combinant allergens and the allergenic epitopes will help in designing appropriate immunotherapeutic vaccine which has proved to be the most successful treatment for allergic rhinitis.


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Role of medicinal plants in the traditional health care system: A case study from Nanda Devi Biosphere Reserve

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Tolchha-Bhotiya sub-community, inhabiting the buffer zone villages of Nanda Devi Biosphere Reserve, has strong faith and belief in traditional health care system, viz. herbal treatment. Twenty-five plant species are generally being used along with other materials and plant products in different combinations to cure fifteen major diseases. About eight and nine plant species are used for curing more than one disease. However, for some rare and serious diseases like tuberculosis, rheumatism, internal wounds and fractures, a few people, particularly those belonging to higher income group, prefer allopathic treatment. Since the knowledge of various medicinal plants being used in herbal treatment and their method of use is confined to local practitioner – *vaidhya* – it is of utmost importance to record this knowledge for future generations, otherwise it will be lost forever in the process of acculturation, which is taking place in the community at an alarming rate.

The Nanda Devi Biosphere Reserve (NDBR) was established on 18 January 1988 under the UNESCO's Man and Biosphere programme (MAB), and is located in the northern part of western Himalaya. The Reserve comprises of a central core zone (624.62 km²) surrounded by a buffer zone (1612.12 km²). In 1992, it was declared as one of the world's heritage sites by the World Heri-

1For correspondence.
tage Committee. It includes an area of reserve forests, civil forests, panchayat forests and farmlands. A total of 17 villages are situated in the buffer zone of NDBR, of which ten villages fall in Garhwal (district Chamoli) and seven villages in Kumaon (districts Pithoragarh and Bageshwar). Four villages are presently uninhabited.

The present study was carried out in the ten buffer zone villages in Chamoli district of Garhwal Himalaya which has a total population of 2253. From geomorphological point of view, the buffer zone occupies the entire Rishi Ganga catchment (a tributary of Dhauli Ganga), which is encircled by Higher Himalayan peaks, particularly Nanda Devi, India's second highest peak which flanks the northern part of the reserve (Figure 1). The climatic year consists of three seasons; summer (April to June), rainy (June to September) and winter (October to February). Average rainfall is 928.81 mm. Monthly maximum and minimum temperature ranges between 24.0°C and 14.0°C and 7.5°C and 3.0°C respectively.

A study of Tolchha-Bhotiya sub-community, which belongs to the Indo-Mongolid ethnic group, was undertaken. The members of this sub-community inhabit the buffer zone and mainly occupy the forested regions. The rural settlements are located in the altitudinal limit of 2200 to 3600 amsl. Except for residents of Reni, Lata, Peng, Phagti and Tolma villages, all households of Tolchha-Bhotiya sub-community have two permanent dwellings; one in the high altitude between 2200 and 3600 amsl, and the other in the lower valley between 800 and 1500 amsl. Literacy in these villages was recorded around 36.7%. Almost all the households are involved in agriculture on rainfed terraces. Livestock comprises cows, bullocks, sheep, goat, horses and mules. Wild resources of plant and animal origin make a significant contribution to food security. The inhabitants of the community mostly rely on traditional remedies which use medicinal plants, both cultivated as well as gathered by them. For diagnosis and treatment of their medical problems, they prefer to consult vaidiyas (local medical practitioners). These local healers use a variety of medicinal plants, the side effects of which are either rare or not known. Other ancient systems of medicine such as Ayurveda, Unani and Homeopathy also make such claims.

Though several studies on plant use by different tribal communities in their traditional health care system have been carried out in different parts of Himalaya1-7, studies of the present nature, particularly on the Tolchha-Bhotiya sub-community, are not available. Moreover, rapid acculturation is taking place in Bhotiya community, resulting in erosion of traditional values and indigenous knowledge of health care available with vaidiyas. The present paper is an attempt to supply: (i) the dependence of the Bhotiya tribe on herbal and allopathic treatment for curing some of the ailments, (ii) the contribution of medicinal plants in herbal treatment, and (iii) documentation of indigenous knowledge related to composition of medicinal plants in various drugs and the method of prescribing these drugs.

