Ethno-medicobotanical observations on some tribal communities of Tripura, India

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Abstract
Recent ethno-medicobotanical study among Halam, Tripuri and Chakma ethnic groups of Tripura recorded the use of thirty four plants belonging to thirty families have been recorded which are found to be useful in curing various ailments. Some of the interesting plants are Alocasia indica, Celosia cristata, Phlogacanthus thyrsiformis Spilanthus paniculata, Cardiospermum halicacabum etc. Quite good number of new mode of uses are also recorded.

Key words: Tripura, Ethnobotany, tribal communities.

INTRODUCTION
Man is depending on the plants since their origin for all kinds of necessities, including food, shelter, clothes, medicine etc. Ethnobotany is an offshoot of botany that deals with the plants used by ethnic people. The plants and records of uses of such plants in India dates back to the Vedic and Pre-Vedic era and Dr. K. E. Janaki Ammal in 1954 (Ammal 1954) was the first person to initiate such studies in this country.

Considerable ethnobotanical works have been done in North-East India specially in Arunachal Pradesh, Assam, Manipur and Meghalaya including Jain & Borthakur (1980), Sinha (1986), Dutta Choudhury (1999), Shil (2007), Tiwari et al. (1978), Bhattacharjee et al. (1977), Gogoi et al. (1979), Rao & Jamir (1982), and Nath & Maiti (2003). Dutta Choudhury et al (2008) also recorded substantial amount of information on the medicinal uses of ferns and fern allies of this region.

Kalita & Surajit (2004) studied the plant based medicines used by the rural people of Dibrugarh district of Assam for curing 18 different diseases using 28 different species. Tamuli & Saikia (2004) recorded the use of 33 species of plants by Zeme Nagas of N.C. Hills district of Assam. Khumbongmayum et al. (2005) studied the therapeutic applications of 120 ethnomedicinal plants of Manipur, belonging to 106 genera and 57 families. However, the ethnobotanical publications from Tripura is scanty though as much as 31% of the state population are tribals and there are as many as 16 tribal groups living in the state. Shil (2007) carried out detailed ethnobotanical work on Reang tribe of Tripura but the major segment comprising of other tribal groups remained unexplored till date.

METHODOLOGY
Exhaustive field surveys have been undertaken covering all seasons for gathering information on each and every species used by tribal people as medicines. Surveys were conducted in Jaithang, Balidhum and Nabincherra villages of Tripura inhabited respectively by the Halam, Tripuri and Chakma communities.

Plants have been collected in their flowering and fruiting stage as far as possible from the natural habitat and serially tagged with field numbers and recorded different information in the
field note book. Specimens were processed into mounted herbarium sheets following Jain & Rao (1977) and were deposited in the Silchar Herbarium for further use. Plants were identified using local flora including Hooker (1872 - 1897), Kanjilal et al 1930 – 1940, Bor (1940) and Deb (1981 - 1983). A set of the specimens will be deposited at ASSAM Herbarium.

Ethnobotanical methodologies as suggested by Schultes (1960, 1962), Jain (1964, 1967, 1991) and Jain & Mudgal (1999) have been followed during field study. Informants include local medicine-men, village headmen and aged and experienced people. Queries have been made repeatedly, occasionally taking help from interpreters for confirmation of data on each medicinal plant. Data on each plant have been recorded as follows: (a) Sl. No. (b) Scientific name (c) Family (d) Vernacular Name (e) name of the tribe (f) Parts used (g) Mode of utilization and (h) Established report of use.

Recorded plants are enumerated below along with their scientific and local names, family, parts used, mode of use, and established uses of such plants.

**ENUMERATION**

*Ageratum conyzoides* L. [Asteraceae]; LN: Khomorochewk & Shyamtuli; Community: Halam & Tripuri

Parts used: Leaves & twigs; Method of use: Paste used as antihaemorrhagic by Halams; juice used as an expectorant by Tripuris.

Known uses: Root juice antilithic; leaf juice styptic, applied to cuts and sores, externally in ague (Chopra et al. 1956)

Note: Its antihemorrhagic and expectorant properties are new reports amongst the Halams.

*Alocasia indica* Schultes [Araceae]; LN: Maitu bulai; Community: Tripuri

Parts used: Modified root; Method of use: Root paste used against rheumatism.

Known uses: Leaves styptic, astringent, tuber useful in piles and constipation (Chopra et al. 1956);

Note: Its anti-rheumatic property was reported for the first time.

Note: Similar practice found among certain other tribes also.

*Alpinia nigra* (Gertner) Burtt [Zingiberaceae]; LN: Peitranga; Community: Chakma

Parts used: Rhizome; Method of use: Juice of rhizome is used against dyspepsia

Known uses: Different species of *Alpinia* used in/as fever, rheumatism, bronchial infections, expectorant, stomachic, stimulant, aphrodisiac, carminative, emetic (Chopra et al. 1956).

Note: No previous record of its use against dyspepsia.

*Althea rosea* (L.) Cavan [Malvaceae]; LN: Kumai; Community: Chakma

Parts used: Seeds; Method of use: Seed paste applied on children’s the head during cold

Known uses: Seeds demulcent, diuretic, febrifuge; roots astringent, demulcent useful in dysentery. Flowers cooling, diuretic, used in rheumatism (Chopra et al. 1956).

Note: Its application as external ointment is now reported for the first time by the Chakma people.

*Ananas comosus* (L.) Merrill [Bromeliaceae]; LN: Amortui; Community: Tripuri.

Parts used: Fruit & leaf base; Method of use: Paste of leaf base consumed in diarrhoea.

Known uses: Leaf juice anthelmintic, unripe fruits abortifacient, juice of fruit antiscorbutic (Chopra et al. 1956).

Note: Anti- diarrheic use is a new record.

*Azadirachta indica* A. Jussieu [Meliaceae]; LN: Neem; Community: Halam.

Parts used: Leaves; Method of use: Leaves boiled in water and used to bathe the patient during malaria and chicken pox.
**Known uses:** Young fruits, bark and root bark astringent, antiperspirant; leaves as poultice in boils, antiseptic in ulcers and eczema; gum demulcent tonic in cataract; dry flowers tonic, stomachic; oil stimulant, antiseptic in rheumatism and skin diseases; bark, gum, leaf and seeds in scorpion stings and snake bites; berries purgative, emolument and anthelmintic (Chopra et al. 1956).

**Note:** Its use on malaria and chicken pox is a new report.

*Bambusa* sp. [Poaceae]; **LN:** Waa-epahang; **Community:** Tripuri.

**Parts used:** Entire plant; **Method of use:** Powder of the green portion of stem is used as antihemorrhagic.

**Known uses:** Various species emmenagogue, astringent, anti-hemorrhagic, emolument, used in hematemesis, tonic useful in fever, cough, menorrhagia, nausea, vomiting, snake bite and given to horses in cough and cold (Chopra et al. 1956).

**Bryophyllum calycinum** Salisbury [Crassulaceae]; **LN:** Khurojot; **Community:** Chakma.

**Parts used:** Leaves; **Method of use:** Powdered with sugar to control dysentery and diarrhoea.

**Known uses:** Juice of leaves styptic; seed on fresh cuts and abrasions, bruises, burns and superficial ulcers, given in bilious diarrhoea, lithiasis (Chopra, et al., 1956).

**Note:** Report of anti-dysenteric property is new.

*Cajanus cajan* (L.) Millsp. [Fabaceae]; **LN:** Khokhlaing; **Community:** Chakma.

**Parts used:** Leaves & Twigs; **Method of use:** Paste of leaves and twigs applied throughout the body in jaundice.

**Known uses:** Seeds in snake-bite; paste of seeds and leaves used to control milk flow (Chopra et al. 1956).

**Note:** Widely used as a hepatoprotective agent.

*Calotropis gigantea* (L.) R.Brown ex Aiton [Asclepiadaceae]; **LN:** Angarpata; **Community:** Chakma.

**Parts used:** Leaves; **Method of use:** Leaves heated and applied locally to relieve pain.

**Known uses:** Root bark anti-dysenteric, diaphoretic, expectorant, emetic, applied as paste in elephantiasis; tincture of leaves used in intermittent fevers; latex irritant, purgative; powdered flowers given in cold asthma and indigestion (Chopra et al. 1956).

**Note:** External application of warm leaves in pain relief is a new report.

*Cardiospermum halicacabum* L. [Sapindaceae]; **LN:** Heda- bhokta; **Community:** Chakma.

**Parts used:** Leaves; **Method of use:** Paste of the leaves applied on the body during measles.

**Known uses:** Plant used in rheumatism, stiffness of limbs, snake-bite. Root diaphoretic diuretic, aperients, laxative, rubefacient, emmenagogue, occasionally used in rheumatism, lumbago and nervous diseases; leaves rubefacient, poultice in rheumatism; leaf juice used in ear ache (Chopra et al. 1956).

**Note:** External remedy to measles is new report.

*Carica papaya* L. [Caricaceae]; **LN:** Paypay; **Community:** Chakma.

**Parts used:** Fruit; **Method of use:** Fruits are used as stomachic.

**Known uses:** Latex of unripe fruits used to remove freckles and blemishes from skin, anthelmintic; ripe fruits stomachic, carminative, diuretic; seeds vermifuge, emmenagogue, used to quench thirst (Chopra et al. 1956).

**Celosia cristata** L. [Amaranthaceae]; **LN:** Radhachuro phool; **Community:** Chakma.

**Parts used:** Leaves; **Method of use:** Leaf juice taken orally as antihemorrhagic during parturition.

**Known uses:** Seeds anti-diarrheic, aphrodisiac, useful in blood diseases, eye and for oral sores (Chopra et al. 1956).

**Note:** Use of leaf juice as an antihemorrhagic is a new report.
Centella asiatica (L.) Urban [Apiaceae]; LN: Perup; Community: Halam.
Parts used: Leaves; Method of use: Eaten either as paste or cooked as a vegetable in dysentery and diarrhoea.
Known uses: Plant useful as alternative and tonic in diseases of skin, leprosy, nerves and blood; leaves useful for improving memory and in syphilitic skin diseases (Chopra et al. 1956).
Note: Leaf juice commonly used in dysentry and diarrhoea.

Clerodendrum viscosum Ventenat [Verbenaceae]; LN: Killiaishak; Community: Chakma.
Parts used: Leaves; Method of use: Cooked as vegetable; juice used as expectorant; leaf decoction used to check high blood pressure.
Known uses: Plant useful in inflammations, anorexia, dyspepsia, flatulence, helminthiasis, cough, asthma, bronchitis, hiccough, chronic skin diseases, leucoderma, leprosy and fevers. The leaves can be used or external application in headache (http://ayurvedicmedicinalplants.com/plants/223.html, 2009).
Note: Its hepatoprotective property is a new report.

Crinum asiaticum L. [Amaryllidaceae]; LN: Khobaron; Community: Chakma.
Parts used: Leaves; Method of use: Leaf juice used in rheumatism both for man and domestic animals.
Known uses: Many species of Crinum used as laxative, expectorant, anti-bilious and in urinary troubles; also used as emollient, emetic, burns, infections, etc.; bulbs used as rubefacient, in piles and abscesses; leaf juice used in ear-ache (Chopra et al. 1956).
Note: The anti-rheumatic property of the plant is a new report.

Costus specious (Koenig ex Retzius) Smith [Costaceae]; LN: Mylongma Khotomai; Community: Tripuri.
Parts used: Leaves and stem; Method of use: Leaf juice used as an ingredient of a medicine for jaundice; sap of stem used to remove parasites from ears.
Known uses: Root astringent, purgative, depurative, stimulant, tonic, anthelmintic, antinode in snake bite (Chopra et al. 1956).
Note: The report of hepatoprotective and insecticidal properties of the species is new.

Curcuma caesia Roxburgh [Zingiberaceae]; LN: Kalahalud; Community: Chakma.
Parts used: Rhizome; Method of use: Rhizome extract reduces the action of intoxicants, i.e. as anti-narcotic.
Note: No medicinal properties of this plant have been reported in the literatures consulted.

Cynodon dactylon (L.) Persoon [Poaceae]; LN: Dubba; Community: Chakma.
Parts used: Young twigs; Method of use: Shoot extract is anti-haemorrhagic.
Known uses: Decoction of roots diuretic in dropsy, secondary syphilis; root infusion in piles, crushed roots in chronic gleet; plant juice astringent, useful in cuts and wounds, diuretic, used in dropsy and anasarca, useful in diarrhoea, dysentery, nervous diseases and eye troubles (Chopra et al. 1956).

Chromolaena odoratum (L.) King & Robinson [Asteraceae]; LN: Cheikhmarimshiekh; Community: Halams.
Parts used: Leaves; Method of use: Leaf paste used to stop bleeding.
Known uses: Fish poison (Chopra, et al., 1956); Note: Anti haemorrhagic property of the plant has not been reported by Chopra et al. 1956).

Euphorbia nerifolia L. [Euphorbiaceae]; LN: Sairapat; Community: Halams.
Parts used: Entire plant; Method of use: Leaves heated on fire and placed on chest to control cough.
Known uses: Milky juice used as purgative, for skin diseases; roots in scorpion sting, snake bite, as antiseptic and fish poison (Chopra et al. 1956).
Note: The use of leaves to control cough is a new report.

Ficus hispida L. [Moraceae]; LN: Mayungmai; Community: Tripuri.
Parts used: Raw fruit; Method of use: The fruit smashed and dipped in milk for 3-4 days. This milk is later given to cure jaundice.
Known uses: Fruit, seed & bark purgative, emetic (Chopra et al. 1956).
Note: Its hepatoprotective property is a new report.

Jatropha curcas L. [Euphorbiaceae]; LN: Girogaachh; Community: Chakma.
Parts used: Branches; Method of use: Small pieces of branches used as tooth brush (datim); sap is thought to be very good for gum infections.
Known uses: Seeds and roasted nuts purgative; latex useful in scabies, eczema and ringworm; leaves lactagogue, rubefacient (Chopra et al. 1956).
Note: Its anti-dysenteric property is a new report.

Mangifera indica L. [Anacardiaceae]; LN: Thaihai; Community: Halam.
Parts used: Stem Bark; Method of use: Bark kept immersed in water for 3-4 days and the filtrate is used against dysentery.
Known uses: Leaves used in scorpion sting; ripe fruits laxative, diuretic, astringent and anti-haemorrhagic; unripe fruits in ophthalmia and eruptions; rind of fruit astringent, stimulant and stomachic; seeds used in asthma; corydals anthihemorrhagic, stops nasal bleeding, anthelmintic; bark astringent, used in uterine bleeding, haemoptysis and melena, diarrhoea (Chopra et al. 1956).
Note: Its anti-dysenteric property is a new report.

Mimosapudica L. [Mimosaceae]; LN: Cheaken laite; Community: Halam.
Parts used: Entire plant; Method of use: Leaf paste applied on acne and pimples.
Known uses: Leaves and roots used in piles and fistula; leaf paste applied to hydrocele; leaf and stem used in scorpion sting (Chopra et al. 1956).
Note: The antiseptic properties of the plant is a new report.

Momordica charantia L. [Cucurbitaceae]; LN: Gangrauk; Community: Tripuri.
Parts used: Fruits and twigs; Method of use: Fruits anthelmintic; juice of twigs used in dyspepsia.
Known uses: Leaf juice emetic, purgative, used in biliousness, burning of soles of feet; fruits and leaves purgative, emetic, used in piles, jaundice, leprosy and as vermifuge (Chopra et al. 1956).

Musa ornata Roxburgh [Musaceae]; LN: Mot; Community: Halam.
Parts used: Entire plant; Method of use: Flowers juice is given in dysmenorrhoea and menorrhagia.
Note: No such uses of the plant have been found in the literatures consulted.

Piper betle L. [Piperaceae]; LN: Phatui bulai; Community: Tripuri.
Parts used: Leaves; Method of use: Raw leaves carminative and mild stimulant.
Known uses: Leaves aromatic carminative, stimulant; used in respiratory catarrhs, eye troubles, cerebral congestions, satyriasis, as antiseptic and also in snake bite; fruit in cough, root used as oral contraceptive (Chopra et al. 1956).

Phlogacanthus thyrsiformis (Hardwicke) Mabberley [Acanthaceae]; LN: Basakpata; Community: Chakma.
Parts used: Leaves; Method of use: Leaf juice used as an expectorant.
Note: No such use of the plant has been reported in the standard literature.

