ORIGINAL ARTICLES

Ethnomedicinal wisdom of the Tripura tribe of Comilla district, Bangladesh: a combination of medicinal plant knowledge and folk beliefs

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ABSTRACT

The Tripura tribe is one of the well recognized indigenous communities of Bangladesh. They are scattered among several districts of the country, particularly in the southeastern districts. A Tripura tribal community was located in Comilla district. Since tribal medicinal practices, from our previous studies, have been seen to differ among the scattered communities of even the same tribe, an ethnomedicinal survey was conducted among the Tripura community in Comilla district to document their ethnomedicinal practices. It was observed that the tribal medicinal practitioners used a total of 31 medicinal plants in their various formulations, and which plants were distributed into 25 families. The nature of application of the formulations suggested that the tribal practitioners had a good knowledge of the medicinal properties of plants, but also possibly relied to some extent on common folk beliefs. The use of oil from several plants for topical applications suggested that the practitioners possessed good knowledge on the benefit of oil not only for therapeutic purposes, but also on the enhanced absorptive and emollient properties of oil when applied to the skin surface. A review of the relevant scientific literature showed that the use of a number of plants could be validated by existing scientific studies. But at the same time, the use of plants as garlands, or as in one instance, the use of cockroach for treatment, suggested that folk beliefs or maybe even superstitions have also entered the treatment methods of the practitioners. The various formulations of the practitioners were used for treatment of a variety of ailments, which included fever, coughs, swellings, skin infections, bleeding from external cuts and wounds, pain, diabetes, jaundice, spleen disorders, constipation, rheumatism, to lessen pain and blood loss during child delivery, vomiting, helminthiasis, enlargement of liver, dysentery, diarrhea, allergy, and asthma.

Key words: Medicinal plants, tribal medicine, Tripura, Bangladesh

Introduction

A number of indigenous communities are present in Bangladesh. While previous estimates put the number of these communities as less than twenty, recent ethnographic data suggests that the number may exceed even one hundred and fifty. Most of these communities are small and on the verge of assimilation with the Bengali-speaking mainstream population of the country. However, these communities are to a small or large extent still trying their best to maintain their unique cultural traditions, which include their traditional medicinal practices. However, it has to be admitted that most of their cultural traditions are getting diluted by external influences, more so because a number of these indigenous communities have converted to Christianity. Some have converted also to the Muslim religion. The intermingling of Christian, Muslim and indigenous cultures are slowly causing the gradual disappearance of tribal customs and beliefs.

Bangladesh has a small area but is rich in floral species. More than 5,000 floral species have been reported for this country and the number is increasing as more and more parts of the country are being thoroughly studied. Plants produce phytochemicals; many of the phytochemicals have found uses in allopathic medicine as cure for various ailments. Prior to a phytochemical being used as drug, it has to go through a number of pharmacological, toxicological and clinical studies. This makes the process time consuming and laborious. On the other hand, indigenous communities have a long history of using plants as medicines. As a result, close observation of any indigenous communities’ medicinal practices can enable a modern scientist to screen a particular plant for treatment of a specific ailment and to isolate and identify the relevant bio-active compound. Indeed, many important allopathic drugs, e.g. quinine or artemisinin, have been discovered in this manner.

Towards a thorough documentation of the medicinal potential of the country’s plant species, we have been conducting ethnomedicinal surveys among the tribal medicinal practitioners (TMPs) and the traditional folk medicinal practitioners (Kavirajes) of the country for a number of years (Nawaz et al., 2009; Rahmatullah et al., 2009a-c; Chowdhury et al., 2010; Hasan et al., 2010; Hossan et al., 2010; Mollik et al., 2010a,b; Rahmatullah et al., 2010a-g; Akber et al., 2011; Biswas et al., 2011a-c; Haque et al., 2011; Islam et al., 2011; Jahan et al.,
2011; Rahmatullah et al., 2011a,b; Sarker et al., 2011; Shaheen et al., 2011; Das et al., 2012; Hasan et al., 2012; Hossan et al., 2012; Khan et al., 2012; Rahmatullah et al., 2012a-d; Sarker et al., 2012). This has resulted in building up a medicinal plant data base of over 800 medicinal plants of the country, and the number is steadily increasing with newer ethnomedicinal surveys in newer regions and tribes of the country. The objective of the present study was to conduct an ethnomedicinal survey among the Tripura tribal community residing in Comilla district.

