

MEDICINAL FORMULATIONS OF A KANDA TRIBAL HEALER – A TRIBE ON THE VERGE OF DISAPPEARANCE IN BANGLADESH

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Abstract

The Kanda tribe is one of the lesser known small tribes of Bangladesh with an estimated population of about 1700 people (according to them), and on the verge of extinction as a separate entity. To some extent, they have assimilated with the surrounding mainstream Bengali-speaking population, but they still maintain their cultural practices including traditional medicinal practices, for which they have their own tribal healers. Nothing at all has been documented thus far about their traditional medicinal practices and formulations, which are on the verge of disappearance. The Kanda tribe can be found only in scattered tea gardens of Sreemangal in Sylhet district of Bangladesh; dispersion of the tribe into small separated communities is also contributing to the fast losing of traditional medicinal practices. The objective of the present study was to conduct an ethnomedicinal survey among the traditional healers of the Kanda tribe (in fact, only one such healer was found after extensive searches). Information was collected from the healer with the help of a semi-structured questionnaire and the guided field-walk method. A total of 24 formulations were obtained from the healer containing 34 plants including two plants, which could not be identified. Besides medicinal plants, the Kanda healer also used the body hairs of the Asiatic black bear (*Ursus thibetanus*) and bats (*Pteropus giganteus giganteus*) in one of his formulation for treatment of fever with shivering. The ailments treated by the Kanda healer were fairly common ailments like cuts and wounds, skin diseases, helminthiasis, fever, respiratory problems (coughs, asthma), gastrointestinal disorders (stomach pain, constipation, diarrhea), burning sensations during urination, various types of pain (headache, body ache, toothache, ear ache), conjunctivitis, poisonous snake, insect or reptile bites, jaundice, and bone fractures. A number of important drugs in allopathic medicine like quinine, artemisinin, and morphine (to name only a few) have been discovered from observing indigenous medicinal practices. From that view point, the formulations used by the Kanda healer merit scientific studies for their potential in the discovery of cheap and effective new drugs. Scientific validation of the medicinal formulations of the Kanda healer can also be effective for treatment of ailments among this tribe, which does not have or does not want to have any contact with modern medicine.

Introduction

Human beings have suffered from various diseases from antiquity (Sofowara, 1982) and have used medicinal plants, animal parts and mineral formulations for treatment of diseases for thousands of years (Hill, 1989). With the advent of modern or allopathic medicine, the traditional medicinal practices became subjects of derision and were mostly dismissed as superstitions or quackery. However, indigenous communities of practically every country of the world has clung to their own traditional medicinal practices despite the promises of allopathic medicines, either because they lacked access to allopathic medicines, or still used their own ancient formulations out of their own choices. Recent years are witnessing a resurgence of interest among the scientists and allopathic doctors about traditional medicinal practices. This has been due to a number of factors like comparatively high price of allopathic medicines, lack of accessibility to allopathic practitioners and modern hospitals by particularly the rural population of developing countries, emergence of drug-resistant vectors to many allopathic drugs, non-curability of many emerging and old diseases with allopathic drugs, and finally, a recognition that many important allopathic drugs like aspirin, atropine, ephedrine, digoxin, morphine, quinine, and tubocurarine have been discovered following close observations of the traditional medicinal practices of indigenous peoples (Gilani and Rahman, 2005).

Not much anthropological work has been conducted in Bangladesh. Even a decade or two ago, it was believed that the country has only about a dozen tribes including the Chakmas, Marmas and Murongs residing in the southern hilly forested regions of the country, and the Garos, Khasias, Manipuris and the Santals inhabiting the northern semi-forested regions. However, recent and more extensive anthropological researches are indicating that Bangladesh may have more than 100 indigenous communities within the country (usually mentioned as tribes). The vast majority of these tribes are small, and many

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have become partly or totally assimilated within the mainstream Bengali-speaking population (Murmu, 2009). Not much is known about these smaller tribes, some of them being on the verge of extinction. Practically, studies are absent on the tribal medicinal practices. Yet this knowledge is important, because the tribes, mainly from living within or in close proximity to forests, have over the centuries, accumulated a vast amount of experience on the medicinal properties of plants, animals, birds and other species found within or near their habitat.

To document the traditional medicinal practices of the various large and small tribes of Bangladesh before they become irretrievably lost, we had been conducting ethnomedicinal surveys among the various tribes for the last few years (Rahmatullah et al, 2009, 2010, 2011, 2012a-c; Seraj et al, 2011). The Kandas are a small tribal community, who essentially work in the tea gardens scattered throughout Udnachora, Horinchora, Putia, Khejuri, Kurunji, Noapara, and Teliapara in Sreemangal sub-district of Sylhet district in Bangladesh. According to them, their present population is around 1700. The Kandas claim to have arrived in this part from Orissa in India in the nineteenth century, when the then British Government brought them to work in the tea plantations. They also call themselves 'Kui'. The tribe claims to have various sects like Kashyat, Nag, Dading borya, Bora, Holdi, and Bohir bador, although such different sects are now difficult to find, owing possibly to the low tribal population.

