer in 2022 and meet about 3 lakh deaths annually [21]. It is estimated that the number of new cases may touch 27.5 million and 16.3 million deaths worldwide by 2040 [13]. Breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death in females worldwide, accounting for 23% (1.38 million) of the total new cancer cases. Cervical cancer is the most common in 23 countries. Maximum deaths occur worldwide by lung cancer.

Moreover, about 70% of deaths from cancer occur in developing countries [1, 13, 18, 21]. For this reason, researchers have tried discovering new natural anticancer agents to mitigate this lethal disease. In India, the traditional folklore healthcare system was started long before the beginning of the Christian era, in Pre Vedic periods [10]. Medicinal plants have widely been used as a natural source for treating multiple diseases, including cancer [12]. About 80% of people use herbal medicine to cure several diseases globally [3, 4]. Natural remedies are widely used in low-income countries to treat cancer [5, 6, 9].

The present study aims to identify and explore the medicinal plants used to cure cancer by the indigenous population of Hamirpur district, Himachal Pradesh. It also contributes to society by providing ethnopharmacological knowledge related to cancer treatment in the study area.

This study shows that the area of Hamirpur district is rich in wild flora and has a vast diversity of medicinal plants. The meeting with local peoples or villagers revealed that the uses of medicinal plants are in the hands of limited people who keep the knowledge of the plant's secrets to other people. Even if they do not disclose this information to their family members, they pass it on to the selected members of the family and other also. So, the information pertains the uses of these plants are in the hand of some Sianas (expert in herbal medicines or herbal vendor) or old peoples, and the young generation is not well aware of the utilisation of these plants. But this information is not recorded scientifically, and the oral and codified transmitted knowledge will be extinct or disappear; therefore urgently needed to record this information.

1. Materials and Methods

2.1 Study Area

Hamirpur district is situated between 76°18'– 76°44' East longitude and 31°52'30" North Latitudes. The area is hilly and covered by the Shivalik range, and the elevation varies from 450—1,000 meters. This region possesses a rich diversity of herbal or

medicinal wealth which needs exploration. The floral richness makes it more suitable for ethnobotanical exploration of various plants to treat various diseases, including cancer. This paper discusses 35 plant species that are used to cure cancer by the natives of district Hamirpur. Such studies would provide an understanding of the floral significance for rational utilisation, dissemination, and conservation in the future.

2.2 Methodology

Throughout the study period, the Hamirpur district's various locales underwent the ethanol-botanical survey. The collection of ethnomedical data was done using a questionnaire method. 500 informants were chosen at random during the interviews, which were conducted in the neighbourhood. Regardless of their sex, level of education, or line of work, the respondents were chosen based on their availability and desire to share their knowledge. In most cases, knowledgeable elders/informants between the ages of 45 and 65 were contacted, including the local traditional healers, drug salesmen, and women. Discussions and individual interviews were undertaken to gather information regarding ethnomedicinal plants, plant products, regional plant names, ways of making medicines and administering them, and dose and timing according to age. Alongside this, a field investigation was conducted to gather plant samples. A herbarium was created to house the plant specimens that were collected for the study. A thorough ethnobotanical research was conducted to identify different medicinal plants that were either in the vegetative, blooming, or fruiting stages when they were utilised to treat cancer-related issues. The anti-cancerous plants identified during the investigation were verified using the pertinent standard Floras [10] and voucher specimens kept in the department's herbarium at Panjab University in Chandigarh.

Table 1 lists the plants alphabetically by family, local name, employed plant part(s), traditional preparation, in vivo and in vitro anti-cancerous activity, and other historically used pharmacological activities.

2. Result and Discussion

2.1 Diversity of recorded plant species

In this study, information on 35 plant species of 33 genera belonging to 24 families used for cancer ailments was documented from different sites in Hamirpur district, Himachal Pradesh. A total of 500 respondents (259 females and 241 males) selected randomly from diverse educational and occupational profiles were contacted including the homemakers, mid-wives, shopkeepers, farmers, village chiefs, local practitioners, and

the "vaidyas."The 35 anti-cancerous plant species and their common names, useful part(s), availability status, modes of preparation, and administration were documented (Table 1).

