1 Introduction

1.1 Bioprospecting and brief phytophraphy of chosen species of *Strychnos*

Bioprospecting is the study of plant, microbe and animals resources that may be of commercial value. It is a rapidly developing field wherein biologists, chemists and other researchers are involved in building data base of the commercially potential bioresources (Figure 1). Several bioprospecting strategies are being initiated at global level in evaluating the bio resources for the benefit of human welfare. India has huge bioresource potential. Bioprospection is intended for economic purposes (e.g., new drugs, crops, industrial products). Bioprospection of under explored/ unexplored plant resources have relevance for the improvement of the rural/tribal community and economy. Before 1992, biological resources were considered a common heritage of humankind, as scientists could take samples from anywhere in the world without any specific permission.

The Convention on Biological Diversity (CBD, 1992) establishes sovereign national rights over biological resources. Though not granted property upon natural resources, biodiversity-rich countries are committed to: i) conserve their biodiversity ii) develop it for sustainable use and iii) share the benefits resulting from their use. In short, bioprospection has to be allowed by the biodiversity-rich country and must bring as much benefit to it (and to the communities that traditionally use these resources) as to
corporations (usually from developed countries) and universities collecting the bioresource. The scientific leads for new plant-based pharmaceuticals have been generated through:

a) High-throughput screening programs (Hunter, 2001) and
b) Ethno botanical studies (Houghton, 1995).

In recent times, the drug discovery research has been shifted to high-throughput screening coupled with computational and molecular modeling. Ethno botanical information is invaluable for the identification of potential compounds for novel pharmaceuticals. However, this important source for potential medicines (the knowledge of indigenous healers) is being lost at an alarming rate (Cox, 2000). The plant resources that the traditional healers rely upon are vanishing. *Strychnos* is one among these (Table 1).

Medicinal plants generate substantial income for the rural people in developing countries through the sale of wild-harvested material. The collectors are often the economically weaker sections of the population such as tribes, landless people and woman. In central part of Nepal, 50-100 % of households depend on medicinal plants and materials being traded to the wholesale markets (Olsen, 2005). The money received represents 15-30% of the total income of poorer households. In India also the same phenomenon occurs and majority of tribes depend on this plants.
Table 1: Brief phytography of the research material investigated

<table>
<thead>
<tr>
<th>Parts</th>
<th><em>Strychnos potatorum</em></th>
<th><em>Strychnos nuxvomica</em></th>
<th><em>S. wallichiana</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant</td>
<td>A medium sized deciduous tree having height up to 12 meters.</td>
<td>A medium sized deciduous tree having height up to 20 meters.</td>
<td>It is a woody climbing shrub.</td>
</tr>
<tr>
<td>Bark</td>
<td>Cracked and scaly bark.</td>
<td>Dark grey or yellowish grey bark.</td>
<td>Dark grey or yellowish grey bark.</td>
</tr>
<tr>
<td>Trunk</td>
<td>Irregularly fluted.</td>
<td>Fairly straight.</td>
<td>Irregularly fluted.</td>
</tr>
<tr>
<td>Leaves</td>
<td>Simple, opposite, elliptic, acute, 15x6.25 cm, glabrous, shining.</td>
<td>Broadly elliptic, coriaceous, glabrous.</td>
<td>Simple, opposite, Oval to oblong, Bluntly acuminate.</td>
</tr>
<tr>
<td>Flowers</td>
<td>White fragrant, axillary cymes</td>
<td>Numerous, greenish white in terminal cymes.</td>
<td>Small greenish yellow, Compound axillary cymes</td>
</tr>
<tr>
<td>Fruits</td>
<td>Ovoid or globose, glabrous berries, black when ripe.</td>
<td>Globose, orange-red when ripe.</td>
<td>Berry as large as an orange.</td>
</tr>
<tr>
<td>Seeds</td>
<td>One or two; yellow, circular, not much compressed.</td>
<td>Discoid</td>
<td></td>
</tr>
</tbody>
</table>
The *Strychnos* is widely distributed in India especially in Andhra Pradesh. The physiological features of *S. nux-vomica* and *S. potatorum* and *S. wallichiana* were demonstrated (Table-1). These species has huge economic importance and as well as widely used in traditional medicine (Table-2, 3 and 4). In Andhra Pradesh *S. nux-vomica* and *S. potatorum* have been contributing significantly to the village economy. *S. nuxvomica* and *S. potatorum* fruits are harvested during November-March. Girijan Co-operative Corporation Limited is organising collection via a network of gatherers, looking into fair-pricing of the produce and benefit sharing among the local communities (Tables 2). *Strychnos potatorum*, is widespread in the villages of Salugu Panchayat of Vishakapatnam district. The predominant tribal groups are Bagatas, Valmikis, Nookadoras, Malis, and Kutias. Seeds of *S. potatorum* are source of a coagulant and tribes use it as a simple method for the treatment of drinking water (Figures 2-5)
Table 2: Traditional uses of *Strychnos potatorum*