Materials and Methods

This study was conducted in Comilla Sadar Thana area of Comilla district. A Tipra Para was in the area. The Tripura tribe is also known as the Tipra tribe and Para means village. The community had two TMPs, one of whom was a Muslim and has joined the tribe and has been accepted by the tribe as one of the tribal community. The other was Hindu by religion and by birth was a tribal community member. Their particulars are given below.

1. Kamal Hossain, Muslim but has joined the tribe and is now considered as a member, age over 40 years, Comilla Cantonment Area, Kotbari, Comilla Sadar Thana, Comilla district
2. Subrata Tripura, age over 55 years, Tipra Para, Jammura, Comilla Sadar Thana, Comilla district

Informed consent was first obtained from the two TMPs. The TMPs were told about the purpose of our visit and consent obtained to disseminate any information obtained in national and international publications. A number of visits were made to the tribe to get acquainted with the TMPs and the tribal people and to build up rapport with them.

The TMPs could speak fluent Bengali and interviews of the TMPs were conducted in Bengali, which was also the language of the interviewers. Actual interviews were conducted with the help of a semi-structured questionnaire and the guided field-walk method of Martin (1995) and Maundu (1995). In this method, the TMPs took the interviewers on guided field-walks through areas from where they collected their medicinal plants, pointed out the plants and described their uses. Plant specimens were photographed and collected on the spot, pressed, dried and brought back to Dhaka for complete identification by Mr. Manjur-Ul-Kadir Mia, ex-Curator and Principal Scientific Officer of the Bangladesh National Herbarium.

Results and Discussion

The Tripura tribe is also known as Tipra or Tirpa tribe. Currently, they use the Bengali language for everyday use. However, they have their own language, which is known as Kokborok. Kok means language, and borok means humans in Tripura language, so the whole word translates into language of human beings.

Table 1: Medicinal plants and formulations of the Tripura tribe residing in Comilla district, Bangladesh.

