Strychnos spinosa (Loganiaceae)

English: Kaffir orange, spiny monkey orange, monkey orange, green monkey orange, natal orange French: Strychnos German: Kaffernorange Afrikaans: Dorinklapper

African vernacular names:
Chwabo: Marocobai Hausa: Kwokua Kilongo: mkome Lunda: mutungi Ndebele: Ihlala, umhlali, umgono, umkomatane, umkimbatshami Shona: Muzumi, muzunhu, mutamba, muzumwe Swahili: kwakwa Northern Tswana: Mogorogoro Zulu: Umlala

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The plant

The name of plant genus Strychnos is known by very toxic substances like strychnine and curare. Originally these substances have been prepared by cooking the plant bark with water and thickening the result to a paste. The residue, a brown resinous paste with a bitter smell is used by indigenous people for arrow poisons.
In the botanical system the genus Strychnos is divided in three groups:

1) One group from Central and South America with 74 species
2) Another group from Asia, Australia and Polynesia with 44 species
3) A remaining group of 75 species.

Among these species Strychnos spinosa can be included into the third group. In Tropical and Southern Africa it is used as hunting venom. 28 synonyms are known (8).
The plant is growing in open regions, not in rain forests, as a tree up to 45 m heighth or as a climbing scrub, heavily branched. The canopy is flattish and irregular. Leaves are dark green and glossy, ovate or elliptic, 5.5 – 7.5 cm in diameter, turning yellow in autumn. Flowers are greenish white in dense heads at the end of branches during September - February. After good rains fruits appear, so called monkey oranges. They are smooth, large and green, ripening to yellow, 8 – 15 cm in diameter like a grapefruit. Inside of them tightly packed hard brown seeds can be found, surrounded by a fleshy, edible covering with sweet-sour smell.

Plant parts used

Leaves and twigs, bark of the stem and root, the root, the fruits

Constituents

Concerning the genus Strychnos generally, toxic substances are known, namely monoterpene alkaloids, strychnine alkaloids like C-toxiferine, C-dihydrotoxiferine, C-curarine, and C-calebassin. The known medicinal plant Strychnos nux-vomica contains strychnine 1 % and brucine 1.5 %. In contradiction to this in the species S. spinosa the content of total alkaloids is only around 0.1 % or less
In a dichloromethane **leave** extract no alkaloids (tested by TlC with Dragendorff reagent) could be found. But four triterpenoids and four sterols could be isolated. Between those two compounds with an antitrypanosomal activity were saringosterol and 24-hydroperoxy–24-vinyl cholesterol (3). But in an earlier work three indolo-monoterpinoid alkaloids (akagerine, 10-hydroxyakagerine, and kribine) could be investigated (3).
In 1971 S. spinosa was tested with TlC. The extracts gave only weakly positive alkaloid reactions, all around 0.1 %. (2).

But from the **stem bark** of S. spinosa two new tertiary alkaloids could be detected. By means of spectral data they were identified as 11-methoxy-diabolin and 12-hydroxy-11-methoxy-diabolin (9).
The **flesh of fruits** contains 0.0012 % and the **pericarp** 0.009 % of alkaloids (8).
In the **oil of the seeds** 5.3 % sterols and fatty acids could be found, between these 8 sterols like ß-sitosterol, stigmasterol, campesterol, and cholesterol (8).
The hydrodestillation of S. spinosa **leaves** yielded an **essential oil** with 22 compounds. According to the GC-MS analysis the main components were palmitinic acid (34.3 %), linalool (16.0 %) and E-phytol (6.7 %) (4).

Traditional uses

In all areas of Eastern Africa where S. spinosa is growing all parts of the plant are used against nearly all diseases:
In Gambia washing of wounds and eyes with the decoct of the leaves and putting them on the open wounds; in Tansania the sap of leaves against bites of snakes. For strengthening of little children the drinking of the leave extract and bathing them in it is used.
The powdered root and extract of it is applied against inner complaints like such ones of the stomach, of the bowels, against diarrhoea, against worms. Powdered leaves are utilized against syphilis, and against madness a mixture of young leaves and faeces of a lion is put on the shaved head. In North-Eastern Nigeria leaves and fruits are consumed by lactating Fulani women to stimulate breast milk production (7).
In an ethnobotanical study, made with interviews in Ghana there was a new recommendation of S. spinosa for treatment of malaria (1).

Results of experimental studies

Antitrypanosomal activity
Out of a dichloromethane leave extract eight triterpenoids and sterols were isolated; two of them, saringosterol and 24-hydroperoxy-24-vinylcholesterol, possessed antitrypanosomal activity in vitro with IC50 values of 7.8+/-1.2 and 3.2+/-1.2 µMol, respectively (3).
The essential oil from leaves was tested in vitro on Trypanosoma brucei brucei bloodstream forms and on murine macrophages (J774). The essential oil itself was active on the parasites with IC 50 13.5 µg/ml. Nerolidol and linalool, components of this oil had a higher potency on the trypanosomes with IC50 values of 1.7 and 2.50 µg/ml (=7.6 and 16.3 µMol). The activity of these two compounds can be caused by their oxygenated structure (4).

Results of clinical studies

No results were available

Toxicology

Generally the toxicity of the triterpene molecules is suggested to be caused by two quarternary N-atoms or by one quarternary atom together with a further tertiary protonised N-atom, respectively. The toxic alkaloids block ganglia being antagonists of acetylcholine. They react with the receptor of acetylcholin and effect relaxing of the muscles with transverse striation. The final effect is inability of motion and paralysis of respiration.
The toxic substances react only on the parenteral way. The oral uptake of the toxic substances is very slow, if hunters eat their spoil and the elimination is faster. Therefore the captured animals can be eaten by men.
In all green parts of S. spinosa the alkaloid con tent is too low that serious intoxications must not be expected, but the extract of the stem bark can be toxic. In a pharmacological study with mice 17-O-methylakagerine gave clonic and tonic convulsions with a CD50 value at 45,3 mg/kg. Akagerine itself had a CD50 value at 50 mg/kg (11).

Dosage

Extractum Strychni: Single dose: 0.01 g
Limiting value daily: 0.05 g (12)

Evaluation

The alkaloid content of S. spinosa belonging to the group of African Strychnos species is **very low**. Therefore the green parts of the plant seem to be nearly non toxic. But they contain phytosterols which may act synergistically with alkaloids. But in most cases the green parts are eaten by browsers and monkeys without any damages reported elsewhere.
Water extracts cannot solve the big molecules of the alkaloids and steroids. Therefore tea preparations can be used against little daily ailments like sleeplessness or discomforts of the bowels. But lipophilic extracts, like such ones with ethanol or dichloromethane must be seen with caution, because here the big active molecules can be solved.

The application of lipophilic extracts with men and animals must be argued against.

The ripe fruits are eaten by monkeys and baboons. They have a sweet smell and people like them (monkey orange). Unripe fruits are bitter. In Israel there are intentions to prepare plantations for cultivation of fruits (10).

Strychnos spinosa

Use of leaves on wounds	**(*)**
Tea from green parts	**
Ripe fruits	***
Use of lipophilic (alcoholic) extracts	**- - -**

References Strychnos

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