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Traditional Antihelminthic Potential of Plants of Palampur Region of Lower Foothills of Shivalik Range of Himachal Pradesh

Nitesh Kumar, Ruchika Devi*, Saurav, Sunita Saklani[1] and Neelam Kumari

Department of Biosciences, Himachal Pradesh University, Shimla-171 005, India
[1]Department of Zoology, Sidharth Govt. "Utkrisht" College Nadaun-177 033, India
**E-mail: thakurruchi078@gmail.com*

***Abstract*:** Traditional medicine has relied heavily on wild herbs, shrubs, and trees especially when treating helminthic illnesses. Various wild plants are utilized for their antihelminthic properties, offering natural and accessible alternatives to synthetic drugs. Among these are *Cordia dichotoma, Emblica officinale* (Indian gooseberry) and *Morus alba*. These plants are home to bioactive substances like tannins, flavonoids, alkaloids, and saponins, which exhibit potent antihelminthic activities. Traditional preparation methods include consuming raw extracts, powders, decoctions, and infusions. Modern scientific research supports these traditional uses, highlighting the efficacy of these plants in disrupting the metabolism of parasitic worms, altering their membrane permeability, and stimulating the host's immune response. The use of wild plants not only provides a sustainable and cost-effective treatment option but also preserves indigenous knowledge and promotes biodiversity. Despite the promising potential, there is a need for standardized dosages and comprehensive clinical trials to ensure safety and efficacy. The integration of traditional knowledge with modern science could enhance the management of helminthic infections, particularly in resource-limited settings.

***Keywords*:** Antihelminthic, Traditional uses, Traditional knowledge, Wild plants

Globally, plants have long been used for medicinal purposes. These herbal remedies are often viewed as having lower toxicity and being gentler than pharmaceutical drugs, while also serving as a valuable source of bioactive compounds. In many developing countries, where modern medical systems may be limited, medicinal plants continue to be relied upon as a primary source of healthcare (Kaci et al., 2022). Himachal Pradesh, with a geographical area of 55,673 km², forms part of the Trans and Northwest Himalayas, renowned for its unique biodiversity, with forests covering 66.45% of the state's total area, including 59.3% protected and 3.41% reserve forests (Kumar and Sharma 2016). Within this rich ecological landscape, the Palampur region in Kangra District, located in the lower foothills of the Shivalik range, supports a diverse ecosystem that has been sustainably utilized by local communities for generations (Singh et al., 2021). These regions are especially rich in plants with medicinal potential, including antihelminthic species (Rajeswari 2014). As the majority of the population in Palampur Tehsil resides in rural areas, the prevalence of unhygienic and unhealthy lifestyles contributes to the infiltration of parasitic worms into their bodies, leading to various diseases such as helminthiasis. Helminthiasis is an infection caused by parasitic roundworms in the intestines (Kumar et al., 2015). The two main groups of worms to which these species belong are nematodes (roundworms) and platyhelminths (flatworms), which include both cestodes (tapeworms) and trematodes (flukes) (Mali and Mehta 2008). The significant worldwide health concern, helminthiasis is especially frequent in tropical and subtropical areas where sanitation and hygiene standards may be low (Busari et al., 2024, King 2019). The consumption of contaminated food or water, contact with contaminated soil, or bites from infected vectors (such as mosquitoes or flies) are the three main ways that helminthiasis is transmitted (Tahseen 2018). Direct contact with animals or people who are infected can also result in infection. A significant section of the global population suffers from helminthic diseases, which are among the most prevalent illnesses in humans (Tariq et al., 2009). Traditional healers in Palampur and surrounding areas have traditionally used a range of wild plants that have been shown to be beneficial in treating parasitic worm infestations when it comes to treating helminthic illnesses. These healers play a crucial role in managing, conserving, and ensuring the sustainable use of medicinal plants, a knowledge passed down through generations from their ancestors (Gangadhar 2022). The rich flora of this region includes numerous species reported to possess antihelminthic properties (Rajeswari 2014). This traditional knowledge represents a valuable resource for the potential development of new antihelminthic treatments, highlighting the importance of preserving both the biodiversity of the region and the associated Indigenous knowledge (Kumari et al., 2019). The indigenous population of this region has preserved and passed down extensive knowledge about medicinal plants through oral traditions and cultural