3.2 Life forms

In the present study, trees were the primary source of medicinal plants, accounted about 34 %, followed by herbs (31%), shrubs (29%),vines and fungi (3%), respectively (Figure1). The plants in our study belonged to 24 families with the most projecting family Fabaceae and Solanaceae (04 species each) followed by Rutaceae (3 species), Apocynaceae, Asclepiadaceae, Verbenaceae (2species each), and other families have one species each (Figure-2). In agreement with this, Chasange et al. [7] from Combodia and Rahman and Parvin [20] recorded Fabaceae as the largest family among all recorded medicinal plant species from Bangladesh. Kumar and Bharati [16] also reported a similar finding from Uttar Pradesh.

Life Forms

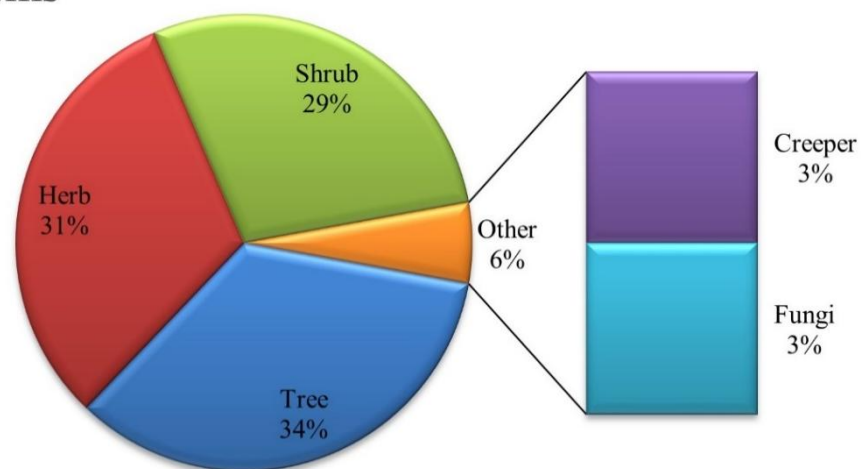


Figure 1.Life forms of the plants in the study region

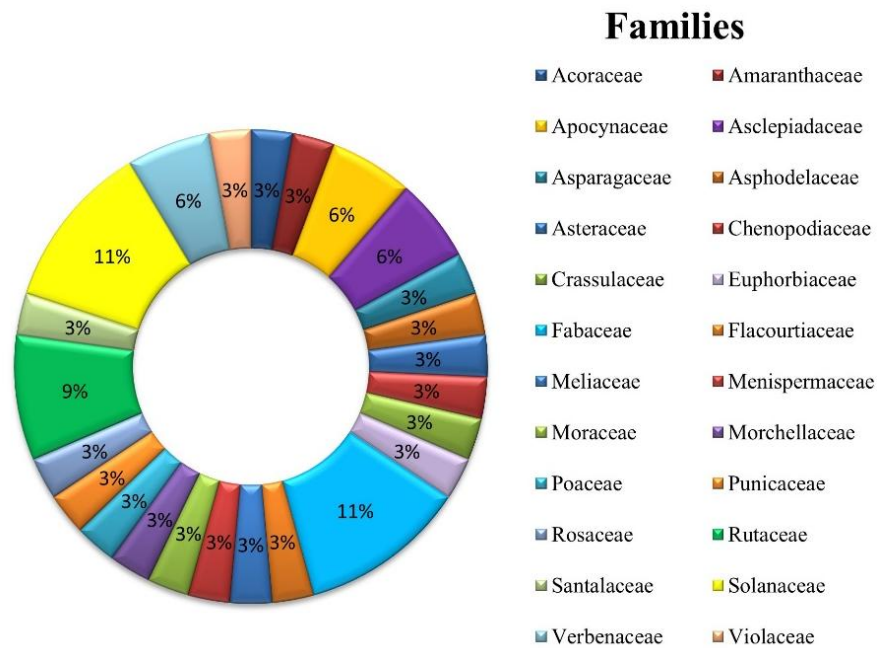


Figure 2. Family-wise distribution of medicinal plants.