Psidium guajava L. [Myrtaceae]; LN: Sapri; Community: Halam.
Parts used: Fruits and twigs; Method of use: Young twigs are chewed in dysentery.
Known uses: Root bark reported to be astringent, used in diarrhoea; fruits laxative; leaves astringent, used against diarrhoea, cholera, vomiting, wounds and ulcers (Chopra et al. 1956).
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Note: Plant's anti-dysenteric property is a new report.

Scoparia dulcis L. [Scrophulariaceae]; LN: Naipungchewk; Community: Halam.
Parts used: Entire plant; Method of use: Decoction used as an anthelmintic for infants aged 6 months to 1 year.
Known uses: Plant infusion used as ague and as an emetic (Chopra et al. 1956).
Note: Its use as paediatric anthelmintic is a new report.

Spilanthes paniculata Wallich ex. DC. [Asteraceae]; LN: Ausha; Community: Halam.
Parts used: Leaves; Method of use: Juice is used in dyspepsia.
Note: No medicinal use of the plant been reported in standard literature.

Stephania spp. [Menispermaceae]; LN: Thandamanik; Community: Chakma.
Parts used: Leaves; Method of use: Leaf paste is applied on the belly in stomach-ache.
Known uses: Various species used as astringent, in pulmonary tuberculosis, asthma, dysentery, fever, diarrhoea, dyspepsia, urinary troubles (Chopra et al. 1956).
Note: The Its external use in stomach-ache is a new report.

Terminalia chebula Retzius [Combretaceae]; LN: Bukhala buhai; Community: Tripuri.
Parts used: Fruits; Method of use: Fruits used as an astringent and stomachic.
Known uses: Fruits astringent, laxative, locally applied on wounds and ulcers; used in stomatitis, carious teeth, bleeding and ulceration of gums; bark diuretic, cardiac otonic (Chopra et al. 1956).

RESULT AND DISCUSSION

Altogether 34 species of plants of ethnomedicinal importance belonging to 30 families of angiosperms were collected. These plants are enumerated here along with their scientific and local names, family, parts used, mode of use, and established uses. A note has been provided whenever it was felt necessary.

Of all the recorded plants 33 were found to be of medicinal importance and the remaining one plant is anti-narcotic. Out of the 34 species identified taxonomically, 16 are in their wild state and 10 are cultivated for several medicinal purposes. Remaining 4 species are reported to cultivated as well as growing in the wild.

LITERATURE CITED

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A FEW ETHNOMEDICINAL HEPATOPROTECTIVE PLANTS OF TRIPURA STATE, INDIA: A FIELD STUDY

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ABSTRACT

A survey was carried out to study some of the hepatoprotective ethnomedicinal plants used by ethnic groups of Tripura. A total of twenty five plant species were collected belonging to twenty two families. These plants have been reported to be used as a single medicine and also in combination of two or more components. Some of the interesting plants include *Neptunia prostrata*, *Oroxylum indicum*, *Cajanus cajan*, *Ficus racemosa*, *Costus speciosus*, *Mimosa pudica*, *Entada scandens*, etc.

INTRODUCTION

Perhaps, as early as Neanderthal man, plants were believed to have healing powers. The earliest records of uses of phytomedicine have been found in Babylonian crisis of 1770 B.C. and Egyptian crisis of 1550 B.C. (Anna, 1993). Medicinal properties have also been exhibited by several polyherbal preparations from the Ayurveda (Bhattacharya & Kumar, 1997). In this context, mention might be made of the polyherbal preparations, Trasnias and Ashtwarga, a group of eight drugs (Kumar, 2007).

There is wide evidence of the potential of medicinal plants in the traditional systems till these days. In the recent years, over 13,000 plants of ethno-medicinal importance have been studied (Dhanukar et al., 2000). About 250 years ago, 2,50,000-3,00,000 higher plants were the source of drugs for the world's population (Duke, 1990). Phytochemicals of medicinal importance could be classified as oligosaccharides, polyphenols, indoles, isothiocyanates, allylic sulphur compounds, terpenes, phytic acid and saponins (Srinivasan, 2007). Besides vast cultural heritage of India, we also have a rich treasure of ethnomedical knowledge. A total of 425 plant species are used by the local herbal doctors of Ladakh including *Podophyllum hexandrum*, *Aconitum heterophyllum*, *Artemisia sp.*, *Gentiana aliguda* etc. (Sharma, 2006). *Ageratum*
conyzoides has been known to have anti-inflammatory, lithographic, styptic, vulnerary, anti-hemorrhagic, anti-allergic and other medicinal properties (Sisodia & Siddiqui, 2007). Chelidonium majus is extensively used in traditional systems of medicine against various liver ailments (Biswas et al., 2007). Annona senegalensis is used traditionally in Nigeria to treat victims of snakebite. The extract was found to directly detoxify the snake venom (Adzu et al., 2005). Cat's claw (Uncaria tomentosa (UT) and Uncaria guianensis (UG)) have the antioxidative and anti-inflammatory properties due to presence of alkaloids and flavonoids (Sandoval et al., 2002). Besides, plants like Centella asiatica, Acalypha indica, Ageratum conyzoides, Zehneria scabra are some of the most widely used ethnomedical plants (Shamungou, 2007).

Tripura, the small State, is a rich site for wide variety of biodiversity. A large number of plants are being used by the tribes for medicinal purposes. A vast majority of them have still remained unexplored because of inaccessibility to those areas where the medicine men of different ethnic communities reside. Unfortunately, only a little ethnobotanical work has been carried out in the whole state (Shil, 2007). In the ethnomedicine of Tripura, Abutilon indicum is known as to be in anthelmintic, Acalypha indica is used as a poultice of fresh leaves on ulcers and also as emetic. Ageratum conyzoides leaves are used as antihemorrhagic and in skin diseases. Adenanthera pavonina is used as anthelmintic, antirheumatic and against vomiting (Singh, 2007). Although very little work has so far been done on ethnomedical plants of Tripura, there is, however, a vast potential in this aspect.

MATERIALS AND METHODS

Exhaustive field surveys were undertaken covering all seasons for gathering information on hepatoprotective species useful in the herbal medicine of the tribal people. Surveys were conducted in Jaitang, Balidhum and Nabincherra villages of Tripura inhabited by the Halam, Tripuri and Chakma communities respectively.

Plants were collected in their flowering and fruiting stage as far as possible from their natural habitats and serially tagged with collection numbers. Information regarding the medicinal plants used by the Halams, Tripuris, Chakmas and Manipuris were collected from the medicine- men, village headmen and the aged and experienced people by both oral conversations and direct observations. Ethnobotanical methodology as suggested by Schultes (1960, 1962), Jain (1964, 1967, 1985, 1987 and 1989) was followed during collection of information.

Drying, poisoning and identification of the specimens was done consulting a number of Floras and Monographs, especially Flora of British India (Hooker, 1872- 1897), Flora of Assam, Vol. 1-4 (Kanjilal et al., 1934-1940; Bor, 1940), Flora of Tripura State (Deb, 1981, 1983).

Data on each plant was recorded as follows: (a) Serial No., (b) Scientific name, (c) Family, (d) Vernacular Name, (e) Name of the tribe, (f) Parts used, (g) Mode of utilization and (h) Established report of use.

Instant pressing of specimens, as far as possible was done. Rainy seasons’ specimens were pressed by spraying 10% formaldehyde. Succulent, bulbous and rhizomatous plants were boiled till the plant turned yellow and pressed properly. Dried specimens were poisoned properly with a saturated solution.
of HgCl₂, dissolved in absolute alcohol and mounted with fish glue on standard (42 x 28 cm) sheets. Field data with collection number, locality, short description, vernacular name, collector's name were transferred from the field notebook to printed level on the right hand corner of the herbarium sheet for ready identification.

One set of identified herbarium sheets has been deposited at the Assam University, Silchar Herbarium for future studies.

Arrangement of plants has been made alphabetically with the correct nomenclature, followed by the names of family, data recorded regarding tribe's name, vernacular name, parts used, mode of utilization and established reports of utilization of the medicine.

### RESULTS

During the present investigation, altogether 25 species of plants, belonging to 21 different families of angiosperms and 1 family of pteridophytes have been recorded for their hepatoprotective properties. All these plants have been reported from four different ethnic groups of Tripura.

The plants studied have been used both singly and in combinations. Amongst these, 14 plants have been used as the only component of the medicine, two plants are used in combination with animal products, 11 plants have been used in different combinations in 5 different medicines and 3 plants have been used in both combination medicines and as single phytomedicine.

#### Table 1. Hepatoprotective plants of Tripura.

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Name of the plant</th>
<th>Family</th>
<th>Vernacular name</th>
<th>Part used</th>
<th>Mode or purpose of utilization in hepatoprotection</th>
<th>Established report of utilization</th>
<th>Mode of utilization</th>
<th>Citation percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Aegle marmalos</td>
<td>Rutaceae</td>
<td>Bael</td>
<td>Fruits</td>
<td>Gum from the fruit is administered @ 1 teaspoon daily.</td>
<td>Pulp of unripe fruit is aromatic, cooling, laxative. Unripe or half ripe fruit is astringent, stomachic, digestive &amp; used in diarrhoea. Root bark is used in intermittent fevers &amp; as fish poison (Chopra et al., 1956).</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Averrhoa carambola</td>
<td>Averrhoaceae</td>
<td>Kamranga</td>
<td>Fruit</td>
<td>Dried fruits of A. carambola are antiseborrhic and used against fever. Ripen fruits in piles &amp; febrile excitement are made into a liquid mixture in 1:1:1 ratio and taken orally twice daily up to 7 days.</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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3. **Azadirachta indica A. Juss.**

   *Meliaceae*  
   *Neem*  
   *Bark*

   Bark is soaked in water for some time in parthenware vessel. It is then taken out, dried and powdered. A crab is taken separately, its outer chitinous covering is rejected and the inner organism is burnt to ashes. This ash is mixed with the bark powder in 1:1 ratio and made into tablets. Taken 1 tablet thrice daily for one week.

4. **Cajanus cajan** (Linn.) Millsp.

   *Fabaceae*  
   *Khokhilaung Leaves and twigs*

   Soup is administered along with rice as many times a day as possible.

5. **Clerodendrum viscosum** Vent

   *Verbenaceae*  
   *Bhaitphul Roots*

   The root extract is administered to the patient of jaundice.

6. **Costus speciosus** (Zingiberaceae)

   *Costaceae*  
   *Mailongma- Leaf Kholomai*

   Extract of leaf is taken (as fresh as possible).

7. **Cuscuta reflexa** Roxb.

   *Cuscutaceae*  
   *Swarnahtta Entire plant*

   Decoction taken @ 1 tablespoon daily for 4 to 5 days.

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Young fruit, root bark & bark are astringent and antiperspirant. Leaves used as poultice in boils, antiseptic in ulcers & eczema. Gum demulcent tonic in cataract. Dry flowers used as tonic, stomachic. Oil of seeds is stimulant, antiseptic, used in rheumatism & skin diseases. Bark, gum, leaf and seeds are used in scorpion sting and snake bites. Berries are purgative, emollient and anthelmintic (Chopra et al., 1956).

Seeds used in snakebite. Paste of seeds and leaves used to control milk flow (Chopra et al., 1956). Juice of leaves is reported to be used by the Reang people against fever (Dutta Choudhuri & Shil, 2008). Roots are astringent, purgative, depurative, stimulant, tonic, anthelmintic, used in snake bite (Chopra et al., 1956). Seeds are carminative, anthelmintic. Entire plant is purgative and used in itching & protracted fevers. Infusion of plant used as wash for sores. Stem is useful in bilious disorders (Chopra et al., 1956).
<table>
<thead>
<tr>
<th>No.</th>
<th><strong>Scientific Name</strong></th>
<th><strong>Family</strong></th>
<th><strong>Parts Used</strong></th>
<th><strong>Use</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td><em>Entada rheedei</em></td>
<td>Mimosaceae</td>
<td>Root bark</td>
<td>Pasted and taken in very low concentration with water. Seeds used as fish poison, antiperiodic, emetic and anthelmintic. Seeds' paste is applied to local glandular swellings. Stem is emetic. Juice of wood and bark is applied externally to ulcers (Chopra et al., 1956).</td>
</tr>
<tr>
<td>9.</td>
<td><em>Ficus hispida</em></td>
<td>Moraceae</td>
<td>Raw fruit</td>
<td>The fruit is smashed lightly and dipped in milk for 3-4 days. Then the fruit is taken out and the milk is given to the patient. Fruits, seeds and bark are purgative and emetic. (Chopra et al., 1956).</td>
</tr>
<tr>
<td>10.</td>
<td><em>Kalanchoe pinnata</em></td>
<td>Crassulaceae</td>
<td>Leaves</td>
<td>Juice of the leaves is taken regularly by the patient. Leaves used in bruises, wounds, boils and insect bites. Leaves rubbed into paste and applied to hydrocele. Leaves and stem are used in scorpion sting (Chopra et al., 1956).</td>
</tr>
<tr>
<td>11.</td>
<td><em>Leucas aspera</em></td>
<td>Lamiaceae</td>
<td>Leaves and twigs</td>
<td>Decoction is taken @ 2 tbsp daily. The informant guarantees recovery within 3 days. Plant is antipyretic and insecticidal. Flowers used in cold. Juice of leaves used in psoriasis, scabies and chronic skin eruptions. Leaves considered useful in chronic rheumatism (Chopra et al., 1956).</td>
</tr>
<tr>
<td>12.</td>
<td><em>Mangifera indica</em></td>
<td>Anacardiaceae</td>
<td>Bark</td>
<td>Bark is soaked in water overnight and made into paste with leaves and twigs of <em>Cajanus cajan</em> in 1:1 ratio and converted to tablets. Taken twice daily. Leaves of <em>M. indica</em> are used in scorpion sting. Ripe fruit laxative, diuretic, astringent and anti-haemorrhagic. Unripe fruit useful in ophthalmia and eruptions. Rind of fruit is used as astringent, stimulant and stomachic. Seeds used in asthma. Kernel antihaemorrhagic,</td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Genus</td>
<td>Part Used</td>
<td>Description</td>
</tr>
<tr>
<td>-----</td>
<td>---------</td>
<td>-------</td>
<td>-----------</td>
<td>-------------</td>
</tr>
<tr>
<td>13</td>
<td><em>Marsilea quadrifolia</em></td>
<td>Marsileaceae</td>
<td>Leaves</td>
<td>Leaves cooked with minimum spice and the soup is given to the patient of jaundice.</td>
</tr>
<tr>
<td>14</td>
<td><em>Mimosa pudica</em></td>
<td>Mimosaceae</td>
<td>Root</td>
<td>The powdered root of the white flowered variety with equal quantity of stem bark powder of <em>Sida rhombifolia</em> is made into paste with water, made to tablets and taken thrice daily for one week.</td>
</tr>
<tr>
<td>15</td>
<td><em>Neptunia oleracea</em></td>
<td>Mimoseae</td>
<td>Branches</td>
<td>The air sacs are removed from the branches. The extract of the branches is taken. (In as much quantity as possible)</td>
</tr>
<tr>
<td>16</td>
<td><em>Oroxylum indicum</em></td>
<td>Bignoniaceae</td>
<td>Bark</td>
<td>Bark is boiled in water and concentrated till the color changes to that of tea. The cooled extract is taken with 2 teaspoons of sugar in glass of extract as many times a day as possible.</td>
</tr>
<tr>
<td>17</td>
<td><em>Sida rhombifolia</em></td>
<td>Malvaceae</td>
<td>Bark</td>
<td>The decoction of the bark is taken in case of jaundice.</td>
</tr>
</tbody>
</table>

The plant is refrigerant and astringent (Chopra et al., 1956).

Leaves and root of *M. pudica* are used in piles and fistula. Leaves rubbed into paste applied to hydrocele. Leaves and stem used in scorpion sting (Chopra et al., 1956).