<table>
<thead>
<tr>
<th>Part</th>
<th>Importance in traditional medicine.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole plant</td>
<td>Ayurveda, Siddha, Unani, Folk, Modern, Tibetan and Homeopathy Systems of Medicine.</td>
</tr>
<tr>
<td>Root</td>
<td>Fever, Epilepsy.</td>
</tr>
<tr>
<td>Leaves</td>
<td>Used for ulcer.</td>
</tr>
<tr>
<td>Bark</td>
<td>Powdered bark mixed with lime juice is given during cholera.</td>
</tr>
<tr>
<td>Seeds</td>
<td>Local application in case of eye diseases. A paste of seeds is reported to be consumed internally along with little tender coconut milk against urinary disorders and retention of urine. The ripe seeds are used for clearing muddy water.</td>
</tr>
</tbody>
</table>
**Table 3:** Traditional uses of *Strychnos nux-vomica*

<table>
<thead>
<tr>
<th>Part</th>
<th>Importance in traditional medicine.</th>
<th>Systems of Medicine.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole plant</td>
<td>Ayurveda, Siddha, Unani, Folk, Modern, Tibetan and Homeopathy</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Powerful poison in large doses produces titanic convulsions and eventually death, while smaller doses it causes mental derangement.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Effective as animal poison, used as insecticide to kill vermin, it is also effectively used in paralysis, as it acts upon the spinal marrow without affecting the brain.</td>
<td></td>
</tr>
<tr>
<td>Fruits</td>
<td>Fruit pulp used in treating paralytic affections of paws and foot.</td>
<td></td>
</tr>
<tr>
<td>Seeds</td>
<td>Diabetes, gonorrhea, anemia, asthma, bronchitis, constipation, intermittent and malarial fevers, insomnia, cardiopalmus, skin diseases, paralysis and weakness of limbs. In southeast Asia tribes use the seeds in the preparation of arrow and dot poisons</td>
<td></td>
</tr>
<tr>
<td>Leaves</td>
<td>Applied as poultice in treating chronic wounds, used for ulcer, leaf decoction used in paralytic complaints.</td>
<td></td>
</tr>
<tr>
<td>Bark</td>
<td>Powdered bark mixed with lime juice is given during cholera.</td>
<td></td>
</tr>
<tr>
<td>Root</td>
<td>Antidote for venomous serpents and snakes, leprosy, paralysis. The root bark is used in cholera.</td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Traditional uses of *Strychnos wallichiana*

<table>
<thead>
<tr>
<th>Part</th>
<th>Importance in traditional medicine.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whole plant</td>
<td>Ayurveda, Siddha, Unani, Folk, Modern, Tibetan and Homeopathy Systems of Medicine. The plant is used in intermittent fevers, antihelminthic, and externally in cutaneous diseases, especially for alleviating the pain, attending the swelling in the confluent smallpox, obstinate malarial fevers cachexia and dyspepsia.</td>
</tr>
<tr>
<td>Fruits</td>
<td>Fruit pulp used in paralysis.</td>
</tr>
<tr>
<td>Seeds</td>
<td>Intermittent fevers, malaria.</td>
</tr>
<tr>
<td>Leaves</td>
<td>Intermittent fevers, treating chronic wounds, leaf decoction used in paralytic complaints.</td>
</tr>
<tr>
<td>Bark</td>
<td>Intermittent fevers, cutaneous diseases.</td>
</tr>
<tr>
<td>Root</td>
<td>Roots used as antivenom in case of snake bite and this species yields the real, or at least one sort of lignum colubrinum.</td>
</tr>
</tbody>
</table>
Strychnine and brucine salts are extracted from *S. nux-vomica*. These salts are being used in the preparation of strychnine sulphate/chloride tablets for dog poison. The Girijan Cooperative Corporation Ltd. (Visakhapatnam) developed a product from seeds of *S. potatorum* which has been used the removal of turbidity from potable waters.