A detailed household survey was conducted, involving all (419) households of the ten buffer zone villages of NDBR. The head of each household was interviewed to understand their dependence on herbal and allopathic treatment. The respondents were categorized into three different income groups: poor, medium and rich. The information thus collected was confirmed by field observations during a two-year study where the plant species being used under local names, were identified with their scientific names and parts of the plant used were assessed. The information related to quantity/dosage of medicine prepared from different medicinal plants and prescribed to the patient for particular period of time was obtained from the local medical practitioners.

Most of the respondents (92-93%) were found to depend on herbal treatment and for the fifteen major ailments assessed in detail for the present study (Figure 2), the dependence ranged between 95 and 96% of households. Only 7-8% households preferred allopathic treatment and, that too, for particular diseases like tuberculosis, rheumatism, asthma, fracture, etc.

Likewise, among the different income group categories, in all the ten buffer zone villages, people belonging to the poor income group chose herbal treatment compared to people of medium- and rich-income groups.
Figure 2. Dependency on traditional health care system (herbal) and allopathic treatment for different ailments.

Figure 3. Dependency on traditional health care system (herbal) and allopathic treatment by the people of different income groups of buffer zone villages of NDBR.

(Figure 3). Survey showed that about 5–25% households in 8 villages belong to rich income group, 3–5% households in six villages to medium income group and 2–5% households in three villages to poor income group preferred allopathic treatment for some specific ailments. In contrast, all the households in Dronagiri and Garpak villages were found to be totally dependent on herbal treatment even for serious ailments.
<table>
<thead>
<tr>
<th>Disease</th>
<th>Plant species used</th>
<th>Composition of medicine and their use method</th>
<th>Doses of medicine prescribed to the patient at a time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>*Pleuraxpermum angelicoides (DC.) CL.  **Chippi&lt;br&gt;*Orchis latifolia (L.) **Hathazari&lt;br&gt;*Picrorrhiza kurooa (Royle ex Benth) **Katuki</td>
<td>50 g root of <em>P. angelicoides</em>, 10 g of cumin seed and 7–8 grains of black pepper milled together and boiled with 200 ml water on moderate flame up to 5–10 min and kept for cooling. The liquid is drunk to cure fever. 50 g tuber of <em>O. latifolia</em> boiled with 200 ml water and the decoction is obtained which is mixed with one spoon sugar and 10 g seed of coriandrum and further boiled up to 5–10 min on moderate flame with 200 ml water. This juice is drunk to cure fever. 20 g of root placed in 200 ml water for 2–3 h and then mixed with 5 g black pepper powder. Liquid is drunk to cure fever.</td>
<td>4 spoons (3) 2 spoons (3) 40 ml (2)</td>
</tr>
<tr>
<td>Headache</td>