Various scattered communities of the tribe live in areas adjacent to the tea gardens where both male and female members work in the plucking of tea leaves. Their pay is poor, which leads to a poor standard of living more so, because tribal members do not possess their own land and so cannot have alternate income sources from utilizing the land. Five persons form the administrative unit of each community (Banu, 2010). 'Behara' judges during any dispute. 'Samajpati' gives decisions on any community-related matter. 'Montri' acts as an aide to Samajpati. 'Poricha' arranges for food during social festivals. Finally, 'Chatia' maintains contact between families of the community. The Kandas have a patriarchal society and only males can own any property. They have their own language, which at present is 'Uriya', the language spoken by the people of Orissa in India. The elderly generation can speak another language, which they claim as their original language, namely 'Kanda farsi'. Their religion was previously animistic, but now they worship the gods and goddesses of the Hindu religion. Their diet consists of rice, which is eaten with lentils, fish, meat and vegetables. Since their traditional medicinal practices (consisting mainly of medicinal plants and incantations) are fast disappearing, it was the objective of the present study to conduct an ethnomedicinal survey among the Kanda community working in Horinchora Tea Garden at Sreemangal in Sylhet district of Bangladesh.

Materials and Methods

The present study was conducted among the Kanda community residing in Horinchora of Sreemangal sub-district of Sylhet district, Bangladesh between September 2010 and July 2011. The community was a small community and comprised of about 120 households with a population of around 550 members. Adult male and female members of the household as well as children from around the age of 12 worked in the Horinchora Tea Garden. Their work consisted of plucking tea leaves all day, and they were paid on the amount of leaves plucked. They did not own any land but resided on land provided to them by the owner of the tea plantation. The pay was meager, and their economic status can only be described as very poor. Alternate work was not available, the tea estate being in a semi-forested hilly region of the country.

Among the several Kanda communities surveyed in various adjoining tea estates in the region, this community had a practicing tribal medicinal practitioner or healer. People from adjoining tea estates would also visit this healer. Informed consent was initially obtained from the healer, namely Sitesh Kanda (age 40) to interview him and to publish any information obtained, in national or international publications. The healer was thoroughly apprised at first (before beginning of any interviews) of the purpose of our visit (i.e. to obtain, document and publish any traditional medicinal information that he gives), and he readily approved, because he also felt that this traditional medicinal knowledge will get lost within the next few years, if not properly documented. The healer was very helpful in providing information and in procuring plant specimens.

Interview of the healer was 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 healer took the interviewers on guided field-walks through areas from where he collected his medicinal plants, pointed out the plants and described their uses. Medicinal plants were collected and photographed on the spot, dried and brought back to Bangladesh National Herbarium at Dhaka for identification. Voucher specimens were deposited at the Medicinal Plant Collection Wing of the University of Development Alternative. All interviews were conducted in Bengali since the Kanda healer could speak this language like the interviewers; however, plant names were documented in the Kanda language. It was noted that the names of a number of plants were the same in both Kanda and Bengali language. The healer, in his formulations, used also body hairs from two mammals, namely the Asiatic black bear, and the giant bat. The first was brought in from India as Sylhet does not have bears any more, but the second was available locally. The skin of the Asiatic black bear was kept in the house of the healer from which he would pluck hairs when necessary for his formulation. Bats were caught and dried and kept in that stage, and hairs plucked from the body whenever it was necessary to use them in his formulation. Both species were identified by a competent zoologist accompanying the team members when they visited the community for interviews.

Results

The Kanda healer used a total of 34 plant species in his 24 formulations. These plant species included two species,

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which Bangladesh National Herbarium botanists were not able to identify. The botanists at Bangladesh National Herbarium mentioned that the flora of Sylhet Division (of which Sylhet district forms a part) are yet to be explored in details, so these two plant species could be new species. The Kanda names for these two plant species were talmoli and bajramoli (see Serial Number 5). Notably, talmuli in the Bengali language is the Bengali name for *Curculigo orchioides*. However, since this is a common plant in Bangladesh, the Herbarium should not have had any difficulty in identifying this plant. So it appears more probable that talmoli (in the Kanda language) represents a new plant species, and probably unique to the Sylhet area. The 32 identified plant species used by the healer were distributed into 29 families, with the Acanthaceae family providing the maximum number of plants at three. The results are shown in Table 1.