**1.2 Ethnopharmacological importance**

Ethno botany deals with the study and relationship between humans and nature. Ethnic people are highly knowledgeable about the plants and their medicinal values. This knowledge is passed through oral communication from generation to generation. Over the last century, ethno botany has evolved into a specialized discipline that looks at the people-plant relationship in a multidisciplinary manner, such as ecology, economic botany, pharmacology, public health and other disciplines as needed (Balick and Cox, 1996). Ethno botany also deals with studies among the tribal and rural people for recording their unique knowledge about plant wealth and for discovering new resources of herbal drugs, edible plants and other economic aspects of plants (Anonymous, 1983). The predominant tribes in Andhra Pradesh are: Koya, Jathapu, Valmiki, Kondareddy, Nokareddy, Gonds, Kodulu, Chenchu, Eruka, Enadi etc and these tribal populations provide considerable information about the use of many plants and their parts. There are considerable economic benefits in the development of indigenous medicines and in the use of medicinal plants for the treatment of various diseases. Plants have been used since ancient times for the treatment of various ailments. The traditional system of medicine together with folklore continues to
serve a large portion of the population, particularly in rural areas, in spite of considerable advancement in modern medicines.

In recent years, there has been growing interest in alternative therapies and the therapeutic use of natural products, especially those derived from plants. In a report recently published by the World Bank, (Lambert et al., 1997) pointed out that preserving and enhancing the plant knowledge and use was equivalent to “rescuing a global heritage”. Traditional medicinal practices are important part of the primary healthcare system in the developing world (Sheldon et al., 1997). Herbal medicines are comparatively safer than synthetic drugs. About 25% of drugs prescribed worldwide come from plants, 121 of such active compounds being in current use. Of the 252 drugs considered basic and essential by the WHO, 11% are exclusively of plant origin and a significant number are synthetic drugs obtained from natural precursors. According to WHO as many as 80 % of the world’s population depends on traditional medicine for their primary health care needs (Azaizeh et al., 2003). The medicinal plant Strychnos has long been studied for its pharmacological properties, including analgesic and antipyretic. It is used in the treatment of Parkinson’s disease and as an anti-diabetic. Some of the important research findings on S. potatorum (Figure 6), S. nux-vomica (Figure 7) and S. wallichiana were documented in Tables 5-7 respectively.
1.3 Review of literature on phytochemistry and economic importance of selected species of *Strychnos*

Table 5: Selected works on *S. potatorum*

<table>
<thead>
<tr>
<th>Research findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reports on the mechanism of the clarification of muddy water by seeds.</td>
<td>Subbaramiah and Sanjiva Rao, 1937</td>
</tr>
<tr>
<td>A pilot study on the use of nirmali seed as a coagulant aid.</td>
<td>Bulusu and Sharma 1965</td>
</tr>
<tr>
<td>Diaboline is the major alkaloid found in root, stem, leaves and seeds.</td>
<td>Singh, 1974</td>
</tr>
<tr>
<td>Nirmali seed –as an efficient naturally occurring coagulant.</td>
<td>Tripathi et al., 1976</td>
</tr>
<tr>
<td>Reported the presence of isomotiol, sitosterol, stigmasterol and campesterol from the leaves and the bark mixtures.</td>
<td>Singh et al., 1978</td>
</tr>
<tr>
<td>Reports on the chemical constituents of the seeds, and seed oil and as well as pharmacological studies on the alkaloid content.</td>
<td>Singh et al., 1973; 1976; 1977; 1980; Kapoor, 1988</td>
</tr>
<tr>
<td>Synthesis and anti hypotensive activity of diaboline.</td>
<td></td>
</tr>
<tr>
<td>Reports on seed consists of mannogalactan is composed of mannose and galactose; tested for antihypercholesterolemic activity on rats and their results suggested that manaogalactan showed inhibition on cholesterol and triglycerides.</td>
<td>Rao et al., 1990</td>
</tr>
<tr>
<td>Twenty-four compounds have been isolated and identified in the root bark.</td>
<td>Massiot et al., 1992</td>
</tr>
</tbody>
</table>
Reports on the composition of the coagulant polysaccharide fraction from seeds and found that this fraction comprises a 1:1.7 mixture of a galactomannan and a galactan.