Leaves of *Sida rhombifolia* useful in swellings. Stem mucilaginous, demulcent and emollient. Roots useful in rheumatism. Entire plant used in rheumatism and pulmonary tuberculosis (Chopra et al., 1956).
<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Family</th>
<th>Parts Used</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>18.</td>
<td><em>Terminalia cuneata</em> Roth</td>
<td>Combretaceae</td>
<td>Bark</td>
<td>Bark of <em>Terminalia cuneata</em> along with that of <em>Averrhoa carambola</em> are made into paste in 1:1 ratio and boiled well in milk (150g bark in 1 ltr). The milk is cooled and kept in an earthen ware with the paste within. After approx. 21 hours, the milk gets curdled. The bark paste is then removed and the milk is taken.</td>
</tr>
<tr>
<td>19*.</td>
<td><em>Enhydra fluctuans</em> Lour.</td>
<td>Asteraceae</td>
<td>Leaves and twigs</td>
<td>Juice of entire plant of <em>Ipomoea aquatica</em> is emetic, purgative, antinotoxine to opium and arsenic poisoning. Plant considered wholesome for females suffering from nervous and general debility (Chopra et al., 1956). <em>E. fluctuans</em> leaves laxative, useful in skin &amp; nervous affections, antibilious, demulcent (Chopra et al., 1956).</td>
</tr>
<tr>
<td>20*.</td>
<td><em>Ipomoea aquatica</em> Forsk. &amp; L.</td>
<td>Convolvulaceae</td>
<td>Leaves</td>
<td>Extract of all three components in the ratio of 1:1:1 is administrated @ 1 tblsp thrice daily.</td>
</tr>
<tr>
<td>21*.</td>
<td><em>Ludwigia adscendens</em> (L.) Hara</td>
<td>Onagraceae</td>
<td>Leaves and twigs</td>
<td>Decoction of all ingredients (22, 23) along with leaves of <em>Averrhoa carambola</em> and leaves of the red flowered variety of <em>Mimosa pudica</em> Linn. (Vern name-Cheakenalite) in the ratio of 1:1:1 is taken as many times a day as possible.</td>
</tr>
<tr>
<td>22.</td>
<td><em>Centella asiatica</em> (Linn.) Urban</td>
<td>Apiaceae</td>
<td>Entire shoot</td>
<td>Entire plant of <em>Centella asiatica</em> is used as tonic in diseases of skin, leprosy, nerves and blood. Leaves used as tonic for improving memory and in</td>
</tr>
</tbody>
</table>
24. Ocimum gratissimum L. Lamiaceae Bantulasi Leaves and twigs Extract of O. gratissimum & Z. officinale is mixed in 1:1 ratio and is modified administered one teaspoon daily till disease is cured.

25. Zingiber officinale Rosc. Aada Leaves and twigs Modified storage stem

Medicine referred when after jaundice the body get filled with water.

SUMMARY & DISCUSSION

The plant parts used by the tribal man are equally diverse as the medicines made from them. Almost all parts are used ranging from inflorescence to leaves, twigs, bark, roots, fruit, seeds and even root bark has been found to be the component of ethnic phytomedicine. Among the 25 hepatoprotective plants, 12 are reported to be cultivated and the rest have been reported in the wild. Among the cultivated species, some are collected from the local markets.

No written literature is available, except for a Chakma medicine man who had a collection of the diseases and their remedies written in the form of a manuscript in Pali language. According to him, this manuscript had been passed onto him through his ancestors. But he refused to bring it in front of anybody. In all other cases, the information was found to be inherited orally from generation to generation.

An earlier study on another ethnic group, the Reangs of Tripura, was done by Shil (2007) which recorded medicinal plants of that community as a whole, special work on hepatoprotective plants of Tripura is not available. No special attention was given to any particular category of ethnomedicinal plants. The present preliminary report deals exclusively with the hepatoprotective prope-
rty of the ethnomedicinal plants used by the Halams, Tripuris, Chakmas and Manipuris.

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Antimicrobial Activity of Stem Bark Extracts from the Plant *Oroxylum indicum* Vent.

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Abstract

Antimicrobial activity test was done to check the sensitivity of different microbes towards various crude extracts and a column fraction of the plant *Oroxylum indicum* Vent. The methanol, ethyl acetate, 70% and 100% ethanol extracts were found to possess remarkable antibacterial properties. The extracts were tested for antimicrobial activity against three different species of Gram positive and Gram negative bacteria. The results were compared to three antibiotics taken as standard. The zone of inhibition (ZOI) as shown by 100% ethanol extract against Bacillus subtilis was almost at par with Tetracyclin and Amikacin and greater than that of Ampicillin. The ZOI of the ethyl acetate was greater than that of Ampicillin but less than the other two antibiotics. In E. coli, the column fraction of the 70% ethanol extract showed greater resistance than the standard Ampicillin. The ZOI of the ethyl acetate was greater than that of Ampicillin but less than the other two antibiotics. In Pseudomonas aeruginosa, the 70% ethanol extract showed resistance greater than that of the standard drug Amikacin. In all other cases, the zones of inhibition exhibited by the shown extracts were less than that shown by the standard antibiotics.

Key words: Antimicrobial activity, sensitivity, antibiotic, *Oroxylum indicum*

Introduction

With gradually increasing cases of human diseases all around the world, the incidents of antibiotic resistant microbes have also increased to a great extent. Although pharmacological industries have produced a number of new antibiotics in the last three decades, the resistance to these drugs by microorganisms has increased.

In general, bacteria have the genetic ability to transmit and acquire resistance to drugs, which are utilized as therapeutic agents (Cohen, 1992). It is now extremely important to find alternative treatments for microbial infections (João, et al., 2004). The spread of multiple antibiotic-resistant pathogenic bacteria has been recognized by the World Organization for Animal Health (OIE), the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) as a serious global human and animal health problem. The development of bacterial antibiotic resistance is an increasingly troublesome situation due to the frequency with which new resistant phenotypes are occurring (OIE Terrestrial Manual, 2008). From 1980 to 1990, Montelli and Levy documented a high incidence of resistant microorganisms in clinical microbiology in Brazil. This fact has also been verified in other clinics around the world (Montelli and Levy, 1991). Limitations of synthesized compounds in the treatment of chronic diseases and the potential of plant based medicines as a more effective and cheaper alternative was probably responsible for the fast growing industry of herbal medicine (Rojas et al., 1992).

A vast ethnobotanical lore exists in India from ancient time which can be of real use in the formulation of effective antimicrobials. The use of plant extracts and phytochemicals, both with known antimicrobial properties, can be of great significance in therapeutic treatments. In the last few years, a number of studies have been
conducted in different countries to prove such efficiency of plant derived drugs (Almagboul, et al., 1985; Evans, 1996; Ikram and Inamul, 1984; Izzo, et al., 1995; Kubo et al., 1993; Shapoval, et al., 1994; Sosua, 1991).

Several plants have so far been reported for their antimicrobial activity from around the world. The seeds of *Garcinia kola* are considered to possess antimicrobial properties and used in the treatment of bronchitis and throat infections (Iwu, 1993). In northern Nigeria, the stem bark of *Ficus sycomorus* is used to treat fungal disease, jaundice and dysentery (Keay, 1989). The Tamangs of Nepal are known to use plants like *Gonostegia hitra*, *Bergenia ciliata* and *Rhus javanica* are some of the antimicrobial phytomedicines in their traditional medicine practices (Shrestha, 1988). Fruit, leaf and root extracts of *Tribulus terrestris* L., an Iraqi ethnomedicinal plant used as urinary anti-infective was also found to be effective against a large number of microbes, when tested *in vitro* (Al-Bayati and Al-Mola, 2008). The antimicrobial activity from *Mikania triangularis*, tested against five genera of bacteria and three genera of yeast, and showed it had activity against *Bacillus cereus*, *E. coli*, *P. aeruginosa*, *S. aureus* and *S. epidermidis* (Cruz, et al., 1996). In a bioassay with *Pyricularia oryzae* as target fungus 42 Traditional Chinese herbal Medicines were found to show bioactivity (Hu et al., 2001). In Argentina, a research tested 122 known plant species used for therapeutic treatments (Anesini and Perez, 1993). It was documented that among the compounds extracted from these plants, twelve inhibited the growth of *Staphylococcus aureus*, ten inhibited *Escherichia coli*, and four inhibited *Aspergillus niger* and also reported that the most potent compound was one extracted from *Tabebuia impetiginosa* (Alonso-Paz, et al., 1995).

*Oroxylum indicum* Vent., also known as Shoyanka, Sonpatha or Midnight Horror has long been reported for its medicinal properties. Reports indicate the plant being used as an important constituent of several Ayurvedic and tribal medicines (Anonymous, 1998; Bhattacharjee, 2000; Kirtikar and Basu, 1996; Warrier, et al., 1995; Yoganarasimhan, 1996). It is a small to medium sized deciduous tree with light grayish brown, soft, spongy bark; large pinnate, bipinnate or tripinnate ovate or elliptic leaves; lurid, purple, fleshy, flowers and large, flat, sword shaped capsules full of many flat and papery thin seeds with broad silvery wings (Tiwari et al., 2007). This plant is used as an astringent, carminative, diuretic, stomachic, and aphrodisiac and is valued for stimulating digestion, curing fevers, coughs and other respiratory disorders (John, 2001). The plant is reported to possess anti-inflammatory, diuretic, anti-arithmetic, antifungal, and antibacterial activities (Warrier et al., 1995). The medicinal uses of *Oroxylum indicum* and the components of the tree which encourage these uses are impressively set out in the Introduction to Genetic diversity in *Oroxylum indicum* (Jayaram and Prasad, 2009). The antimicrobial activity of the petroleum ether, ethyl acetate and methanol extracts have been reported (Uddin, et al., 2003). The tree was distributed throughout the greater part of India but now it is listed amongst endangered species in many areas in the country (Gokhale and Bansal, 2006). The existence of *O. indicum* in natural population is highly threatened and has been categorized as vulnerable by the government of India (Ravikumar and Ved, 2000).

**Materials and methods**

Fresh stem bark of the plant was collected from the tribal village of Jaithang, situated in North Tripura district of Tripura state. Stem bark sections of the plant were air dried and extracted using organic solvents of gradually increasing polarity in a Soxhelet apparatus and stored in air tight Borosil glass containers for future use. For extraction methodologies as suggested by Van Beek (1999) was followed. Antimicrobial assays were then performed with the crude extracts and the column fractions as previously described by Bauer, *et al.* (1966) with some modifications. The bacterial strains were collected from the microbiology laboratory of the Silchar Medical College and maintained at 4°C in the Ethnobotany and Medicinal Plants Laboratory of Assam University until future use. Each extract was pipetted onto a sterile paper disc that had been suspended on top of a dissecting needle. The
solvent was allowed to evaporate and the discs were then placed onto the surface of Petri dishes that had previously been surface-inoculated with individual test strains at 10^6 dilution. Plates were then incubated at 37°C for 24 hrs (Akhtar, et al., 2008). Solvent control discs were prepared in the same manner and were never observed to inhibit bacterial growth. Ampicillin, Amikacin and Tetracyclin discs were used as antibiotic standards on each plate. The discs used were those manufactured by HiMedia Laboratories, Pvt. Limited Mumbai- 400 086, India. After incubation, the diameter of clear zone surrounding each disc was measured to the nearest mm. An extract was considered active if one or more replicate extracts produced a zone of inhibition >1 mm beyond the edge of the disc. The area of this zone of inhibition was calculated for each replicate assay of discs treated with extracts, and for the standard antibiotic discs (Jenkins, et. al., 1998).

**Reading the zones of inhibition:** Zone sizes are measured from the edge of disc to the edge of the zone. The zones of inhibition in each case was measured by considering the following the factors:

<table>
<thead>
<tr>
<th>Zone size</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equal to wider than or not more than 3 mm smaller than the control</td>
<td>Susceptible</td>
</tr>
<tr>
<td>Zone size greater than 3 mm, but smaller than the control by more than 3 mm</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Zone sizes 3 mm or less</td>
<td>Resistant</td>
</tr>
</tbody>
</table>

**Results and Discussion**

The present work reports the antimicrobial properties of the 70% and 100% ethanol extracts in addition to the methanol and ethyl acetate extracts of the plant. The results obtained have been recorded in **Table - 1**. According to the readings obtained from the Zones of Inhibition (ZOI) exhibited by the different extracts on the microbial strains, the 100% ethanol extract was found to show the maximum activity (11mm) against *Bacillus subtilis* which was greater than that exhibited by the standard antibiotic Ampicillin (6mm) and equivalent to Tetracyclin (11mm).

<table>
<thead>
<tr>
<th>Microbial strain</th>
<th>Zone of inhibition (in mm)</th>
<th>Antibiotics</th>
<th>Extracts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Ampicillin</td>
<td>Tetracyclin</td>
</tr>
<tr>
<td><em>Bacillus subtilis</em> (Gram positive)</td>
<td>6mm</td>
<td>11mm</td>
<td>12mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Amikacin</td>
<td>Ethyl acetate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7mm</td>
<td>5mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Methanol (70%)</td>
<td>4mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ethanol (100%)</td>
<td>11mm</td>
</tr>
<tr>
<td><em>E. coli</em> (Gram positive)</td>
<td>5mm</td>
<td>12mm</td>
<td>12mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3mm</td>
<td>4mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6mm</td>
<td>4mm</td>
</tr>
<tr>
<td><em>Pseudomonas aeruginosa</em> (Gram negative)</td>
<td>9mm</td>
<td>14mm</td>
<td>2mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7mm</td>
<td>4mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ethanol (100%)</td>
<td>7mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ethanol (100%)</td>
<td>5mm</td>
</tr>
</tbody>
</table>

As interpreted from the zone size, *Bacillus subtilis* showed susceptibility towards the 100% ethanol extract as compared to all the antibiotics. The zone of inhibition was the largest (11mm) as compared to all other microbial strains taken into consideration during the present study. The strain also showed susceptibility towards the ethyl acetate extract with a ZOI of 7mm as compared to Ampicillin (ZOI- 6mm). The strain showed intermediate effect towards all the other extracts as compared to the three antibiotics.

*E. coli* showed susceptibility towards all the extracts as compared to the standard drug Ampicillin. In case of both Tetracyclin and Amikacin, ethyl acetate extract showed resistance. The effect was intermediate with rest all other extracts.
**Antimicrobial Activity of Stem Bark**

*Pseudomonas aeruginosa* showed susceptibility towards the 70% ethanol extract as compared to Ampicillin. Susceptibility was also exhibited towards the 70% ethanol extract and the 100% ethanol extract as compared to the standard drug Amikacin. The strain was found to exhibit intermediate activity towards the methanol extract in all cases. The ethyl acetate extract with a zone of inhibition of 2mm showed resistance.

**Conclusion**

The goal of in vitro antimicrobial susceptibility testing is to provide a reliable predictor of how an organism is likely to respond to antimicrobial therapy in the infected host. This type of information aids in selecting the appropriate antimicrobial agent, aids in developing antimicrobial use policy, and provides data for epidemiological surveillance. Such epidemiological surveillance data provide a base to choose the appropriate empirical treatment (first-line therapy) and to detect the emergence and / or the dissemination of resistant bacterial strains or resistance determinants in different bacterial species (*OIE Terrestrial Manual, 2008*). The need for antimicrobial agents from natural sources contributes to the development of effective screening systems (*Hu et al., 2001*). The study showed the activity of different extracts of *Oroxylum indicum* towards the three strains of Gram positive and Gram negative bacteria. The results are show that in many cases the plant could be the source of a potent antibacterial medicine.

*O. indicum* is propagated naturally by seeds, however, the seed set is poor and seed viability is low. Problems related with its natural propagation and indiscriminate exploitation for medicinal purpose has pushed *O. indicum* to the list of endangered plant species of India (*Tiwari, et al., 2007*). Now that, in addition to its numerous other medicinal properties, the antimicrobial properties of *Oroxylum* are also coming to light, effective steps are to be taken for its propagation so that this valuable tree does not face the danger of extinction.

**References**


Antimicrobial Activity of Stem Bark


Plants Used Against Gastro-Intestinal Disorders and As Anti-Hemorrhagic by Three Tribes of North Tripura District, Tripura, India: A Report

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Abstract
The tribals of Tripura depend basically on different herbs for their treatment. The field work documented about nineteen plant species used against stomach disorders and as anti-hemorrhagic by three different tribes, the Halams, Tripuris and Chakmas of North Tripura district of Tripura state, India. Some of these have been known for ages for their medicinal properties, while, others have been recorded for the first time amongst these people. Some of the plants are reported to be in their wild state and others are domesticated.

Key words: Herbs, Stomachic, Digestive, Tripuri, Chakma, Halam.