3.3 Plant Parts used

Out of the recorded total plant species, the leaf component was the most commonly used for the preparation of ethnomedicine (Figure3). Fifteen plant species have been utilised for their leaf part, followed by the whole plant (12 species), Bark (08), Root (06), Fruit/Pod/seed (06), Stem (05), Flower, and Latex (02 each). Our results conform with other's reports in the literature [1, 18]. Leaf, bark, and fruit were major components used to prepare medicines. Powder and decoction were frequently used as the mode of preparation by the local community, followed by Juice, fresh and ashes form. In most cases, the cancer patient usually takes a dose after a meal for a better result.

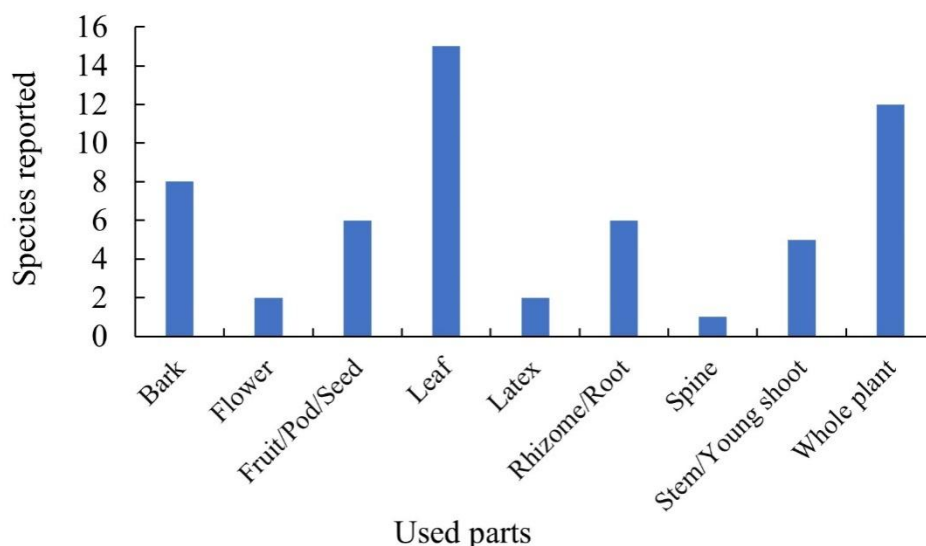


Figure 3. Contribution of plant's part for cancer treatment.

3.5 Medicinal Importance:

Cancer is a lethal disease which rapidly spreading all over the world due to several reasons. A general assumption indicates that every sixth death in the globe may be due to cancer. However, World Health Organization estimated that cancer has caused 10 million people's death worldwide in 2020. Therefore, it becomes necessary to investigate any possible cancer treatment from allopathy to herbal or ayurvedic. The medicinal Importance of plant species depends upon the uses of the plants cited by the informants and the total citations quoted by all informants of the same species. Hence, to get such estimated reports, there is an urgent need to find out herbal drugs to prevent this serious killer and dreadful disease. In the present study, selected plants have been identified through citations of the best herbal plants for curing different cancerous conditions. Out of thirty-five species, *Vitex negundo*, *Tinospora cordifolia*, *Aloe vera*, *Achyranthes aspera*, *Withania somnifera*, *Adhatoda vasica*, *Azadirachta indica*, *Premna latifolia*, *Cynodon dactylon*, *Mimosa pudica*, *Datura innoxia*, *Dalbergia sissoo*, *Datura stramonium*, *Catharanthus roseus*, *Acorus calamus*, *Achyranthes aspera*, *Calotropis procera*, were considered adequate for cancer treatment (Table 1). These results were confirmed by the findings of various workers [4, 5, 11]. In their review paper, Ayele et al. [2] discuss 65 anti-cancerous plants; different researchers have scientifically studied only 30 plants at different times for their therapeutic value/pharmacological activity. Other studies also show our finding [14, 15, 17, 19]. The study showed that plant species cited less may be most important than other more cited species. Hence, these plants need to be assessed for their anti-cancerous chemical

compounds and pharmaceutical activities to find more solutions in fighting cancer-like diseases.