Adinolfi et al., 1994

Reported that a seed offers nuclear waste treatment, capable of binding heavy metals.

Jayaram, 1993; Puvvada and Chandrasekhar 1997

The antidiarrhoeal activity of the methanol extract of the dried seeds has been evaluated out in rats using different models, castor oil-induced diarrhoea, effects on gastrointestinal motility and on PGE2-induced gastric enteropooling.

Biswa et al., 2002

Posses strong anti diabetic activity.

Mandal, et al., 2002

The methanolic seed extract exhibited strong anti diuretic activity in Wistar albino rats and concluded that this evidence further supports the use of the seeds as a diuretic in folk remedies.

Biswa et al., 2001

Seeds are used in the Indian traditional system of medicine for the treatment of hepatopathy, nephropathy, gonorrhea, leucorrhoea, gastropathy, bronchitis, chronic diarrhoea, strangury, renal and vesicle calculi, diabetes and eye diseases.

Sanmugapriya et al., (2006)

Seeds exhibit the hepatoprotective and antioxidant activities.
Table 6: Selected works on *S. nux-vomica*

<table>
<thead>
<tr>
<th>Research findings</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strychnine possesses the strychnan group, which was isolated for the first time</td>
<td>Pelletier</td>
</tr>
<tr>
<td>by Pelletier and Caventou.</td>
<td></td>
</tr>
<tr>
<td>Brucine was also discovered by them in 1819.</td>
<td></td>
</tr>
<tr>
<td>The major components are strychnine and brucine, both existing in mixture with</td>
<td>Desnoix,</td>
</tr>
<tr>
<td><em>igasuric acid</em>, a tannic principle identical with caffeo-tannic acid. Igasurin</td>
<td></td>
</tr>
<tr>
<td>was also reported.</td>
<td></td>
</tr>
<tr>
<td>The effect of seed storage on the alkaloidal content.</td>
<td>Puntambekar, 1947</td>
</tr>
<tr>
<td>Reports on the Ayurvedic process of purification of seeds.</td>
<td>Srivastava <em>et al.</em>, 1953</td>
</tr>
<tr>
<td>Reports on the morphology and histology of the seeds</td>
<td>Turner <em>et al.</em>, 1963</td>
</tr>
<tr>
<td>Reports on the separation of minor alkaloids.</td>
<td>Monache 1968</td>
</tr>
<tr>
<td>Reports on the phytochemical and pharmacological importance of African <em>Strychnos</em></td>
<td>Sandberg <em>et al.</em>, 1969; 1970</td>
</tr>
<tr>
<td>species and comparative study on the convulsant effects of <em>Strychnos</em> alkaloids.</td>
<td></td>
</tr>
<tr>
<td>Reports on the biosynthesis of strychnine</td>
<td>Heimberger and Scott, 1973</td>
</tr>
<tr>
<td>Reports on the effect of purification (shodhan) on the alkaloid concentration of</td>
<td>Agrawal and Joshi, 1977</td>
</tr>
<tr>
<td>kuchila seeds.</td>
<td></td>
</tr>
<tr>
<td>Alkaloids of Sri Lankan <em>S. nux-vomica</em>; identified 22 alkaloids have been</td>
<td>Baser and Bisset, 1982</td>
</tr>
<tr>
<td>isolated from root bark and leaves.</td>
<td></td>
</tr>
</tbody>
</table>
The presence of different alkaloids in *S. nux-vomica*. 

Strychnine and brucine were well characterized has been previously reported in other *Strychnos* species e.g. *S. nux-vomica, S. lucida* R. Br., *S. ignatti* Berg., (Asia), *S. icaja* Bail (Africa) and *S. panamensis* Seem (Central America).


