

ORIGINAL ARTICLE

Use of Menispermaceae family plants in folk medicine of Bangladesh

¹Rownak Jahan, ²Mst. Afsana Khatun, ¹Nusratun Nahar, ¹Farhana Israt Jahan, ¹Anita Rani Chowdhury, ¹Aynun Nahar, ¹Syeda Seraj, ¹Mostafi Jumrut Mahal, ¹Zubaida Khatun, ¹Mohammed Rahmatullah

¹Department of Biotechnology & Genetic Engineering, University of Development Alternative, Dhanmondi, Dhaka, Bangladesh.

²Dept. of Pharmacy, Lincoln College, Mayang Plaza, Block A, No 1, Jalan SS 26/2, Taman Mayang Jaya, 47301, Petaling Jaya, Selangor Darul Ehsan, Kuala Lumpur, Malaysia.

Rownak Jahan, Mst. Afsana Khatun, Nusratun Nahar, Farhana Israt Jahan, Anita Rani Chowdhury, Aynun Nahar, Syeda Seraj, Mostafi Jumrut Mahal, Zubaida Khatun, Mohammed Rahmatullah, Use of Menispermaceae family plants in folk medicine of Bangladesh; *Adv. in Nat. Appl. Sci.*, 4(1): 1-9, 2010.

ABSTRACT

The Menispermaceae family of flowering plants comprises of about 70 genera and 420 species. The plants belonging to this family are mostly climbing plants and the great majority of the species can be found in countries with a tropical climate. Although small, the family contains a number of plants with scientifically recognized important pharmacological activities. The folk medicinal system of Bangladesh mainly relies on medicinal plants for treatment of various ailments, where the folk medicinal practitioners (otherwise known as Kavirajes) use whole plants or plant parts for oral or topical administration for treatment of ailments. We conducted an ethnomedicinal survey throughout over 100 regions and among seven different tribes of Bangladesh to collect data on the use of Menispermaceae family plants for medicinal purposes. Data was collected with the help of a semi-structured questionnaire and plant specimens as pointed out by the Kavirajes were identified at the Bangladesh National Herbarium. Six species belonging to the Menispermaceae family were observed to be in use by the Kavirajes. These six species were *Cocculus hirsutus*, *Stephania glabra*, *Stephania japonica*, *Tinospora cordifolia*, *Tinospora crispa*, and *Tinospora sinensis*. Of the six species, *Stephania japonica* and *Tinospora cordifolia* were most frequently used for treatment of ailments like diabetes, edema, pain, bone fracture, debility, gastrointestinal disorders, respiratory tract disorders, helminthiasis, malaria, hepatic disorders, tuberculosis, measles, urinary tract disorders, and hypertension. The folk medicinal use of several of these plants has been validated through scientific studies.

Key words: Menispermaceae, folk medicine, Bangladesh

Introduction

The Menispermaceae family of flowering plants is a medium-sized family comprising of 70 genera and about 420 species. Most species in this family are climbing plants and found in the tropics. Although the number of species in this family is not large compared to some other plant families, a number of plants belonging to this family are important plants, being used in the traditional medicines of a number of countries. Several plants have also been scientifically recognized as to containing phytochemical constituents with important pharmacological activities. The following paragraphs shall cite a few examples of scientific findings on Menispermaceae family plants.

Corresponding Author: Professor Dr. Mohammed Rahmatullah, Pro-Vice Chancellor University of Development Alternative House No. 78, Road No. 11A (new) Dhanmondi R/A, Dhaka-1205 Bangladesh
E-mail: rahamatm@hotmail.com Fax: 88-02-8157339

Three acetylcholinesterase inhibitors (which have recently gained importance as potential drugs in the treatment of Alzheimer's disease) have been isolated from tubers of a Thai medicinal plant belonging to the Menispermaceae family, namely *Stephania venosa*. They have been identified as quaternary protoberberine alkaloids – stepharanine, cyclanoline, and *N*-methyl stepholidine (Ingkaninan, K., 2006). Anti-bacterial, anti-fungal, anti-plasmodial, and cytotoxic activities have been reported for the root bark alkaloidal extract of the plant *Albertisia villosa* and an isolated bisbenzylisoquinoline – cycleanine, which validates its traditional use in Congolese medicine for treatment of malaria and other infectious diseases (Lohombo-Ekomba, M.L., 2004). The methanolic leaf extract of *Cissampelos mucronata* reportedly demonstrated protective action against indomethacin-induced ulcer in rats (Nwafor, S.V. and P.A. Akah, 2003). Antinociceptive and anti-arthritis activity has been reported of *Cissampelos pareira* roots (Amresh, G., 2007). Aporphine alkaloids isolated from aerial parts of *Cissampelos capensis* have been shown to demonstrate anthelmintic activity against *Haemonchus contortus* (Ayers, S., 2007). The ethyl acetate soluble extract of stems of *Macrococcus pomiferus* was found to inhibit cyclooxygenase-2 (Su, B.N., 2004). The alcoholic stem extract of *Coscinium fenestratum* has been reported to possess anti-diabetic activity when studied in streptozotocin-nicotinamide induced type 2 diabetic rats (Shirwaikar, A., 2005).