Plants are the combination of two or more plants used to cure specific diseases and might be used to cure different diseases [4]. In our study, we found that some local informants agreed that they use some particular plants together for a specific ailment if required for treatment of a specific ailment. In general, there is much evidence in the earlier literature and from scientific documents that the combined form of a plant species can be a better and more effective remedy for some non-curable ailments. In the present study, the leaf powder of one hundred one plants, except those plants having milky extract and poisonous, is used to cure incurable diseases like cancer and HIV. On the other hand, many informants reported that two or more plants are used to fix the same or specific condition, i.e., ashes of *Datura innoxia*, leaves of *Azadirachta*, and Whole Plant of *Calotropis* are used to cure cancer. *Osyris arborea* powder or leaf, bark, and root decoction is used to cure cancer and menstrual disorder. Similarly, the leaf and bark of *Syziium cummni* are also used to cure cancer, like mouth cancer by the local people. *Cynodon dactylon* is applicable for preventing bleeding from the nose and urinal problems, and cancer. In the present study, some new uses of plant species for medicinal purposes have been recorded, which were not reported before.

Table 1. Plants used to cure Carcinogenic diseases by the local people of Hamirpur district.

Sr. No	Name of Plant	Family	Part used	Mode of Administration
1	<i>Acacia Arabica</i> Wild	Fabaceae	Bark, Pod	Bark or Pod powder is taken twice daily. The fresh bark is boiled in sufficient water until its volume leaves 1/4, added a small amount of Black pepper and the required amount of jaggery are stored in the bottle after cooling, and then it is taken 20-25 ml twice daily.
2	<i>Achyranthus aspera</i> Linn	Amaranthaceae	W.P.	Three leaves with sugar are given empty stomach daily, Meal should be taken after one hour.
3	<i>Acorus calamus</i> Linn.	Acoraceae	Rhizome	Powder of Rhizome mixed with the Leaves powder of <i>Adhatoda vasica</i> and leaves Powder of <i>Vitex negundo</i> in 2:4:1 ratio. Then take 5-10 gm. twice daily after Meal.
4	<i>Adhatoda vasica</i>	Apocynaceae	Leaf	Two leaves of <i>Adhatoda vasica</i> , <i>Vitex negundo</i> each, and a small piece rhizome of <i>Acorus calamus</i> are pounded and taken with water on an empty stomach daily.
5	<i>Agave americana</i> Linn	Asparagaceae	Leaf, Young shoot	Infusion of 50 gm. to 100 gm. dried leaves taken in 500-1000 ml water mixed small amount of Black pepper powder, taken ½ to 1 small cup one time per day or alternate day.
6	<i>Aloe vera</i> Tourn ex Linn	Asphodelaceae	Leaf and Stem	In the lower fresh part, the mean Stem of the plant is removed, and then it is eaten with salt on an empty stomach, especially for curing blood cancer.

