

Traditional use and role of wild edible fern *Diplazium esculentum* and *Pteridium aquilinum* in socio-economic development of District Mandi of Himachal Pradesh, North Western Himalaya

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Abstract: Present study has been conducted in (31°42' 29.4" N latitudes and 76° 55' 52.92" E longitudes) Mandi district of Himachal Pradesh, North West Himalaya. It covers approximately 3,950 km² area comprising 469 panchayats and 3374 villages with 2, 19, 145 households. The total human populations is 9, 99,777 and livestock population is 67355. District Mandi is endowed with rich floristic diversity and offers a rich source of wild food plants. *Diplazium esculentum* and *Pteridium aquilinum* are wild growing popular edible fern of District Mandi of Himachal Pradesh locally known as *Lingad* and *Lingdu*. Rural community in hills of district Mandi are directly and indirectly involved in collection and processing of these wild edible fern. They sell these ferns fresh and pickled. Value addition raises market value of these food plants up to 30 to 50%, as *Diplazium esculentum* is sold fresh at the price of Rs 40 to 80/kg in local market and its pickle is sold at comparatively high price of Rs 400 to 450/kg. Pickle is very much liked by local people and sold in local and national or international fair of Mandi region. It is served with local dishes like '*siddu*' and '*kachouri*' and is good source of earning for inhabitants of study area. Focused study on role and use of wild edible food plants at genus and species level was not done earlier, so present study was done to assess Traditional use and role of wild edible fern *Diplazium esculentum* and *Pteridium aquilinum* in socio-economic development of District Mandi of Himachal Pradesh, North Western Himalaya.

Keywords: Wild food plants, Capacity building, Rural community, Economic potential.

I. INTRODUCTION

The North Western Himalayas is the part of Indian Himalayan Region and is a rich store house of biodiversity which is readily utilized by the rural communities of the region as source of food (Wild edible), fodder, fuel, medicine, timber, making agriculture tools, religious and various other purposes [1]. Area is mostly hilly and land holding of people in the region are small and they cannot afford optimum agricultural input. Therefore, they rely on a number of unconventional food plants as a source of food, fiber, medicine and other material. These plants can have immense potential to act as an important source of food in time of scarcity, these also offer variety to our existing food resources and are good source of earning for local people because many of these are commercially sold in local, national or international market with high price. *Diplazium esculentum* and *Pteridium aquilinum* members of botanical family Ploypodiaceae are among the most popular wild growing ferns of District Mandi of Himachal Pradesh. Commonly *Diplazium esculentum* is known as vegetable fern and locally it is called as *Lingad*. *Diplazium esculentum* also known by many synonym viz *Anisogonium esculentum*, *Asplenium*

ambiguum, *Asplenium esculentum*, *Athyrium esculentum*, *Callipteris ambigua*, *Callipteris esculenta*, *Digrammaria esculenta*, *Diplazium malabaricum*, *Hemionitis esculenta* and *Microstegia esculenta* while *Pteridium aquilinum* having synonym *Eupteris aquiline*, *Pteridium latiusculum*, *Pteridium pinetorum*, *Pteris aquiline*, *Pteris capensis*, *Pteris decomposita*, *Pteris lanuginose*, *Pteris latiuscula* is known as *Lingdu* in local or Pahari dialect. No common name has been assigned to this edible wild fern. Several traditional preparations are made out of these two wild ferns and also served local social gatherings. Every ear tons of *lingad* and *lingdu* worth lakhs of rupees is sold in the vegetable markets of Himachal towns, so these are important commercial commodities for local people of Mandi area. This entire supply of these ferns comes from forests as these food plants still have not been brought under cultivation. Besides Himachal, these ferns also grow in the forests of Kashmir and Uttaranchal. In general, a number of studies have been carried out in wild edible plants at international level [2. 3.4.5.6.7], at national level [1,8,9,10,11,12,13] and at state level [14,15, 16.17. 20..21.22.23] by number of researchers, but focused study on traditional uses and role of *Diplazium esculentum* and *Pteridium aquilinum* for socio-economic development of District Mandi has

not been carried out so far. So, present study has been carried out in Distt. Mandi of Himachal Pradesh with main objective: 1) To know the habit, habitat, morphology and distribution of *Diplazium esculentum* and *Pteridium aquilinum* 2) To document traditional uses of *Diplazium esculentum* and *Pteridium aquilinum* 3) To know method of harvesting of *Diplazium esculentum* and *Pteridium aquilinum* 4) To know the role of *Diplazium esculentum* and *Pteridium aquilinum* in income generation. 5) Future recommendation.