practices. This wisdom encompasses various aspects of plant use, harvesting techniques, and preparation methods for therapeutic applications. Some commonly used plants include *Punica granatum* and *Emblica officinalis. P. granatum* contain bioactive substances with potential anthelmintic properties, such as cucurbiti. The bark, roots, and fruit rind of this plant have all been traditionally employed for their therapeutic qualities, which include anthelmintic action (Kiran et al., 2024). Pomegranate compounds including punicalagin and ellagic acid have been investigated for their antiparasitic properties. *E. officinalis* L. is also known by another name, amla, the Indian gooseberry is a highly valued medicinal herb in Ayurveda (Yadav and Singh 2023). It is used in traditional formulations to treat intestinal parasites and is thought to have anthelmintic qualities. These are just a few of the many antihelminthic herbs that are traditionally observed in Palampur (Rawal et al., 2023). In this study, the traditional antihelminthic activities of plants were investigated. Both wild edible plant species and cultivated plants were selected for this purpose. Their potential to combat helminthic infections was explored through this research. It is also necessary to record customary knowledge regarding the utilization of plant resources of this region as folk remedies for various health problems including helminth-related problems for the benefit of future generations.

MATERIAL AND METHODS

The study included extensive field surveys across various villages in Kangra District, Himachal Pradesh, conducted in different seasons. Researchers used interactive interview methods, including questionnaire surveys, informal gatherings, field observations, and group discussions. They interviewed knowledgeable individuals aged 35 to 65, including men, women, youths, and elders, mostly involved in agriculture and horticulture. Semi-structured questionnaires were used to collect details on the traditional use of medicinal plants. Initially, plant specimens were shown to villagers and local healers to gather information on their therapeutic uses. Detailed information was then collected about the plants, the parts used, and how they were utilized. The documented information was analyzed based on several parameters. Fresh plant samples were collected and identified using

a. *Aegle marmelos* (L.) Correa b.*Bauhinia vahlii* Wight & Arn. c. *Justicia adhatoda* L d.*Murraya koenigii* (L.) Spreng. e. *Bauhinia variegata* Linn. f. *Punica granatum* L. g. *Pyrus pashia* Buch.-Ham. ex D. Don. h. *Vitex negundo*

Fig. 2. Wild plants of Palampur region of lower foothills of Shivalik range of Himachal Pradesh

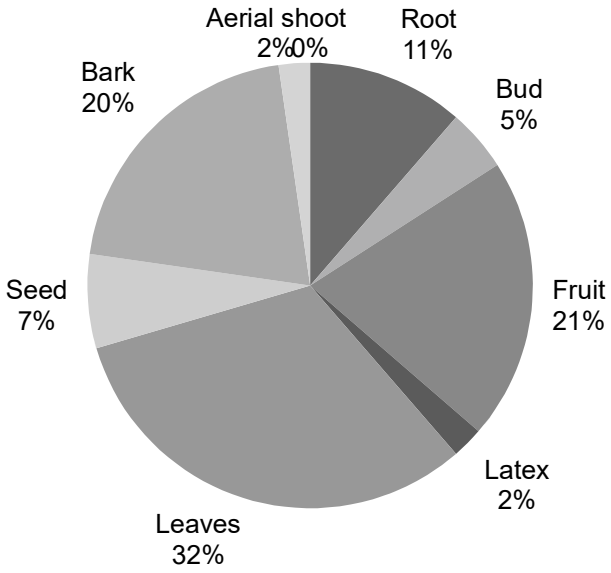

Fig. 3. Percentage of different plant parts used as Antihelminths

Table 1. Traditional anthelmintic potential of some medicinal plants that are used by local and rural people in Palampur region of lower foothills of Shivalik range of Himachal Pradesh