Overall, the formulations used by the healer were fairly simple. Whole plant or plant parts were made into paste, or macerated to obtain juice and then used orally or topically. More often, a single plant or plant part was used for treatment of a single disease; however, sometimes a plant may be used for treatment of two very diverse ailments. For instance, the leaves of *Hygrophilia schulli* were used only to stop bleeding from cuts and wounds (see Serial Number 1). The leaves of *Justicia gendarussa* were used for treatment of helminthiasis in children (see Serial Number 3). On the other hand, the soft pulp within the plant, *Opuntia dillenii* was used both for treatment of burning sensations during urination as well as for treatment of constipation (see Serial Number 7). Complex formulations were also observed to be used for what appeared to be simple ailments. For treatment of coughs (see Serial Number 9), three plant parts were used, namely sap coming out from fruits of *Terminalia bellerica* and *Terminalia chebula* (when plucked) mixed along with ginger (dried rhizome of *Zingiber officinale*).

The healer often used additives in his formulations like ginger, honey or mustard oil. Honey was used along with juice obtained from macerated leaves of *J. gendarussa* for treatment of helminthiasis in children (see Serial Number 3). In this case, the healer mentioned that honey was used to make the juice more palatable to children, who otherwise may not drink the juice, or spit it out. However, honey was also used in paste of leaves prepared from fried leaves of *Achyranthes aspera* for treatment of asthma (see Serial Number 4). Incidentally, this was the only formulation when a plant part was orally administered in the cooked, i.e. fried form. In this case, the healer mentioned that honey possesses therapeutic values, especially in the treatment of respiratory disorders, since it soothes the throat and calms nerves. Sugar was used with the soft pulp of *O. dillenii* (see Serial Number 7) to make the pulp sweet in taste and so more palatable. For treatment of diarrhea and dysentery, the macerated roots of *Villebrunea integrifolia* were advised to be taken with cooked rice.

One of the most widely used plant part was seeds of *Piper nigrum*, which were used in five of the twenty four formulations (see Serial Numbers 5, 6, 10, 13, and 20). In the first instance, the seeds were used along with bark of *Holarrhena antidysenterica* for treatment of stomach pain; in the second instance, the seeds were used along with *Rauwolfia serpentina*, *Elettaria cardamomum*, and *Syzygium aromaticum* for treatment of fever; in the third instance, the seeds were used along with *Hodgsonia macrocarpa* also for treatment of fever; in the fourth instance, the seeds were used along with *Euphorbia hirta* for treatment of diarrhea; and in the fifth instance, the seeds were used along with *Plumbago indica*, *Calotropis gigantea*, *Senna sophera* and *Carum bulbocastanum*, again for the treatment of stomach pain. It appears that seeds of *P. nigrum* may have soothing effects in gastrointestinal disorders as well as possess anti-pyretic effects.

In only one formulation, the Kanda healer used body hairs from two mammals in combination with plant parts (see Serial Number 4). In this instance, the body hairs of the Asiatic black bear (*Ursus thibetanus*) and the giant bat (*Pteropus giganteus giganteus*) were used with roots of *A. aspera* and *S. sophera* for treatment of fever with shivering. The treatment method was also esoteric. All four items were tied to the body with a white thread (note that the healer mentioned that the thread color can be white only). Whether this actually works or not remain to be scientifically determined.

Discussion

The Kanda healer did neither treat a wide variety of ailments nor treated complex ailments. The ailments that were treated included cuts and wounds (to stop bleeding), skin diseases, helminthiasis, fever, respiratory tract disorders (asthma, coughs), gastrointestinal troubles (stomach pain, constipation, diarrhea, dysentery), burning sensations during urination, pain (headache, body ache, toothache, ear ache), conjunctivitis, poisonous snake, insect or reptile bites, jaundice, and bone fractures. It is possible that much of the Kanda medicinal knowledge has been lost because of the decimation of the tribe, or that the knowledge has been lost because more and more, the younger generations, particularly, are losing interest in maintaining ancient tribal practices and getting assimilated with the mainstream population and modern ways. However, this does not decrease the importance of the formulations still in existence; if scientific research can validate the use of these formulations, it will offer the Kanda tribe a cheaper way of dealing with common ailments without the need for visiting far-away allopathic doctors and clinics. Moreover, since these plants are within the immediate vicinity of the Kanda's habitats, these plants can provide quicker relief because of their easy availability.

Paste of leaves of *H. schulli* was applied with mustard oil and salt to stop bleeding from cuts and wounds (see Serial Number 1). Mustard oil is a known anodyne, i.e. it relieves pain, which is a consequence of cuts and wounds. The warmth of the oil would also have a soothing effect. Moreover, the oil would be helpful in having lipid soluble phytochemicals from being easily absorbed through the skin. Salt would help dry the wound, and as such cuts and wounds are treated with saltwater in home remedies. In Ayurveda (Indian system of traditional medicine), roots and seeds of the plant are used as diuretic, and for treatment of diseases of the urogenital tract, arthritis, and edema. In Siddha system of Indian traditional medicine, the leaves are used to treat diarrhea. As such, this particular use of this plant by the Kanda healer can be said to be a new use of the plant. Leaves of

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Table 1. Medicinal formulations of a Kanda tribal healer.