II. METHODOLOGY

Present study is based on both primary (Field observation and interview through questionnaire) and secondary data.

Study area:

Mandi district (31°42' 29.4" N latitudes and 76° 55' 52.92" E longitudes) of Himachal Pradesh, North West Himalaya (Fig.1) covers approximately 3,950 km² area comprising 469 panchayats and 3374 villages with 2, 19, 145 households. The total human populations of study area is 9, 99,777 and livestock population is 67355. Altitudinal range of study area varies from 500-4034 m. It supports diverse habitats, species, communities and Ecosystems. The vegetation mainly is of sub-tropical and temperate types and mostly dominated by broad leaved deciduous and evergreen and coniferous types. (District Economic and Statistical Department, Mandi, H.P)



Fig.1. Google map of study area.

Method:

Survey and sampling of *Diplazium esculentum* and *Pteridium aquilinum* were done (Rapid) between amsl 500-4034 m in the study area. Information on altitudinal range, habit, habitat (s) and utilization pattern like edible, medicinal and commercial uses etc. of *Diplazium esculentum* and *Pteridium aquilinum* was gathered by interviewing knowledgeable persons and local people involved in collection and marketing of these ferns through questionnaire (Table.1).

Table 1. List of informants of study area possessing traditional knowledge of using and marketing of *Diplazium esculentum* and *Pteridium aquilinum*.

Sr. No.	Name	Age	Gender	Address	Profession
1.	Budhi Ram	62	Male	Village Chhoa Dhar P.O. Bagachanogi Tehsil-Thunag	Agriculture
4.	Bhakam Ram	47	Male	Village Dhawas P.O. Bagachanogi Tehsil-Thunag	Agriculture
5.	Kusum	36	Female	Village Bhanwad, P.O.- Maloh, Tehsil-Sundenagar	Pickle making
10.	Bhop Singh	70	Male	Village Baga P.O. Bagachanogi Tehsil-Thunag	Agriculture
11.	Baldev Singh	51	Male	Village Baga P.O. Bagachanogi Tehsil-Thunag	Agriculture
12.	Khimi Devi	45	Female	Village Patyoda, P.O.- Maloh, Tehsil-Sundenagar	Agriculture, Pickle making
13.	Sunita	50	Female	Village Keran, P.O.- Sundernagar, Tehsil-Sundenagar	Agriculture, Stitching
14.	Jethu Ram	58	Male	Village Baga P.O. Bagachanogi Tehsil-Thunag	Agriculture
15.	Kanshi Ram	58	Male	Village Chohat P.O. Bagachanogi Tehsil-Sundenagar	Agriculture
16.	Mr. NaagRam	65	Male	Village chubhani, P.O. Bahyla, Tehsil-Thunag	Hakim, Agriculture
17.	Parvati devi	65	Female	Village Baragaon P.O. Drang Tehsil-Padhar	Agriculture
18.	Champa devi	24	Female	Village Jadron, P.O.- Bayla, Tehsil-Sundenagar	Traditional processing
19.	Sheela Devi	48	Female	Village – Shikari, P.O – Kalahod, Tehsil – Sundar nagar,	Vegetable
20.	Chinta	24	Female	Village – Shikari, P.O – Kalahod, Tehsil – Sundar nagar,	Broom making & agriculture
21.	Anup chand	34	Male	Village Baga P.O. bagachanogi Tehsil – Sundar nagar,	Agriculture
22.	Begi Devi	40	Female	Village Kataula, P.O. Nerchowk. Tehsil Sadar Mandi.	Lingad selling & farming
23.	Sumitra en	60	Female	Village & P.O.Talyahar Tehsil Sadar Mandi.	Pickle selling
24.	Kripal singh	35	Male	Village chohat p.o. Bagachanogi	Agriculture
25.	Lata devi	43	Female	Village-Kamand, P.O. Kamand, Tehsil Sadar Mandi.	Pickle and Badiyan selling