<table>
<thead>
<tr>
<th>Serial Number</th>
<th>Scientific Name</th>
<th>Family Name</th>
<th>Local Name</th>
<th>Parts used</th>
<th>Disease, Symptoms, Formulations, and Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Andrographis paniculata Burm. f.</td>
<td>Acanthaceae</td>
<td>Chirota</td>
<td>Leaf, Flower</td>
<td>Fever arising suddenly during the night. 250g leaves are thoroughly cleaned and added to 300g water and boiled on an earthen oven. When the water has evaporated by approximately half, the mixture is strained to separate leaves from the decoction. 3-4 teaspoonfuls of the decoction are orally administered twice daily, in the morning on an empty stomach and following the afternoon meal. This is continued for 3-5 days. Also see Serial Numbers 7, 10.</td>
</tr>
<tr>
<td>2</td>
<td>Justicia adhatoda L.</td>
<td>Acanthaceae</td>
<td>Bashok</td>
<td>Leaf, root, flower</td>
<td>Coughs. 1 kg of leaves is thoroughly boiled in 1 p°a (local measure approximating 250g) water. The mixture is then strained to separate the liquid from the solid portions. One teaspoonful of the liquid portion is orally taken with honey thrice daily till cure. Tuberculosis. Two to three raw roots and flowers are chewed on an empty stomach once daily. At the same time, it has to be ensured that the patient gets a well-balanced diet. Also see Serial Number 10.</td>
</tr>
<tr>
<td>3</td>
<td>Achyranthes aspera L.</td>
<td>Amaranthaceae</td>
<td>Uth lengra</td>
<td>Stem</td>
<td>See Serial Number 15.</td>
</tr>
<tr>
<td>4</td>
<td>Amaranthus spinosus L.</td>
<td>Amaranthaceae</td>
<td>Kata maira</td>
<td>Leaf</td>
<td>See Serial Number 21.</td>
</tr>
<tr>
<td></td>
<td>Scientific Name</td>
<td>Family</td>
<td>Part Used</td>
<td>Condition/Use</td>
<td></td>
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<tr>
<td>5</td>
<td><strong>Crinum asiaticum</strong> L.</td>
<td>Amaryllidaceae</td>
<td>Leaf, fruit</td>
<td>Swelling of toe or leg fingers. At first, leaves of <em>Crinum asiaticum</em> are collected and thoroughly cleaned. Leaves are then crushed to obtain juice, which is mixed with oil obtained from seeds of <em>Ricinus communis</em>. The combination is warmed and massaged thoroughly on the swelled fingers or toes. Also see Serial Number 27.</td>
<td></td>
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<tr>
<td>6</td>
<td><strong>Mangifera indica</strong> L.</td>
<td>Anacardiaceae</td>
<td>Leaf</td>
<td>See Serial Number 21.</td>
<td></td>
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<tr>
<td>7</td>
<td><strong>Alstonia scholaris</strong> (L.) R. Br.</td>
<td>Apocynaceae</td>
<td>Sap</td>
<td>Skin infections. 5 tolas of sap of <em>Alstonia scholaris</em> are mixed with 5 tolas of pure mustard oil (oil obtained from seeds of <em>Brassica nigra</em>). The mixture is warmed for 15-20 minutes when it forms a cream. The infected area on the skin is thoroughly cleaned and the cream is applied to the area. Generally this is done for about a month. During this time, the patient is advised to drink water in which leaves of <em>Andrographis paniculata</em> have been soaked. During this time, any eating of beef, eggs and any type of fish is forbidden.</td>
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<tr>
<td>8</td>
<td><strong>Cosmos bipinnatus</strong> Cav.</td>
<td>Asteraceae</td>
<td>Flower petal</td>
<td>See Serial Number 10.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td><strong>Mikania cordata</strong> (Burm. f.)</td>
<td>Asteraceae</td>
<td>Stem</td>
<td>Bleeding from external cuts and wounds. Juice is obtained from crushed stems. The wounded area is then thoroughly cleaned and the juice topically applied. Then the place is bandaged with a clean cloth.</td>
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<tr>
<td>10</td>
<td><strong>Spilanthes paniculata</strong> Wall. ex DC.</td>
<td>Asteraceae</td>
<td>Flower, leaf</td>
<td>Toothache. 2-3 flowers are chewed 5-6 times daily and orally taken. This process will give a pungent taste to the mouth. Diabetes. Leaves and flowers of <em>Spilanthes paniculata</em> are mixed with flowers of <em>Andrographis paniculata</em>, leaves of <em>Coccinia grandis</em>, and flower petals of <em>Cosmos bipinnatus</em>. The combination is crushed to obtain juice. At the same time leaves of <em>Andrographis paniculata</em> and <em>Justicia adhatoda</em> are thoroughly dried and powdered. The powder and the juice are then mixed together. Pills prepared from the mixture are taken once daily (one pill per dose) for 21 consecutive days on an empty stomach.</td>
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<tr>
<td>11</td>
<td><strong>Terminalia arjuna</strong> (Roxb) W. &amp; A.</td>
<td>Combretaceae</td>
<td>Bark</td>
<td>Heart disorders, fluttering of heart. One kg of bark is boiled with 1 kg of cow milk till the liquid evaporates. Then the bark is dried in a cool place. The bark is then powdered in a ‘haman dista’. One spoonful of this powder is orally administered to the patient in the morning and evening with one spoonful of honey. This is done consecutively for 30 days.</td>
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<tr>
<td>12</td>
<td><strong>Kalanchoe pinnata</strong> (Lam.) Pers.</td>
<td>Crassulaceae</td>
<td>Leaf</td>
<td>Kidney stones. One poa of leaves is mixed with one poa camphor and 3 liters water and boiled till the volume is about 2 liters. Then the decoction is cooled and strained through a piece of cloth. One cup of the strained liquid portion is taken orally thrice daily for 21 consecutive days. The patient is then asked to urinate in a clear pot and the pot is inspected to determine whether the stone has come out.</td>
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<tr>
<td>13</td>
<td><strong>Brassica nigra</strong> (L.) Koch</td>
<td>Cruciferae</td>
<td>Seed oil</td>
<td>See Serial Numbers 7, 18, 27.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td><strong>Coccinia grandis</strong> (L.) Voigt</td>
<td>Cucurbitaceae</td>
<td>Leaf, stem, fruit</td>
<td>Diabetes. Leaves and stems are cleaned and crushed in a ‘haman dista’ (iron mortar and pestle, manufactured locally) with a little water to obtain juice. The juice is regularly taken orally to keep blood sugar under control. The amount of juice to be taken daily is determined by the Kaviraj. Fruits are fried in soybean oil and eaten as vegetable to also control diabetes. Also see Serial Number 10.</td>
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</table>
| 15 | *Cuscuta reflexa* Roxb. | Cuscutaceae | Swarno lota | Stem | Jaundice. The stems of *Achyranthes aspera* are first sliced into small pieces. The slices are made into a garland with the stem of *Cuscuta reflexa*. The garland is worn around the head by the jaundiced patient. The garland slowly gets bigger with time and reaches the legs. The more the garland gets bigger, the more the jaundiced patient gets cured. Generally it takes 20-25 days.