Serial Number	Scientific Name	Family Name	Local Name	Utilized Part	Ailment(s) and formulation(s)
1	<i>Hygrophila schulli</i> (Buch.-Ham.) M.R.Almeida & S.M.Almeida	Acanthaceae	Kata hez	Leaf	To stop bleeding from cuts and wounds. Paste of leaves is first mixed with a little salt. Mustard oil [oil obtained from seeds of <i>Brassica juncea</i> L. (Cruciferae)] is then warmed to the extent where it can be tolerated by the body. Paste of leaf, salt and warm mustard oil is then applied to cuts and wounds and the area tightly bandaged with a piece of cloth.
2	<i>Adhatoda vasica</i> Nees	Acanthaceae	Kala bashok	Leaf	Skin infections, skin diseases. Juice obtained from macerated leaves is applied to affected areas 2-3 times daily.
3	<i>Justicia gendarussa</i> Burm. F.	Acanthaceae	Pata bahar	Leaf	Helmintic infections in children (symptoms: distended abdomen, stomach pain, anal itching). Leaves are macerated in a tin cup to obtain juice which is mixed with honey and taken. Ratio of leaf juice to honey is 1:1 spoonful.
4	<i>Achyranthes aspera</i> L.	Amaranthaceae	Upama rong	Root, leaf	Bleeding from deep cuts and wounds. Roots are macerated and applied to cuts and wounds to stop bleeding. The paste is not washed away till the area is totally healed. Fever with shivering. Roots of <i>Achyranthes aspera</i> are mixed with roots of <i>Senna sophera</i> (L.) Roxb., body hairs of Asiatic black bear (<i>Ursus thibetanus</i> , local name: bhalluk), hairs of bat (<i>Pteropus giganteus giganteus</i> , local name: badur) and tied with a white colored thread to the body. Snake bite. Paste of roots are applied to snake-bitten area, nails, palm of hands and at the same time taken orally. Asthma (symptoms: respiratory difficulties, local term: hapani). Leaves are fried and made into a paste with honey. The paste is taken twice daily after meals. Dosage is ½ spoonfuls in primary stages of asthma, and 2 spoonfuls for chronic asthma.
5	<i>Holarrhena antidysenterica</i> (Roxb. ex Fleming) Wall. ex A. DC.	Apocynaceae	Kuruchi	Bark	Stomach pain. Bark of <i>Holarrhena antidysenterica</i> is mixed with talmoli (unidentified plant), roots of bajramoli (unidentified plant), and five seeds of <i>Piper nigrum</i> L. (Piperaceae). The mixture is macerated and taken in the morning for three consecutive days. Dosage is 2-3 spoonfuls or a pill made from these 2-3 spoonfuls of mixture.
6	<i>Rauwolfia serpentina</i> Benth.	Apocynaceae	Patal gorul	Root	Fever. One inch amount of root is taken and mixed with 7-8 seeds of <i>Piper nigrum</i> L. (Piperaceae), one fruit with seeds of <i>Elettaria cardamomum</i> Maton (Zingiberaceae), one clove [<i>Syzygium aromaticum</i> (L.) Merr. and L.M. Perry, Myrtaceae] and water. Pills or syrup is prepared from the mix. 4-5 spoonfuls are taken after meals every two days.