26.	Jagdish Thakur	52	Male	Village Chanala. P.O. Kamand Tehsil Sadar Mandi.	Perist, Farming
27.	Kamla Sharma	48	Female	Village Chanala. P.O. Kamand Tehsil Sadar Mandi.	Pickle seller
28	Barjee Devi	50	Female	Village Sakrayar P.O. Kamand, Tehsil Sadar Mandi.	Pickle seller
29	Anupriya	18	Female	Village kotli, P.O.Samrahm, Tehsil Kotli.	Farming and broom making
30	Meena Devi	26	Female	Village Dari, P.O. Chail chowk. Tehsil chachyot,	Agriculture

Identification of samples was done with the help of local and regional floras [24, 25,26,27] Plants were analysed for traditional uses of food preparation and their role in income generation.

III. RESULT

Distribution, habit and habitat.

Diplazium esculentum and *Pteridium aquilinum* both are herbaceous annual fern of Mandi District. *Diplazium esculentum* grows at humid, shady moist locations, mostly along water streams and springs in hill forests between an altitudinal range of 1300 to 1900 m above the sea level.

Pteridium aquilinum also grows wild along the streams, water channels and other shady moist locations in forests as well as in farms at altitudinal zone ranging from 1450 to 1850 m. But it does not grow everywhere, even in Himachal Pradesh, it is seen growing in a special climatic zone falling between an altitudinal range of 1450 to 1850 m.

Morphological variation among two ferns.

Lingad (Diplazium esculentum) plant:

Lingad is a tufted fast-growing perennial fern. It usually grows wild on exposed grassy slopes. It is with stout creeping rhizome growing in the soil substratum which is not visible from the outside. Rhizome of *lingad* produces numerous fronds which are mostly tripinnate. covered with short rufous scales of about 1 cm length. Uppermost pinnae are simple.

When fully developed, the pinnae can be 0.6 to 1.8 m in length and 30-60 cm in width. Fig.2.

Lingdu (Pteridium aquilinum) plant:

Lingdu is terrestrial fern with erect rhizome, 5-10 x 2-4 cm; scales are 5-7 x 1-1.2 mm, lanceolate, acuminate, entire or rarely fimbriate, dark brown and membranous.

Fronds are 1.5-2 x 0.6-0.8 m, bipinnate; stipe 0.8-1 m long, polished above, grooved; lamina is rhomboid in outline, rachis is grooved; pinnae are 22-30 x 10-15 cm, elliptic-lanceolate, acuminate in outline, pinnae towards distal part lanceolate-acuminate, lobed to serrate; costa are grooved above and raised below; pinnules are 5-8 x 1-2 cm, lanceolate, acuminate, lobed to serrate, lobes oblong, retuse, serrulate, base of pinnules truncate, basal pinnules are stipitate, upper one are sessile, progressively reduced towards apex, terminal pinnae exceptionally larger; costules grooved above and raised below, veins pinnate, indistinct above, raised below, anastomosing.

Sori are 3.5 mm long, dark brown, linear, along veins, indusia are brownish.

Sporangial capsule is 312.5 x 250 µm subglobose, stalk is 375 µm long.