Phenolic alkaloids from *Menispermum dauricum* has been shown to demonstrate a protective effect against myocardial cerebral ischemia/reperfusion injury in rabbits (Wang, F., 2005). Two alkaloids (dehydrooemerine and cepharanthine) isolated from *Stephania rotunda*, as well as a dichloromethane extract of the plant showed inhibitory activity against *Plasmodium falciparum*, which validates to some extent the plant's traditional use against fever (Chea, A., 2007). Leaves and rhizome methanol extracts of *Albertisia delagoensis* reportedly also tested positive against *Plasmodium falciparum* (De Wet, H., 2007). Anti-microbial components active against *Staphylococcus aureus* have been reported to be present in *Tinospora capillipes* (Yu, Y., 2007). A 70% methanolic leaf extract of *Cyclea peltata* has been shown to protect against cisplatin-induced renal toxicity and oxidative damages (Vijayan, F.P., 2007). Dauricumidine, an alkaloid isolated from *Hypserpa nitida* reportedly showed promising anti-viral activity in hepatitis B virus-transfected Hep G2.2.15 cell line (Cheng, P., 2007). Anti-plasmodial and anti-trypanosomal activities have been reported for extracts of various parts of the plant *Triclisia sacleuxii* (Murebwayire, S., 2008). The hasubanane-type alkaloids, periglaucines A-D, isolated from the plant *Pericampylus glaucus* has been shown to inhibit hepatitis B virus surface antigen secretion in Hep G2.2.15 cells. Two other alkaloids isolated from the same plant, namely norruffscine and (-)-8-oxotetrahydropalmitine, exhibited inhibitory activity against human immunodeficiency virus, HIV-1 (Yan, M.H., 2008). Furanoditerpenoids, isolated from the stems of *Fibraurea tinctoria* reportedly showed anti-inflammatory activity when tested against carrageenan-induced mice paw edema (Su, C.R., 2008). Prevention and regression of liver fibrosis (for which there is currently no safe or effective treatment) induced by carbon tetrachloride in rats has been observed with the plant, *Stephania tetrandra* (Chor, J.S., 2009). The leaf extract of *Cissampelos sympodialis* has been observed as a possible novel and safe treatment for psoriasis (Feily, A. and M.R. Namazi, 2009).

Taken together, it can be seen that a number of Menispermaceae family plants have been observed to possess pharmacological components of clinical significance. Many of the scientific findings have been conducted on the basis of the traditional uses of the Menispermaceae family plants. Bangladesh has a rich history of folk medicine administered by traditional medicinal practitioners, known as Kavirajes, who rely mostly on plants or plant parts for treatment of various ailments. It was the objective of the present study to conduct a randomized survey in various regions and among various tribes of Bangladesh to collect data on the use of Menispermaceae family plants in the folk medicinal system of the country.

Materials and Methods

2.1 Survey areas and tribes

Out of the 64 districts comprising Bangladesh 24 districts were included in the present survey. These districts were Bagerhat, Bogra, Brahmanbaria, Chittagong, Comilla, Dinajpur, Feni, Habiganj, Joypurhat, Khagrachari, Magura, Maulvibazar, Naogaon, Narsinghdi, Natore, Nilphamari, Noakhali, Pabna, Patuakhali, Rajshahi, Rangpur, Sherpur, Sylhet, and Tangail. The various tribes that were included in the present survey were the Chak, Chakmas, Garos, Marmas, Santals, Tonchongas and the Tripuras. Surveys were carried out amongst the Kavirajes of tribal and rural areas, since the predominantly rural population of Bangladesh as well as the tribal population relies on Kavirajes for their primary health-care needs.

2.2. Data collection and mode of survey

A total of 111 Kavirajes were interviewed in the present survey. The criterion for selection was the Kaviraje's expertise in treatment of diseases as acknowledged by the local people. Following informed consent obtained from the Kavirajes, interviews were conducted with the help of a semi-structured questionnaire. The basic method followed was that of Martin (1995) and Maundu (1995), known as the guided field-walk method. In this method, the Kavirajes took the interviewers on field walks through the areas from where he collects the medicinal plants, points out the plants to the interviewers, and describes the plant parts used, formulations, ailments treated, and dosages. All information was double-checked with the Kavirajes in later evening sessions. Plant specimens were collected, dried on the field and brought back to Bangladesh National Herbarium for identification. While conducting interviews of the tribal Kavirajes (also known as ojhas among the Chaks and the Chakmas), interviews were conducted in the tribal language with the help of an interpreter. Usually, the interpreter happened to be the Headman of the tribe, who was fluent in both his language as well as Bangla, the language spoken by over 98.5% of the population of Bangladesh.

3. Results

It was observed that six species of Menispermaceae family plants belonging to three genera were used by the Kavirajes interviewed in the present survey. The results are shown in Table 1. Besides whole plant, various plant parts were also used by the Kavirajes, which included leaves, roots, stems, flowers, and bark. It was observed that a single plant part or a combination of plant parts may be used for treatment of any given ailment. Usually the ailments treated differed between use of a single plant part and a combination of parts from the same plant. For instance, the leaf of *Stephania japonica* was used to treat ailments like cardiovascular disorders, diarrhea in children, and edema, while a combination of leaf and flower of the same plant was used for treatment of bone fracture or debility. The flowers were used alone for purification of blood and for ovarian problems. On the other hand, a single plant part as well as a combination of plant parts was sometimes be used to treat similar ailments. For instance, leaves or a combination of leaves and roots of *Stephania japonica* were used to treat fever, diarrhea, or urinary problems.