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					Contraindication: Pregnant women should take lesser amounts.
7	<i>Opuntia dillenii</i> (Ker Gawl.) Haw	Cactaceae	Shoktopana	Soft pulp within the plant	Burning sensations during urination, constipation. First the bark is removed to gather the soft pulp. The pulp is sliced into small pieces and one piece is taken on an empty stomach. Alternately, one piece is macerated and taken with sugar.
8	<i>Cleome rutidospermum</i> DC.	Capparaceae	Bon shoshya	Leaf, fruit	Headache. Leaves or fruits are macerated and applied as a paste to the forehead.
9	<i>Terminalia bellerica</i> (Gaertn.) Roxb	Combretaceae	Bahera, Bahara, Bayera urissa	Sap coming from fruit when the fruit is plucked	Coughs. Sap coming from fruits of <i>Terminalia bellerica</i> and <i>Terminalia chebula</i> (Gaertn.) Retz. (Combretaceae, local name: hortoki) are mixed and kept in water overnight. Ginger is then added to the mixture. 4-5 spoonfuls of the mixture is taken once daily in the morning for three days.
10	<i>Hodgsonia macrocarpa</i> Cogn.	Cucurbitaceae	Patal gur	Root	Fever. Roots are macerated and mixed with 3-5 powdered seeds of <i>Piper nigrum</i> L. (Piperaceae, local name: gol morich). The mixture is orally taken twice daily before meals. Dosage is ½ spoonfuls for children and 2 teaspoonfuls for adults.
11	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Shorno lota	Whole plant	Sprain in sole of foot. Whole plant is tied around the foot. At the same time macerated whole plant is taken with ginger for 7 days.
12	<i>Euphorbia candelabrum</i> Kotschy	Euphorbiaceae	Sidh gach	Leaf	Coughs in children. Juice obtained from macerated leaves of <i>Euphorbia candelabrum</i> and <i>Ocimum tenuiflorum</i> L. (Lamiaceae, local name: tulsi) is mixed with honey and orally administered. Dosage is 1 spoonful taken 2-3 times per day.
13	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Jhuti pata	Whole plant	Diarrhea. Whole plants are first washed and then mixed with a small number of seeds of <i>Piper nigrum</i> L. (Piperaceae) and water. Paste or pills prepared from the mix is taken thrice daily either before or after meals. For paste, dosage is 1 spoonful for children and 3 spoonfuls for adults.
14	<i>Litsea monopetala</i> (Roxb.) Pers.	Lauraceae	Menda khal	Bark	Body ache. One spoonful of macerated bark is rubbed onto painful areas.
15	<i>Sida cordifolia</i> L.	Malvaceae	Bherella	Sap coming out when leaf stalk is broken	Toothache (symptoms: pain, swelling of gums, black spots on teeth). A piece of cloth is tied to a stick and then warmed over a fire. The warm cloth is then dipped into the sap 3-4 times. The cloth is then applied to the problematical tooth/teeth, till foam is created at the area. This is done regularly till cure. (Note that the Kaviraj considered that the toothache, swelling of gums and blackening of tooth may happen due to infect infestation of the tooth or teeth). Diarrhea. Sap is mixed with sugar and water to make a sherbet, which is taken once daily before meals. Dosage is 2-3 spoonfuls. Skin rash. Sap is applied to affected areas of skin.

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16	<i>Phrynium pubinerve</i> Blume	Marantaceae	Gai goruda	Whole plant	Ear ache. Whole plant is warmed over a fire when a sap starts oozing out from the plant. The sap is applied as drops internally into the ears. Dosage is 2-3 drops once daily in the morning.
17	<i>Azadirachta indica</i> A. Juss.	Meliaceae	Neem, Bai neem	Leaf	Helminthiasis. Leaves are macerated and a small amount of water added. 2-3 spoonfuls of the mixture are taken for three days on an empty stomach. Alternately, one pill prepared from the macerated mix is taken as above.
18	<i>Moringa oleifera</i> Lam.	Moringaceae	Sajna pata	Leaf	Conjunctivitis. Juice obtained from macerated leaves is applied to eyes (2-3 drops).
19	<i>Peperomia pellucida</i> L.	Piperaceae	Paneri	Whole plant	Poisonous snake, insect or reptile bites. Whole plant is cleaned, macerated and turned into a paste, which is then applied by the sides of the bitten place. Note that the paste cannot be applied on top of the bitten place.
20	<i>Plumbago indica</i> L.	Plumbaginaceae	Dhola chita	Root	Stomach pain (as if the stomach is twisted). Roots of <i>Plumbago indica</i> is missed with whole plants of <i>Calotropis gigantea</i> R. Br. (Apocynaceae, local name: akondo), whole plants of <i>Senna sophera</i> (L.) Roxb. (Fabaceae, local name: gura chakunda), whole plants of <i>Carum bulbocastanum</i> (L.) W. D. J. Koch (Umbelliferae, local name: sahara), a few seeds of <i>Piper nigrum</i> L. (Piperaceae) and macerated. Pills are prepared from the macerated mix. Dosage is three pills, one each to be taken in the morning, night, and the following morning. Tooth infection (considered as insect infestation of tooth). Macerated root is applied to base of affected tooth.
21	<i>Monochoria vaginalis</i> (Burm. f.) C. Presl.	Pontederiaceae	Nouka gach	Leaf	Jaundice (symptoms: yellow coloration in eyes, loss of appetite, sleeplessness). Juice obtained from macerated leaves is taken thrice daily till cure.
22	<i>Thysanolaena maxima</i> (Roxb.) Kuntze	Poaceae	Jharu gach	Flower	Vomiting tendency, stomach trouble. Crushed flowers are taken with water.
23	<i>Villebrunea integrifolia</i> Gaudich	Urticaceae	Bon ria	Root	Diarrhea, dysentery. Macerated roots are taken with rice.
24	<i>Cissus quadrangularis</i> L.	Vitaceae	Har bhanga, Har jora	Stem	Bone fracture. Macerated stems are slightly warmed and applied to the fractured area with a bandage tied to the area.