Spores are 37.5 x 30 µm, yellowish, ellipsoid, monolet and granulose. Fig.2

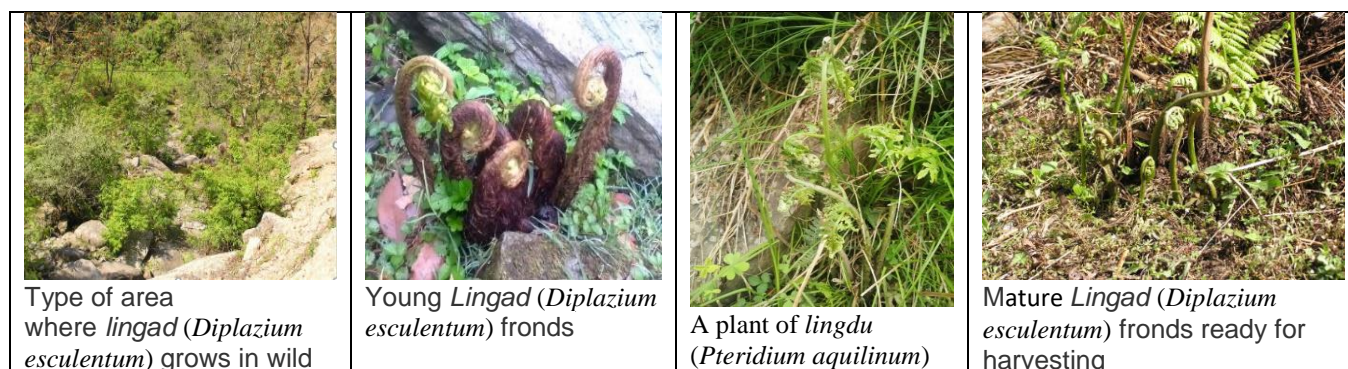


Fig. 2. Images showing habitat and morphology of *Diplazium esculentum* and *Pteridium aquilinum*.

Traditional Uses:

Inhabitants of Mandi collect fronds of these edible ferns from wild habitat as a source of food, medicine and material for their local personal and commercial uses. Mainly these ferns are popular as wild vegetable but some people use them as a mulch, fertilizers, thatching and packing material. *Diplazium esculentum* is also used as decorative material by some people or in some famous restaurants during its early developing stage due to its coiled fronds

Edible uses:

Fronds of both these ferns can be pickled and made into delicious vegetable which is eaten along with chapatis or rice during the main course. *Lingad (Diplazium esculentum)* is more used as a vegetable or pickle in comparison to *Pteridium aquilinum*, which is used as a vegetable only. *Pteridium aquilinum* is known for its characteristic pleasant flavour which is liked by many people. It is a popular seasonal delicacy of the Mandi area.

Special curries like 'dum' and 'madhara' with exclusive recipes are made from *Lingad* (*Diplazium esculentum*) in Mandi area and served as special dishes on many special occasions like festivals, marriages and birthday ceremonies. *Lingad* (*Diplazium esculentum*) is especially popular among the members of the Sood community of Mandi, who have their own recipes for *lingad* (*Diplazium esculentum*) curries. The young fronds of *Diplazium esculentum* are stir-fried, used in salads and served in *dhavs*, restaurants and hotels. Fig.3.

Preparing vegetable:

The fronds of (*Diplazium esculentum*) are hairy. These hairs have to be removed before cooking. It is easily done by rubbing the fronds with a thick piece of cloth. Some prefer to remove the hairy skin which is quite thin and is easily peeled off. The fronds are then cut into small pieces and cooked as per choice.

Ingredients:

Fronds of *lingad* or *lingdu*, 1 kg; mustard oil, 2-4 table spoons; coriander powder, 1 tea spoon; fenugreek powder, 1/2 teaspoon; cumin seeds, 1 tea spoon; turmeric powder, 1 tablespoon; red chillies, 2-4; medium sized chopped onion, 1-2; chopped garlic cloves, 4-6; salt according to taste; curd, 3-4 cups; chopped green coriander leaves, 1/2 cup amount; garam masala, 1/2 tablespoon.

Method:

The fronds are chopped into pieces and boiled. These are then stir fried after adding salt and spices in the same sequence as listed above and eaten as vegetable with *chapatis*. To prepare *curries* add curd and cook for another 10 to 15 minutes. Add garam masala to the recipe and garnish it with chopped green coriander leaves and serve hot with rice.

Pickle from fronds of *lingad* or *lingdu*, is also prepared, which is famous in the Himachal Pradesh and is usually served with local traditional bread like preparations 'kachouri' and 'siddu' in local, regional and national fair.

Pickle:

Ingredients:

Fronds of *lingad* and *lingdu*, 1 kg; mustard oil, 1/2 liter; coriander powder, 1-2 tablespoon; fenugreek powder, 3-4 tablespoons; cumin seeds, 1 tablespoon; turmeric powder, 1 tablespoon; red chillies, 10-12; salt according to taste; mustard seed powder; 1-3 tablespoon.