Introduction
Natural products have been applied to human healthcare for thousands of years. Many drugs presently prescribed by physicians are either directly isolated from plants or are artificially modified versions of natural products (Wang, et al., 2007). These medicines are safe and environment friendly. According to the WHO about 80% of the world’s population relies on traditional medicine for their primary health care (Behera, 2006). Phytotherapy seems to be an alternate system of medicine for the villagers residing in the suburban/rural areas (Nandankunjidam, 2006). A large number of plants are being used as medicinal agents all over the world (Chowdhury, et al., 2005). Limitations of synthesized compounds in the treatment of chronic diseases and the potential of plant-based medicine as a more effective and cheaper alternative, was probably responsible for the fast growing industry of herbal medicine (Rojas et al., 1992). India is endowed with a rich wealth of medicinal plants. Of the 340 plant medicines mentioned in the Charak Samhita (1000 B.C), The Indian Pharmacopoeia (1966) recognizes only 85 medicinal
Plants used in various pharmaceutical preparations. Most of these continue to be gathered from the wild to meet the demand. Thus, despite the rich heritage of knowledge on the use of plant drugs, little attention had been paid to grow them as field crops in the country till the latter part of the nineteenth century (http://www.krishiworld.com/html/medi_aro_plants1.htm). At present, there is an urge need to have a better knowledge of our medicinal plants to save them from extinction and also for our own health needs.

Plants used against stomach troubles and as anti-hemorrhagic are a common class of phytomedicines used in different traditional health care systems. Artichoke Leaf, Turmeric, Banana Powder, caraway, chamomile, dill, fennel, etc., have been found useful in treatment of dyspepsia and as carminatives (http://www.jigsawhealth.com/nat.aspx?&chunkiid). Powdered carom seeds and aniseeds are used by medicine men of Himachal Pradesh against stomach troubles (Bhasin, 2008). Cirsium japonicum De Candole is widely used in traditional herbal medicine for the treatment of hemorrhage in Korea (Kim, et al., 2007). Inflorescence of Typha angustata Borey and Chaub. is used by medicine men of Ratnagiri, Maharashtra for the same purpose (Mokat and Deokule, 2006). Ampelocissus divaricata (Wall. ex Laws.) Planch. leaves are used to stop bleeding and Begonia thomsonii A. DC for diarrhoea by the Reang people of Tripura (Shil and Dutta Choudhury, 2009).

The present survey was conducted on tribal villages belonging to the Tripuri, Halam and Chakma communities of North Tripura district of Tripura state. Various traditional phytomedicinal remedies used by these people against gastrointestinal disorders and as anti hemorrhagic have been studied. The remedies for stomach troubles have been found to be used against dysentery, blood-dysentery, diarrhoea, dyspepsia, stomach-ache, jaundice, worms (anthelmintic) and as carminative and stomachic. The same plant has been, in many cases, found to be used for several symptoms while some others are disease specific.

**Materials and Methods**

Field surveys have been undertaken covering all seasons for gathering information on each and every species useful in the tribal medicine. Plants have been collected in their flowering and fruiting stage as far as possible from the natural habitat and serially tagged with collection numbers. Thorough observation have been made on spot collection of individual plant species and field data recorded as regards location, natural habitat, distribution pattern, nature of roots, tubers, bulbs or rhizomes, etc. The characteristic features which cannot be observed after drying the specimen, such as color and scent in case of flowers and fruits, etc., are recorded on spot. Smaller herbaceous plants have been collected as whole and in case of shrubs, under shrubs, woody herbs and climbers,
Methodologies as suggested by Schultes (1960 and 1962), Jain (1964, 1967, 1987, 1989) have been followed using collection of information on ethnomedicobotanical aspects. Information on medicinal plants have been collected mainly from the medicine men, village headmen and aged and experienced people. Queries have been made repeatedly, occasionally taking asking help from interpreters for confirmation of data on each medicinal plant. For identification of the plants collected, several Floras and Monographs have been consulted, such as Flora of British India (Hooker, 1872-1897) Flora of Assam, Vol. I-IV (Kanjilal, et al., 1934, 1938, 1939 and 1940) and Vol. V (Bor, 1940), Flora of Tripura (Deb, 1981, 1983).

Results

Information regarding the botanical name of the plants, followed by their family, tribe, part used, purpose of utilization, occurrence and usage in ethnomedicine have been recorded. The species have been arranged in alphabetical order.

   Vernacular name: Bael, Tribe: Tripuri
   Part used: Fruits
   Purpose of utilization: Against stomach disorders (*dysentery*)
   Occurrence: Planted in houses and also found to grow in the wild.
   Usage in Ethnomedicine: Fruit extract administered in cases of dysentery and also as a preventive of dysentery.

2. *Ageratum conyzoides* L. [Family- Asteraceae]
   Vernacular name: Khomorochewk, Tribe: Halam
   Part used: Leaves and twigs
   Purpose of utilization: Anti- hemorrhagic
   Occurrence: Found in the wild.
   Usage in Ethnomedicine: Paste of leaves and twigs applied at the site of cut or wound to stop bleeding.

3. *Alpinia nigra* (Gertner) Burtt [Family – Zingiberaceae]
   Vernacular name: Peitranga, Tribe: Chakma
   Part used: Underground stem
   Purpose of utilization: Against stomach disorders (*dyspepsia*)
   Occurrence: Found mainly in the wild, also cultivated in kitchen gardens.
   Usage in Ethnomedicine: The juice of the underground stem is used as medicine in dyspepsia.

4. *Ananas comosus* (L.) Merrill [Family – Bromeliaceae]
   Vernacular name: Amortui, Tribe: Tripuri
Part used: Leaf base
Purpose of utilization: Against stomach disorders (diarrhoea)
Occurrence: Commercially cultivated along the hill slopes.
Usage in Ethnomedicine: The juice of the underground stem is used as medicine in dyspepsia.

5. *Chromolaena odoratum* (L.) King & Robinson [Family- Asteraceae]
Vernacular name: Cheikhmarimshiekh, Tribe: Halam
Part used: Leaves
Purpose of utilization: Anti- hemorrhagic
Occurrence: Found to grow in the wild.
Usage in Ethnomedicine: Fresh leaf paste is applied on the cut to stop bleeding.

6. *Bambusa* sp. [Family- Poaceae]
Vernacular name: Waa Epahang, Tribe: Tripuri
Part used: Shoot epidermis
Purpose of utilization: Anti- hemorrhagic
Occurrence: Found in the wild.
Usage in Ethnomedicine: Powdered shoot epidermis applied on the cut wound to stop bleeding.

7. *Bryophyllum calycinum* Salisbury [Family – Crassulaceae]
Vernacular name: Khurojot, Tribe: Chakma
Part used: Leaves
Purpose of utilization: Against stomach disorders (dysentery &diarrhoea)
Occurrence: Cultivated in kitchen garden and also as an ornamental
Usage in Ethnomedicine: Two to three leaves chewed raw with 1 tablespoon sugar as a cure of dysentery and diarrhoea.

8. *Cajanas cajan* Lina [Family – Fabaceae]
Vernacular name: Khokhlaing, Tribe: Halam
Part used: Leaves and twigs
Purpose of utilization: Against stomach disorders (dysentery &diarrhoea)
Occurrence: Cultivated in kitchen garden
Usage in Ethnomedicine: Soup is given to the patient the juice is taken as many time as possible.

9. *Carica papaya* Linn. [Family – Caricaceae]
Vernacular name: Paypay, Tribe: Chakma
Part used: Unripe fruit
Purpose of utilization: Against stomach disorders (stomachic)
Occurrence: Cultivated in the kitchen garden and also on commercial basis.
Usage in Ethnomedicine: Fruits are cooked as a vegetable and administered during complaints of stomach troubles.

10. *Centella asiatica* (L.) Urban [Family – Apiaceae]
Vernacular name: Perup, Tribe: Halam
Part used: Leaves
Purpose of utilization: Against stomach disorders (dysentery & diarrhoea)
Occurrence: Cultivated in the kitchen garden.
Usage in Ethnomedicine: Eaten either as paste or cooked as a vegetable in dysentery and diarrhoea.

11. *Clerodendron viscosum* Vent [Family- Verbenaceae]
Vernacular name: Bhaitphul, Tribe: Tripuri
Part used: Roots
Purpose of utilization: Against jaundice (hepatoprotective)
Occurrence: Found in the wild.
Usage in Ethnomedicine: The root extract is administrated to the patient of jaundice.

12. *Costus speciosus* (Koen) Sm. [Family- Costaceae]
Vernacular name: Mailongma- khotomai, Tribe: Tripuri
Part used: Leaves
Purpose of utilization: Against jaundice (hepatoprotective)
Occurrence: Found in the wild, also cultivated in tribal houses for its beautiful flowers.
Usage in Ethnomedicine: Extract of leaf is taken (as fresh as possible).

13. *Cynodom dactylon* (L.) Persoon [Family- Poaceae]
Vernacular name: Dubba, Tribe: Tripuri
Part used: Leaves and twigs
Purpose of utilization: Anti- hemorrhagic
Occurrence: Cultivated in the kitchen garden, also found in the wild.
Usage in Ethnomedicine: Leaf extract is applied on the cut to stop bleeding.

14. *Ficus hispida* Linn. f. [Family – Moraceae]
Vernacular name: Mayungmai, Tribe: Tripuri
Part used: Raw fruit
Purpose of utilization: Against jaundice (hepatoprotective)
Occurrence: Found to grow in the wild
Usage in Ethnomedicine: The fruit is smashed lightly & dipped in milk for 3-4 days. Then the fruit is taken out and the milk is administered at regular intervals.

15. *Mangifera indica* Linn. [Family – Anacardiaceae]
Vernacular name: Thaihai, Tribe: Halam
Part used: Stem Bark
Purpose of utilization: Against stomach disorders (dysentery)
Occurrence: Grown in houses for its delicious fruits and shade, also found in the wild.
Usage in Ethnomedicine: Bark kept immersed in water for 3-4 days. The water is filtered out and the filtrate is used as medicine for dysentery.

16. *Mentha* sp. [Family-Lamiaceae]
Vernacular name: Sabrang, Tribe: Chakma
Part used: Leaves
Purpose of utilization: Against stomach disorders (blood dysentery and dyspepsia)
Occurrence: Found mainly in the wild, also cultivated in kitchen gardens.
Usage in Ethnomedicine: Soup of the leaves is administered in cases of dyspepsia.

17. *Mikania scandens* (Linn.) Willderow [Family- Convolvulaceae]
Vernacular name: Refujie, Tribe: Tripuri
Part used: Entire shoot part
Purpose of utilization: Anti-hemorrhagic
Occurrence: Found to occur in the wild
Usage in Ethnomedicine: Shoot part rubbed against hands and the juice is applied on the cut to stop bleeding.

18. *Momordica charantia* Linn. [Family – Cucurbitaceae]
Vernacular name: Gangrauk, Tribe: Tripuri
Part used: Raw fruits and leaves and twigs
Purpose of utilization: Against stomach disorders (worms and dyspepsia)
Occurrence: Cultivated in the kitchen garden.
Usage in Ethnomedicine: Fruits are considered to be anthelmintic. Juice of leaves and twigs is used in dyspepsia.

19. *Oroxylum indicum* Vent. [Family- Bignoniaceae]
Vernacular name: Kaak-rakung, Tribe: Halam
Part used: Especially stem bark, fruits & leaves also used.
Purpose of utilization: Against jaundice (hepatoprotective)
Occurrence: Found to grow in the wild.
Usage in Ethnomedicine: Bark is boiled in water and concentrated till the colour changes to that of tea liquor. The cooled extract is taken with 2 tablespoons of sugar in a glass of extract as many times a day as possible.

20. *Piper betle* Linn. [Family – Piperaceae]
Vernacular name: Phatui bulai, Tribe: Tripuri
Part used: Leaves
Purpose of utilization: Against stomach disorders (carminative)
Occurrence: Cultivated on commercial scale, also found to grow in the wild.
Usage in Ethnomedicine: Raw leaves used as a carminative.

   Vernacular name: Sapri, Tribe: Halam
   Part used: Young twigs
   Purpose of utilization: Against stomach disorders (dysentery)
   Occurrence: Cultivated in almost all houses
   Usage in Ethnomedicine: The young twigs are chewed in dysentery.

22. *Scoparia dulcis* Linn. [Family – Scrophulariaceae]
   Vernacular name: Naipungchewk, Tribe: Halam
   Part used: Shoot part
   Purpose of utilization: Against stomach disorders (anthelmintic)
   Occurrence: Found in the wild.
   Usage in Ethnomedicine: The decoction of the plant is used as an anthelmintic for infants of age 6 months to 1 year.

23. *Sida rhombifolia* Linn. [Family – Malvaceae]
   Vernacular name: Laghaniti, Tribe: Chakma
   Part used: Bark
   Purpose of utilization: Against jaundice (hepatoprotective)
   Occurrence: Found to grow in the wild.
   Usage in Ethnomedicine: The decoction of the bark is taken in case of jaundice.

24. *Spilanthes paniculata* Wallich ex. DC. [Family – Asteraceae]
   Vernacular name: Ansha, Tribe: Tripuri
   Part used: Leaves
   Purpose of utilization: Against stomach disorders (dyspepsia)
   Occurrence: Found to grow in the wild.
   Usage in Ethnomedicine: Leaf extract is used in dyspepsia.

25. *Stephania* sp. [Family – Menispermaceae]
   Vernacular name: Thandamanik, Tribe: Chakma
   Part used: Leaves
   Purpose of utilization: Against stomach disorders (stomach ache)
   Occurrence: Found to grow in the wild.
   Usage in Ethnomedicine: Leaf paste is applied on the stomach in stomach-ache.

   Vernacular name: Bukhala buthai, Tribe: Tripuri
   Part used: Fruits
   Purpose of utilization: Against stomach disorders (stomachic)
   Occurrence: Found to grow in the wild.
Usage in Ethnomedicine: Fruit used as an astringent and stomachic.

Discussion

The present work has reported, besides the common medicinal plants, several plants for the first time for their medicinal value. A total of twenty-six plants have been reported for their medicinal value. 21 plant species belonging to 21 genera and 21 families are reported against stomach troubles. Amongst these, 5 plants have been reported for dyspepsia, 3 plants for diarrhoea, 5 plants for dysentery, 1 for blood dysentery, 2 as stomachic, 1 as carminative, 2 as anthelmintic, 6 as hepatoprotective and 1 plant against stomach ache. 5 plants belonging to 5 genera and 3 families are reported as anti-haemorrhagic. An earlier study done by Shil (2007) recorded the various ethnomedicinal plants used by the Reang people of Tripura. In comparison to the plants reported by him against stomach troubles only the use of Mangifera indica as an anti-dysenteric agent and the use of Chromolaena odorata and Cynodon dactylon as anti-haemorrhagic have been found to coincide with the medicinal plants reported in the present work. Other plants like Centella asiatica, Psidium guajava, Terminalia chebula and Alpinia nigra have also found to be reported by Shil (2007) among the Reangs, but for other medicinal properties.

Conclusion

Although India has a rich treasure of ethnomedicinal plants, only a small fraction of it has yet come to the service of the human kind. Tripura is a small state in the far end of North-east India. In spite of being one of the richest biodiversity zones, a vast part of North-east India has still remained unexplored. Moreover, much work has not been done on the three tribes under consideration in the present study. Despite the rich heritage of medicinal plants, little attention had been paid towards them as field crops. At present, there is an urge need to pay serious attention towards our medicinal plants for our own health needs and also to save them from the threat of extinction.

During the study, plants used for a variety of physiological complaints have come to light. The plants used by the tribal people have been found to be very much disease specific.

Acknowledgement

The authors are thankful to the tribal people of the Tripuri, Chakma and Halam communities who shared their valuable knowledge of the medicinal plants and their use in the respective traditional medicinal systems. The authors are also grateful to Mr. Babhrubahan Chakma, Mr. Tamburliana Halam, Mr. Rajendra Deb Barma and Mr. Makhan Pal who accompanied to various sites as interpreters while interacting with the tribal people.
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Dyspepsia (http://www.jigsawhealth.com/nat.aspx?&chunkid)


TRADITIONAL KNOWLEDGE OF ETHNOMEDICINAL HEPATOPROTECTIVE PLANTS USED BY CERTAIN ETHNIC COMMUNITIES OF TRIPURA STATE

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ABSTRACT
Hepatoprotective plants constitute an important part in the traditional medicinal practices of the different ethnic communities of Tripura. Recent studies on the traditional knowledge of the Tripuri, Halam, Chakma and Darlong ethnic communities of Tripura state recorded around 52 hepatoprotective plants from 36 families. A maximum of 19 hepatoprotective plants have been recorded from the Chakma medicine men followed by 16 from the Tripuris, 13 amongst the Halam people and 6 plants recorded from the Darlong informants. Plants have been found to be used as individual component or in combinations of two or more. Almost all plant parts are used in the different hepatoprotective formulations. Many of the plants are used by more than one communities in different combinations. However, administration of the crude drug and its dosage depends widely on the different forms of hepatic illness like ordinary jaundice, childhood jaundice, long term jaundice, cirrhosis, liver injury due to alcoholism, etc. Some of the important plants recorded include Cassia alata, Kaempferia rotunda, Kaempferia galanga, Abelmoschus manihot, and many more. The hepatoprotective property of 21 plants has been recorded for the first time during this study.