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Adhatoda vasica (synonym – *Justicia adhatoda*) was used by the Kanda healer for treatment of skin infections and skin diseases (see Serial Number 2). Use of leaves in Indian folk medicine for treatment of skin diseases has been reported (Dhankhar et al, 2011). The plant is extensively used in Ayurvedic and Unani systems of Indian traditional medicine for treatment of respiratory disorders (Prakash et al, 2011). Leaves of *J. gendarussa* were used by the healers for treatment of helminthiasis in children (see Serial Number 3). The leaves are known to contain β -sitosterol (Duke, 1992), which reportedly possess anthelmintic properties (Deepak et al, 2002). Honey was used with leaf juice to make the mixture more palatable to children.

Methanolic extract of leaves of *Achyranthes aspera* has been scientifically reported to demonstrate anti-pyretic activity (Sutar et al, 2008). However, it is to be noted that the roots of this plant were used for treatment of fever with shivering (see Serial Number 4), and moreover they were tied with roots of *Senna sophera*, and not used orally by the Kanda healer. *S. sophera* is considered as an anti-spasmodic plant in Indian traditional medicine (Khare, 2007), which fits in with treatment of shivering, but once again the roots were not orally administered. This form of treatment by tying roots thus seems to be a treatment unique to the Kanda healer. *A. aspera* leaves were orally administered in the fried form by the healer for treatment of asthma; ashes of the plant have been reported to be orally administered for treatment of asthma and coughs in Ayurveda (Khare, 2007). According to Ayurveda, the plant is bitter, pungent, heating, laxative, stomachic, carminative and useful for the treatment of vomiting, bronchitis, heart disease, piles, itching abdominal pains, ascites, dyspepsia, dysentery and blood diseases (Shukla et al, 2011). Paste of roots of *A. aspera* was used by the healer for treatment of snake bite; an identical use of flowers of the plant has been reported in Indian folk medicinal treatment for snake and other reptile bites (Nadkarni, 2005). Leaves of the plant were used by the Kanda healer to treat asthma. Ethanol extract of whole plant has been reported to have beneficial effect in toluene-diisocyanate-induced occupational asthma in rats (Goyal et al, 2007).

The bark of *Holarrhena antidysenterica* was used by the Kanda healer along with two unidentified plants, and seeds of *Piper nigrum* for treatment of stomach pain (see Serial Number 5). *Holarrhena antidysenterica* has also been reported to be useful for gastrointestinal disorders (Kavitha et al, 2004; Gilani et al, 2010). In Ayurveda, the plant is regarded as anti-colitis; the plant has also been described as anti-spasmodic and hypoglycemic (Mitra and Rangesh, 2004). The seeds of *P. nigrum* are regarded as carminative (see below). Since bloating (formation of gas) can be a cause of stomach pain, the use of the seeds of *P. nigrum* along with the bark of the anti-colitis plant, *H. antidysenterica* for treatment of stomach pain is not unprecedented, and can be a result of influences of other traditional Indian medicinal practices on the Kanda tribal healer's practices. The essential oil of *P. nigrum* contains eugenol as one of its major constituents (Musenga et al, 2007). The analgesic effects of orally administered eugenol have been reported in acetic acid-induced gastric pain mice model (Park et al, 2011). As such, administration of *P. nigrum* seeds (which contains eugenol) can play a role in alleviating stomach pain. The seeds also have been reported to contain besides eugenol, components like caryophellene oxide, limonene, β -pinene, and α -phellandrene (Musenga et al, 2007). All the above-noted compounds have been reported to demonstrate analgesic or antinociceptive properties (Chavan et al, 2010; do Amaral et al, 2007; Liapi et al, 2007; Lima et al, 2012). Together, all these constituents of *P. nigrum* can play a synergistic effect in alleviation of pain and which justifies the Kanda healer's use of *P. nigrum* seeds for treatment of stomach pain.

