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# Pharmacological Activities of *Strychnos nux-vomica*

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## *Abstract*

*Herbal drugs are used to treat different disorders in traditional medicine system. Herbal drugs are more safe and effective in comparison to the synthetic drugs. They also have wide array of therapeutic activities which depends on their chemical constituents. Strychnos nux-vomica is used to treat various disordersrelated to different system of the body i.e., CNS, Immune System and Respiratory System since ancient time in Ayurveda and Chinese medicine. In this review an effort has been made to magnify antitumor, antidiabetic and immunomodulation, analgesic, anti-inflammatory, anticonvulsant activities of Strychnos nuxvomica.*


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# Introduction

Nux-vomica was introduced in Europe in the sixteenth century. Due to its poisonous effect it is not used in medicine [1]. It occurs in India, Sri Lanka and Burma. It is found in tropical forests especially in Manbhund, Tamilnadu, Tranvancore - Cochin, Konkan Malabar, Orissa and other regions of country. It is also occasionally planted in gardens. Plant occurs in warm regions of India upto an altitude of 1204 meters (4000 ft.) in wild state. Frequently growing in Orissa, Madras, Cochin, Bengal and Bihar [2] The plant is small to medium sized tree upto 10-18 meters in height, branches spreading, often with axillary thorns, bark smooth, whitish in color. Strychnine and brucine are two main active constituent of the plant. It shows different types of activities i.e antitumor, anticonvulsant, antinflammatory, analgesis, hepatoprotective, immunomodulatory activity.[3] It is a colorless,bitter,odourless and prism shaped crystals. Nux-vomica is found in different types of species, these are *Strychnosstieute*, *Strychnostoxifera*, *Strychnos*signatti, *Strychnos pseudo*etc. This drug is used from ancient times in preparation of different types of homeopathic remedies [4]. The plant is small to medium sized tree, upto 10-18 meters in height, branches spreading, often with axillary thorns, bark smooth, whitish in color. Leaves shining, opposite, broadly ovate to elliptic, rounded or slightly cordate and 5-nerved at base, upto 15 cm long, petiole upto 1.5 cm. long. Tree changes leaves during hot season, occasionally leafless for a short time. Flowers greenish-white, interminal, pedunculate, compound cymes. Calyx-lobes acute, pubescent outside. Corolla hypocrateriform, lobes minutely tomentose on margins. Stamens subsessile inserted inside the mouth of corolla tube. Style sparsely woolly hairy. Berry as large as an orange or subspherical yellowish brown orange like berries. Berry on strongly thickened branches, globular, orange red, up to 7 cm. across. Seeds 4, sariceous, flat, nearly circular with silky hairs radiating from the centre. From the hilum a ridge which is not raphe connects the position of the micropyle at the circumference. They are very hard when dried. Embryo is seen at the micropylar end with a cylindrical radicle and two cordate cotyledons. They possesses an intensely and persistently bitter taste. [5]

## Chemical composition

Plant contain mainly alkaloids ranges from 2.6 % to 5.3 %. Strychnine ($C_{21}H_{22}O_2\ N_2$) and brucine ($C_{23}H_{26}O_4N_2$) are the two main alkaloids (Fig.1) which are present in the whole plant but bark contains only brucine. Minor alkaloids present are vomicine ($C_{22}H_{21}N_2O_4$), colubrine ($C_{22}H_{24}O_3N_2$) pseudostrychnine ($C_{21}H_{22}O_3N_2$), pseudobrucine ($C_{24}H_{28}O_5N_2$). The


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glucosideloganine is also present. Pseudostrychnine is nontoxic. Recent research have found that the leaves contain vomicine (major constituent) alkaloid along with strychnine [6].

| Name | R1 | R1 |
|---|---|---|
| Strychnine | H | H |
| Brucine | $OCH_3$ | $OCH_3$ |