Key Words: Hepatoprotective, Traditional Knowledge, Ethnic Communities, Tripura

INTRODUCTION
Despite the advances in allopathic medicine, herbal drugs play an important role in treatment of various ailments including hepatopathy (liver ailments) (Ibrahim, et al., 2008). Medicinal herbs are widely used in the treatment of liver diseases like hepatitis, cirrhosis, and loss of appetite (Cupp, 1999). Silybum marianum, Picrorrhiza kurroa, Andrographis paniculata, Phyllanthus niruri, and Eclipta alba are some of the proven hepatoprotective medicinal herbs (Bisset (ed),1994). Dependence on plants is still seen widely among the ethnic groups of the world and the ethnic communities of Tripura are no exception. Plants and their use in ethnomedicine occupies a major portion of tribal ethnomedicine in Tripura. Tripura a land of diverse ethnic groups is also blessed with great variety of ethnomedicinal plants. The present work specially highlights the hepatoprotective plants used by three of the ethnic communities of the state. The ethnomedicinal lore of the people of the state on the use of plants as hepatoprotective agents has been enlisted in detail in the enumeration part.

MATERIALS AND METHODS
Study site: The study site included the Exhaustive field surveys have been undertaken covering all seasons for gathering information on each and every species used by tribal people as medicines. Communities under study: Surveys were conducted in different villages of Tripura inhabited respectively by the Halam, Darlong, Tripuri and Chakma communities. Plants have been collected in their flowering and fruiting stage as far as possible from the natural habitat and serially tagged with field numbers and recorded different information in the field note book.
Specimens were processed into mounted herbarium sheets following Jain & Rao (1977) and were deposited in the Silchar Herbarium for further use. Plants were identified using local flora including Hooker (1872–1897), Kanjilal et al. 1934–1940, Bor (1940) and Deb (1981–1983). A set of the specimens will be deposited at Assam University Herbarium.

Ethnobotanical methodologies as suggested by Schultes (1960, 1962), Jain (1964, 1967, 1991) and Jain & Mudgal (1999) have been followed during field study. Informants include local medicine-men, village headmen and aged and experienced people. Queries have been made repeatedly, occasionally taking help from interpreters for confirmation of data on each medicinal plant. Data on each plant have been recorded as follows: (a) Sl. No. (b) Scientific name (c) Family (d) Vernacular Name (e) name of the tribe (f) Parts used (g) Mode of utilization and (h) Established report of use. Recorded plants have been enlisted in Table 1 along with their scientific and local names, family, parts used, mode of use, and established uses of such plants.

Table 1: Detailed description of the Ethnomedicinal Hepatoprotective plants collected

<table>
<thead>
<tr>
<th>Sl no.</th>
<th>Scientific name</th>
<th>Family</th>
<th>Local name</th>
<th>Name of community</th>
<th>Part used</th>
<th>Process of utilization</th>
<th>Established report</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.</td>
<td><em>Achyranthes aspera</em> Linn.</td>
<td>Amaranthaceae</td>
<td>Apang</td>
<td>Darlong</td>
<td>Shoot</td>
<td>Administered @ 1 teaspoon thrice daily for 15 days.</td>
<td>Root paste in kidney and urinary disorders and in skin infections (Majumdar <em>et al.</em>, 2006).</td>
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<tr>
<td></td>
<td>Plant Name</td>
<td>Family</td>
<td>Part Used</td>
<td>Preparation/Use</td>
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<tr>
<td>3.</td>
<td>Aegle marmelos Correa</td>
<td>Rutaceae</td>
<td>Leaves</td>
<td>Pounded to paste with equal quantities of leaves of Cajanus cajan and a little water and 1 cupful extract taken in the morning in empty stomach in jaundice in combination with red palm candy. One teaspoonful gum daily for 2 days in jaundice. Pulp of ripe fruit in dysentery. Tripuri: Fruit pulp as medicine and as preventive of dysentery. Chakma: Leaves chewed raw after heavy meals.</td>
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<tr>
<td>4.</td>
<td>Alocasia indica Schultes</td>
<td>Araceae</td>
<td>Leaves</td>
<td>Paste of the rhizome administered @ one teaspoon daily for 1 week. Leaves styptic, astringent, tuber useful in piles and constipation (Chopra et al., 1956).</td>
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<tr>
<td>5.</td>
<td>Alpinia conchigera Griffith</td>
<td>Zingiberaceae</td>
<td>Roots</td>
<td>Root extract administered @ two teaspoon daily. Different species of Alpinia used in fever, rheumatism, bronchial infections and as expectorant, stomachic, stimulant, aphrodisiac, carminative, emetic (Chopra et al. 1956).</td>
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<td>6.</td>
<td>Alstonia scholaris (Linn.) R. Br.</td>
<td>Apocynaceae</td>
<td>Bark</td>
<td>Pounded with a little hot water and administered @ ¼ cup thrice daily. Bark infusion administered once a day in malarial fever (Purakayastha, et al., 2007).</td>
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<tr>
<td>7.</td>
<td>Amaranthus spinosus Linn.</td>
<td>Amaranthaceae</td>
<td>Roots</td>
<td>Root extract administered @ two teaspoon twice daily for 3-4 days. Root extract orally in chest pain and snake bite (Dutta Choudhury and Shil).</td>
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<tr>
<td>8.</td>
<td>Andrographis paniculata (Burm. f.) Wall ex Nees</td>
<td>Acanthaceae</td>
<td>Leaves</td>
<td>Extract administered @ 1 teaspoon twice daily for 15 days. Juice of whole plant in stomach troubles (Purakayastha).</td>
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<tr>
<td><strong>10. Averrhoacarambola</strong>&lt;br&gt; Linn.</td>
<td>Averrhoea&lt;br&gt;ac</td>
<td>Kanranga</td>
<td>Halam</td>
<td>Ripe fruit&lt;br&gt;</td>
<td>Ripe fruit with stem bark of <em>Oroxyllum indicum</em> Vent. are smashed and mixed with the ash of shell of a mussel. All the three are made into a liquid mixture in 1:1:1 ratio and taken.</td>
<td>Dried fruits antiscorbutic and used against fever. Ripe fruits in piles &amp; febrile excitements (Chopra, et al., 1956). Ripe fruit pulp in fever, bleeding piles, urinary stone and jaundice (Singh, et al., 2003). Fruit infusion in leucorrhoea. Bark infusion in piles (Purakayastha, et al., 2007).</td>
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<tr>
<td><strong>11. Baccaureasapida</strong>&lt;br&gt; (Roxb.) Muell. Arg.</td>
<td>Euphorbiaceae</td>
<td>Pheko</td>
<td>Darlong</td>
<td>Stem bark&lt;br&gt;</td>
<td>1 teaspoon paste administered twice a day with ½ cup of hot water for jaundice.</td>
<td>Seeds in snake-bite; paste of seeds and leaves used to control milk flow (Chopra, et al. 1956).</td>
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</tr>
<tr>
<td><strong>12. Cajanascajan</strong>&lt;br&gt; (L.) Millsp.</td>
<td>Fabaceae</td>
<td>Khokhlain&lt;br&gt;g</td>
<td>Halam</td>
<td>Leaves&lt;br&gt;and twigs&lt;br&gt;</td>
<td>Soup is given in stomach troubles. Juice taken as many time as possible in jaundice.</td>
<td>Root bark antidiysenteric, diaphoretic, expectorant, emetic, applied as paste in elephantiasis; tincture of leaves used in intermittent fevers; latex irritant, purgative, powdered flowers given in cold asthma and indigestion (Chopra et al. 1956).</td>
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<tr>
<td><strong>13. Calotropisgigantea</strong>&lt;br&gt; (L.) R.Brown ex Aiton</td>
<td>Asclepiadaceae</td>
<td>Angarpata</td>
<td>Chakma</td>
<td>Leaves&lt;br&gt;</td>
<td>2 tablespoons of extract administered daily for 2 weeks.</td>
<td>Decoction of root with fermented rice in gonorrhoea and amenorrhoea. Also considered to be demulcent, diaphoretic and diuretic (Duke and Ayensu, 1985).</td>
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</tr>
<tr>
<td><strong>14. Canna indica</strong>&lt;br&gt; Linn.</td>
<td>Cannaceae</td>
<td>Nirbish</td>
<td>Halam</td>
<td>Rhizome&lt;br&gt;</td>
<td>Extract @ 2 teaspoon once daily for 15 days.</td>
<td>87</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td><strong>Cardiospermum halicacabum</strong> L.</td>
<td>Sapindaceae</td>
<td>Heda-bhokta</td>
<td>Chakma</td>
<td>Leaves</td>
<td>Paste administered @ 1 teaspoonful twice daily for 10 days.</td>
<td>Plant used in rheumatism, stiffness of limbs, snake-bite. Root diaphoretic diuretic, aperient, laxative, rubefacient, emmenagogue, occasionally used in rheumatism, lumbago and nervous diseases; leaves rubefacient, poultice in rheumatism, leaf juice used in ear ache (Chopra et al. 1956).</td>
</tr>
<tr>
<td>16.</td>
<td><strong>Carica papaya</strong> L.</td>
<td>Caricaceae</td>
<td>Paypay</td>
<td>Chakma and Darlong</td>
<td>Fruits, roots</td>
<td>Chakma- Fruits are used as stomachic. Darlong- Root extract administered @ 2-3 teaspoon thrice daily in jaundice.</td>
<td>Latex of unripe fruits used to remove freckles and blemishes from skin, anthelmintic; ripe fruits stomachic, carminative, diuretic; seeds vermifuge, emmenagogue, used to quench thirst (Chopra et al. 1956).</td>
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<tr>
<td>17.</td>
<td><strong>Cassia alata</strong> L.</td>
<td>Caesalpinae</td>
<td>Delong pata</td>
<td>Chakma</td>
<td>Leaf</td>
<td>Leaf paste made to tablets and administered @1 tablet thrice daily after meals for 1 week.</td>
<td>Leaf extract antiparasitic and anthelmintic (Khan and Rashid, 2006).</td>
</tr>
<tr>
<td>18.</td>
<td><strong>Celosia cristata</strong> L.</td>
<td>Amaranthaceae</td>
<td>Radhachur o phool</td>
<td>Chakma</td>
<td>Leaf</td>
<td>Juice taken orally as antihemorrhagic during parturition.</td>
<td>Seeds anti-diarrheic, aphrodisiac, useful in blood diseases, eye and for oral sores (Chopra et al. 1956).</td>
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<tr>
<td>19.</td>
<td><strong>Centella asiatica</strong> (L.) Urban</td>
<td>Apiaceae</td>
<td>Perup</td>
<td>Halam</td>
<td>Leaf</td>
<td>Eaten either as paste or cooked as a vegetable.</td>
<td>Plant useful as alternative and tonic in diseases of skin, leprosy, nerves and blood; leaves useful for improving memory and in syphilitic skin diseases (Chopra et al. 1956).</td>
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<tr>
<td>20.</td>
<td><strong>Cicca acida</strong> (Linn.) Merr</td>
<td>Euphorbiaceae</td>
<td>Har boroi</td>
<td>Tripuri</td>
<td>Stem bark</td>
<td>Decoction @ 1 teaspoon thrice daily.</td>
<td>As a remedy for liver troubles and for blood purification (Das et al.,</td>
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<td></td>
<td>Common Name</td>
<td>Family</td>
<td>Scientific Name</td>
<td>Parts Used</td>
<td>Uses</td>
<td>Applications</td>
<td></td>
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<tr>
<td>21.</td>
<td>Clerodendrum viscosum Ventenat</td>
<td>Verbenaceae</td>
<td>Chakma-Killiashak</td>
<td>Leaves, root</td>
<td>Extract used as expectorant; decoction used in high blood pressure. Root extract administered @ 1 teaspoon thrice daily in fever.</td>
<td>Root paste applied locally in dental caries. Root extract in abdominal pain (Rahman, et al., 2007).</td>
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<td></td>
<td>Halam-Bhatipaata</td>
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<tr>
<td>22.</td>
<td>Costus speciosus (Koenig ex Retzius) Smith</td>
<td>Costaceae</td>
<td>Mylongma Khotomai</td>
<td>Leaves and stem</td>
<td>Leaf juice used as an ingredient of a medicine for jaundice; sap of stem used to remove parasites from ears.</td>
<td>Root astringent, purgative, depurative, stimulant, tonic, anthelmintic, antidote in snake bite (Chopra et al. 1956).</td>
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<tr>
<td>23.</td>
<td>Crinum asiaticum L.</td>
<td>Amaryllidaceae</td>
<td>Khobaron</td>
<td>Chakma</td>
<td>Leaves</td>
<td>Leaf juice used in rheumatism both for man and domestic animals.</td>
<td>Many species of Crinum used as laxative, expectorant, anti-bilious and in urinary troubles; also used as emollient, emetic, burns, infections, etc.; bulbs used as rubefacient in piles and abscesses; leaf juice used in ear-ache (Chopra et al. 1956).</td>
</tr>
<tr>
<td>24.</td>
<td>Cynodorum dactylon (L.) Persoon</td>
<td>Poaceae</td>
<td>Dubba</td>
<td>Halam</td>
<td>Young twigs</td>
<td>Ingredient of a four component mixture for jaundice.</td>
<td>Decoction of roots diuretic in dropsy, secondary syphilis; root infusion in piles, crushed roots in chronic gleet; plant juice astringent, useful in cuts and wounds, diuretic, used in dropsy and anasarca, useful in diarrhoea, dysentery, nervous diseases and eye troubles (Chopra et al. 1956).</td>
</tr>
<tr>
<td>25.</td>
<td>Eclipta alba L. Mant.</td>
<td>Asteraceae</td>
<td>Kalasona</td>
<td>Chakma</td>
<td>Leaf</td>
<td>Administered @ 2 teaspoon twice daily</td>
<td>Leaf extract administered orally in bleeding from nose and mouth (Yusuf, et al., 2007).</td>
</tr>
<tr>
<td>26.</td>
<td>Elusine indica (L.) Gaertn</td>
<td>Poaceae</td>
<td>Halam</td>
<td>Leaves</td>
<td>Decoction along with Mimosa pudica, Centella asiatica.</td>
<td>Plants of this genus are reported for their activity in abdominal</td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td><em>Enhydra fluctuans</em> Lour.</td>
<td>Asteraceae</td>
<td>Halancha</td>
<td>Chakma</td>
<td>Leaves and twigs</td>
<td>Extract in equal quantity with <em>Ipomea aquatica</em> and <em>Jussiaea repens</em> administered @ 1 teaspoon thrice daily for 1 week.</td>
<td>Used in treatment of nervous ailments, skin diseases and as a laxative (Chopra <em>et al.</em> 1956).</td>
</tr>
<tr>
<td>29.</td>
<td><em>Euphorbia nerifolia</em> L.</td>
<td>Euphorbiaceae</td>
<td>Sairapal</td>
<td>Halam</td>
<td>Leaves</td>
<td>Leaves heated on fire and placed on chest to control cough.</td>
<td>Milky juice used as purgative, for skin diseases; roots in scorpion sting, snake bite, as antiseptic and fish poison (Chopra <em>et al.</em> 1956).</td>
</tr>
<tr>
<td>30.</td>
<td><em>Ficus hispida</em> Linn. f.</td>
<td>Moraceae</td>
<td>Mayungma</td>
<td>Tripuri</td>
<td>Unripe fruit</td>
<td>2-3 fruits are smashed lightly &amp; dipped in a glass of milk for 3-4 days. Then the fruit is taken out and the milk is administered @ ¼ cup at 2 hours interval.</td>
<td>Fruit, seed &amp; bark purgative, emetic (Chopra <em>et al.</em> 1956).</td>
</tr>
<tr>
<td>31.</td>
<td><em>Jatropha curcas</em> Linn.</td>
<td>Euphorbiaceae</td>
<td>Girogaach</td>
<td>Chakma</td>
<td>Branche s</td>
<td>Sap of the branches applied locally at the sites of tooth infections</td>
<td>Seeds and roasted nuts purgative; latex useful in scabies, eczema and ringworm; leaves lactagogue, rubefacient (Chopra <em>et al.</em> 1956).</td>
</tr>
<tr>
<td>32.</td>
<td><em>Kaempferia galanga</em> L.</td>
<td>Zingiberaceae</td>
<td>Kamala</td>
<td>Chakma</td>
<td>Mature leaves</td>
<td>Two teaspoon of extract every morning in empty stomach for 1 week.</td>
<td>Essential oils from rhizomes in indigestion, cold, pectoral and abdominal pains, headache and toothache.</td>
</tr>
</tbody>
</table>
### Research Article