Methoxy-3 icajine.

Reports on the *kupilu satva*, the seeds treated with milk were less toxic than those treated with ghee or aloe and ginger, and crude samples; their lethal dose was 12 times higher than that of the crude samples.


Traditional uses and ethnobotany of "Kuchila"

Sen et al., 1983.

TLC and spectroscopic analysis of strychnine and brucine

Gaitonde and Joshi, 1985

The screening of 46 alkaloids isolated from various *Strychnos* species and tested on several cell lines (i.e. B16 melanoma, Flow 2002, DB A/2 Mouse ascites tumor, He La cells)

Leclercq et al., 1986

Reports on the comparative pharmacognosy of *S. nux vomica* and *S. potatorum* based on the stem barks

Chakraborti, et al., 1988
Reports on the relationship between alkaloids in semen strychni and its processing.

In the treatment of dyspepsia, diseases of the nervous system, chronic rheumatism, in incontinence of urine in children, in sexual impotence and for rejuvenation

Reports on different chromatographic methods including HPLC for the effective separation of alkaloids

Different chromatographic methods including HPLC for the effective separation of alkaloids

Anti inflammatory properties have been described for Strychnos alkaloids or extracts

Reports on the effect of brucine lethality in mice

Analysis of spectral data for $^{13}$C NMR of sixteen Strychnos alkaloids

Effect of processing on the alkaloids in S. nux-vomica

Determination of strychnine and brucine by capillary zone electrophoresis

Presence of vomicine in callus cultures of S. nux-vomica.

Polysaccharides from seeds of Strychnos species

Sha et al., 1989.

Kapoor, 1990

Verpoorte and Svendsen 1975; Egloff et al., 1982; De and Bisset 1991

Verpoorte and Svendsen 1975; Egloff et al., 1982; De and Bisset 1991

Tits et al., 1991

Marvin et al., 1991

Cai et al., 1994

Wu et al., 1994

Zong, and Che, 1995

Bandyopadhyay et al., 1995

Corsaro et al., 1995
A new HPLC method for the assay of alkaloids in *S. nux-vomica* and *Strychnos ignatii*  
*Biala et al., 1996.*

Strychnine is powerful spinal cord convulsant, but the functions of the brain cortex and subcortical centres are not influenced  
*Neuwinger, 1996*

Seasonal variation of strychnine and brucine in vegetative parts  
*Bandopadhyay and De, 1997*

The effect of *S. nux-vomica* alcohol extract on lipid peroxidation in rat liver.  
*Tripathi and Chaurasia, 1997*

Reported different isolated alkaloids (more than 40 types) that are composed of mainly monomeric tertiary indole alkaloids, dimeric teriatiary alkaloid and a few quartenary alkaloids.  
*De, 1997*

The determination of strychnine and brucine in the seeds, root, stem and leaves of *Strychnos* species by HPLC.  
*Gu et al., 1997*

Reports on several traditional drug-processing methods on the alkaloid content, their composition, acute toxicity of the processed drug and cytotoxic assessment of alkaloids from the processed seeds on the tumor cell lines  
*Cai et al., 1990; 1993; 1994; 1995; 1996; 1998*

Reports on the influence of processing methods on alkaloid content, toxicity and effect of *S. nux-vomica*  
*Chen et al., 1998*

The separation and purification of strychnine from crude extract by high-speed countercurrent chromatography  
*Miao et al., 1998*

Influence of processing methods on alkaloid, toxicity and effect  
*Chen et al, 1998*
Separation and purification of strychnine from crude extract of *S. nux-vomica* L. by high-speed countercurrent chromatography

Occurrence of free radicals in Ayurveda and revealed that Rasayana drugs are similar to antioxidants and could be used to manage diseases mediated by the free radicals and concluded that *S. nux-vomica* having the potential antioxidant property along with other plants

Loganin, isolated from *S. nux-vomica*, had a significant effect in the prevention of galactosamine-induced hepatic damage in rats

The chemical structure of strychnine was elucidated in 1947 owing to the major contributions of H. Leuchs and Sir Robert Robinson. Its absolute configuration was determined by X-ray crystallography in 1956 and total synthesis was achieved in 1963 by Woodward *et al.*

Toxic effects of alkaloid extracts on the behaviour of chromatophores and mucous glands of Indian minor carp *Labeo bata* (Ham.)