It appears that the Menispermaceae family plants were used in general to treat diseases arising out from bacterial, fungal or parasitic infections. Examples of such infections are sexually transmitted diseases (gonorrhea, syphilis), urinary tract infections, tuberculosis, fever, coughs, diarrhea, fungal infections of the skin and helminthiasis. Three plant species belonging to the Menispermaceae family were used for treatment of malaria, suggesting that this family may be a potential source for anti-malarial drugs. Two plants belonging to the *Tinospora* genus were used to treat diabetes.

Some formulations or mode of treatment used by the Kavirajes are detailed in Table 2. It is to be noted that the mode of use of a given plant to treat any particular ailment differed among the Kavirajes from different areas. Leaf juice from *Stephania japonica* was administered orally to treat fever by the Kavirajes of Begumganj in Noakhali district. On the other hand, the traditional medicinal practitioners of the Tripura tribe in Khagrachari district used water in which leaves and stems of the same plant were boiled for treatment of fever by bathing patients in the boiled and the then cooled water. The Garo tribe residing in Ghatail and Madhupur in Tangail district administered the whole plant orally for treatment of fever. It was further observed that Menispermaceae plants may be combined with other plants for treatment of ailments. The Garo tribe residing in Sherpur district used the young leaves and stems of *Clerodendrum viscosum* with stems of *Tinospora cordifolia* for treatment of fever, muscle pain, joint ache, and gastrointestinal discomfort. It is also interesting that the same formulation was used by the Garo tribe to treat the above-mentioned ailments, which are quite diverse by nature in terms of symptoms and causative factors. Using the same formulation for treatment of diverse ailments was also noted in other places. For instance, the Kavirajes of South Sahapur, Noakhali district used a mixture of *Santalum album*, *Tinospora sinensis*, and *Adenanthera pavonina* for treatment of tuberculosis, debility (weakness), as well as burning sensations during urination. In all three of the above cases, the same regimen for treatment was followed in that the mixture of the three plant parts were administered orally twice daily for 1-3 months.

4. Discussion

A perusal of the scientific literature showed that at least some of the uses of medicinal plants by Kavirajes have been validated through scientific studies. The results are summarized in Table 3. It appears from the scientific findings thus far that the *Tinospora* genus may be a useful source of phytochemicals for treatment of diabetes. Diabetes is a debilitating disease affecting a considerable portion of the world's population and

Table 1; Plant species belonging to the Menispermaceae family used in folk medicines of Bangladesh.

Botanical name	Local name(s)	Part(s) used	Ailment(s) treated
<i>Cocculus hirsutus</i> L. Diels synonym <i>Menispermum hirsutum</i>	Sundal shona, Dhui lota (Bangla).	1. Whole plant 2. Leaf, stem (in combination)	1. Gonorrhoea, eczema, malaria. 2. Sedative, low sperm count.
<i>Stephania glabra</i> Miers synonym <i>Stephania rotunda</i> Hook. f. & Thoms.	Muchi lota (Bangla).	1. Leaf	1. Fungal infections of the skin.
<i>Stephania japonica</i> (Thunb.) Miers synonym <i>Menispermum japonicum</i> Thunb.	Aknodi, Akonadi, Akondi, Fuit pata, Taka-muti, Makondi, Moshi lota, Mochni pata, Datache, Mucchani, Dual, Modi-ani, Nimukha, Phot pata, Dhoi pata, Foter pata, Dudh-raaz pata, Doi pata, Pitha pata gach (Bangla); Toanak (Chak tribe); Muicchani lota (Chakma and Tonchonga tribes); Naimara, Fotik bifang, Akanadi, Prachina, Pathika (Garo tribe); Toak-nueh-pang (Marma tribe); Karendha-mannhe (Santal tribe); Muich-chali lota, Dufai-u-chena (Tripura tribe).	1. Whole plant 2. Leaf 3. Stem 4. Meristem 5. Root 6. Flower 7. Leaf, flower (combination) 8. Leaf, root (combination) 9. Leaf, stem (combination) 10. Leaf, root, bark (combination)	1. Edema, headache, diabetes, infectious diseases, eczema, acne, sprain, dysentery, sexual weakness, to increase sperm, vomiting, fever, burning sensations in the body, gynecological problems, piles, cough, bloating, leprosy, helminthiasis, cardiovascular disorders, poisoning, ward off evil spirits (magic). 2. Cardiovascular disorders, diarrhea in children, edema, whitish discharge during urination, burning during urination, diarrhea caused by excessive outside temperature, abscess, pain, helminthiasis, skin diseases, fever, spermatorrhea. 3. Arthritis, joint displacement, bone fracture, indigestion, presence of mucus in stool, leucorrhoea, fatigue in hand or leg, fever. 4. Debility, excessive milk in nursing mother's breasts. 5. Coughs, throat pain (adults), colic, ear lesions (children), to ease delivery. 6. Blood purifier, problems related to ovary. 7. Bone fracture, debility. 8. Fever, diarrhea, urinary problems. 9. Fever in small children, jaundice. 10. Fever, diarrhea, cholera, acidity, difficulties in delivery during pregnancy.
<i>Tinospora cordifolia</i> (Willd.) Hook.f. & Thoms. Synonym <i>Tinospora glabra</i> (Burm f.) Merr., <i>Menispermum cordifolium</i> Willd., <i>Cocculus cordifolius</i> DC, <i>Menispermum glabrum</i> Brum.f. Heru-awar (Santal tribe);	Guloncho lota, Guloncho, Gronchi lota (Bangla); Gulnoi, Guloncho, Poddoo guloncho, Guruchi, Samorjofu (Garo tribe); Teel lota gach, Dusha shandari (Tripura tribe).	1. Whole plant 2. Stem 3. Shoot tip 4. Root 5. Leaf, root (combination) 6. Leaf, stem (combination)	1. Malaria, liver diseases, tuberculosis, gout, asthma, febricity, measles, burning sensations in body, coughs, mucus, fever, helminthiasis constipation, stomach ache, leucorrhoea, to increase thirst (i.e. to induce drinking), rheumatism, piles, respiratory problems, cardiovascular disorders, infrequent urination, bloating, enlarged spleen, skin infections, swelling of legs and hands, hypertension, diabetes, snake bite, pain, urinary tract disorders. 2. Frequent fever, muscle pain, joint ache, gastrointestinal discomfort, helminthiasis, rheumatism, chicken pox. 3. Hepatic disorders, diabetes, high fevers. 4. Malaria. 5. Dripping of saliva from mouth, loss of movement of tongue. 6. Rheumatism, fever, fever with mucus, gastric troubles, leucorrhoea, pain during urination, edema.
<i>Tinospora crispa</i> (L.) Hook.f. & Thoms. Synonym <i>Menispermum crispum</i> L., <i>Tinospora rumphii</i> Boerl.	Ghol-loai, Guloncho -bun, Poddoo golanchi, Poddoo khurchi, Golonchi, Bashi-shondori, Aam-guloncho (Bangla).	1. Whole plant 2. Stem 3. Leaf, stem (combination)	1. Tetanus, leprosy, diabetes, malaria, jaundice, syphilis, sprain, eczema, sedative, debility, pain, loss of appetite, cold, fever. 2. Body ache, rheumatic pain, jaundice. 3. Pyrexia (fever of unknown origin).
<i>Tinospora sinensis</i> (Lour.) Merrill synonym <i>Campylus sinensis</i> Lour., <i>Tinospora malabarica</i> (Lam.) Hook. f. & Thomson	Guloncho (Bangla).	1. Stem	1. Tuberculosis, debility, burning sensations during urination.