Method:

The fronds are cut into small pieces, boiled for 2 minutes and dried in full sunlight for 4 to 5 hours. Now in hot mustard oil these are mixed with spices listed above. Add to it mustard seed powder to make it sour and place inside a ceramic jar in full sunlight for 5-19 days. After 10 to 15 days it is ready to eat.

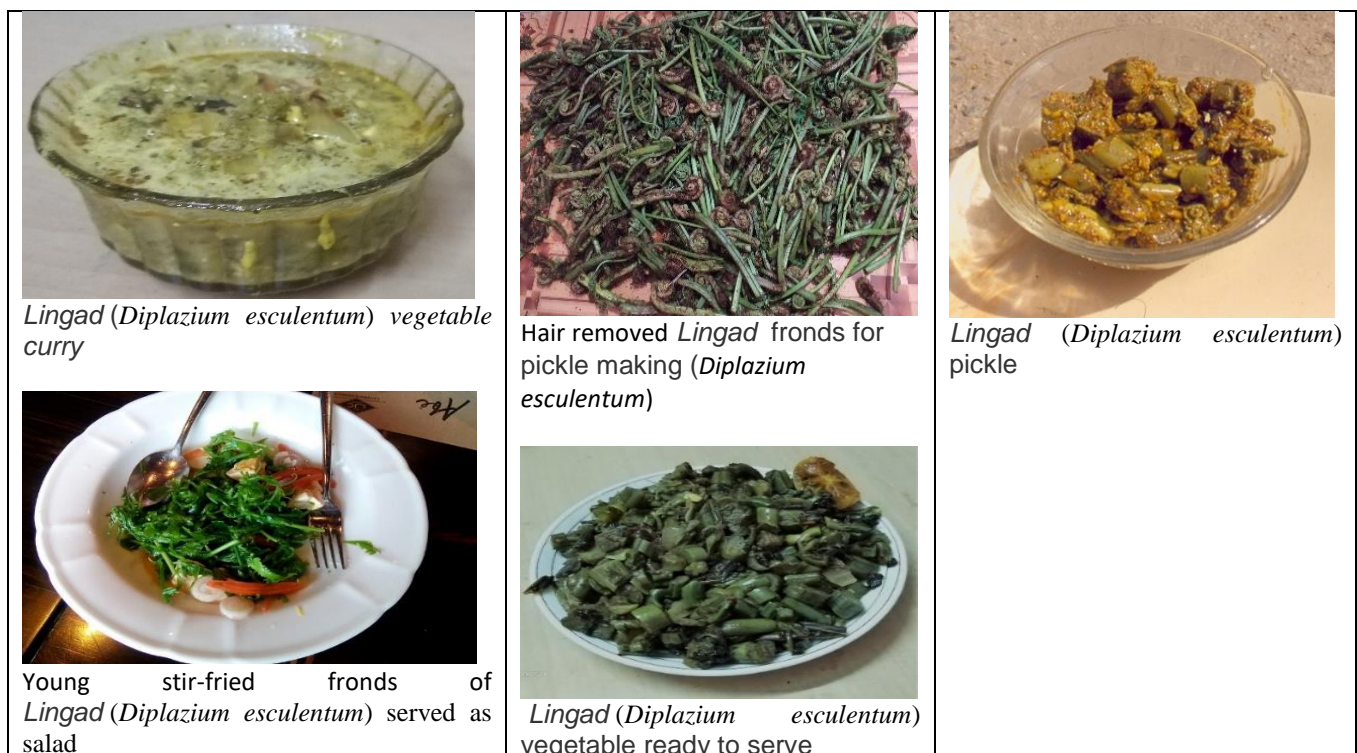


Fig.3. Images showing traditional edible uses of *Diplazium esculentum* and *Pteridium aquilinum*.

Harvesting Fronds:

The young hairy, blackish green fronds of *lingad* (*Diplazium esculentum*) are the edible part used in cooking. As soon as the weather starts warming up after winter, new fronds start emerging as a coil. This coil keeps

growing upwards and is harvested when it is 15 to 20 cm long. *Lingad* (*Diplazium esculentum*) frond are harvested and fit for cooking only at this stage. These are around 1 cm thick at base, 6 – 9 inches long, erect but coiled at the apex. These fronds are in fact leaf stalks with developing

leaves at the top. Afterwards, the leaves open up, increase in size and the succulent stem turns woody, no longer fit for cooking. Therefore, it has a limited season. Fig.4

Only tender fronds of these wild ferns are used in cooking, that starts emerging from mid-April are suitable for cooking vegetable and pickle. Their season continues for about ten to twelve weeks.