16 | *Cyperus rotundus* L. | Cyperaceae | Badar chora | Bark, root | Splenic disorders. One kg bark is boiled in 3 kg water for 2 – 2.5 hours. ½ cup of the water is taken daily orally for 21 days. Indigestion. Juice obtained from crushed root is orally taken.

17 | *Ricinus communis* L. | Euphorbiaceae | Veron, Verenda | Seed oil | The seeds are first thoroughly cleaned and then crushed followed by boiling with water. Oil within seeds will then float on the water. The water is dried and the oil collected for treatment of various ailments. To lessen pain and blood loss during delivery of pregnant women. ½ tola oil is mixed with 1 tola water and orally administered to pregnant women during delivery. Constipation. Vegetables are fried in 1 tola oil and eaten. Skin infections. 1 tola of seed oil from *Ricinus communis* mixed with one tola of seed oil from *Sesamum indicum* to make a cream. The cream is then applied topically to affected areas of skin with a piece of cotton. Note that nail scratching has to be avoided during application of the skin. Also see Serial Numbers 5, 18.

18 | *Desmodium gangeticum* (L.) DC. | Fabaceae | Chalani | Whole plant | Rheumatism. Whole plants are thoroughly cleaned and slightly crushed in a ‘haman dista’. The juice obtained following crushing is then put in an earthen vessel and boiled in with water. This process releases oil from the juice, which floats on the water. The boiling is continued till the water evaporates leaving the oil in the vessel. The oil is then thoroughly applied to the parts of the body affected with rheumatism. Occasionally, oil obtained in the above manner from *Desmodium gangeticum* whole plant is mixed with oil obtained from seeds of *Ricinus communis* and mustard oil (oil obtained from seeds of *Brassica nigra*) to improve its effectiveness.

19 | *Mentha spicata* L. | Lamiaceae | Bala pata | Leaf | Continuous vomiting. Two teaspoonfuls of juice obtained from crushed leaves are orally taken thrice daily. Foul odor in mouth. Two clean leaves are thoroughly chewed followed by gargling of mouth with clean water. The mouth will then feel cold and fresh.

20 | *Ocimum tenuiflorum* L. | Lamiaceae | Tulshi | Leaf | Coughs. Leaves of *Ocimum tenuiflorum* are crushed or macerated to obtain juice. One teaspoonful of juice is taken orally with honey, ginger slices (rhizome of *Zingiber officinale*), and dried floral buds of *Syzygium aromaticum* thrice daily.