Botanical name	Family	Local name	Part used	Uses
Asparagus racemosus Willd.	Asparagaceae	Sansarpali, Sansfain, Shatavri	Root	The roots of this plant are dried and ground into a fine powder. 3-6 grams of this powder mixed with lukewarm is taken orally once or twice daily, usually mixed with water, honey, or milk, to expel tapeworm infections.
Aegle marmelos (L.) Correa	Rutaceae	Bill, bail patri	Fruit	5-10g powder of unripe fruit is taken with lukewarm water on an empty stomach for 4-5 days to cure intestinal worms.
Ageratum conyzoides L.	Asteraceae	Phulanu	Bud	The10-15 floral buds of this plant are dried and crushed to make a fine powder, and 6-8 grams of this powder is taken on an empty stomach with lukewarm water daily for three days to expel various types of worms for example flatworms and liver fluke from the body.
Aloe barbadensis Mill.	Liliaceae	Kawaraya, Ghritkumari	Leaf	5-10ml of juice from its fresh leaves are used to drink daily to kill parasitic intestinal worms like threadworms.
Argemone mexicana L.	Papaveraceae	Bharbhand, Kanduri	Root	5-10ml decoction of its roots is taken daily three times to eliminate the intestinal worms. The grind powder of its root is taken with juice extracted from the onion bulb to expel the pinworms immediately.
Bauhinia vahlii Wight & Arn.	Fabaceae	Torr	Bark	3-4g of dried powder of its stem bark is taken with lukewarm water twice daily for 4-5 days to expel and kill the larvae and adults of intestinal parasitic worms, mainly *Ascaridia galli*.
Bauhinia variegata Linn.	Fabaceae	Karyala, Kachnar	Bark, Bud	3g dried bud powder of this plant is taken two times a day with lukewarm water to expel the intestinal worms. 5-10ml decoction of its bark is taken empty stomach for three days to expel the liver fluke and flatworms.
Cordia dichotoma G.Forst	Boraginaceae	Lasuda	Leaf, Fruit	3-5ml juice from fresh leaves is used to drink daily for one weekto expel the parasitic intestinal worms. 50-100 grams of roasted fruits eaten for one week tothe expulsion of threadworms.
Chenopodium album L.	Chenopodiaceae	Bathu	Leaf, Seed	10-15ml of infusions made from leaves and seeds boiling together are used to drink daily two times a day for one week to treat intestinal worms mainly hookworm and pinworm.
Cannabis sativa Linn.	Cannabinaceae	Bhang	Leaf	15-20 ml decoction of leaves is taken three times a day for three to four days to get rid of intestinal threadworm.
Emblica officinalis Gaertn	Euphorbiaceae	Amla	Fruit	The dried fruit is ground into a fine powder. Traditionally, the powder is consumed in small doses, often mixed with water, honey, or ghee. The regular consumption of amla powder is believed to help in expelling intestinal worms like hookworms due to its potent antihelminthic properties.
Ficus palmata L.	Moraceae	Fegra, Khasra, Jangli Anjir	Fruit	4-5 dried fruits are often consumed directly or soaked in water overnight. Eating this soaked dried fruit in the morning on an empty stomach is believed to help expel intestinal worms.
Ficus religiosa L.	Moraceae	Peepal	Bark, Latex	Decoction prepared from its bark is beneficial for killing and paralyzing various kinds of intestinal worms mainly Ascaris. The latex of this plant possesses vermifuge properties and is used to expel various kinds of worms.
Justicia adhatoda L.	Acanthaceae	Basuti, Vaska	Leaf and Bark	20–25 ml of juice extracted from the leaves and bark is drunk once a day for one week to eliminate threadworm and hookworm.
Mallotus philippensis (Lam.) Müll.Arg.	Euphorbiaceae	Kamala	Seed, Fruit, Bark, Leaf	The decoction prepared from its dried seed, leaves, fruit, and bark with water which is taken 3 times a day for 3 days is used to kill and expel the tapeworms.
Melia azedarach L.	Meliaceae	Drek	Leaf, Seed	Decoction prepared from its leaves is taken daily once a day for 2-3 weeks to expel parasitic worms. Dried seed powder with lukewarm water is taken two times daily for half a week to treat intestinal worms.
Morus alba L.	Moraceae	Toot	Root, Fruit	5-10ml decoction prepared from the root is used to drink after a meal for one week to expel the stomach worms. 30–50 grams of fresh fruits have been eaten daily to cure the intestinal worms.