Roots of *Rauwolfia serpentina* (see Serial Number 6, used by the Kanda healer in combination with other plant parts to treat fever) are traditionally used in Indian traditional medicine to increase uterine contractions and for expulsion of fetus in difficult cases. However, it is to be mentioned in this context that this plant, despite its hypotensive effects, have long been used by the Hindus of India to treat fever (Herbal monograph, 2012). Other plant parts used with *R. serpentina* for treatment of fever by the Kanda healer included fruits with seeds of *E. cardamomum*, seeds of *P. nigrum* and dried flower buds of *S. aromaticum*. The latter three are all spices and are indicated in Indian traditional medicines like Ayurveda, Unani, and Siddha as carminative, stomachic, and often anti-asthmatic. As such, their inclusion by the Kanda healer for treatment of fever needs to be scientifically determined. The essential oils of *P. nigrum* and *S. aromaticum* contain eugenol [see above; also Sereshti et al, 2012; Kamatou et al, 2012]. Fever is often accompanied by pain; in that case, the use of spices containing eugenol in the Kanda healer's treatment of fever has scientific validity, for eugenol has analgesic properties (see above). Moreover, eugenol has been reported to possess gastroprotective activity (Santin et al, 2011). The fruits of *E. cardamomum* reportedly also demonstrated gastroprotective activity against gastric lesions induced by aspirin, ethanol and pyloric ligation in rats; the fruits are also used in the Unani system of medicine to treat gastrointestinal disorders (Jamal et al, 2006). It is possible that the Kanda healer's use of the three spices may be to ameliorate any gastrointestinal disturbances caused by fever, or to ameliorate any gastrointestinal disturbances caused by administration of *R. serpentina* roots. It is also noteworthy in this regard, that the plant, *Sesuvium portulacastrum*, is used in traditional medicines of South Africa and Haiti to treat fever. Analysis of essential oil from the plant, which demonstrated anti-microbial activity, indicated presence of β -pinene, limonene, 1,8-cineole, and α -humulene (Magwa et al, 2006). These components are present in *P. nigrum* and *E. cardamomum* (Musenga et al, 2007; Sereshti et al, 2012). Two other components have been identified in the plant *Schinus polygamus*, which demonstrated anti-pyretic activity and activity against a broad spectrum of Gram-positive and Gram-negative bacteria (Erazo et al, 2006). These two compounds, namely β -sitosterol and β -pinene have been reported in *E. cardamomum* (Duke, 1992) and *P. nigrum* (Musenga et al, 2007). Thus inclusion of plant parts from these two plants in the Kanda healer's treatment of fever may be scientifically justified from two view points, namely, anti-pyretic activity and anti-microbial activity, various microbial organisms being causative agents for a number of types of fever.

An infusion of dried or fresh flowers of *Opuntia dillenii* (see Serial Number 7) is used in Indian traditional medicine (Ayurveda) for treatment of prostatitis, which may cause burning sensations during urination (Khare, 2007); the Kanda healer prescribed the soft pulp of the plant for treatment of burning sensations during urination. The leaves and fruits of *Cleome rutidospermum* were used by the Kanda healer for treatment of headache (see Serial Number 8). A scientific report has pointed out the analgesic, anti-inflammatory and anti-pyretic properties of ethanolic extract of this plant (Bose et al, 2007).

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The fruits of *Terminalia bellerica* (see Serial Number 9) are used in Ayurveda and Unani medicines for treatment of coughs, bronchitis and upper respiratory tract infections (Khare, 2007; Saraswathi et al, 2012); the Kanda healer used the sap that oozes out when the fruit is plucked for treatment of coughs. This sap was used with sap coming out of fruits of *Terminalia chebula* when plucked, and ginger [dried powdered rhizomes of *Zingiber officinale* Roscoe (Zingiberaceae)]. Ginger is a common Ayurveda and folk medicinal remedy for treatment of coughs, while fruits of *T. chebula* are used in Ayurvedic medicines for treatment of chronic cough, asthma, coryza, dyspnea and sore throat. Ginger is also a popular herbal remedy for treatment of coughs in Trinidad (Clement et al, 2007). For treatment of fever, the Kanda healer used roots of *Hodgsonia macrocarpa* along with seeds of *P. nigrum* (see Serial Number 10). While the scientific validity of using *H. macrocarpa* is yet to be determined, the efficacy of *P. nigrum* in treatment of fever has been discussed above. *Cuscuta reflexa* (See Serial Number 11) is used in Unani medicine for numbness (Meena et al, 2010). The Kanda healer used the plant for treatment of sprain in sole of foot, which may result in possible numbness, particularly if the sprain is severe. For treatment of coughs in children, the Kanda healer used juice from macerated leaves of *Euphorbia candelabrum* and *Ocimum tenuiflorum* (see Serial Number 12). The latter has wide Ayurvedic medicinal uses for its beneficial effect in cough and breathing problem due to phlegms. The anti-tussive effect of the latter plant (synonym: *Ocimum sanctum*) has also been scientifically validated (Nadig and Laxmi, 2005).