<table>
<thead>
<tr>
<th>No.</th>
<th><strong>Species</strong></th>
<th><strong>Family</strong></th>
<th><strong>Part Used</strong></th>
<th><strong>Preparation</strong></th>
<th><strong>Use</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>33.</td>
<td><em>Kaempferia rotunda</em> L.</td>
<td>Zingiberaceae</td>
<td>Bhojoraphool</td>
<td>Aqueous decoction @1/2 cup a day taken for 1 week.</td>
<td>Applied in Indonesia as the traditional insect repellent (Chan, et al., 2009).</td>
</tr>
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</tr>
<tr>
<td>35.</td>
<td><em>Lasianthus lucidus</em> Blume</td>
<td>Rubiaceae</td>
<td>Junilat</td>
<td>Extract administered @1 teaspoon thrice daily for 1 week.</td>
<td>Various species of genus <em>Lasianthus</em> are used in venereal diseases (Crab, 1932).</td>
</tr>
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</tr>
<tr>
<td>37.</td>
<td><em>Mangifera indica</em> Linn.</td>
<td>Anacardiaceae</td>
<td>Thaithai</td>
<td>Dry stem bark</td>
<td>Leaves used in scorpion sting; ripe fruits laxative, diuretic, astringent and antihaemorrhagic; unripe fruits in ophthalmia and eruptions; rind of fruit astringent, stimulant and stomachic; seeds used in asthma; cotyledons anthemorrhagic, stops nasal bleeding, anthelmintic; bark</td>
</tr>
<tr>
<td>No.</td>
<td>Plant Name</td>
<td>Family</td>
<td>Place Name</td>
<td>Part Used</td>
<td>Uses</td>
</tr>
<tr>
<td>-----</td>
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<td>---------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>38.</td>
<td><em>Mimosa pudica</em> L.</td>
<td>Mimosaceae</td>
<td>Cheaken</td>
<td>Leaves and root</td>
<td>Leaf paste applied on acne and pimples. Root extract @ 1 teaspoon twice daily in jaundice. Leaves and roots used in piles and fistula; leaf paste applied to hydrocele; leaf and stem used in scorpion sting (Chopra et al. 1956).</td>
</tr>
<tr>
<td>39.</td>
<td><em>Momordica charantia</em> L.</td>
<td>Cucurbitaceae</td>
<td>Gangrauk</td>
<td>Fruits and twigs</td>
<td>Extract @ 2 teaspoons daily. Leaf juice emetic, purgative, used in biliousness, burning of soles of feet; fruits and leaves purgative, emetic, used in piles, jaundice, leprosy and as vermifuge (Chopra et al. 1956).</td>
</tr>
<tr>
<td>40.</td>
<td><em>Momordica cochinchinensis</em></td>
<td>Cucurbitaceae</td>
<td>Shamokaro 1</td>
<td>Unripe fruit</td>
<td>Cooked as curry with small fishlings. The curry is administered along with the regular meals of the patient of jaundice. Fruits and leaves are used in external application for lumbago, ulceration and fracture of bones. The seeds are used in the treatment of ulcers, sores and obstructions of liver and spleen (Vashista, 1974).</td>
</tr>
<tr>
<td>41.</td>
<td><em>Ocimum gratissimum</em> L.</td>
<td>Laminaceae</td>
<td>Bantulsi</td>
<td>Leaves</td>
<td>Extract administered in 1: 1 ratio with rhizome extract of <em>Zingiber officinale</em> @ 1 teaspoon twice daily for 1 week. Used in treatment of upper respiratory tract infections, diarrhea, headache, fever, ophthalmic, skin disease and pneumonia (Correa 1932, Onajobi 1986, Ilori et al., 1996).</td>
</tr>
<tr>
<td>42.</td>
<td><em>Ocimum sanctum</em> L.</td>
<td>Laminaceae</td>
<td>Tulsi</td>
<td>Leaves</td>
<td>Extract administered @ 1 teaspoon twice daily for 1 week. Used against cough, fever, dysentery, stomach diseases and as mosquito repelliant (Khan and Rashid, 2006).</td>
</tr>
</tbody>
</table>
| 43. | *Oldenlandia corymbosa* Linn. | Rubiaceae | Khetpapa | Leaves              | Extract administered @ 2 teaspoon thrice daily for 1 week. Used in African folk medicine for snake bite, given during labour to induce strong uterine also used in treatment of

---

**References:**
<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Family</th>
<th>Part Utilized</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>Oroxylum indicum (L.) Vent.</td>
<td>Bignoniaceae</td>
<td>Stem bark</td>
<td>The cooled aqueous extract is taken with 2 tablespoons of sugar in 300ml as many times a day as possible. Root bark in fever, bronchitis, intestinal worms, leucoderma, asthma, inflammation, anal troubles, etc. Fruits and seeds as expectorant, purgative and bitter tonic (Kirtikar and Basu, 1996). Stem bark in jaundice (Mokat and Deokule, 2006). Root bark as tonic and astringent, in diarrhoea, dysentery and rheumatism. Tender fruits refreshing and stomachic. Seeds are purgative (Tiwari, <em>et al.</em>, 2007).</td>
</tr>
<tr>
<td>45</td>
<td>Phlogacanthus thyrsiflorus (Hardwicke) Mabberley</td>
<td>Acanthaceae</td>
<td>Leaves</td>
<td>Leaf extract @ 1 teaspoon twice daily after meals.</td>
</tr>
<tr>
<td>46</td>
<td>Psidium guajava L.</td>
<td>Myrtaceae</td>
<td>Fruits and twigs</td>
<td>Young twigs chewed in empty stomach every morning for 1 week. Root bark reported to be astringent, used in diarrhoea; fruits laxative; leaves astringent, used against diarrhoea, cholera, vomiting, wounds and ulcers (Chopra <em>et al.</em> 1956).</td>
</tr>
<tr>
<td>47</td>
<td>Scoparia dulcis L.</td>
<td>Scrophulariaceae</td>
<td>Leaves and twigs</td>
<td>½ glass of taken once daily for 3-4 days in empty stomach. Plant infusion used as an astringent and as an emetic (Chopra <em>et al.</em> 1956).</td>
</tr>
<tr>
<td>48</td>
<td>Spilanthes paniculata</td>
<td>Asteraceae</td>
<td>Leaves</td>
<td>Juice administered @ 1 teaspoon thrice daily for 3-4 days. Inflorescence used to brush teeth in toothache (Hynniewta and Kumar, 2008).</td>
</tr>
</tbody>
</table>
### RESULTS

A total of 52 species of plants of ethnomedicinal importance belonging to 36 families of angiosperms were collected. These plants are enumerated here along with their scientific and local names, family, parts used, mode of use, and established uses. A note has been provided wherever necessary.

All the plants recorded were found to be angiosperms. Of all the plants recorded 22 plants have been reported from the respective tribes for the first time to have hepatoprotective property. Among these, 6 have been reported from the Tripuri community, 10 from the Chakmas, 5 from Halams and 1 plant have been reported from the Darlongs (Figure 2).

Out of the 34 species identified taxonomically, 25 are in their wild state and 24 are cultivated for several medicinal purposes. Remaining 3 species are reported to cultivated as well as growing in the wild. As shown in Figure 3, a maximum of 29 formulations have been reported from leaves and twigs followed by

<p>| | | | | |</p>
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</thead>
<tbody>
<tr>
<td>49.</td>
<td><em>Stephania japonica</em> (Thunb.) Miers.</td>
<td>Menispermaceae</td>
<td>Thandamanik</td>
<td>Chakma</td>
</tr>
<tr>
<td>50.</td>
<td><em>Typhonium trilobatum</em> (L.) Schott.</td>
<td>Araceae</td>
<td>Kharkun</td>
<td>Tripuri</td>
</tr>
<tr>
<td>51.</td>
<td><em>Urena lobata</em> L.</td>
<td>Malvaceae</td>
<td>Rongaachh (C)</td>
<td>Chakma (C)</td>
</tr>
<tr>
<td>52.</td>
<td><em>Zingiber officinale</em> Rosc.</td>
<td>Zingiberaceae</td>
<td>Aada</td>
<td>Tripuri</td>
</tr>
</tbody>
</table>

Research Article

9 from stem and stem bark, 6 from fruits, 5 from rhizome, 3 from roots, 2 from seeds and nuts and 1 formulation from branch. No hepatoprotective formulation was reported from the floral organs.

![Pie chart showing the percentage of plants collected from different communities.

Figure 2: Percentage of plants collected from different communities

![Bar chart showing the number of formulations reported from different plant parts.

Figure 3: Number of formulations reported from different plant parts

Conclusion

The ethnobotanical lore of the four communities studied shows wide usage of medicinal plants, in different proportions and different combinations in the treatment of various hepatic ailments. The present work reports the use of 52 such plants of which 21 plants have been reported for the first time for their hepatoprotective property during the present work.

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Antibacterial Activity of a Compound From Stem Bark Of *Oroxylum indicum* Vent. and its MIC Against Antibiotic Resistant Bacteria

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¹Ethnobotany and Medicinal Plants Research Laboratory, Dept. of Life Science and Bioinformatics, Assam University, Silchar- 788011, Assam, India.
²Pharmacognosy and Phytotherapy Research Laboratory, Division of Pharmacognosy, Jadavpur University, Kolkata, India

Compound SDP_F38 from the ethyl acetate extract of the stem bark of the plant *Oroxylum indicum* Vent. was tested for its antibacterial activity and compared with crude extracts. Bacterial strains used were *Bacillus subtilis*, *Escherichia coli* and *Pseudomonas aeruginosa*. SDP_F38 and crude extracts were pipetted onto sterile paper discs and placed on the surface of petridishes previously surface-inoculated with test strains at 10⁶ dilutions and incubated at 37°C for 24 hrs. Ampicillin, Amikacin and Tetracycline were used as antibiotic standards. Minimum Inhibitory Concentrate (MIC) of SDP_F38 was tested with Amikacin as standard. Inhibition shown by SDP_F38 was always greater than the standard Ampicillin for all concentrations studied. Similar results were obtained with 25%, 50% and 100% extracts for *B. subtilis* with Tetracycline as standard. MIC was 8µg/ml and 16µg/ml for *E. coli* 468 and *P. aeruginosa* respectively. Antibacterial activity was, in certain cases, found to be even more than the standard antibiotics. Thus, the study ascertains the value of this widely used plant and the compound isolated from it (SDP_F38), which could be of considerable interest to the development of new drugs. The study shows the property of compound SDP_F38 as a potent antimicrobial drug against multidrug resistant pathogenic bacteria.

**Key words:** *Oroxylum indicum*, ethnomedicinal, antibacterial, SDP_F38, MIC

**INTRODUCTION**

The spread of multiple antibiotic resistant pathogenic bacteria has been recognized by WHO, FAO and OIE as a serious global human and animal health problem, alternative treatments for microbial infections thus gaining importance. Plant based medicines have the potential of a more effective and cheaper alternative in this case.

*Oroxylum indicum* Vent., has been repeatedly reported for its antimicrobial activities.

The present work indicates the antimicrobial potential of a compound isolated from the stem bark of the plant and its MIC (Minimum Inhibitory Concentrate) against antibiotic resistant strains.

**MATERIALS AND METHODS**

**Plant material:** Plant material was collected from the village, Jaithang, in the North Tripura District of Tripura State, India. The sample (Coll. No. S.D. 66) was identified from a voucher specimen from the Assam University Herbarium, Dept. of Life Science and Bioinformatics, Assam University and a specimen was deposited there.

**Isolation of the compound:** Fresh stem bark sections of the plant were shade dried and powdered. It was then defatted with petroleum ether. Then the plant material was extracted using ethyl acetate to yield the crude extract. For extraction methodologies as suggested by Van Beeck was followed. The ethyl acetate extract of the plant was then subjected to column chromatography to yield the fraction SDP_F38 as done earlier.

**Test organisms:** The test organisms used included *Bacillus subtilis*, *Pseudomonas aeruginosa* and *Escherichia coli* and a multidrug resistant strain of *E. coli* (E. coli 468).

*E. coli* 468 was acquired from a tertiary referral hospital and isolated from a patient suffering from Urinary Tract Infection. The strain is resistant to Ampicillin, Cefotaxime, Ceftriaxone, Cefepine, Aztreonam, Gentamicin, Nettilmicin, Ciprofloxacin and Co-trimoxaole. The strain is susceptible to Imipenem, Piperacillin/ Tazobactum and Amikacin and harbours bla6SBL gene.

**Antibacterial assay:** Antibacterial assays were performed as previously described by Bauer, et al. and Jenkins, et. al with some modifications.

SDP_F38 in gradually increasing concentrations was pipetted onto sterile paper discs. After drying, these discs were placed on the surface of Petri dishes previously surface-inoculated with test strains at 10⁶ dilutions and incubated at 37°C for 24 hrs. Solvent control discs prepared similarly never inhibited bacterial growth. The bacterial strains used were *B. subtilis*, *E. coli* and *P. aeruginosa*. Ampicillin, Amikacin and Tetracycline discs (manufactured by Hi Media Laboratories, Pvt. Limited Mumbai- 400 086, India.) were used as antibiotic standards on each plate. MIC was tested against multidrug resistant strain of *E. coli* (E. coli 468) and *P. aeruginosa*.

**Minimum Inhibitory Concentrate (MIC):** The assay for determining the MIC was done as per Ghosh et al. with minimum modifications. The strains used were *Pseudomonas*
Das et al.: Antibacterial Activity of a Compound From Stem Bark Of Oroxylum indicum Vent. and its MIC Against Antibiotic Resistant Bacteria

P. aeruginosa and a multidrug resistant strain of Escherichia coli (E. coli 468) isolated from a hospitalized patient suffering from Urinary Tract Infection. This strain E. coli 468 is resistant to the drugs Ampicillin, Cefotaxime, Ceftriaxone, Cefepine, Aztreonam, Gentamicin, Netilmicin, Ciprofloxacin, and Cotrimoxazole. It is susceptible to Imipenem, Piperacillin/Tazobactam and Amikacin. The MIC was tested against Amikacin (Mikacin, Manufactured by Aristo).

Table 1: Structural detailing of SDP_F38

<table>
<thead>
<tr>
<th>IR bands</th>
<th>Assignments</th>
<th>Mass Spectral data</th>
<th>1H NMR spectral data</th>
</tr>
</thead>
<tbody>
<tr>
<td>2924 cm⁻¹</td>
<td>Alkyl C-H stretching</td>
<td>243</td>
<td>1 7.85</td>
</tr>
<tr>
<td>1656 cm⁻¹</td>
<td>Conjugated C=C stretching</td>
<td>212</td>
<td>3 6.64</td>
</tr>
<tr>
<td>1284 cm⁻¹</td>
<td>C-O stretching</td>
<td>285</td>
<td>5 6.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>241</td>
<td>9 7.52</td>
</tr>
<tr>
<td></td>
<td></td>
<td>91</td>
<td>10 7.24</td>
</tr>
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<td></td>
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<td>13 7.51</td>
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<td>14 6.6</td>
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<td>20 2.1</td>
</tr>
</tbody>
</table>

Details of the structural analyses

Structure elucidation: From the structural detailing the tentative structure of SDP_F38 has been given in Fig 1.