<td><em>Aconitum heterophyllum</em> Wall. Ex Royle **Atis&lt;br&gt;Rhododendron anthopogon (D. Don) **Awon&lt;br&gt;Cicerbita macrorhiza (Beauv.) **Katari **Nardostachys grandiflora (DC.) **Jatamansi&lt;br&gt;Pinseepia utilis (Royle) **Bhainkal&lt;br&gt;Cirtium vesutum (D. Don) **Biskanara</td>
<td>Root paste applied on the forehead to cure headache 100 g powder of dried leaves mixed with 1 spoon sugar and 200 ml water added into it and boiled for few minutes. After cooling juice is drunk to cure headache. Juice of fresh leaves is drunk and paste of root rubbed on the forehead to cure headache.</td>
<td>5 g (2) 20 ml (2) 6–7 drops (3)</td>
</tr>
<tr>
<td>Rheumatism</td>
<td><em>Nardostachys grandiflora</em> (DC.) **Jatamansi&lt;br&gt;Prinseepia utilis (Royle) **Bhainkal&lt;br&gt;Carica vesutum (D. Don) **Biskanara</td>
<td>10 g paste of root mixed with 50 g ghee (purified semi liquid butter), mildly heated for 5 min and soon after, rubbed on the joints to cure rheumatism.</td>
<td>10 g (4) 6–7 drops (2) 4–5 drops (4)</td>
</tr>
<tr>
<td>Dyspepsia</td>
<td><em>Picrorrhiza kurooa</em> (Royle ex Benth) **Katuki&lt;br&gt;Smlacena purpurea (Wall) **Payanu&lt;br&gt;<em>Aconitum heterophyllum</em> Wall. Ex Royle **Atis&lt;br&gt;<em>Orchis latifolia</em> (L.) **Hathazari **Pleuraxpermum angelicoides (DC.) CL. **Chippi&lt;br&gt;Paeonia emodi (Wall ex Royle) **Chandra</td>
<td>50 g dried root milled along with 2 spoons sugar and 5 g dried leaves of <em>Crocus sativa</em>. Powder eaten to cure dyspepsia. 50 g dried leaves fried in 4–5 spoons oil of <em>Prunus persica</em> (Kiroi) and consumed to cure dyspepsia. 50 g tuber boiled with 400 ml water to prepare decoction of 100 ml which after two spoons sugar are added and drunk to cure diarrhoea. 100 ml decoction of <em>O. latifolia</em> tuber mixed with 20 g root powder of <em>P. kurooa</em>. Liquid is drunk to cure diarrhoea. 50 g root paste of <em>P. angelicoides</em> mixed with 20 g dried leaves of <em>Allium</em> spp. and fried with 3 spoons ghee and eaten to cure diarrhoea.</td>
<td>20 g (2) 20 g (4) 20 ml (2) 14–15 ml (2) 20 g (2)</td>
</tr>
<tr>
<td>Tooth ache</td>
<td><em>Potentilla falcins</em> (Wall ex Hook) **Bhradanti&lt;br&gt;Sausurea costus (Falc.) Lipsch **Kut&lt;br&gt;<em>Picrorrhiza kurooa</em> (Royle ex Benth) **Katuki</td>
<td>Paste of the root used as an ointment around the infected teeth.</td>
<td>5 g (1)</td>
</tr>
<tr>
<td>Stomach ache</td>
<td><em>Carum carvi</em> (Linn.) **Kalajeora&lt;br&gt;Megacarpova polyandra (Benth.) **Baruna</td>
<td>100 ml decoction of the <em>S. costus</em> tuber mixed with 4–5 drops of oil of <em>Prunus armenica</em> and ½ spoon of salt. A few small drops of this product are placed on infected teeth to cure toothache. 50 g root dipped in 200 ml water for 2–3 h and afterwards 2 spoon honey is added into it and mixture drunk to cure stomach-ache. 20 g seed of <em>C. carvi</em> milled with 5 g sindhi salt and 10 g root of <em>S. costus</em> and eaten to cure stomach-ache. 100 g dried leaves of <em>M. polyandra</em> mixed with 10 g bark powder of <em>Taxus baccata</em>, and fried in 2–3 spoons of ghee and eaten to cure stomach-ache.</td>
<td>1 spoon (2) 3 spoon (1) 10–15 g (2) 20 g (3)</td>
</tr>
</tbody>
</table>
### Table 1. (Continued)