*S. nux-vomica* (detoxified) assessed for sexual activity in rats and found that significant effect in sexual activity
The *Nux vomica* x V30, prepared with 90% ethanol from the ethanolic seed extracts has an effect of reducing sleeping time in the male adult albino mice

The use of *S. nux vomica* as an anti-ageing substance could be related to the anti-lipid peroxidation property of strychnine

HPLC method for determination of brucine in seed dressing agents

Methanolic plant extracts were more effective and significantly reduce induction time of diarrhoea and total weight of the faeces than aqueous plant extracts against the castor-oil induced diarrhoea

Anti alcoholic effect on toads

HPLC method which is accurate, simple and reliable for determination of strychnine and brucine in semen *strychni* and its processed products

Reports on the analgesic and anti-inflammatory activities of brucine and brucine N-oxide extracted from *S. nux-vomica* for evaluating pharmacological profiles

Reports on the presence of iridiod glycosides

A new method for the analysis of herbal Chinese medicines by capillary electrophoresis coupled to mass spectrometry

*Sukul et al., 1999*

*Tripathi and Chaurasia, 2000*

*Zhu et al., 2000*

*Shoba and Thomas, 2001*

*Sukul et al., 2001*

*Jiang et al., 2002*

*Yin et al., 2003*

*Zhang et al., 2003a*

*Feng et al., 2003*
A method to study the pharmacokinetic process in rat plasma of the alkaloids from processed seeds with RP-HPLC and concluded that this method is a good reference for pharmacokinetics in human bodies

A method by capillary electrophoresis with field-enhanced stacking for rapid and sensitive determination of strychnine and brucine

The structure and composition of strychnine and brucine which were quite complex and elucidated based on the IR, $^1$H-NMR, $^{13}$C-NMR and MS the spectral data. Strychnine chemical formulae is $C_{21}H_{22}N_2O_2$ with molecular weight of 334.42, while composition in brucine is $C_{23}H_{26}N_2O_4$, with molecular weight 394.47

The analysis of strychnine from detoxified seeds using liquid chromatography-electrospray mass spectrometry

An efficient method for the determination of strychnine in blood by liquid chromatography

The identification and quantification of the toxic alkaloids, strychnine and brucine, from postmortem specimens

Xu et al., 2003
Zhang et al., 2003
Verpoorte et al., 1977; Verpoorte 1980; Cai et al., 1994; Wang et al., 2004
Duverneuial et al., 2004.
Choi et al., 2004
Duverneuial et al., 2004
Wang et al., 2004
The $^1$H NMR spectrometry and multivariate analysis techniques were applied for the metabolic profiling of three *Strychnos* species: *S. nux-vomica* (seeds, stem bark, root bark), *Strychnos ignatii* (seeds), and *Strychnos icaja* (leaves, stem bark, root bark, collar bark).

An enantioselective total synthesis of (-)-strychnine was accomplished through Michael reaction and described that chemistry paves the way for the synthesis of more advanced *Strychnos* alkaloids.

The potent anti snake venom activity of the ethanolic seed extract of *S. nux-vomica* and the neutralizing effects of extracts against *Daboia russelii* and *Naja kaouthia* venom.

BHUX, a polyherbal formulation, is used to prevent atherosclerosis and has anti-inflammatory property which also consists of *S. nux-vomica* as one of the major ingredient with other plants.

Some species of *Strychnos* have been employed mainly in hunting and fishing, as an adjunct to weapons and as well as in antiplasmodial activity.

Concentration and determination of strychnine alkaloid in biological fluids.
Reported an easy, rapid method for simultaneous separation and determination of strychnine and brucine and its preparation by nonaqueous capillary electrophoresis

A simple, fast and sensitive method for the quantitative determination of strychnine residues in urine

A rapid method for separation of strychnine and brucine on a dynamically modified poly (dimethylsiloxane) microchip, followed by electrochemical detection

The methanolic extract along with other plant extracts were showed antihypouricaemic activity with 50% inhibition against potassium oxonate-induced hyperuricaemia in mice.