7	<i>Azadirachta indica</i> A. Juss	Meliaceae	Bark, leaf	The fresh bark of about 1/2 kg is crushed and boiled in 5 litres of water till it becomes 1/4 of its volume, filtrate and added 400 gm. honey in it, Then about 30-40 ml is taken on an empty stomach daily for 3-4 months or till recovery.
8	<i>Bryophyllum pinnata</i> (Lam.) Oken.	Crassulaceae	Leaf	Fresh leaf extract of about 1/2 cup is taken on an empty stomach daily.
9	<i>Calotropis giagantea</i> R.Br	Asclepiadaceae	Flower, Leaf, Latex, W.P.	Whole plants of <i>Datura innoxia</i> , leaves of <i>Azadirachta</i> , and Whole Plant of <i>Calotropis</i> were dried under shade, burnt with flame, and collected the whole material's ashes, meshed with clothes and Taken 5-10 gm. were daily two times with water after Meal. The dosage of ashes should be decreased if the patient feels weakness. Fruits are fried in the Deshi ghee of cow until they are properly burnt. Then 1/2 small spoon is taken one time orally. Powder of flowers 5-10 gm is taken two times daily, Milky latex along with Turmeric powder is also applied externally for tumors or warts.
10	<i>Calotropis procera</i> (Ait) R.Br. Ait	Asclepiadaceae	Flower, Leaf, Latex, W.P.	Whole plants of <i>Datura innoxia</i> , leaves of <i>Azadirachta</i> , and Whole plant of <i>Calotropis</i> were dried under shade, burnt with flame, and collected the ashes of the whole material, meshes with clothes, and Taken 5-10 gm. were daily two times with water after Meal, The dosage of ashes is decreased if the patient feels weakness. Fruits are fried in the Deshi ghee of cow until they are adequately burnt. Then 1/2 small spoon is taken one time orally. Powder of flowers 5-10 gm. is taken twice daily; Milky latex and Turmeric powder are also applied externally for tumors or warts.
11	<i>Catharanthus roseus</i> (L.) G.Don.	Apocynaceae	W.P.	Extract of the whole plant about 30-50 ml is taken orally on an empty stomach daily, especially for blood cancer.
12	<i>Chenopodium album</i> Linn	Chenopodiaceae	W.P.	Roots dried under shade are ground to a powder which is taken 5-10 gm. on an empty stomach daily for 2-3 months.
13	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	WP	Fresh whole plant about 500 gm. by weight is boiled in four liters of water till it becomes 1/4 one liter, added 400 grams honey in it, then it is taken 40-50ml on empty stomach in the morning and evening before Meal two times daily till recovery.
14	<i>Dalberia sissoo</i> Roxb.	Fabaceae	Leaf, Bark	Leaves extract or Juice about 1 cup is taken on an empty stomach daily in the morning.
15	<i>Datura innoxia</i> Mill	Solanaceae	WP	Whole plants of <i>Datura innoxia</i> , leaves of <i>Azadirachta</i> , and Whole Plant of <i>Calotropis</i> were dried under shade, burnt with flame, and collected the ashes of the whole material were, meshed with clothes, and taken 5-10 gm daily two times with water after Meal, The quantity of ashes is decreased if the patient feels weakness. Fruits are fried in the Deshi ghee of cow till they are properly burnt in it. Then 1/2 small spoon is taken one time orally.
16	<i>Datura stramonium</i> Linn	Solanaceae	Root, leaf, Fruit	Whole plants, leaves of <i>Azadirachta</i> , and Whole Plant of <i>Calotropis</i> dried under shade, burnt with flame, and collected the ashes of the whole material, meshes with clothes and taken 5-10 gm daily two times with water after Meal; the quantity of ashes is decreased if the patient feels weakness. Fruits are fried in the Deshi ghee of cow until they are adequately burnt. Then 1/2 small spoon is taken once daily to cure cancer and tumor. Seeds powder in small amounts is taken with water daily.