Note that Bangla is the language spoken by more than 98.5% inhabitants of Bangladesh; Chak, Chakma, Garo, Marma, Santal, Tonchonga and Tripura tribes are some of the tribal people of Bangladesh and have their own distinctive languages. The Garo tribe inhabits the north-central districts of Bangladesh; the Santal tribe inhabits the northern most districts of Bangladesh, while the Chak, Chakma, Marma, Tonchonga and the Tripura tribes inhabit the Chittagong Hill Tracts forest region in the south-eastern part of Bangladesh. The various tribes of Bangladesh account for about 1.5% of the total population of the country.

Table 2: Some tribal- and area-based formulations of Menispermaceae family medicinal plants for treatment of different ailments.

Botanical name	Plant parts used	Ailment(s) treated	Formulations	Area of use
<i>Stephania japonica</i>	Leaf	Edema	Paste of leaf is prepared. One teaspoonful of paste is mixed with one teaspoonful of water in which rice has been washed and the mixture administered orally to patients.	Chak tribe, Khagrachari district.
<i>Stephania japonica</i>	Leaf, flower	Bone fractures, debility	Leaves are tied around the fractured area till cure. Leaves or flowers are immersed in warm water and taken for 7 days as treatment for debility (weakness).	Bhelamoyee, Dinajpur district.
<i>Stephania japonica</i>	Whole plant	Dysentery	1 teaspoonful of juice obtained from crushed whole plant is taken twice daily for 2-4 weeks.	Matubhuiyan, Feni district.
<i>Stephania japonica</i>	Leaf, root	Fever, diarrhea, urinary diseases	Leaf juice is taken every morning for 1 week in case of fever. A combination of leaf and root juice is taken orally every day for fever, diarrhea or urinary diseases till cure.	Begumganj, Noakhali district.
<i>Stephania japonica</i>	Leaf, stem	Fever in small children	Leaves and stems are boiled in water. The children are bathed in the water when it has become cold. This is done once daily for several days.	Tripura tribe, Khagrachari district.
<i>Stephania japonica</i>	Leaf	Diarrhea in children	Juice from crushed leaves is administered daily for 2-3 days.	Tripura tribe, Mirsharai, Chittagong district.
<i>Stephania japonica</i>	Whole plant	To increase sperm, coughs, fever, vomiting, helminthiasis	4 annas (local measure, 1 anna = 62.5g) of whole plant are administered orally till cure.	Garo tribe, Ghatail and Madhupur, Tangail district.
<i>Stephania japonica</i>	Root	To ease delivery (when childbirth is delayed even though the fetus is in the correct position)	Root paste is applied to the vaginal area.	Mahasthangarh, Bogra district.
<i>Stephania japonica</i>	Leaf, stem	Jaundice, abscess	The leaves with stem are made into a garland with at least seven twirls. The garland is then worn around the wrist. The person that has put the garland around the patient's wrist must not touch the patient for 7 days (remedy for jaundice). For abscess, leaf juice is applied to abscess.	Bagha, Rajshahi district.
<i>Tinospora cordifolia</i>	Stem	Frequent fever, muscle pain, joint ache, gastrointestinal discomfort	Young leaves and stems of <i>Clerodendrum viscosum</i> along with stems of <i>Tinospora cordifolia</i> are squeezed to obtain juice. 75 ml of juice is administered orally once daily for 7 days.	Garo tribe, Sherpur district.
<i>Tinospora cordifolia</i>	Stem	Helminthiasis, rheumatism, chicken pox	The stem is cut into pieces, soaked in water overnight, and the water administered orally the following morning for helminthiasis or rheumatism. For rheumatism the dose is 1 chatak (local measure = 62.5g). The juice of the stem of <i>Tinospora cordifolia</i> (1/2 poa, local measure = 125g) is mixed with 1/2 poa of juice from leaves of <i>Momordica charantia</i> and is administered orally thrice daily as treatment for chicken pox.	Garo tribe, Madhupur, Tangail district
<i>Tinospora cordifolia</i>	Leaf, root	Dripping of saliva from mouth, loss of movement of tongue	The leaves and roots are made into a paste with fruits of <i>Terminalia chebula</i> , fruits of <i>Terminalia bellerica</i> , wood from <i>Santalum album</i> , leaves of <i>Abrus precatorius</i> , and leaves of <i>Andrographis paniculata</i> , dried, powdered and made into pills the size of beans (seeds of <i>Dolichos lablab</i>). The pills are taken thrice daily for 7 days.	Santal tribe, Rajshahi district.