The strychnine and brucine showed pharmacological effects on several neurotransmitter receptors, including some members of the super family of ligand-gated ion channels

A new method for the enrichment of Strychnos alkaloids in biological samples via liquid-phase micro-extraction based on porous polypropylene hollow fibers combined with on-line sweeping in micellar electrokinetic chromatography

The anti-tumor effects of the four alkaloids: brucine, strychnine, brucine N-oxide and isostrychnine from the seed, on the human hepatocellular carcinoma cell lines (SMMC-7721 and HepG2)
### Table 7: Selected works on *S. wallichiana*

Reports on the presence of indole alkaloids from the leaves of *S. wallichiana* Steud. ex DC which was collected from Bangladesh and found that icajine and novacine are the major alkaloids, while strychnine, brucine, pseudostrychnine, *N*-methyl-sec.-pseudo-β-coubrine, 14-hydroxyicajine, strychnine-*N*-oxide and brucine-*N*-oxide *S. wallichiana* seeds used as an adulterant of *S. nux-vomica*. It is one of the most endangered species according to IUCN red listed category.

<table>
<thead>
<tr>
<th>Authors</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisset and Choudhury,</td>
<td>1974</td>
</tr>
<tr>
<td>Anonymous</td>
<td>2001</td>
</tr>
</tbody>
</table>
Bioprospecting is the study of plant, microbe and animals resources that may be of commercial value. It is a rapidly developing field wherein biologists, chemists and other researchers are involved in building a database of commercially potential bioresources.

Figure 1: The scientific leads for the discovery of plant-based pharmaceuticals have been generated through: a) High-throughput screening and b) Ethnobotany. Ethnobotany deals with studies among the tribal and rural people for recording their unique knowledge about plant wealth and for search of new resources of herbal drugs, edible plants and other economic aspects of plants.
**S. potatorum**
Cleaning nut tree, Indian gum nut.

The name of the plant refers to its traditional use as a water purifier: one of the dried nuts is rubbed hard for a short time around the inside of the earthenware water pot; on settling, the water is left pure and tasteless (Remington et al. 1918, Gupta and Chaudhuri 1992). See table 2 for details.

**S. nux-vomica**
Emetic nut tree, Poison nut

The seeds of this plant are a source of the exceedingly poisonous, bitter-tasting alkaloids strychnine and brucine. Known as Nux Vomica, Semen Nucis Vomicae, or Semen Strychni, as per Pharmacopoeias (Remington et al., 1918, Wade 1977) See table 3 for details.

**S. wallichiana**
Snakewood
See table 4 for details

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**Figure 2**: Bioprospecting *Strychnos potarorum*, *S. nux-vomica* and *S. wallichiana*. Lakshminarasimhan (2003) drew attention to the confusion over a period of 250 years regarding the identity of *Strychnos colubrina*, formally proposing that the name be rejected in favour of *Strychnos wallichiana*. 

*Strychnos* Linn.
Loganiaceae
(Strychnaceae)
Figure 3: Girijan Cooperative Corporation Ltd (GCCL), Andhra Pradesh plays an crucial role in the socio-economics of the rural/tribal community. GCCL procures and sells minor forest produce for e.g. seeds, nuts, gums, resins, barks, roots etc. Bioprospection of under explored/ unexplored plant resources have relevance for the improvement of the the rural/tribal community economy.
**Figure 4:** Graph demonstrating statistics of *Strychnos nux-vomica* seed procurement and value.

Source: Girijan Co-operative Corporation Limited, Visakhapatnam, Government of A.P.
**Figure 5:** Yeruka and yanadi tribes exploiting *Strychnos* sp. in Andhra Pradesh

*a.* *S. wallichiana* - root collection by local tribe at kutlamari valley (Rapur-veligonda range)

*b.* Destruction of *S. nux-vomica* in natural population

*c.* Natural deciduous forest

*d.* Forest clearance

*e.* *S. nux-vomica* wood collection by local tribes
**Figure 6:** *Strychnos potatorum* - Analysis of numbers of papers/mentions over time.

Figure 7: *S. nux-vomica* - Analysis of numbers of papers/mentions over time