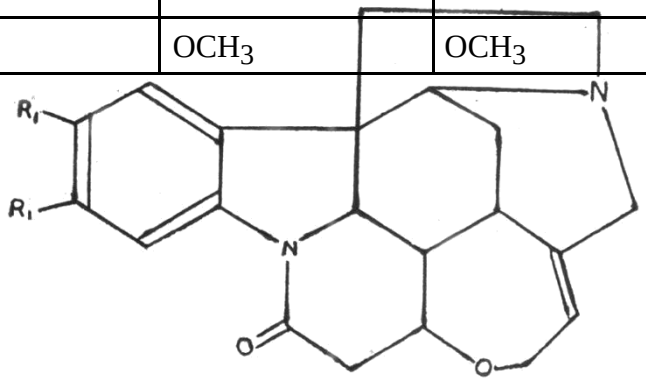



**Fig.1: Structure of Strychnine and Brucine**

## Ayurvedic Formulations

The drug Kupeelu is employed as an important ingredient of various classical formulations viz. AgnitundiVati, VisatindukaVati, Visamusti Yoga, Kupeeluhingvadi Yoga, Navajivana Rasa, Laksmivilasa Rasa, Krimimudgara Rasa and other compounds which are clinically used in several diseases. Thus, a number of medicinal preparations containing Kupeelu are recommended in treatment of different diseases. As a single drug medication, shuddhakupeeluchurna is frequently prescribed in different diseases with good results [7].

## Uses

**External uses:** It is used as analgesic and antiarthritic agent. Seeds of nux vomica prevents oozing and foul smelling ulcers with curcumin. Pulp of leaves is very beneficial in oozing ulcers.

**Internal uses:** It stimulates nervous system and strengthens nerves. Useful in disorders like neuralgia, hemiplegia, insomnia. It is used as an appetizer, digestive and astrinngent due to its pungent and bitter taste. It alleviate cough and useful in inflammation of lungs. is useful in dermatitis, pruritis and excess perspiration [8].

## Pharmacological Activities

***Antitumor activity***


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Strychnine and brucine shows significant inhibition against HepG2 cell proliferation confirmed by MTT (Microculturetetrazolium tests) assay. Brucine also shows characteristic features of programmed cell death such as cell shrinkage, membrane blebbing etc. [9] Immunoblot findings show that brucine significantly decreased cyclooxygenase-2's protein expression level, whereas both caspase 3 and caspase 3 exposures including protease activity increased in HepG2 cells, indicating the pro-active apoptotic effect of brucine involvement of cyclooxygenase 2 and caspase-3. [[10]]

Intracellular levels of the endothelial endothelial factor (VEGF), interleukin 12, necrotic factor (TNF-α), caspase 3, -8 and -9 are assessed for cell proliferation and viability, by means of Elisa and the enzyme activity study. Brucine caused HepG2 cell death by apoptosis. The cells are observed under inverted microscope to identify HepG2 cell death patterns of brucine-induced cells. The HepG2 cells experience significant change in form and volume after 36 hours of exposure to 0.5 mM brucine. Cells get shrank after treatment which are separated from culture plate, and small apoptotic species formed. Alternatively, these morphological changes related to apoptosis were not observed in control cells. [11]

## Anti-inflammatory and Analgesic activity

Strychnine from nux vomica shows significant analgesic and anti-inflammatory activity after transdermal administration. Brucine also shows significant protective effects against thermal and chemical stimuli in hot plate and writhing test.[12] Brucine shows good results as compared to strychnine in acetic acid induced writhing test due to complete transdermal absorption at the same dosage.[13]

## Immunomodulatory activity

*Strychnos nux-vomica* also shows immunomodulatory effect. This activity was assessed by Duddukuri on an induction of IgE antibody direct for ovalbumin on the murine model. Following the intraperitoneal administration of aqueous stem extract from the plant together with ovalbumin, the IgE ovalbumin specific antibody was substantially suppressed in mice. However, there are no significant changes in the overall ELISA-evaluated IgE antibody reaction to ovalbumin. This finding suggests that nux vomica is suppressive in IgE-specific antigens and its possible use in allergic conditions. [14]

## Conclusion

*Strychnos nux-vomica* is used in complementary systems of medicine since ancient time due to its different therapeutic activities. Hence, Herbal drugs are the main tool of


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complementary system of medicine. Research works carried out on *Strychnos Nux-vomica* revealed its wide spectrum of therapeutic activities i.e., anti-inflammatory, analgesic, antidiabetic, anti-tumor and immunomodulatory activity.However, more efforts are required to replicate and validate same activities in clinical trials

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