Table 2: Continue

<i>Tinospora cordifolia</i>	Leaf, stem	Fever, fever with mucus, gastric troubles, leucorrhoea	Two tolas (local measure, 1 tola = 11.4 g) each of the (leaves and stems) of the plant and roots of <i>Piper longum</i> is boiled in ½ ser (local measure, 1 ser = 500 g) water till the volume is reduced by half. The water is then taken orally for fevers. The leaves and stems of the plant are mixed with <i>Euphorbia ingens</i> stems and <i>Piper longum</i> leaves and made into a paste. The paste is administered orally for fevers with mucus, gastric troubles and for leucorrhoea.	Garó tribe, Ghatail and Madhupur, Tangail district.
<i>Tinospora cordifolia</i>	Stem	Stomach ache	6 teaspoonfuls of juice obtained from crushed vines of the plant are mixed with slices of <i>Zingiber officinale</i> rhizomes and administered orally as treatment for stomach ache.	Shalikhá, Magura district.
<i>Tinospora crispa</i>	Stem	Body ache, rheumatism	Juice obtained from crushed stem is massaged onto affected areas.	Bhelamoyee, Dinajpur district.
<i>Tinospora sinensis</i>	Stem	Tuberculosis, debility, burning sensations during urination	2 tolas of <i>Santalum album</i> wood is mixed with 2 tolas of stems of <i>Tinospora sinensis</i> and 2 tolas of bark of <i>Adenanthera pavonina</i> . 4 teaspoonfuls of the mixture is taken twice daily for 1-3 months.	South Sahapur, Noakhali district.

Note that although the Kavirajes had no hesitation in divulging the names of the plants, plant parts used, and ailments treated, in general they did not want dissemination of specific formulations or description of how the whole plant or plant part was prepared and used, on the ground that it would be harmful to their commercial interests. The information given in the above Table was obtained from Kavirajes who agreed to this information being disseminated.

Table 3: Scientific validations of some traditional uses of Menispermaceae family plants in Bangladesh

Plant	Traditional use	Relevant scientific findings with References
<i>Cocculus hirsutus</i>	Malaria	Repellent, ovicidal, and oviposition-deterrent activities against <i>Culex tritaeniorhynchus</i> (Elango, G., 2010); oviposition-deterrent, ovicidal, and repellent activities against <i>Anopheles subpictus</i> (Elango, G., 2009; Elango, G., 2009).
<i>Tinospora cordifolia</i>	Rheumatism	Beneficial effects of b-ecdysone isolated from the plant on joint, epiphyseal cartilage tissue and trabecular bone in ovariectomized rats (Kapur, P., 2010) suggesting that it may be of value in treatment of osteoporosis and osteoarthritis; anti-osteoporotic potential of ethanolic stem extract demonstrated in female Sprague-Dawley rats (Kapur, P., 2008).
<i>Tinospora cordifolia</i>	Diabetes	Hypoglycemic effect observed with aqueous, alcoholic, and chloroform extracts of leaves in normal and alloxan-diabetic rabbits (Wadood, N., 1992); hypolipidemic action of roots in alloxan-diabetic rats (Stanely Mainzen Prince, P., 1999); anti-oxidant activity of roots in experimental diabetes (Prince, P.S. and V.P. Menon, 1999); hypoglycemic action of roots in alloxan-diabetic rats (Stanely, P., 2000); anti-oxidant action of root extract in alloxan diabetic rats (Stanely Mainzen Prince, P. and V.P. Menon, 2001); hypoglycemic and hypolipidemic action of root extract in alloxan-diabetic rats (Stanely Mainzen Prince, P. and V.P. Menon, 2003); restoration of anti-oxidant defense by root extract in alloxan-induced diabetic rat liver and kidney (Prince, P.S., 2004); restoration of anti-oxidants by root extract in heart and brain of alloxan-induced diabetic Wistar rats (Prince, P.S., N. Kamalakkannan, 2004); hypoglycemic activity observed with a compound (saponarin) – an a-glucosidase inhibitor isolated from the plant (Sengupta, S., 2008); preventive effect of stem extract against high fructose diet-induced insulin resistance and oxidative stress in male Wistar rats (Reddy, S.S., 2009); a-glucosidase inhibition by stem extract (Chougale, A.D., 2009); beneficiary effect of stem extract against high fructose diet-induced abnormalities in carbohydrate and lipid metabolism in Wistar rats (Reddy, S.S., 2009).
<i>Tinospora cordifolia</i>	Hepatic disorders	Chemopreventive ability of an epoxy clerodane diterpene isolated from the plant against diethylnitrosamine-induced hepatocellular carcinoma (Dhanasekaran, M., 2009); protective effect of the plant against anti-tubercular drugs isoniazid-, rifampicin-, and pyrazinamide-induced hepatic damage in rats (Panchabhai, T.S., 2008); modulation of hepatoprotective and immunostimulatory functions in carbon tetrachloride intoxicated mature albino rats (Bishayi, B., 2002).
<i>Tinospora cordifolia</i>	Coughs, mucus	Protective action of plant extract against allergic rhinitis (Badar, V.A., 2005).
<i>Tinospora cordifolia</i>	Cardiovascular disorders	Cardioprotective activity of alcoholic extract of the plant in ischemia-reperfusion induced myocardial infarction in rats (Rao, P.R., 2005).
<i>Tinospora crispa</i>	Diabetes	Anti-oxidant constituents identified in extract of the plant, which can be of potentially beneficial effects in diabetes (Cavin, A., 1998); anti-hyperglycemic and insulinotropic effect (Noor, H. and S.J. Ashcroft, 1998); hypoglycemic effect in moderately diabetic rats with concomitant improvement in insulinaemia (Noor, H. and S.J. Ashcroft, 1989); induction by extract of dosage-dependent stimulation and potentiation of basal and glucose-stimulated insulin secretion, respectively in rat islets and HIT-T15 B cells (Noor, H., 1989).