21 | *Sida rhombifolia* L. | Malvaceae | Biledi | Root, whole plant | Helminthiasis. Roots of *Sida rhombifolia* are dried and powdered and mixed with powdered seeds of *Nigella sativa*. A little amount of pure mustard oil is added to the mixture and thoroughly mixed. Pills are prepared from the mixture and dried thoroughly under the sun. Pills are kept in a tight container. Two pills are taken orally daily in the morning with slices of rhizomes of *Zingiber officinale* till cure. Jaundice (arising from hepatic disorders). Whole plants of *Sida rhombifolia* are crushed with a little water in a ‘haman dista’ (iron mortar and pestle, manufactured locally) with leaves of *Amaranthus spinosus* and leaves of...
| No. | Plant Name | Family | Part Used | Disease/Condition
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</thead>
<tbody>
<tr>
<td>22</td>
<td><em>Azadirachta indica</em> A. Juss.</td>
<td>Meliaceae</td>
<td>Leaf, Stem</td>
<td>Skin disorders. Leaves are boiled in water followed by bathing in the warm water daily. At the same time, pills made from macerated young leaves are dried under the sun. Two pills are taken daily for 7 days. Tooth infections, foul odor in mouth. Teeth are brushed with stems. This process also removes foul odor from the mouth.</td>
</tr>
<tr>
<td>23</td>
<td><em>Streblus asper</em> Lour.</td>
<td>Moraceae</td>
<td>Leaf, stem</td>
<td>Coughs. One teaspoonful of juice obtained from crushed leaves is taken thrice daily with talnishri (crystalline sugar prepared from sap of <em>Borassus flabellifer</em> L. (Arecaceae)) till cure. Respiratory difficulties. Stems are worn as garland around the neck. This is generally done for 20-21 days and by this time the patient is usually cured. To remove fear from mind. Juice obtained from crushed leaves of <em>Streblus asper</em> and <em>Xeromphis spinosa</em> is taken orally.</td>
</tr>
<tr>
<td>25</td>
<td><em>Sesamum indicum</em> L.</td>
<td>Pedaliaceae</td>
<td>Seed oil</td>
<td>See Serial Number 17.</td>
</tr>
<tr>
<td>26</td>
<td><em>Nigella sativa</em> L.</td>
<td>Ranunculaceae</td>
<td>Kalo jeera</td>
<td>See Serial Number</td>
</tr>
<tr>
<td>27</td>
<td><em>Xeromphis spinosa</em> (Thunb.) Keay</td>
<td>Rubiaceae</td>
<td>Fruit, thorn</td>
<td>Enlargement of liver. Ripe fruits are collected and soaked in mustard oil (oil obtained from seeds of <em>Brassica nigra</em>) and for 15-20 days kept in the sun for drying. Pickles are then made from the dried fruits. 2-3 fruit pickles are taken each day. Note that the fruits are sweet in taste. Alternately, 7 thorns of <em>Xeromphis spinosa</em> and fruits of <em>Citrus asiaticum</em> are cleaned and placed on the patient’s navel. Then a flame is lit in an earthen vessel containing ghee (clarified butter) and also placed on the patient’s navel. Then the name of the patient and the name of the disease are uttered. Then the patient’s name is written on a thorn and each thorn is individually stuck into one fruit. The thorn pierced fruits are then placed over an oven. The more the fruit dries up, the more the patient improves. Generally this process is done over 7 days. Also see Serial Number 23.</td>
</tr>
<tr>
<td>28</td>
<td><em>Aegle marmelos</em> (L.) Corr.</td>
<td>Rutaceae</td>
<td>Bael</td>
<td>Dysentery. Young fruits are cut into small pieces and dried under the sun. 2-3 of the dried pieces are soaked in water and the mixture taken orally with molasses. Depending on the severity, the treatment can be continued up till 7 days. During this period of treatment, the patient is forbidden to eat <em>Tenualosa ilisha</em> Family: Clupeidae, local name: ilish, English name: hilsa) fish or beef. Diarrhea. This medication is given to patients without informing the patient. One tola (local measure approximating 12.5g) of the hard skin of the fruit is powdered and mixed with a little amount of mustard oil. Pills are prepared from the mixture. Pills are taken thrice daily for 7 days. During this treatment period, patients are forbidden to eat fruits of <em>Tamarindus indica</em> L. (Family: Fabaceae, local name: tetul, English name: tamarind).</td>
</tr>
<tr>
<td>29</td>
<td><em>Glycosmis pentaphylla</em> (Retz.)</td>
<td>Rutaceae</td>
<td>Leaf, stem</td>
<td>Helminthiasis. One poa of leaves and 3 talas of water are boiled in an earthen stove till the amount reaches 2 talas. The decoction is then</td>
</tr>
</tbody>
</table>
strained to separate leaves from the liquid portion. One teaspoonful of the liquid is orally taken at night for 3 consecutive days. Note that the patient should be more than 10 years old. Tooth infections, swelling of gums. Teeth are brushed with stems.