<table>
<thead>
<tr>
<th>Condition</th>
<th>Plant Species</th>
<th>Description</th>
<th>Doses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wounds and cuts &amp; boils</td>
<td><em>Saussurea ambvalata.</em> (DC.) Edgew. <strong>Brahim kamal</strong> <em>Cirsiurn vesutum.</em> (D. Don) <strong>Biskanara</strong> <em>Rheum webbianum.</em> (Royle) <strong>Tarir</strong></td>
<td>100 ml decoction of dried leaves mixed with 1/2 spoon of salt and few drops of this applied in the infected portion to cure boils, cuts and wounds. Juice of fresh leaves mixed with 3-4 drops of mustard oil and applied externally on the infected portion to cure boils and wounds. 100 g powder of dried leaves mixed with 2 spoons of mustard oil and paste rubbed externally to cure boils and wounds.</td>
<td>20 ml (2)</td>
</tr>
<tr>
<td>Asthma</td>
<td><em>Allium humile.</em> (Kunth.) <strong>Pharan</strong> <em>Betula utilis.</em> (D. Don) ex Benh. <strong>Bhojpatra</strong> <em>Megacarpae polyandra.</em> (Benth.) <strong>Barmoa</strong></td>
<td>5 g dried leaves of <em>A. humile</em> and 10 g root powder of <em>S. costus,</em> fried in 2 spoons ghee and eaten to cure asthma. 50 g resin of <em>B. utilis</em> milled with 20 g leaf powder of <em>P. emodi</em> and fried in 2 spoons oil of <em>P. armenica</em> oil and drunk to cure asthma. 100 ml root decoction of <em>M. polyandra</em> mixed with 1 spoon sugar and 4-5 drops of <em>P. armenica</em> oil and drunk to cure asthma.</td>
<td>10 g (4)</td>
</tr>
<tr>
<td><strong>Tuberculosis</strong></td>
<td><em>Nepata discolor.</em> (Royle ex Benh.) <strong>Khirku</strong> <em>Cirsiurn vesutum.</em> (D. Don) <strong>Biskanara</strong></td>
<td>50 ml (3)</td>
<td>50 ml (4)</td>
</tr>
<tr>
<td><strong>Jaundice</strong></td>
<td><em>Picrorhiza kurrooa.</em> (Royle ex Benh.) <strong>Katuki</strong> <em>Saussurea costus.</em> (Falc.) Lipsch. <strong>Kut</strong></td>
<td>150 ml decoction of dried leaves mixed with 2-3 spoons honey and drunk to cure tuberculosis. 100 ml root decoction of <em>S. costus</em> mixed with 2 spoons honey and 50 ml milk and drunk to cure jaundice.</td>
<td>100 ml (5)</td>
</tr>
<tr>
<td><strong>Eye diseases</strong></td>
<td><em>Berberis aristata.</em> (Roxb. ex DC.) <strong>Chotru</strong> <em>Betula alnoides.</em> (D. Don) <strong>Kabhoj</strong></td>
<td>100 ml root decoction (juice) (root 100 g + water 250 ml), few drops applied to cure eye infection. 100 g ash of burn bark mixed with 2 spoons ghee and paste applied on the eye lid to cure eye diseases/eye infection.</td>
<td>2-3 drops (5)</td>
</tr>
<tr>
<td><strong>Cold and cough</strong></td>
<td><em>Hippophae rhamnoides.</em> (Serv.) <strong>Amesh</strong> <em>Betula utilis.</em> (D. Don) ex Benh. <strong>Bhojpatra</strong></td>
<td>100 ml decoction of fruit juice mixed with 1 spoon sugar and 30-40 g flour of <em>Eleusine coracana</em> and eaten to cure cold and cough. 50 g resin of <em>B. utilis</em> boiled with 250 ml water on moderate flame for 10-15 min and mixed with 2 spoons ghee and 1/2 spoon salt and drunk to cure cold and cough.</td>
<td>20 g (2)</td>
</tr>
<tr>
<td><strong>Hurt and fracture</strong></td>
<td><em>Saussurea ambvalata.</em> (DC.) Edgew. <strong>Brahim kamal</strong> <em>Pinus wallichiana.</em> (Jaccks.) <strong>Kail</strong></td>
<td>200 ml decoction of root or leaves mixed with 2-3 spoons oil of <em>Cedrus deodara</em> and applied externally to cure hurt. Resin of <em>P. wallichiana</em> mildly heated and used to plaster on fractured part which is immediately covered by the bark of <em>B. utilis</em> which reduces the pain and cures sprain and fracture.</td>
<td>100 ml (1)</td>
</tr>
<tr>
<td><em>Pregnancy</em></td>
<td><em>Betula utilis.</em> (D. Don) ex Benh. <strong>Bhojpatra</strong></td>
<td>100 g resin of <em>B. utilis</em> and 50 g seed kernels of <em>Prunus persica</em> (kirol) ground into paste and then mixed with 2 spoons honey. This is eaten by women during the period of pregnancy to provide internal strength and also to control miscarriage.</td>
<td>100 g (3)</td>
</tr>
<tr>
<td><strong>Juglans regia.</strong> (L.) <strong>Jangli skhrot</strong> <em>Orchis laetifolia.</em> (L.) <strong>Hathazari</strong></td>
<td>Oil extracted from the seed kernels mildly heated and rubbed on the swollen legs of the pregnant women. 200 ml decoction of the tuber of <em>O. laetifolia</em> flavoured with 200 ml milk and 2 spoons sugar and drunk by women during the period of delivery as a tonic.</td>
<td>20 ml (6)</td>
<td></td>
</tr>
</tbody>
</table>