Table 3: Continue

<i>Tinospora crispa</i>	Malaria	<i>In vitro</i> blood schizonticidal activity against <i>Plasmodium falciparum</i> chloroquine resistant strain (W2) (Bertani, S., 2005); anti-malarial activity observed with chloroform extract of the plant (Najib Nik A., 1999).
<i>Tinospora crispa</i>	Sprain	Inhibition by stem extract of carragenin-induced foot pad edema in rats (Higashino, H., 1992).

which cannot be cured by conventional allopathic treatments. From that view point, any new source of lead compounds for treatment of this disease can be of major importance. It is also to be noted from Table 3, that two Menispermaceae plants used in Bangladesh for traditional treatment of malaria have been validated by scientific findings. Other notable findings are that the Menispermaceae family plants used in Bangladesh can be of interest in treatment of rheumatism, hepatic disorders, and cardiovascular disorders, all of which can represent major scientific advances if further studies lead to discovery of effective phytochemicals against the above-mentioned ailments.

Traditional medicinal knowledge is fast disappearing because of the non-interest shown by modern medicinal practitioners. Yet this knowledge can be useful in discovery of newer and more effective drugs because this knowledge of treatment with medicinal plants has been tested over the centuries. At the same time, it is of prime importance to immediately start conservation efforts of these medicinal plants, for due to rapid increases in human habitat, the plants are disappearing from the wild and it is becoming more difficult to collect them. Science will suffer an irreversible loss if these plants become extinct due to neglect.

References

- Amresh, G., P.N. Singh and Ch.V. Rao, 2007. Antinociceptive and antiarthritic activity of *Cissampelos pareira* roots. *Journal of Ethnopharmacology*, 111: 531-536.
- Ayers, S., D.L. Zink, K. Mohn, J.S. Powell, C.M. Brown, T. Murphy, R. Brand, S. Pretorius, D. Stevenson, D. Thompson and S.B. Singh, 2007. Anthelmintic activity of aporphine alkaloids from *Cissampelos capensis*. *Planta Medica*, 73: 296-297.
- Bishayi, B., S. Roychowdhury, S. Ghosh and M. Sengupta, 2002. Hepatoprotective and immunomodulatory properties of *Tinospora cordifolia* in CCl₄ intoxicated mature albino rats. *Journal of Toxicological Sciences*, 27: 139-146.
- Badar, V.A., V.R. Thawani, P.T. Wakode, M.P. Shrivastava, K.J. Gharpure, L.L. Hingorani and R.M. Khiyani, 2005. Efficacy of *Tinospora cordifolia* in allergic rhinitis. *Journal of Ethnopharmacology*, 96: 445-449.
- Bertani, S., G. Bourdy, I. Landau, J.C. Robinson, P. Esterre and E. Deharo, 2005. Evaluation of French Guiana traditional antimalarial remedies. *Journal of Ethnopharmacology*, 98: 45-54.
- Cavin, A., K. Hostettmann, W. Dyatmyko and O. Potterat, 1998. Antioxidant and lipophilic constituents of *Tinospora crispa*. *Planta Medica*, 64: 393-396.
- Chougale, A.D., V.A. Ghadyale, S.N. Panaskar and A.U. Arvindekar, 2009. α-Glucosidase inhibition by stem extract of *Tinospora cordifolia*. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 24: 998-1001.
- Chor, J.S., J. Yu, K.K. Chan, Y.Y. Go and J.J. Sung, 2009. *Stephania tetrandra* prevents and regresses liver fibrosis induced by carbon tetrachloride in rats. *Journal of Gastroenterology and Hepatology*, 24: 853-859.
- Chea, A., S. Hout, S.S. Bun, N. Tabatadze, M. Gasquet, N. Azas, R. Elias and G. Balansard, 2007. Antimalarial activity of alkaloids isolated from *Stephania rotunda*. *Journal of Ethnopharmacology*, 112: 132-137.
- Cheng, P., Y.B. Ma, S.Y. Yao, Q. Zhang, E.J. Wang, M.H. Yan, X.M. Zhang, F.X. Zhang and J.J. Chen, 2007. Two new alkaloids and active anti-hepatitis B virus constituents from *Hypserpa nitida*. *Bioorganic and Medicinal Chemistry Letters*, 17: 5316-5320.
- Dhanasekaran, M., A.A. Baskar, S. Ignacimuthu, P. Agastian and V. Duraipandiyar, 2009. Chemopreventive potential of Epoxy clerodane diterpene from *Tinospora cordifolia* against diethylnitrosamine-induced hepatocellular carcinoma. *Investigational New Drugs*, 27: 347-355.
- De Wet, H., F.R. Van Heerden, B.E. Van Wyk and R.L. Van Zyl, 2007. Antiplasmodial activity and cytotoxicity of *Albertisia delagoensis*. *Fitoterapia*, 78: 420-422.
- Elango, G., A.A. Rahuman, A. Bagavan, C. Kamaraj, A.A. Zahir, G. Rajakumar, S. Marimuthu and T. Santhoshkumar, 2010. Efficacy of botanical extracts against Japanese encephalitis vector, *Culex tritaeniorhynchus*. *Parasitology Research*, 106: 481-492.
- Elango, G., A. Bagavan, C. Kamaraj, A. Abdul Zahir and A. Abdul Rahuman, 2009. Oviposition-deterrent, ovicidal, and repellent activities of indigenous plant extracts against *Anopheles subpictus* Grassi (Diptera: Culicidae). *Parasitology Research*, 105: 1567-1576.
- Elango, G., A.A. Rahuman, A. Bagavan, C. Kamaraj, A.A. Zahir and C. Venkatesan, 2009. Laboratory study on larvicidal activity of indigenous plant extracts against *Anopheles subpictus* and *Culex tritaeniorhynchus*.

