Achyranthes aspera (Amaranthaceae)

English: Chaff-flower, Hawai chaff flower, devil`s horse whip, prickly chaff flower
French: Achyranth a feuilles rudes, collant, gendarme,
Spanish: Mosotillo, rabo de gato, rabo de chango, rabo de raton
Arabian: na`eem, no`eim, mahoot, wazer (Yemen)
Philippines (Tagalog): Hangod
Hindi (different dialects): Lamchichra, latjira, sonpur
African vernacular names:
Swahili: Turura Sotho: Bohomane, bohome-bo-bolek, mo-tswarak-gano
Belgian Congo: Denge, gnegna, kalambata, lenge, lenamo

The plant

A perennial stiff erect herb, 0.2 – 2.0 m high, is growing up to 1000 m height. Stems are square, leaves elliptic ovate or broadly rhombate, 5 – 22 cm long, 2 – 5 cm broad, and adpressed pubescent. The inflorescences are 8 - 30 cm long, with many single, white or red flowers, 3 - 7 mm wide. Flowering time is in summer.
The plant is widespread in the world as a weed, in Baluchistan, Ceylon, Tropical Asia, Africa, Australia and America. In the northern part of India it is known as a medicinal plant in different systems of folk medicine

Plant parts used

The whole plant, the root, the seeds

Constituents

Compounds in the **seeds** of A. aspera are the saponins A and B. They are glycosides of oleanolic acid. The carbohydrate components are the sugars D-glucose, L-rhamnose, D-glucuronic acid (= Saponin A). Saponin B is the ß-D-galactopyranosyl ester of Saponin A (13). The content of free oleanolic acid in A. aspera **roots** is 0.54 % (4,34).
From the **roots** ecdysterone and oleanolic acid have been isolated. In the unripe **seeds** saponines, oleanolic acid, amino acids and hentriacontane, a long chained carbohydrate, have been found.
In the **shoots** an aliphatic dihydroxyketone 36,37-dihydroxyhenpentacontan-4-on and triacontanol could be found (4). Two long chain compounds, isolated from the **shoots,** have been characterized as 27-cyclohexylheptacosan-7-ol and 16-hydroxy–26-methylheptacosan-2-on by chemical and spectral investigations (18).
The petrol extract of the **shoots** produced a yellow semi-solid mass. From this a pink coloured essential oil with a pleasant odour and an aliphatic alcohol (17-pentatriacontanol) were found (10).
The **whole plant was** extracted with methanol. After the removal of the solvent the residue was extracted successively with different solvents and with butanol by column chromatography. Ecdysterone, a phytoecdysone, was yielded and characterized by its colour and special chemical reactions. Contents (g/kg) were: 0.25 (**seeds**), 0.09 (**roots**), 0.04 (**stem**, **leaves**) (3). The pronounced insect moulting hormonal activity of this extract from the **roots** has been found due to the presence of ecdysterone (2).
In an investigation for alkaloids only one indication was found in A. aspera **stems**. But this was assessed only by color reactions and not with modern techniques. Therefore this result can be neglected. It is in contradiction to the general characteristics of the familie Amaranthaceae to which A. aspera belongs (10).

Traditional uses

Through age-long trial and error methods there is a treasure of informations about plants used medicinally often in hidden ethnic groups. Old Indian medicinal systems like Ayurveda are using plants for many symptoms. In a newer study 23 medicinal claims were recorded for A. aspera, but not veryfied by experimental data (1,15).
Based on an ethnopharmacological survey of Gonda district forests (India) in 1994 plants which are widely used in folk medicine three medicinal claims for A. aspera roots were investigated

1) For snake bites the ground root is given with water until the patient vomits and regains consciousness
2) A fresh piece of root is used as tooth brush
3) Crushed leaves rubbed on aching back to cure strained back (28).
   Seven leaves, crushed, and taken as a single dose twice a week, -on Tuesday and Sunday, can effectively treat the bite of a dog, if delivered within 21 days after the bite (27).