30  **Datura metel L.**  Solanaceae  Dhatura  Leaf, root  

Allergy. Leaves are dried and powdered. A little amount of pure mustard oil or honey is then mixed with the powder. Pills prepared from the mixture are dried in the sun. One pill is administered orally in the morning each day till cure.

Asthma. Roots are collected, washed, thoroughly dried and powdered. A banana is then halved and a small hole made in one of the halves. Half teaspoon of powder and a small cockroach (*Ectobius pallidus*, tawny cockroach, Blattellidae) is then put inside the half and the halves joined by pressing the halves together. The banana is then orally administered to the patient.

31  **Zingiber officinale**  Roscoe  Zingiberaceae  Ada  Rhizome  

See Serial Numbers 20, 21.

The Tripuras claim to have come to their present dwelling place from Agartola in Tripura district of India. It is to be noted that during British rule in India and prior to partition in 1947, Comilla district of present Bangladesh used to be part of Tripura State of then undivided India. Following partition in 1947, Comilla district became part of the then East Pakistan, the eastern part of Pakistan. Since 1947, the Tripuras have settled in Comilla district. The Tripuras reside in the southwest region of Comilla district among the Jammura and Lalmi Hills. Generally 15-20 families reside in any given area. At present, 40-50 families are residing among the Jammura and Lalmi Hills.

The Tripuras are ‘Sonaton’ Hindus by religion. However, some have converted to Christianity and a minority section has become Muslims. As a result of staying among the mainstream Bengali-speaking population, the Tripuras have now adopted a large portion of Bengali culture. Previously, when their present dwelling place used to be densely forested, the Tripuras used to live in houses made of bamboos called ‘machangs’. The main house would be built about 5 feet from ground level. Nowadays they live like other Bengali-speaking people in houses built on level land. Their houses are now built from either tin or soil.

On the whole, the Tripuras are economically poor. Their main occupation is agriculture. They cultivate on the slopes of hills, which is known as ‘jhum’ cultivation. In this form of cultivation, two or more crops are cultivated in the same field. The different crops are harvested at different time periods, when the particular crop has matured and is ready for harvesting. Following one cultivation period, cultivation is not done on the same tract of land for a number of years. During this time, the Tripuras burn bamboo and other plants and trees on the previously cultivated land and mix the ashes with the soil. The burning process on the land also gets rid of soil pests and increases the fertility of the soil. Those Tripuras who cultivate on plain land cultivate like the Bengali settlers, i.e. they use the same land for cultivation year after year. Some Tripuras own shops in two nearby markets known as Cantonment Market and Saber Market. Women from some Tripura families also nowadays augment the family income through weaving clothes and making other utensils at home.