*Very often used by the inhabitants.*
**Local name of the plants.
Values within parentheses indicate doses per day.

A total of 25 medicinal plant species were reported to be used by the local people in traditional health care system to cure fifteen major ailments in the buffer zone villages (Table 1). Among 25 medicinal plant species, 9 species were used to cure more than one ailment method of using these plants varied according nature of the ailment. In majority of the cases, a combination of leaves, stem, fruit and root/tuber is dru.
rubbed on the body to cure ailment(s). Mostly decoction is extracted by just crushing the plant parts in a mortar but sometimes plant parts are boiled with water, and the liquid decanted. Decoction of some plants is applied externally on the wounds or the infected part of the body. In some cases (skin ailments), the patient is given a bath of the decoction. Paste of some plants is plastered to set dislocated or fractured bones or for muscular sprain. Ailments like body ache, cuts, wounds, scabies, boils and skin diseases are treated by external application of the paste. In some cases, combinations of plants are used for best results. The rules of collection time, plant part, storing techniques and the method of preparation are largely known by local faith healers.

Due to illegal and excessive exploitation, populations of some of the medicinal plant species such as Aconitum heterophyllum, Podophyllum hexandrum, Orchis latifolia, Nardoschys grandiflora, Taxus baccata, etc. have now become rare, endangered and threatened. Furthermore, because of ban on legal collections, local medical practitioners were facing problems in getting appropriate plant parts of desired quantity for curing the various ailments. Detailed studies to assess the availability of medicinal plants in the Himalayan alpine pastures are limited because of a variety of constraints.

Since the traditional values, culture, faith and indigenous knowledge related to traditional health care system of Tolchha-Bhotiya sub-community are facing serious challenges due to acculturation, brought about by migration of the younger generation to cities and these urban migrants show a gap in the cultural beliefs and practices with those of the local inhabitants, the recording of indigenous knowledge based on traditional health care system becomes increasingly important.


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Induction of transplantable malignant tumours in mice by repeated short exposures to continuous wave (25 kHz) ultrasound

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40 Balb/C female mice were subjected to continuous wave ultrasound (25 KHz) exposure through the shaven abdomen at the rate of 60 s/day/mouse and 17 times within a span of 51 days. The treated animals along with an equal number of control (not exposed to ultrasound) ones were kept under observation till death or sacrificed for investigation. The exposed animals aged at a much faster rate (vis-à-vis control ones) with significant loss of hair, loss of mobility and wrinkled skin and died much earlier (life span 0.92 ± 0.4 years vis-à-vis 2.0 ± 0.5 years of the control ones). The exposed animals produced large amount of fluid with many abnormal carcinoma-like cells in the peritoneal cavity and each one of the 7 out of 10 animals sacrificed for investigation (vis-à-vis none in the respective control group) exhibited development of at least one tumour. The ultrasound-induced tumour cells could be transplanted from one strain of mice (Balb/C) to another strain (ICR) and vice-versa without any single failure for several times in succession.

ULTRASOUND is being increasingly used in biology and medicine. At the kHz frequency level, it is mostly used for laboratory purposes (breaking of cells, DNA, etc.), while at the MHz level of frequency it is generally used in short pulses for medical diagnosis and therapy. It is believed to be non-invasive and harmless to such an extent that even pregnant mothers are frequently subjected to ultrasound scanning. In fact, many investigators did not find any significant harmful effect of the diagnostic ultrasound. On the other hand, there are reports of the production of chromosomal aberrations and lung damage by the diagnostic ultrasound. While reviewing the possible biological effects of ultrasound, Dunn observed that (i) no short-term harmful effect of diagnostic ultrasound in humans had been reported and (ii) no long-term effect had been investigated.

Ultrasound produced cavitation and free radicals in particular, besides other effects in aqueous medium. Both at the kHz and MHz frequency levels, ultrasound has recently been shown to produce OH· free radicals in water at rates comparable to each other and

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