- Parasitology Research, 104: 1381-1388.
- Feily, A. and M.R. Namazi, 2009. *Cissampelos sympodialis* Eichl (Menispermaceae) leaf extract as a possible novel and safe treatment for psoriasis. Sao Paulo Medical Journal, 127: 241-242.
- Higashino, H., A. Suzuki, Y. Tanaka and K. Pootakham, 1992. Inhibitory effects of Siamese *Tinospora crispa* extracts on the carragenin-induced foot pad edema in rats (the 1st report). Nippon Yakurigaku Zasshi, 100: 339-344.
- Ingkaninan, K., P. Phengpa, S. Yuenyongsawad and N. Khorana, 2006. Acetylcholinesterase inhibitors from *Stephania venosa* tuber. Journal of Pharmacy and Pharmacology, 58: 695-700.
- Kapur, P., W. Wuttke, H. Jarry and D. Seidlova-Wuttke, 2010. Beneficial effects of b-ecdysone on the joint, epiphyseal cartilage tissue and trabecular bone in ovariectomized rats. Phytomedicine, 17: 350-355.
- Kapur, P., H. Jarry, W. Wuttke, B.M. Pereira and D. Seidlova-Wuttke, 2008. Evaluation of the antiosteoporotic potential of *Tinospora cordifolia* in female rats. Maturitas, 59: 329-338.
- Lohombo-Ekomba, M.L., P.N. Okusa, O. Penge, C. Kabongo, M.I. Choudhary and O.E. Kasende, 2004. Antibacterial, antifungal, antiplasmodial, and cytotoxic activities of *Albertisia villosa*. Journal of Ethnopharmacology, 93: 331-335.
- Martin, G.J., 1995. Ethnobotany: a 'People and Plants' Conservation Manual, Chapman and Hall, London, pp: 268.
- Maundu, P., 1995. Methodology for collecting and sharing indigenous knowledge: a case study. Indigenous Knowledge and Development Monitor, 3: 3-5.
- Murebwayire, S., M. Frédéric, V. Hannaert, M.C. Jonville and P. Duez, 2008. Antiplasmodial and antitrypanosomal activity of *Triclisia saculeuxii* (Pierre) Diels. Phytomedicine, 15: 728-733.
- Najib Nik A., N. Rahman, T. Furuta, S. Kojima, K. Takane and M. Ali Mohd, 1999. Antimalarial activity of extracts of Malaysian medicinal plants. Journal of Ethnopharmacology, 64: 249-254.
- Noor, H. and S.J. Ashcroft, 1998. Pharmacological characterization of the antihyperglycaemic properties of *Tinospora crispa* extract. Journal of Ethnopharmacology, 62: 7-13.
- Noor, H. and S.J. Ashcroft, 1989. Antidiabetic effects of *Tinospora crispa* in rats. Journal of Ethnopharmacology, 27: 149-161.
- Noor, H., P. Hammonds, R. Sutton and S.J. Ashcroft, 1989. The hypoglycaemic and insulinotropic activity of *Tinospora crispa*: studies with human and rat islets and HIT-T15 B cells. Diabetologia, 32: 354-359.
- Nwafor, S.V. and P.A. Akah, 2003. Effect of methanolic leaf extract of *Cissampelos mucronata* A. Rich against indomethacin induced ulcer in rats. Indian Journal of Experimental Biology, 41: 181-183.
- Panchabhai, T.S., S.V. Ambarkhane, A.S. Joshi, B.D. Samant and N.N. Rege, 2008. Protective effect of *Tinospora cordifolia*, *Phyllanthus emblica* and their combination against antitubercular drugs induced hepatic damage: an experimental study. Phytotherapy Research, 22: 646-650.
- Prince, P.S., M. Padmanabhan and V.P. Menon, 2004. Restoration of antioxidant defence by ethanolic *Tinospora cordifolia* root extract in alloxan-induced diabetic liver and kidney. Phytotherapy Research, 18: 785-787.
- Prince, P.S., N. Kamalakkannan and V.P. Menon, 2004. Restoration of antioxidants by ethanolic *Tinospora cordifolia* in alloxan-induced diabetic Wistar rats. Acta Poloniae Pharmaceutica, 61: 283-287.
- Prince, P.S. and V.P. Menon, 1999. Antioxidant activity of *Tinospora cordifolia* roots in experimental diabetes. Journal of Ethnopharmacology, 65: 277-281.
- Reddy, S.S., P. Ramatholisamma, R. Karuna and D. Saralakumari, 2009. Preventive effect of *Tinospora cordifolia* against high-fructose diet-induced insulin resistance and oxidative stress in male Wistar rats. Food and Chemical Toxicology, 47: 2224-2229.
- Reddy, S.S., P. Ramatholisamma, B. Ramesh, R. Baskar and D. Saralakumari, 2009. Beneficiary effect of *Tinospora cordifolia* against high-fructose diet induced abnormalities in carbohydrate and lipid metabolism in Wistar rats. Hormone and Metabolic Research, 41: 741-746.
- Rao, P.R., V.K. Kumar, R.K. Viswanath and G.V. Subbaraju, 2005. Cardioprotective activity of alcoholic extract of *Tinospora cordifolia* in ischemia-reperfusion induced myocardial infarction in rats. Biological & Pharmaceutical Bulletin, 28: 2319-2322.
- Su, B.N., W.P. Jones, M. Cuendet, L.B. Kardono, R. Ismail, S. Riswan, H.H. Fong, N.R. Fransworth, J.M. Pezzuto and A.D. Kinghorn, 2004. Constituents of the stems of *Macroccoccus pomiferus* and their inhibitory activities against cyclooxygenases- 1 and -2. Phytochemistry, 65: 2861-2866.
- Shirwaikar, A., K. Rajendran and I.S. Punitha, 2005. Antidiabetic activity of alcoholic stem extract of *Coscinium fenestratum* in streptozotocin-nicotinamide induced type 2 diabetic rats. Journal of Ethnopharmacology, 97: 369-374.
- Su, C.R., Y.F. Chen, M.J. Liou, H.Y. Tsai, W.S. Chang and T.S. Wu, 2008. Anti-inflammatory activities of furanoditerpenoids and other constituents from *Fibraurea tinctoria*. Bioorganic and Medicinal Chemistry Letters, 16: 9603-9609.