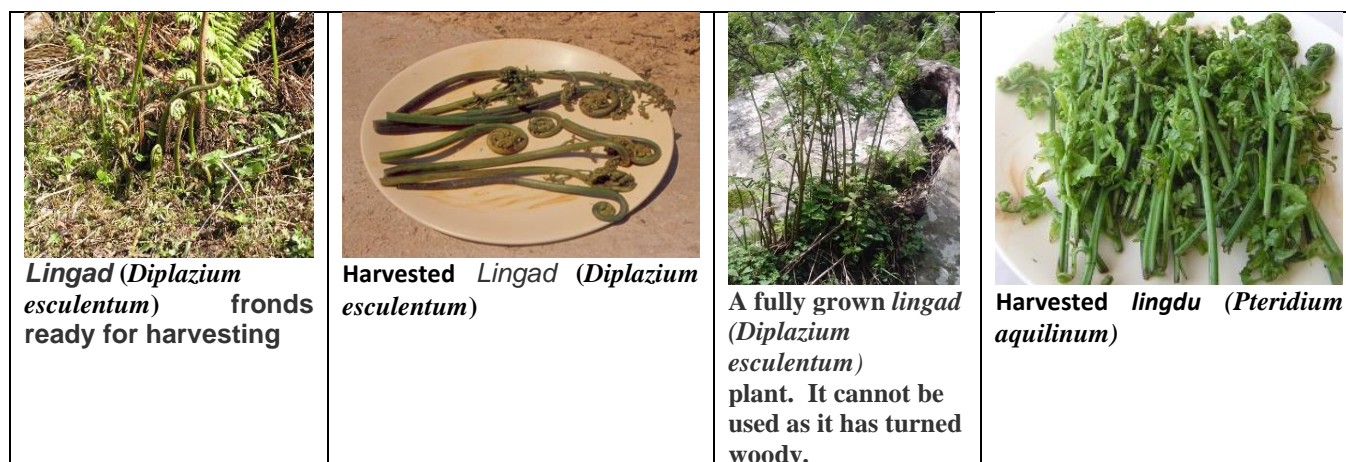


Fig. 4. Images showing harvesting of *Diplazium esculentum* and *Pteridium aquilinum* fronds.

Food value:

The young tender fronds of *lingad* (*Diplazium esculentum*) are mucilaginous. One hundred grams of fresh fronds contain 91.3 g moisture, 1.0 g protein, 100 mg fat, 1.4 g fibre, 600 mg of mineral matter. They also contain 0.98 mg/100 g of beta carotene. [28]

Pteridium aquilinum fronds, both fresh as well as boiled, are known to have antioxidative activities higher than alpha tocopherol. These are low in beta-carotene, medium in Vitamin E, and low in riboflavin, ascorbic acid, calcium and iron. The protein content is 3.2 per cent pp [29].

Medicinal Uses:

Locally decoction of *lingad* (*Diplazium esculentum*) leaves is used as a tonic for women after child birth. Traditionally *lingad* (*Diplazium esculentum*) is used in many medicine [30]

The young shoots of *Pteridium aquilinum* are diuretic, refrigerant and vermifuge [31] They have been taken as a treatment for cancer [32,33]. The leaves have been utilized in a steam bath as a treatment for arthritis [32]. A poultice of the pounded fronds and leaves has been used to cure sores of any type and also to bind broken bones in place [32]. A decoction of the plant has been used in the treatment of tuberculosis [31, 32]. It's root is antiemetic, antiseptic, appetizer and tonic [32]. A tea is also made from the roots that is used in the treatment of stomach cramps, chest pains, internal bleeding, diarrhoea, colds and also to expel worms [32,33]. The poultice of root is applied to sores, burns and caked breasts [32].

Role of Lingad (*Diplazium esculentum*) and lingdu (*Pteridium aquilinum*) in capacity building and entrepreneurship development for rural prosperity: Fig.5.