Cont...

Table 1. Traditional anthelmintic potential of some medicinal plants that are used by local and rural people in Palampur region of lower foothills of Shivalik range of Himachal Pradesh

Botanical name	Family	Local name	Part used	Uses
Murraya koenigii (L.) Spreng.	Rutaceae	Kadi patta	Leaf	5 ml decoction of its leaves is taken two times a day for three days to kill and paralyze the intestinal parasites in humans mainly liver fluke and pinworm and gastrointestinal nematode parasites in sheep.
Nyctanthes arbor-tristis Linn.	Oleaceae	Raat ki Chameli, Haar Shringaar	Leaf, Bark	The extract from its fresh leaves mixed with salt is taken to an empty stomach in the morning for 3 days to eliminate intestinal threadworms. Dried powder of leaves is used with water in cases of liver fluke intestinal worms. Bark extract is also used for expelling roundworms and intestinal worms due to the presence of tannin.
Oxalis corniculata L.	Oxalidaceae	Malori	Leaves	10-15ml decoction made from the leaves is taken daily twice a day for 3-4 weeks to get rid of intestinal worms.
Punica granatum L.	Punicaceae	Dhadu, Dhadan	Bark, Fruit	The dried powder of fruit peel is taken with lukewarm water two times a day for one week killing and paralyzing the worms. The juice extract from the fruit is drunk daily to expel the hookworms.
Pyrus pashia Buch.-Ham. ex D. Don	Rosaceae	Kainth	Bark	3g dried bark churan is taken with lukewarm water and is useful against various kinds of parasitic worms like hookworms and threadworms.
Rubus ellipticus Sm.	Rosaceae	Aakhe	Root	Root decoction of about one teaspoon is given to the children once a day for 4-5 days to get rid of intestinal worms.
Thevetia neriifolia(Pers.) K.Schum.	Apocynaceae	Peeli Kaner	Leaf	5-8ml decoction of leaves of this plant is taken for a week, three times every day to expel the intestinal worms.
Tamarindus indica Linn.	Fabaceae	Imli	Fruit, Leaf	10–15 ml of juice from the fruit drink one time a day for 4-5 days helps expel the worms of the intestine. 5–10 ml of juice from the fresh leaves is drunk daily, two times a day, which helps paralyze and kill stomach worms.
Terminalia chebula Retz.	Combertaceae	Harad	Fruit, Bark	50 ml Juice extracted from its fruit pulp is taken twice daily to eliminate tapeworm and Ascaris. Churan prepared from its dried bark mixed with harad (*Terminalia chebula*) and amla (*Embellica officinalis*) is known as triphalachuran, which is good for digestive problems and possesses antihelminthic properties. So, this churan is used to expel the parasitic worms.
Trifolium rapens L.	Fabaceae	Khukhani	Aerial shoot	2ml decoction of its aerial shoots is taken three times a day for two days to kill and paralyze intestinal helminthic worms mainly tapeworms. This extract is also used to kill intestinal worms in sheep mainly liver fluke.
Urtica dioica L.	Urticaceae	Bichu-buti, Aan	Leaf, Root	Fresh or dried leaves are steeped in hot water to make tea. The tea is consumed regularly to help expel worms and improve overall gut health. Roots of the plant are boiled in water for a longer period to extract active compounds. The resulting decoction is drunk daily for a specified duration, usually a few weeks, to clear hookworm parasitic infections.
Vitex negundo L.	Verbenaceae	Bana	Leaf	3 ml decoction of its leaves is used to kill and paralyze the various kinds of threadworm and flatworm intestinal parasites within a day.

various botanical references, such as 'The Flora of British India' (Hooker 1885), 'Flora of Himachal Pradesh' (Chowdhery and Wadhwa 1984), and 'Flora of Mandi' (Singh 2018).