- Stanely Mainzen Prince, P., V.P. Menon and G. Gunasekaran, 1999. Hypolipidaemic action of *Tinospora cordifolia* roots in alloxan diabetic rats. *Journal of Ethnopharmacology*, 64: 53-57.
- Stanely, P., M. Prince and V.P. Menon, 2000. Hypoglycaemic and other related actions of *Tinospora cordifolia* roots in alloxan-induced diabetic rats. *Journal of Ethnopharmacology*, 70: 9-15.
- Stanely Mainzen Prince, P. and V.P. Menon, 2001. Antioxidant action of *Tinospora cordifolia* root extract in alloxan diabetic rats. *Phytotherapy Research*, 15: 213-218.
- Stanely Mainzen Prince, P. and V.P. Menon, 2003. Hypoglycaemic and hypolipidaemic action of alcohol extract of *Tinospora cordifolia* roots in chemical induced diabetes in rats. *Phytotherapy Research*, 17: 410-413.
- Sengupta, S., A. Mukherjee, R. Goswami and S. Basu, 2008. Hypoglycemic activity of the antioxidant saponarin, characterized as a-glucosidase inhibitor present in *Tinospora cordifolia*. *Journal of Enzyme Inhibition and Medicinal Chemistry*, 1; [Epub ahead of print].
- Vijayan, F.P., V.K. Rani, V.R. Vineesh, K.S. Sudha, M.M. Michael and J. Padikkala, 2007. Protective effect of *Cyclea peltata* Lam on cisplatin-induced nephrotoxicity and oxidative damage. *Journal of Basic and Clinical Physiology and Pharmacology*, 18: 101-114.
- Wang, F., G. Zhao, Q. Lü, L. Qu and L.J. Guo, 2005. Protective effect of phenolic alkaloids from *Menispermum dauricum* on myocardial cerebral ischemia/reperfusion injury in rabbits. *Zhongguo Wei Zhong Bing Ji Jiu Yi Xue*, 17: 154-156.
- Wadood, N., A. Wadood and S.A. Shah, 1992. Effect of *Tinospora cordifolia* on blood glucose and total lipid levels of normal and alloxan-diabetic rabbits. *Planta Medica*, 58: 131-136.
- Yu, Y., Z.B. Yi and Y.Z. Liang, 2007. Main antimicrobial components of *Tinospora capillipes*, and their mode of action against *Staphylococcus aureus*. *FEBS Letters*, 581: 4179-4183.
- Yan, M.H., P. Cheng, Z.Y. Jiang, Y.B. Ma, X.M. Zhang, F.X. Zhang, L.M. Yang, Y.T. Zheng and J.J. Chen, 2008. Periglaucines A-D, anti-HBV and -HIV-1 alkaloids from *Pericampylus glaucus*. *Journal of Natural Products*, 71: 760-763.