Because of staying for a long time with the Bengali-speaking population, the Tripuras currently do not perform their previous festivals and rituals. However, some festivals are performed, among which the main festivals are ‘Baishu’ or New Year festival and performing various types of dances on occasions. New Year festival is celebrated on the last two days of the Bengali month of Chaitra and the first day of the Bengali month of Baishakh. Notably, Chaitra and Baisakh are, respectively, the last and the first month of the Bengali calendar. The last two days of Chaitra month are known as ‘Hari Baishu’. The Tripura tribal people during these two days collect wild flowers from the forests and decorate their houses and domesticated animals with these flowers. Domesticated animals hold special importance to the Tripura tribal people for they help to augment their income. As a result the Tripuras consider domesticated animals as representatives of the Creator. They bathe the animals and decorate them in a well-mannered fashion during the New Year festival. Preparations for the Baishu festival start from the day before the festival. At this time the females wear special dresses known as ‘ragni’, ‘rja’, and ‘rikutu’. Males wear dhotis, a traditional Hindu dress worn around the loins. On this day, the females also prepare various delicious items from powdered rice. Many females collect the leaves of a plant known as ‘laiju’, which leaves are used to prepare a special type of pitha (a sweet dish made from rice powder or wheat powder) known as ‘awan-bang-uee’. On the day of Baishu, the females wake up in the morning before the crowing of the cock; clean their houses, bathe, and perform ‘lampra’ worship. Then they prepare a variety of dishes. Relatives visit to and from between the houses.
Other religious festivals of the Tripuras include ‘kharchi’ puja (worship), ‘ker’ puja, ‘goria’ puja and ‘ganga’ puja. Kharchi puja takes place in the month of July. During this time, the Tripuras offer goats and pigeons as sacrifices. Usually two weeks after the kharchi puja, ker puja takes place. Ker puja is performed to bring well-being to the house and household members. Goria puja is done by all Tripuras. During this puja, chickens are sacrificed. Ganga puja is conducted during harvesting of crops.

The two TMPs were observed to use a total of 31 plants in their various medicinal formulations. These plant species are shown in Table 1 and the various plants were distributed into 25 families. The various formulations of the practitioners were used for treatment of a variety of ailments, which included fever, coughs, swellings, skin infections, bleeding from external cuts and wounds, pain, diabetes, jaundice, spleen disorders, constipation, rheumatism, to lessen pain and blood loss during child delivery, vomiting, helminthiasis, enlargement of liver, dysentery, diarrhea, allergy, and asthma.

A review of the scientific literature demonstrated that a number of plants used by the Tripura TMPs could be justified in their uses through available scientific reports on pharmacological properties of whole plant extracts or individual plant components. For instance, the use of Andrographis paniculata and its constituent, andrographolide for treatment of fever has been reviewed (Jarukamjorn and Nemoto, 2008); notably, the plant was observed to be used by the Tripura TMPs for treatment of fever. Justicia adhatoda was used by the TMPs for treatment of coughs and tuberculosis; the efficacy of this plant in the treatment of both the above ailments has also been reviewed (Dhankar et al., 2011).

The Tripura TMPs used a combination of plants, namely, Spilanthes paniculata, Andrographis paniculata, Coccinia grandis, Cosmos bipinnatus, and Justicia adhatoda for treatment of diabetes. Bio-active metabolites isolated from Spilanthes paniculata included scopoletin, which is known for its anti-diabetic properties (Prachayasittikul et al., 2009). Anti-diabetic property of ethanolic extract of Andrographis paniculata in streptozotocin-induced diabetic rats has also been described (Zhang and Tan, 2000). The blood sugar lowering efficacy of leaves of Coccinia grandis has also been reported (Munasinghe et al., 2011). Cosmos bipinnatus flowers have reportedly strong anti-oxidant properties (Yashaswini et al., 2011), which can be beneficial for diabetic patients, for diabetes induces oxidative stress. The anti-diabetic activities of leaf and root extracts of Justicia adhatoda against alloxan-induced diabetes in rats has been reported (Gulfraz et al., 2011). Taken together, the scientific reports suggest that the plants in combination can give strong anti-diabetic and anti-oxidant effects, which can prove beneficial for the treatment of diabetic patients, and lowering any high blood sugar levels in these patients. The results also point towards the deep knowledge of medicinal plant properties among the Tripura TMPs; they used five plants in combination for treatment of diabetes, and all five plants have been scientifically shown to have beneficial effects against this disease, which demonstrates that the indigenous medicinal practices of various indigenous communities should not be ignored, but rather well studied towards possible discovery of novel drugs.