17	<i>Euphorbia hirta</i> Linn	Euphorbiaceae	W.P.	Powder or decoction form of the whole plant is used to cure nipple tumours in females.
18	<i>Ficus religiosa</i> Linn	Moraceae	Leaf, Bark, Root	The decoction is obtained from bark, leaf, or root added with sufficient honey and taken 30-40 ml daily on an empty stomach.
19	<i>Flacourtia indica</i> (Burm. F.) Merr.	Flacourtiaceae	Bark, Fruit	Decoction or powder form of bark is taken daily two times. Fresh fruits are also helpful.
20	<i>Mimosa pudica</i> L.	Fabaceae (Mimosaceae)	WP	The whole plant is boiled in a sufficient amount of water till it becomes 1/4 left of its volume and then it is taken about 25-30 ml on an empty stomach daily
21	<i>Murraya koenigii</i> Spreng.	Rutaceae	Leaf, fruit	Leaves powder and leaf powder of <i>Aegle marmelos</i> , <i>Adhatoda vasica</i> , and <i>Vitex negundo</i> of 5-10 gm. are taken two times after the Meal. A small amount of black pepper is also added to it.
22	<i>Osyris arborea</i> Wall. Ex A.Dc.	Santalaceae	Bark, Leaf	Decoction and Powder form about 30-40 ml or 5-10 gm. as one dose is taken empty stomach in the morning and before the Meal in the evening with water till recovery. Fresh leaves decoction-like tea may be taken in the morning.
23	<i>Premna latifolia</i> Roxb.	Verbenaceae	Leaf	Leaves decoction of 30-40 ml is taken two times daily. Leaf extract or paste is also applied externally on the skin.
24	<i>Punica granatum</i> Linn.	Punicaceae	Fruit	The outer part of the fruit is dried, ground to Powder, and it is taken 5-10 gm two times daily
25	<i>Pyrus pashia</i> Buch. & Ham.	Rosaceae	Fruit bark	Bark or Pod powder is taken two times daily. The fresh bark is boiled in sufficient water to 1/4 left of its volume, added a small amount of Black pepper and the required amount of jaggery stored in the bottle after cooling and then taken 20-25 ml two times.
26	<i>Randia dumetorum</i> (Retz.) Poir	Rutaceae	Spine, Fruit	Fruit decoction is utilised. Spine paste is applied to the tumor externally.
27	<i>Solanum nigrum</i> Linn.	Solanaceae	W.P.	Whole aerial parts decoction of about 30-40 ml is taken daily.
28	<i>Tamarindus indica</i> Linn.	Fabaceae	Bark	Bark powder 5-10 gm. with water is taken twice daily.
29	<i>Tinospora cordifolia</i> (Wild.) Hook.f.&Thomson.	Menispermaceae	Stem	Fresh Stem crushed, kept in water overnight, one cup is taken empty stomach daily. Stem decoction and Powder of 30-40ml and 5-10 gm are taken orally.
30	<i>Viola serpens</i> Wall	Violaceae	W.P.	Decoction of the whole plant is prepared; add jaggery and a small amount of black pepper. They are taken twice daily.
31	<i>Vitex negundo</i>	Verbenaceae	Root,	Root powder 5-10 gm. is taken twice daily for 1-2 months.
32	<i>Withania somnifera</i> (L.) Dunal.	Solanaceae	Leaf, Root	Leaves or roots are boiled in a sufficient amount of water, the decoction is cooled and stored in bottles and taken two times daily till recovery. Fresh leaves 2-3 in number are chewed directly, and water is taken empty stomach afterwards in the morning daily.
33	<i>Xanthium strumarium</i> Linn	Asteraceae	Root	Root powder 5-10 gm. is taken twice daily for 1-2 months.
34	<i>Zanthoxylum alatum</i> Roxb.	Rutaceae	Leaf	Leaves powder 5-10 gm. is taken with water daily.

Conclusion

The present study provides compressed data about the medicinal plants used to treat the carcinogenic disorder by the local people of the Hamirpur district. The outcome of this work showed that herbal medicine is still used mainly among the people of the study site for fighting cancer. People make their way through this study to contribute toward society by providing detailed analysis, including plant parts used, mode of administration and preparation, and the doses required for cancer treatment. This work will contribute valuable data that can serve as medicine to develop natural compounds against cancer.

Author's Contribution

R.C.B., and H.B., have written the original draft, S.H., S.K. and S.S., reviewing and editing. A.N.S. and C.N., Supervision and data validation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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