E. hirta (see Serial Number 13) is administered in Ayurveda for treatment of female disorders, respiratory ailments (cough, coryza, bronchitis, and asthma), worm infestations in children, dysentery, jaundice, pimples, gonorrhoea, digestive problems, and tumors, diarrhea and dysentery (Kumar et al, 2010); the Kanda healer used it with seeds of *P. nigrum* for treatment of diarrhea, possibly because of the latter's carminative effect, for flatulency or bloating can accompany diarrhea. The roots of *Litsea monopetala* (see Serial Number 14) are used externally in Indian Siddha system of medicine for treatment of pains, bruises and contusions; the Kanda healer typically used macerated bark of this plant to treat body ache. The traditional herbal healers of Chhindwara and Betul districts of Madhya Pradesh, India use bark of this plant to treat dysentery (Vijendra and Kumar, 2010). *Sida cordifolia* (see Serial Number 15) is used in Ayurveda for treatment of spermatorrhea, rheumatism, neurological disorders, polyuria, leucorrhoea, and dysentery (Jain et al, 2011), and in the Siddha system for treatment of diabetes; the Kanda healer used the plant for toothache and diarrhea. The antinociceptive action of *Sida cordifolia* has been scientifically reported (Bonjardim et al, 2011), validating the Kanda healer's use of this plant for toothache. There are no reported uses of *Phrynium pubinerve* for treatment of ear ache (see Serial Number 16), but an ethnomedicinal report indicates that the plant is used along with several other plants for treatment of leprosy by ethnic people residing in Eastern Himalayan region (Choudhary et al, 2011). The use of *Azadirachta indica* (see Serial Number 17) is the same in Ayurveda and the Kanda healer's treatment for helminthiasis. The treatment of conjunctivitis with leaf juice of *Moringa oleifera* (see Serial Number 18) appears to be unique to the Kandas, for Indian folk medicine uses leaf juice as an emetic in high doses. In Ayurveda, the plant is used to treat pain, swelling, inflammation, fever, colic, worms, renal calculi, cough, asthma, jaundice, epilepsy, abscess, splenomegaly and sexual weakness. Similarly, the use of *Peperomia pellucida* (see Serial Number 19) for treatment of snake, insect or reptile bites seems unique to the Kanda healer; in Ayurveda, the plant is used for treatment of constipation, kidney diseases, urinary retention, disuria, urinary tract infections, emaciation, edema and general weakness. The whole plant is used by the Karens of Middle Andaman Islands for treatment of cuts and wounds (Sharief et al, 2005).

The roots of *Plumbago indica* (see Serial Number 20) are used in Indian traditional medicine (Ayurveda, Unani and Siddha) for treatment of dyspepsia (which can cause stomach pain) and to stimulate digestive processes (Khare, 2007); the Kanda healer used the roots for treatment of stomach pain. The Kanda healer used this plant along with *Calotropis gigantea*, *S. sophora*, *Carum bulbocastanum* and *P. nigrum*. The essential oil from *P. nigrum* contains eugenol, the analgesic and gastroprotective effects of which have been discussed earlier. In Ayurveda, *C. gigantea* is considered to be hot, bitter, pungent and laxative and is beneficial in skin diseases, ulcers, enlargement of the spleen, abdominal glands, liver diseases, promotes digestive power and also useful in colic. As such, this plant can contribute to the pain alleviating effect of *P. indica* and *P. nigrum*. The anti-spasmodic property of *S. sophora* (discussed earlier) can also contribute to decrease in stomach pain through decreasing pain-induced spasms. The plant, *C. bulbocastanum* is mentioned in the Ayurveda to be good for diseases of the digestive system, i.e. gastrointestinal disorders. Taken together, the Kanda healer's use of a multitude of plants for treatment of stomach pain indicates a good knowledge of the medicinal properties of each plant or plant part, and shows that the plant or plant parts in combination can prove to be an effective remedy for various gastrointestinal disorders, some of which may cause occurrence of stomach pain.

In Ayurveda, the plant *Monochoria vaginalis* is used for treatment of burns, and scalds, burning sensations, general debility, fever, hemorrhage, cough and scurvy. The Kanda healer's use of leaves of this plant (see Serial Number 21) for treatment of jaundice does not match with known descriptions of use of this plant in Ayurveda. In Unani system, the root is used for toothache and the bark is eaten with sugar for asthma. In Siddha system of traditional medicine, the plant is used for oral health care. The use of the plant, *Cissus quadrangularis*, for treatment of bone fracture by the Kanda healer (see Serial Number 24) has been validated through modern scientific research (Udupa et al, 1961; Udupa and Prasad, 1962, 1964a,b).

Overall, it can be said that a number of treatments of various diseases or symptoms meted out by the Kanda healer with various medicinal plant(s) has similarities in treatment with the same plant(s) for the same disease or symptom in Indian traditional medicinal systems, which includes Ayurveda, Unani and Siddha. This is not surprising, considering that the Kandas most probably have arrived in Bangladesh in comparatively recent times, being brought here by the British rulers from Orissa, India to work in the tea gardens of Sylhet in the nineteenth century. However, some other modes of treatment and the medicinal plants or plant parts used are new and probably picked up by the Kandas following their arrival in present Bangladesh from the local folk medicinal practitioners, or the Kandas have come to using these plant parts and the new modes of treatment through their own tribal practitioner's trials. Some examples of such plants are *Phrynium pubinerve*, *Thysanolaena maxima*, and *Villebrunea integrifolia*.

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It is very much possible that a number of the plants used by the Kanda healer will be scientifically validated in their traditional uses following relevant pharmacological studies. Such validation can not only add to new scientific discoveries but also spur conservation efforts of these medicinal plants, which due to habitat increases, are fast becoming endangered in Bangladesh.

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