Ricinus communis was used by the TMPs for treatment of constipation. The oil obtained from seeds of this plant is known as castor oil, and has been used as a laxative in many countries of the world as a laxative. Desmodium gangeticum was used by the TMPs for treatment of rheumatism; the plant is used for the same purpose by the rural poor of South Kerala, India (Ijinu et al., 2011). Moreover, the plant contains salicin, which reportedly inhibits cyclooxygenase activity, which may prove beneficial in alleviation of inflammation and pain associated with rheumatism (Srivastava et al., 2013). The anti-tussive activity of Ocimum tenuiflorum has been reported (Nadig and Laxmi, 2005), a plant used by the TMPs for treatment of coughs. The Tripura TMPs used Sida rhombifolia and Mangifera indica to treat jaundice; Sida rhombifolia is traditionally used in Arunachal Pradesh, India for cure of jaundice (Shankar et al., 2012), while Mangifera indica is used in parts of Africa for the same purpose (Madunagu et al., 1990).

Available scientific reports thus suggest that the Tripura TMPs possessed considerable knowledge on the medicinal properties of plants, and a number of the plant used by them for treatment of specific ailments can be seen to be validated on the basis of scientific investigation of the pharmacological properties of whole plants or isolated individual constituents. On the other hand, there were several instances where the formulations appeared to lack scientific basis and can be considered as based on traditional folk beliefs. For instance, stems of Achyranthes aspera were sliced into small pieces and made into a garland using the stem of Cuscuta reflexa, which was worn around the head for treatment of jaundice. The garland was said to get bigger with the passing of days, and the more the garland increased in length, the more the jaundiced patient supposedly got cured. It is difficult to visualize how such a treatment can cure jaundice. However, since the process took generally 20-25 days, it is very much possible that the jaundiced patient got cured during this time by himself or herself, and the use of the garland merely had a placebo effect to soothe the mind of the patient and install in the patient a belief that this process is really a healing process. Development of confidence in the patient on the treatment used is also vital in allopathic medicine and quickens the healing process if a firm belief in the efficacy of the medicine can be instilled in the patient.

For treatment of respiratory difficulties, stems of Streblus asper were also advised by the TMPs to be worn around the neck as garland. The garland has to be worn for around 20-21 days and possibly results in the same
placebo effect as described above. A remote possibility, however, could be release of phytochemicals from the stem as it dries up over time, and since the garland is worn around the neck, such phytochemicals may be inhaled by the patient and which can be an effective for cure of jaundice. Nevertheless, as mentioned before, this possibility is remote and needs to be scientifically proven. The TMPs advised swallowing a whole cockroach within a piece of banana and which also contained powdered roots of *Datura metel* as treatment for asthma. Swallowing of cockroaches is a popular belief among Bangladesh folk medicinal practitioners and rural households as an effective treatment for asthma. Whether such treatment is effective also needs to be scientifically proven. It may be mentioned in this connection that various practitioners advise swallowing different species of cockroaches. The TMPs, however, in their treatment, also used roots of *Datura metel*, which can have an intoxicating or sedative effect depending on the amount used, and the roots can provide temporary relief to the asthmatic patient through this intoxicating and/or sedative effect.

Overall, it may be concluded that despite some folk beliefs or superstitions entering the treatment methods of the Tripura TMPs, most other plants used by the TMPs for treatment warrants further scientific studies towards discovery of possibly newer and more efficacious drugs.

References