Table 2: Minimum Inhibitory Concentrate of SDP_F38

<table>
<thead>
<tr>
<th>Replicate No.</th>
<th>Bacterial strains</th>
<th>Concentrations (in µg/ml)</th>
<th>Standard antibiotic (Amikacin)</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>I</td>
<td>E. coli (strain 468)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Pseudomonas aeruginosa</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>II</td>
<td>E. coli (strain 468)</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>Pseudomonas aeruginosa</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>III</td>
<td>Pseudomonas aeruginosa</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Fig. 1. Tentative Structure of Compound SDP_F38
[2-(3-isopropyl-4-p-tolylhepta-2,4-dienyloxy)ethenamine]

Fig. 2: Zone of Inhibition as shown by Standard Antibiotics

Fig. 3. Antimicrobial activity against B. subtilis
Antimicrobial activity and MIC: This study reports that the activity of the compound SDP_F38 isolated from stem bark extracts of *O. indicum* show positive results for both Gram positive and Gram negative bacterial strains. At several instances, the Zone of Inhibition shown by SDP_F38 was greater than that of the standard antibiotics (Figure 2). As seen in Figures 3-5, for all the strains, the Zones of inhibition (ZOI) showed by compound SDP_F38 was always greater than the standard antibiotic Ampicillin for all the concentrations studied. Similar results were obtained with 25%, 50% and 100% extracts for *B. subtilis* with Tetracycline as standard. In most of the concentrations, the Zone of Inhibition shown by the compound was better than that of the crude extracts.

![Fig. 4. Antimicrobial activity against *P. aeruginosa*](image)

![Fig. 5. Antimicrobial activity against *E. coli*](image)

MIC of the compound was calculated to be 8µg/ml and 16µg/ml for *E. coli* 468 and *P. aeruginosa* respectively. Whereas the standard (here Amikacin) did not show any inhibitions at those concentrations. The results for antibacterial and MIC assays have been detailed in Fig(s) 2-5 and Table 2 respectively.

CONCLUSION

Antibacterial activity of SDP_F38 has been found to be even more than the standard antibiotics at many instances. Minimum Inhibitory Concentrate of the compound has been found to be 8µg/ml and 16µg/ml whereas the standard antibiotic, Amikacin did not show any zone of inhibition. Thus, the study ascertains the antibacterial potential of the compound SDP_F38. This could be of considerable interest to the development of new drugs.

ACKNOWLEDGEMENT

The authors express their due gratitude to Dr. Amitabha Bhattacharjee, Assistant Professor, Dept. of Microbiology, Assam University, Silchar for his kind co-operation without which the entire investigation would not have been possible.

REFERENCES


Source of support: Nil, Conflict of interest: None Declared
Phytochemical screening and in vivo hepatoprotective property of crude stem bark extract with reference to a compound isolated from the ethyl acetate extract of Oroxylum indicum


Research Article
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INTRODUCTION:
Oroxylum indicum Vent is a small to medium sized deciduous tree with light grayish brown bark, large petioled compound leaves, purplish red flowers and large flat, sword shaped capsules full of paper thin seeds with broad silver wings (Dwarkanath et al., 2007). Also known as Shonari, Sonpatha or Midnight Hortin, it has been reported to be an important component of herbal medicine since long (Bhattacharyya, 1999; Kishark and Ban, 1999; Warner et al., 1995). Yonamaini and Inamdar, 1996). The medicinal uses of Oroxylum indicum and the compounds of the tree which enumerate these uses make the plant impressive enough for phytochemical research.

MATERIALS AND METHODS:
All the animal experiments were done after taking due permission from the institutional animal ethics committee.

Plant material:
Plant material was collected from the village Khadang in the north iripura District of iripura State, India. The sample (Col. No. SDR-166) was identified from a herbarium specimen from the Yeaux University Herbarium, Dept of Life Science and Biotechnology, Yeaux University, and a specimen was deposited there.

Drugs and chemicals:
The standard drug used to assess the hepatoprotective property was Silymarin in the form of Sildynil-70 tablets manufactured by Maco Labs Limited, solan, Haryana, India. All other chemicals reagents used were of analytical grade manufactured by Qualipure fine chemicals, Novi Mumbai, India, Himedia Labs, Mumbai, India, SRL, Mumbai.

Extraction and preparation of crude extract:
Fresh stem bark sections of the plant were shade dried and powdered. It was then extracted with petroleum ether. Then the plant material was extracted using ethyl acetate, methanol and ethanol to yield the crude extract. For extraction methodology as suggested by van Heek (1999) was followed.

Phytochemical analysis:
A preliminary qualitative phytochemical screening of the different crude extracts used to extract the plant was carried out for alkaloids, tannins, crude oils and fats, saponins, flavonoids, anthraquinones, and glycosides. For the analytical part the standard method (Fauve and Evans, 1996) was followed with minor modifications.

Test animals:
Adult Swiss albino mice were procured from Pasteur Institute, Shillong, Meghalaya and used for the pharmacological studies. The animals were housed in groups of 6 males and 8 females. The animals were housed in polypropylene cages and were fed standard pellet diet and water ad libitum.

CCL4 induced in vivo hepatotoxicity:
For studying CCL4 induced hepatotoxicity the protocol of Horan, S. et al., 2004) was followed with minor modifications.

Statistical analysis:
Results were expressed as SMD ± 95% CI. Statistical analysis were performed using one way ANOVA followed by Post Hoc test. A value of p <0.05 was considered to be statistically significant.
Isolation of the compound: The ethyl acetate extract of the plant was then subjected to column chromatography on a silica gel column (60-120 Mesh, Qualigens Fine Chemicals, Navi Mumbai, India). The solvent system used was petroleum ether with increasing grades of ethyl acetate (PE: pure PE 9.0:0.1 9.0:0.5 9.0:1 8.5:1 8.2 PE:Acetone 1:2:1 and finally pure Acetone). The fraction SDP P38 was fraction no. 38 eluted at PE:Acetone 1:1. The purity of the fraction was analyzed by a HPLC assay. The particular fraction was considered for the hepatoprotective assays as during the peak purity hepatoprotective assays with crude extracts, better results were reported from the ethyl acetate extract.

RESULT:
A. Results for phytochemical screening

<table>
<thead>
<tr>
<th>Chemical analysis</th>
<th>Ether Extracts</th>
<th>Methanol Extracts</th>
<th>Acidic Extracts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tannins</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Alkaloids</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Terpenoids</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Saponins</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Glucosides</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Sugar/phenol</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Negatives</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

(Here, PE = Petroleum ether, E = Ether extract, Meth = Methanol Extract)

A. Details of the structural analysis

<table>
<thead>
<tr>
<th>IR Band assignments</th>
<th>Mass Spectral data</th>
<th>1H NMR spectral data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1724 cm⁻¹</td>
<td>265</td>
<td>5</td>
</tr>
<tr>
<td>1640 cm⁻¹</td>
<td>212</td>
<td>7</td>
</tr>
<tr>
<td>1538 cm⁻¹</td>
<td>265</td>
<td>9</td>
</tr>
<tr>
<td>1514 cm⁻¹</td>
<td>91</td>
<td>10</td>
</tr>
<tr>
<td>1462 cm⁻¹</td>
<td>32</td>
<td>12</td>
</tr>
<tr>
<td>1441 cm⁻¹</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>1424 cm⁻¹</td>
<td>20</td>
<td>16</td>
</tr>
</tbody>
</table>

Fig 1. HPLC graph

Characterization of the isolated compound: From the IR spectrum of the compound, the presence of 1724 cm⁻¹ was ascertained through the presence of characteristic band at 2924 cm⁻¹ (CH stretching). The band at 1640 cm⁻¹ is attributed to conjugated C=C stretching, whereas the band at 1538 cm⁻¹ is designated to aromatic C=C stretching.

The Mass Spectral analysis of the compound provided the molecular weight at m/z 285. The presence of the peak at m/z 91 indicates aromatic C₆H₄ unit. The peak at m/z 214 originate from the exclusion of a very small unit. Fig. 2 shows the Mass spectral fragmentation.
A. Hepatoprotective activity of the crude extracts in comparison to SDP_F38

Table 2: Hepatoprotective activity of the crude extracts in comparison to SDP_F38

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Average SGOT Readings</th>
<th>Average Serum Bilirubin Readings</th>
<th>Average Alkaline Phosphatase Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>26.9 ± 0.148</td>
<td>9.6 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>Vehicle</td>
<td>30.1 ± 0.148</td>
<td>9.1 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>Toxic</td>
<td>32.1 ± 0.148</td>
<td>8.6 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>Petroleum ether</td>
<td>34.1 ± 0.148</td>
<td>8.1 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>Ethyl acetate</td>
<td>36.1 ± 0.148</td>
<td>7.6 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>Methanol</td>
<td>38.1 ± 0.148</td>
<td>7.1 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>SDP_F38 200 mg/kg</td>
<td>34.1 ± 0.148</td>
<td>6.7 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>SDP_F38 400 mg/kg</td>
<td>36.1 ± 0.148</td>
<td>6.2 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>SDP_F38 600 mg/kg</td>
<td>38.1 ± 0.148</td>
<td>5.7 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
<tr>
<td>SDP_F38 800 mg/kg</td>
<td>40.1 ± 0.148</td>
<td>5.2 ± 0.0210</td>
<td>8.0 ± 0.0110</td>
</tr>
</tbody>
</table>

Values are the mean ± Standard Error Mean of 6 rats. Symbols represent statistical significance.

B. Hepatoprotective activity of the compound SDP_F38

Table 3: Hepatoprotective activity of the compound SDP_F38

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Average SGPT Readings</th>
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<th>Average Alkaline Phosphatase Readings</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>Toxic</td>
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<tr>
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</tr>
<tr>
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<td>38.1 ± 0.148</td>
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</tr>
</tbody>
</table>

Values are the mean ± Standard Error Mean of 6 rats. Symbols represent statistical significance.

C. Glycogen content of liver tissues

Table 4: Glycogen content of liver tissues

<table>
<thead>
<tr>
<th>Liver sample</th>
<th>Glycogen content</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>1.42</td>
</tr>
<tr>
<td>Toxic (CCl₃ treated)</td>
<td>0.98</td>
</tr>
<tr>
<td>Standard (Silmanena)</td>
<td>0.94</td>
</tr>
<tr>
<td>Treatment 1: SDP_F38</td>
<td>1.48</td>
</tr>
<tr>
<td>Treatment 2: Petroleum ether</td>
<td>0.97</td>
</tr>
<tr>
<td>Treatment 3: Ethanol extract</td>
<td>1.25</td>
</tr>
<tr>
<td>Treatment 4: Methanol</td>
<td>1.04</td>
</tr>
<tr>
<td>Treatment 5: 100% Ethanol</td>
<td>1.51</td>
</tr>
</tbody>
</table>

Values are the mean ± Standard Error Mean of 6 rats. Symbols represent statistical significance.

Journal of Pharmacy Research Vol.5 Issue 5 May 2012
This study reports that the activity of the crude extract as well as the compound SDP F38 isolated from stem bark extract of O. indica show positive results in CCl4-induced hepatotoxicity.


discussion:
The present piece of work throws light on the hepatoprotective property of a well-known medicinal plant Osyranium indicum (L.) Vent. The ethyl acetate extract of the stem bark of the plant was found to possess hepatoprotective potential well comparable to all the crude extracts of the plant and the standard drug Silymarin. A similar work on the antioxidant activity of leaves of the plant also recorded the hepatoprotective property of the crude leaf extract (Petroleum ether, n-hexane, Chloroform and Ethyl alcohol extracts) (Teerut, et al, 2009). Similar activity was also reported from the ethyl alcohol stem bark extract of the plant by Tripathi, et al (2011) on CCl4 induced hepatotoxicity in rats.

The compound SDP F38 isolated from the ethyl acetate extract of the plant was found to show even better results than the crude ethyl acetate extract of the stem bark of the plant. This was further proved by the histological sections of the liver of mice (Fig. 6). The best results were obtained with the compound at a concentration of 50 mg/kg.

The results show the potent hepatoprotective property of the compound SDP F38, yet further in vivo and in vitro studies are required to know about the other medicinal properties of the compound.

Conclusion:
During the present study, the phytochemical evaluation of different stem bark extracts of Osyranium indicum were found to show the presence of alkaloids, flavonoids, tannins, glycosides, fixed oils and fats. The results of the investigation clearly indicate the hepatoprotective activity of the compound SDP F38 isolated from ethyl acetate extract of O. indica. The results thus indicate that SDP F38 [C6H10O2, (2-iso-propyl-4-polymer-2,4-dienoxy) ethenamidine] gives better results at a dose of 50mg kg-1 compared to Silymarin in CCl4-induced hepatotoxicity in laboratory mice. However, the medicinal properties of SDP F38 demand further studies to know the other medicinal properties of the compound in details.

acknowledgement:
The authors express their deep gratitude to Dr. Sushil Choudhary, CII, Assam University, Silchar for the HPLC and NMR data. The authors are also grateful to Mr. Kocho Singh, CII, Hamirpur for the Mass spectrometry analysis. The authors also extend their gratitude to Dr. Sushil Choudhary, Chemistry, Assam University for the structure elucidation part and Dr. Ramendra Chandra Nath, Dharmajyoti Gour College, Guwahati for the microbiological sections.

REFERENCES:

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Full Length Research Paper

Ethnomedicinal uses of some traditional medicinal plants found in Tripura, India

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Accepted 12 June, 2012

The tribal people of Tripura are accustomed to a wide variety of medicinal plants used in their herbal medicinal practices. A field study carried out on some tribal villages of Tripura (north) reported several plants having multiple applications as herbal medicines. A total of 25 of such plants were recorded from the medicine men and aged villagers of various villages. Some important plants include Oroxylum indicum, Euphorbia nerifolia, Scoparia dulcis, Jatropha curcas and Kaempferia rotunda.

Key words: Tripura, herbal, medicinal plant.

INTRODUCTION

Human beings and plants share an age old relationship. Man has been depending on plants for medicinal purpose before the beginning of the written records. Fossil records suggest that even the Neanderthal people were no exception. About 250 years ago, 250,000 to 300,000 higher plants were the source of drugs for the world’s population (Duke, 1990). Dependence on plants is still seen and it is estimated that 25% of prescription drugs contain active components derived from higher plants (Tiwari and Joshi, 1990).

North east India is one of the major biodiversity hotspots and the state of Tripura is no exception. Although, more than 31% of the state population consists of different ethnic communities, not much work has been done on the ethnobotany of this region. Although Shil (2007) and Singh (2007) carried out detailed work, the major segment comprising of several ethnic groups of Tripura remained unexplored till date.

The present work indicates the multiple formulations in which the ethnomedicinal plants have been used by the same and different ethnic groups in the region.

The study area included the state of Tripura (Figure 1) located in the far end of north east India. Tripura is a land of hills and dense forests located in between 22° 56’ N and 24° 32’ N latitude and 90° 09’ E and 92° 20’ E longitude. The state covers an area of 1,049,169 hectares of which 285,000 hectares is under forest cover.

MATERIALS AND METHODS

Field surveys were undertaken at different sites, covering all seasons. The studies were undertaken during May 2008 to May 2009. The sites covered include Nabincherra, Jaithang, Boonang, Baithangbari, Kalacherra, Balidhum, Noagang, Baruakandi, Chandra Halam Para, Biragibari, Shailenbari and Gobindapur villages of Tripura. Plants were collected in their flowering and fruiting stage and from their natural habitat. Thorough observations were made on spot collection of individual plant species and field data as regards location, natural habitat, distribution pattern, nature of roots, tubers, bulbs or rhizomes, etc., were recorded. Characteristics that cannot be observed after drying, such as color and scent were recorded separately on spot. Smaller herbaceous plants were collected as whole. In the case of shrubs, under shrubs, woody herbs and climbers, respective twigs were collected.

Informations were collected mainly from the medicine men, village headmen and the aged and experienced people. Repeated queries were made for confirmation and data gathered on each plant were cross checked for further verification. Interpreters’ help was taken wherever following the local language was found difficult.

The collected plant specimens were pressed and dried at room temperature. The dried material was then disinfected using HgCl₂ and absolute alcohol. After that, the plants were mounted on the standard size herbarium sheets. The data taken in the field was transferred to the slip pasted on the herbarium sheets. Methodologies as suggested by Schultes (1960, 1962), Jain (1964, 1967, 1991); Jain and Rao (1977); Jain and Borthakur (1980); and...
Das and Choudhury

Jain and Mudgal (1999), was followed in collecting ethnobotanical information. For identification purpose, several Floras and Monographs were consulted, such as Flora of British India (Hooker, 1872-1897) Flora of Assam, Vol. I-V (Kanjilal et al., 1934, 1938, 1939, 1940) and Vol. V (Bor, 1940), Flora of Tripura (Deb, 1981, 1983).

The specimens were deposited in the Assam University Herbarium. The data regarding plants collection were recorded as (a) Sl. no. (b) scientific name (c) family (d) tribe and local name (e) parts used (f) process of utilization and (g) established report of use. The plant specimens were authenticated using the voucher specimen from the Assam University Herbarium.