The current study provided details on wild plants that have antihelminthic properties. The names of the plants' families, local names, botanical names, parts used, and their traditional uses for helminthiasis are listed in alphabetical order, as shown in Table 1. The present study includes 29 plants belonging to 21 families. The predominant families are Fabaceae with 4 plant species, Euphorbiaceae, Rosaceae, and Rutaceae with 2 plant species, and Moraceae with 3 plant species (Fig. 4).

Among the plant parts, leaves are the most commonly used, accounting for 32%, followed by fruits (21%) and bark (20%). Roots are utilized in 11% of the cases, while buds and seeds in 5 and 7percent (Fig 1). Latex and aerial shoots are the least commonly used, each accounting for 2%. This distribution highlights the predominance of leaves, fruits, and bark in traditional antihelminthic practices as shown in Figure

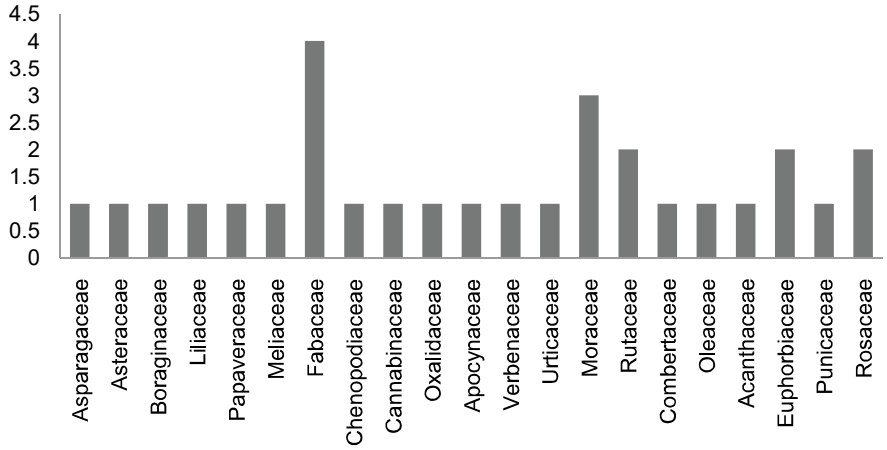

Fig. 4. Showing the predominant families of the plants in the study area having anthelmintic properties

3. The 3-4 g of powder of dried roots of the *Asparagus racemosus* plant mixed with lukewarm water is taken orally once or twice daily, usually mixed with water, honey, or milk, to expel tapeworm infections. Similar results have been shown by Soren and Yadav (2021). The 5-10 ml decoction prepared from the root of *Morus alba* is used to drink after a meal for one week to expel the stomach worms. Devi et al. (2013) also mentioned similar results. The 4-5 dried fruits of *Ficus palmata* are often consumed directly or soaked in water overnight. Eating this soaked dried fruit in the morning on an empty stomach is believed to help expel intestinal worms. Badgujar et al. (2014) observed similar trend.

CONCLUSION

The exploration of wild plants from the Palampur region of Himachal Pradesh for their antihelminthic properties shows the significant potential of traditional medicinal knowledge in addressing parasitic infections. This study has documented various plants traditionally used by local communities, such as *Cordia dichotoma*, *Emblica officinale*, and, which exhibit potent antihelminthic activities. The traditional methods of preparation and administration, including raw extracts, powders, decoctions, and infusions, provide sustainable and cost-effective alternatives to synthetic drugs. These practices not only offer immediate health benefits but also help preserve indigenous knowledge and promote biodiversity. The detailed documentation of these plants' uses, parts utilized, and preparation methods highlights the rich ethnobotanical heritage of the Palampur region. Integrating traditional knowledge with modern scientific research could lead to the development of new, natural antihelminthic drugs, particularly beneficial in resource-limited settings where synthetic drugs may be inaccessible. As a vital resource in the fight against helminthic illnesses, the outcome of the research emphasizes the significance of wild plants. It supports more research into conventional medicine along with contemporary scientific verification to improve the treatment of parasitic illnesses and advance global health solutions.

AUTHOR's CONTRIBUTION

Devi R: Prepared the original draft of the manuscript; Kumar N: edited the manuscript; Saurav, Saklani S, and Kumari N Reviewed the manuscript and confirmed the authenticity of all the data. All authors have read and approved the final manuscript.

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