Lingad (*Diplazium esculentum*) and *lingdu* (*Pteridium aquilinum*) play important role in rural prosperity,

capacity building and entrepreneurship development. *Lingad* (*Diplazium esculentum*) is a good source of earning for the villagers, particularly for the women and children. A discussion with *lingad* sellers of Mandi town revealed that on an average about 100 kg of *lingad* was sold daily at Mandi town only in a season spanning 80 days. This quantity is worth of rupees 3,20,000 at an average price of rupees 40 a kg. *Lingad* is sold in all the big and small towns of District Mandi like Sundernagar, Nerchowk, Kotli, Rewalsar, Chalchowk, Sarkaghat, Mandi sadar, Jogindernagar, karsog, Padhar etc. So, the total annual trade in *lingad* must be worth several lakh rupees.

Lingad has to be collected from odd and difficult places from forests which are located deep inside the natural forests of hilly region around Mandi district. *Lingad* sold at main Mandi town comes from Chail chowk, Kandhi, Gohar areas and the sellers are mostly from Kataula, Mandi and kamand area. The villagers visit the forest to harvest *lingad* in groups of 3 to 4. A person cannot carry more than 25 kg at a time as it has to be carried on head on arduous forest pathways. The fronds are then cleaned, cut and made into small bunches at home, mostly during the night. According to *lingad* sellers, a 60 kg lot of *lingad* collected from forest costs them around 700 rupees including labour and bus fares. They say that one can make about rupees 200-250 a day from its selling. 40 years old Begi Devi, who has been selling *lingad* at Mandi town for the past seven years, says her net profit from *lingad* selling last year was rupees 20,000.

Lingad cost significantly increases after value addition it is processed into pickle and sold at the cost of Rs 400 to 450/kg. *Lingad* pickle is very much liked by inhabitants of study area and usually served with local traditional dishes 'kachouri' and 'siddu'.in famous Shivratri International fair of Mandi District. *Lingad* pickle is in

great demand and members of various Self-Help Groups of Mandi area sell it at Seri munch of Mandi town every Saturday (SHG fair) round the year. Pickle is also available in local markets in different tehsils of District Mandi and also served to tourists in *Dhavas* and hotels.

Tender fronds of *lingdu* (*Pteridium aquilinum*) are collected by villagers from the forest and made into small bunches and sold in nearby towns for anywhere up to 80 rupees a kg.



Fig. 5. Images showing commercial use and selling of *Diplazium esculentum* and *Pteridium aquilinum* fronds.

No fear of extinction:

The happiest part of *lingad* (*Diplazium esculentum*) and *lingdu* (*Pteridium aquilinum*) selling and harvesting is that unlike other useful plants harvested from the wild, there is no decline in the natural population of these ferns. All the *lingad* (*Diplazium esculentum*) sellers opined unanimously that the availability of these ferns in the forest has remained the same and unaffected, which might be because these ferns are not dug up like medicinal herbs. As the individual fronds are cut at the ground level, the natural regeneration remains unaffected.

IV. CONCLUSION

Wild edible fern *Lingad* (*Diplazium esculentum*) and *lingdu* (*Pteridium aquilinum*) are closely intermingled with lifestyle of local people of this region. These are excellent easy source of food and earning for the local people and play important role in uplifting the socio-economic status of rural community of Mandi District.

Discussion

Fern *Lingad* (*Diplazium esculentum*) and *lingdu* (*Pteridium aquilinum*) are an excellent source of livelihood option and people can make money by selling them fresh in growing season and in the form of pickle round the year. These can be harvested from natural habitat without any fear of extinction and offer many advantages from other commercial food crops like these are free from chemical fertilizers, offer variety to our food plate and are rich in nutrient. So, these need to be more popularised as important wild vegetables in local, state or national market and should be served in *dhabas* and hotels.

Recommendation:

At present these ferns are only harvested from wild habitat only and their marketing is limited. In many places their

harvesting is very difficult and time consuming, So, these ferns need to be cultivated and domesticated in large scale for easy harvesting and broadening their marketing or economic potential. These wild ferns as an organic food need to be entered in large scale in the menu of many famous restaurants and hotels of the state and country.

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