RESULTS

During the study, a total of 2 plants each were reported from the families Asteraceae, Euphorbiaceae and Laminaceae. A maximum of 15 formulations were recorded for hepatic illness and jaundice followed by 8 plants for dysentery and 6 plants for diarrhea (Figure 2). The formulations reported involved a maximum use of leaves (16 formulations) (Figure 2). All other plant parts recorded two uses each. Extracts of different plant parts were used mostly to treat different ailments (17 formulations). The highest of 4 different uses was recorded for Kalanchoe pinnata, 3 different uses each was recorded for Aegle marmelos, Aegeratum conyzoides, Azadirachta indica, Cajanus cajan and Euphorbia neriifolia. All other plants recorded 2 uses each. Detailed description of the ethnomedicinal plants with multiple uses have been recorded in Table 1.

There was no standard dose for all the patients for a single herbal formulation in all the cases. However, dosage depends mostly on the intensity of the disease and the age of the person concerned.

DISCUSSION

The present piece of work throws light on some of the plants used for multiple reasons by the ethnic communities of the state. A total of 24 plants were reported from the 5 different ethnic communities of Tripura state used for multiple reasons. Previously, similar study recorded 20 ethnomedicinally important plants from the Kurumba tribe of Tamil Nadu, India (Alagesabooopathi, 2011). In another case, there is a report on 63 ethnomedicinal plants used by the Chakma community residing in Arunachal Pradesh (Sarmah et al., 2008). 50 medicinal plants were reported to be used by the Tripuri medicine men (Majumdar and Dutta, 2007). However, documentations comprising only of the ethnomedicinal plants having diverse uses have not yet been found for the Manipuris Tripuris, Halams, Chakmas or Darlongs. In the present study, a total of 12 plants were recorded for Manipuris, 10 plants for Chakmas, 6 plants for Tripuris, 13 plants for the Halams and 1 plant for the Darlong community (Figure 3).

In spite of all positive initiatives by the villagers for conservation of the traditional knowledge and the ethnomedicinal plants, introduction of ex situ techniques
Table 1. Plants with multiple uses in tribal ethnomedicine of Tripura.

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Scientific name</th>
<th>Family</th>
<th>Tribe and local name</th>
<th>Part used</th>
<th>Process of utilization</th>
<th>Established report</th>
<th>Plants reported for the first time for their specific utilities during this study</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Aegle marmelos Correa</td>
<td>Rutaceae</td>
<td>Chakma, Manipuri and Tripuri - Bael</td>
<td>Leaves, gum from fruit, ripe fruit</td>
<td>1. Chakra leaves pounded to paste with equal quantities of leaves of Cajanus cajan and a little water and 1 cupful extract taken in the morning in empty stomach in combination with molasses in jaundice. 2. Manipuri - One teaspoonful gum is taken once daily for 2 days in jaundice. Pulp of ripe fruit in dysentery. 3. Tripuri - Fruit pulp as medicine and for prevention of dysentery.</td>
<td>Pulp of unripe fruit is aromatic, cooling, laxative. Unripe or half ripe fruit is astringent, stomachic, digestive and used in diarrhea. Root bark is used in intermittent fevers and as fish poison (Chopra, et al., 1955). Useful in indigestion and constipation, unripe fruit is used in dysentery and diarrhea (Pathin and Borah, 2007).</td>
<td>Hepatoprotective property of the leaves and gum of the fruit in a new report.</td>
</tr>
<tr>
<td>2.</td>
<td>Ageratum conyzoides Linn.</td>
<td>Asteraceae</td>
<td>Chakma-Gundhuabon Halam and Tripuri - Shyamtulsli</td>
<td>Leaves and twigs</td>
<td>1. Chakra - Fresh leaf extract used as anti hemorrhagic. 2. Halam - Paste of leaves and twigs used as anti hemorrhagic. 3. Tripuri - Juice used as an expectorant.</td>
<td>Root juice is antilithic; leaf juice is styptic, applied to cuts and sores, externally inague (Chopra et al., 1956).</td>
<td>Expectorant property of the leaves is a new report.</td>
</tr>
<tr>
<td>3.</td>
<td>Ananas comosus (L.) Merril.</td>
<td>Bromeliaceae</td>
<td>Manipuri - Gihom</td>
<td>Leaves</td>
<td>1. Leaf extract with milk and sugar candy in rheumatic swellings 2. Extract of leaf base is taken 1 teaspoon thrice daily in diarrhea.</td>
<td>Used for the treatment of dysuria. Cortex is used as alexipharmic, antilusious, and anti diarrheal and leaves is used against dyspepsia or anti diarrheal agent (Seng, 1999; Sripandkulchais et al., 2000, 2001).</td>
<td>Use as anti- rheumatic is a new report.</td>
</tr>
<tr>
<td>4.</td>
<td>Azadirachta indica A. Juss.</td>
<td>Meliaceae</td>
<td>Halam and Manipuri - Neem</td>
<td>Leaves and stem bark</td>
<td>1. Halam - Leaves boiled in water to bathe patient with malaria and chicken pox. 2. Smoke produced by burning leaves is used as mosquito repellent. 3. Manipuri - Bark paste made to tablets and administered in severe jaundice.</td>
<td>Young fruits, bark and root bark is used as astringent, antiperspirant; leaves as poultice in boils, antiseptic in ulcers and eczema; gum demulcent tonic in cataract; dry flowers tonic, stomachic; oil stimulant, antiseptic in rheumatism and skin diseases; bark, gum, leaf and seeds in scorpion stings and snake bites; berries purgative, emollient and anthelmintic (Chopra et al., 1956).</td>
<td>Hepatoprotective property is a new report.</td>
</tr>
<tr>
<td>5.</td>
<td>Cajanus cajan (L.) Millsp.</td>
<td>Fabaceae</td>
<td>Halam- Khokhlaing Manipuri- Arail</td>
<td>Leaves and twigs</td>
<td>1. Halam - Mature seeds are cocked as a pulse and given in weakness. 2. Leaf and twig paste is applied throughout the body during jaundice. 3. Manipuri - Soup of fresh leaves and twigs is administered in jaundice.</td>
<td>Seeds are used in snake-bite; paste of seeds and leaves are used to control milk flow (Chopra et al., 1956).</td>
<td>Use in physical weakness is a new report.</td>
</tr>
<tr>
<td>No.</td>
<td>Genus</td>
<td>Family</td>
<td>Species</td>
<td>Part</td>
<td>Uses</td>
<td>Properties</td>
<td></td>
</tr>
<tr>
<td>-----</td>
<td>-------</td>
<td>--------</td>
<td>---------</td>
<td>------</td>
<td>------</td>
<td>------------</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Carica</td>
<td>Caricaceae</td>
<td>papaya L.</td>
<td>Root and fruit</td>
<td>1. Manipuri- Extract of raw roots is administered 2 - 3 teaspoon thrice daily in jaundice. 2. Chakma- Unripe fruits is cooked as a vegetable, ripe fruit, eaten raw. Fruits are considered to be stomachic.</td>
<td>Latex of unripe fruits is used to remove freckles and blemishes from skin, anthelmintic; ripe fruits stomachic, carminative, diuretic; seeds vermifuge, emmenagogue, used to quench thirst (Chopra et al., 1956).</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Centella</td>
<td>Apiaceae</td>
<td>asiatica (Linn.) Urban</td>
<td>Leaves and entire shoot</td>
<td>1. Halam- Eatened either as paste or cooked as a vegetable for dysentery and diarrhea. 2. Manipuri- Decoction of the shoot part along with four other ingredients is used as a combination medicine for jaundice.</td>
<td>Plant is useful as alternative and tonic in diseases of skin, leprosy, nerves and blood; leaves are used for improving memory and in syphilitic skin diseases (Chopra et al., 1956).</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Clerodendrum</td>
<td>Verbenaceae</td>
<td>viscosum Vent.</td>
<td>Leaves and root</td>
<td>1. Chakma- Extract is used as expectorant. Decoction of the leaves is used to check high blood pressure. 2. Triputi- Root extract is administered 1 teaspoon thrice daily as febrifuge.</td>
<td>Root paste is used applied locally in dental caries. Root extract in abdominal pain (Rahman et al., 2007).</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Cynodon</td>
<td>Poaceae</td>
<td>dactylon (L.) Persoon</td>
<td>Shoot and roots</td>
<td>1. Chakma- Shoot extract is anti-haemorrhagic. 2. Manipuri- ½ cup of extract of roots is consumed thrice daily for 2 days to get rid of rheumatic swellings.</td>
<td>Decoction of roots diuretic in dropsy, secondary syphilis; root infusion in piles, crushed roots in chronic gleet; plant juice is astringent, useful in cuts and wounds, diuretic, used in dropsy and anasarca, useful in diarrhea, dysentery, nervous diseases and eye troubles (Chopra et al., 1955).</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Euphorbia</td>
<td>Euphorbiaceae</td>
<td>nerifolia Linn.</td>
<td>Leaves</td>
<td>1. Manipuri- Leaves are heated on any fire source and the juice is applied to the ear in any sort of ear infection. 2. Vapor is inhaled as medicine during fever. 3. Halam- Oven heated leaves are placed on the chest to control cough.</td>
<td>Milky juice is used as purgative, for skin diseases, roots in scorpion sting, snake bite, as anti-septic and fish poison (Chopra et al., 1956).</td>
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<td>11.</td>
<td>Jatropha</td>
<td>Euphorbiaceae</td>
<td>curcas Linn.</td>
<td>Branches</td>
<td>1. The sap is applied locally in gum infections. 2. Raw leaves are used in high blood pressure.</td>
<td>Seeds and roasted nuts are purgative; latex is useful in scabies, eczema and ringworm; leaves are lactagogue, rubefacient (Chopra et al., 1956).</td>
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<td></td>
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<td></td>
<td>Use against high blood pressure is a new report.</td>
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<tr>
<td>No.</td>
<td>Genus</td>
<td>Family</td>
<td>Common Name</td>
<td>Flower and rhizome</td>
<td>Application</td>
<td>Comments</td>
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<td>12</td>
<td>Kaempferia rotunda Linn.</td>
<td>Zingiberaceae</td>
<td>Chakma-Bhujoraphul</td>
<td>Flower and rhizome</td>
<td>Applied in Indonesia as the traditional insect repellent (Chan et al., 2009).</td>
<td>Use as a hepatoprotective agent is a new report.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Kalanchoe pinnata Pers.</td>
<td>Crassulaceae</td>
<td>Chakma-Khurajot Manjuri-Patarkuchi</td>
<td>Leaves</td>
<td>Juice of leaves is styptic; seed on fresh cuts and abrasions, bruises, burns and superficial ulcers, given in bilious diarrhea, litiasis (Chopra et al., 1956). Applied in Indonesia as the traditional insect repellent (Chan et al., 1992).</td>
<td>Hepatoprotective and antiseptic property of the plant are new reports.</td>
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<tr>
<td>14</td>
<td>Leucas aspera Spreng.</td>
<td>Lamiaceae</td>
<td>Manipuri-Doron pushpa Twigs</td>
<td>Leaves and twigs</td>
<td>Plant is antipyretic and insecticide. Flowers is used in cold, juice of leaves in psoriasis, scabies and chronic skin eruptions. Leaves useful in chronic rheumatism (Chopra et al., 1956). Leaves in skin diseases and painful swellings (Singh and Pandey, 1998).</td>
<td>Hepatoprotective property is a new report.</td>
<td></td>
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<tr>
<td>15</td>
<td>Marsilea quadrifolia Linn.</td>
<td>Marsileaceae</td>
<td>Manipuri-Lamzenchini Halam-Susni</td>
<td>Leaves</td>
<td></td>
<td>Uses as brain tonic and as a hepatoprotective agent are new reports.</td>
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<tr>
<td>16</td>
<td>Mimosa pudica Linn.</td>
<td>Mimosaceae</td>
<td>Halam-Cheaken lai Chakma-Dugaj lajari</td>
<td>Entire plant</td>
<td>Leaves and roots are used in piles and fistula; leaf paste is applied to hydrocele; leaf and stem used in scorpion sting (Chopra et al., 1956).</td>
<td>Uses as antiseptic and as a hepatoprotective agent are new reports.</td>
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<tr>
<td>17</td>
<td>Momordica charantia Linn.</td>
<td>Cucurbitaceae</td>
<td>Tripuri-Gangrauk</td>
<td>Fruits and twigs</td>
<td>Leaf juice is emetic, purgative, used in biliousness, burning of soles of feet, fruits and leaves purgative, emetic, used in piles, jaundice, leprosy and as vermiluge (Chopra et al., 1956).</td>
<td>Used against dyspepsia is a new report.</td>
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<tr>
<td>18</td>
<td>Musa paradisiaca Roxb.</td>
<td>Musaceae</td>
<td>Halam-Mot</td>
<td>Flower and stolon</td>
<td>Fresh dried rhizomes are used in jaundice. Immature fruits are anthelmintic (Basualdo et al., 1991; Singh and Pandey, 1998).</td>
<td>Uses of flowers in dysmenorrhoea and menorrhagia and stolon in dysentery and diarrhea are new reports.</td>
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<tr>
<td>No.</td>
<td>Scientific Name</td>
<td>Family</td>
<td>Common Names</td>
<td>Part</td>
<td>Properties</td>
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<td>19.</td>
<td><em>Phlogacanthus thrysiflorus</em> (Hardwicke) Mabberley</td>
<td>Acanthaceae</td>
<td>Manipuri-Nunbangha Chakma-Basoput</td>
<td>Leaves</td>
<td>Leaf extract is administered orally in gout and rheumatism (Roy et al., 2008).</td>
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<td>20.</td>
<td>Psidium guajava L.</td>
<td>Myrtaceae</td>
<td>Halam-Sapri</td>
<td>Fruits and twigs</td>
<td>Root bark is reported to be astringent, used in diarrhea; fruits laxative; leaves astringent, used against diarrhea, cholera, vomiting, wounds and ulcers (Chopra et al., 1956). Use against anaemia is a new report.</td>
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<td>21.</td>
<td>Scopania dulcis L.</td>
<td>Scrophulariaceae</td>
<td>Darlong-Bolkearzuwa Halam-Najungchewk</td>
<td>Leaves and twigs</td>
<td>Plant infusion is used as an emetic (Chopra et al., 1956). Use as anthelmintic and hepatoprotective are new reports.</td>
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<td>22.</td>
<td><em>Spilanthes paniculata</em> Wall. ex DC.</td>
<td>Asteraceae</td>
<td>Halam-Ansha</td>
<td>Leaves</td>
<td>Inflorescence is used to brush teeth in toothache (Hyniewt and Kumar, 2008). Use as hepatoprotective and against dyspepsia are new reports.</td>
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<td>24.</td>
<td><em>Oroxylum indicum</em> (L.) Vent.</td>
<td>Bignoniacae</td>
<td>Halam-Kaak-akung Tripuri-Tauharun</td>
<td>Stem bark and immature fruits</td>
<td>Root bark is used in fever, bronchitis, intestinal worms, leucoderma, asthma, inflammation, anal troubles, etc. Fruits and seeds as expectorant, purgative and bitter tonic (Kotikar and Basu, 1996). Stem bark is used in jaundice (Mokat and Deekule, 2006). Root bark as tonic and astringent, in diarrhea, dysentery and rheumatism. Tender fruits is refreshing and stomachic. Seeds are purgative (Tiwari et al., 2007).</td>
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<td>25.</td>
<td>Ocimum sanctum L.</td>
<td>Lamiaceae</td>
<td>Tripuri-Tulsi</td>
<td>Leaf</td>
<td>Used against cough, fever, dysentery, stomach diseases and as mosquito repellant (Khan and Rashid, 2006). Hepatoprotective property is a new report.</td>
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</tbody>
</table>
for the commercially viable species is necessary. This would be a step ahead in conservation of the herbal knowledge and at the same time generate income opportunities for the communities. Establishment of the Tripura Medicinal Plants Board (MPBT) on 12th September 2001 was a step forward in this regard. However, further steps are in this regard.

Conclusion

The study shows the dependence of the ethnic people on the herbal remedies in their day to day life. The people in general were found to be having strong faith in traditional medicine. Most of them were found to thrive only on herbal medicine throughout their life. Traditional knowledge of such kind demands serious conservation measures. The current study may thus prove to be of great use to the researchers, conservationists, foresters and people interested in herbal medicine. The documentation may further help to conserve the traditional knowledge and aid in the improvement of the local people of these areas.

REFERENCES

Bor NL (1940). Flora of Assam, Vol. IV (Gramineae). Govt. of Assam.