In an study on herbal remedies of the Nepalese in Assam authors recommend 5g of root mixed with an equal amount of black pepper powder divided in three parts given three times daily (7). A similar schedule is applied with the same both plants against diarrhoea by Danuwar tribes in Sindhuli district of Nepal (16).
In the northern part of India medicine men use A. aspera as an antidote for snake bites.
10 - 20 g root dried in the shade and powdered is given with water (25).
In the native phytotherapy for women and child diseases A. aspera root is applied with precise prescriptions (8).
Inhaling the fume of A. aspera mixed with Smilax ovalifolia roots is suggested to improve appetite and to cure various types of gastric disorders which are supposed to be caused by an evil-spirit or due to an ill-look of a neighbour (6).
In India indigenous healers recommend the following prescription against diarrhoea:
5 - 10 ml **juice** expressed from the fresh leaves should be given every third hour in case of diarrhoea (26).
There are sixty empirically accepted prescriptions for using plants in veterinary medicine, furthermore.

Results of experimental studies

Antimicrobial and anti-inflammatory activity

A leaf extract from A. aspera collected in different areas of the United Arab Emirates was tested against Gram-positive bacteria. It showed inhibition against Staphylococcus aureus, Bacillus subtilis, E. coli and Aspergillus terreus, respectively. The root extract was less active (5).
An alcohol extract of A. aspera, 375 and 500 mg/kg was tested in carrageenan-induced hind paw oedema and cotton pellet granoloma models in male albino rats. The alcoholic extract showed a maximum inhibition of rat paw oedema of 65.38 % and 72.37 % after 3 h. In a chronic test the extract exhibited 40.03 % and 45.32 % reduction of the granuloma weight in the subacute cotton pellet granuloma model (32).
The ethanolic extract of A. aspera inhibited inflammatory responses in the paw oedema induced by carageenan and Freunds complete adjuvant in mice and rats at concentrations of 100-200 mg/kg. The authors see the traditional use of these plants supported by these results (11).
The indigenous Indian fish Labeo rohita was fed with a diet containing 0.01 %, 0.1 % and 0.5 % of A. aspera seeds. The fish immunized with heat-killed Aeromonas hydrophila were

experimentally infected with living Aeromonas hydrophila, then. In the A. aspera treated groups the mortality was less against controls up to the day after infection. Super oxide anion production, serum bactericidal activity, lysozyme, serum protein, and albumin/globulin ratios became enhanced in Achyranthes-treated groups.
The authors came to the conclusion that A. aspera stimulates immunity and increases resistance against the infection in this fish (31).
The Indian major carp Catla catla was fed a diet with 0.5 % A. aspera seeds for four weeks. After immunisation with chicken erythrocytes, haemagglutination antibody titres, serum globulin levels on days 14 and 21, alpha 1-antiprotease and RNA/DNA ratio of spleen and kidney were higher in the test group, significantly ($p<0.05$). All these results confirm the hypothesis that A. aspera enhances the immunity of Catla catla (22).
From the hexane eluate of A. aspera shoots an essential oil was obtained which is toxic for the fungus Aspergillus aspera. The mycelia growth was inhibited with 100 % by an oil concentration of 3000 ppm (22).

Antiviral and anticarcinogenic effects
In an in vitro assay the methanolic extract of A. aspera leaves (100 µg) revealed significant inhibitory effects on the Epstein-Barr virus early antigen induced by the tumour promoter 12-O-tetradecanoylphorbol-13-acetate in Raji cells. The fraction containing mainly non-polar compounds showed the most significant inhibitory activity (96.9 % and 60 % viability). In the in vivo two stage mouse skin carcinogenesis test the total methanolic extract possessed a pronounced anticarcinogenic effect. The total extract and the fraction are believed to be valuable antitumour promoters in carcinogenesis, maybe (9).

Influence on hormonal status
Adult male Wistar rats orally fed with the aqueous leaf extract of A. aspera at a dose of 200 mg/kg for 7 days exhibited significantly prothyroidic activity. The extract enhanced the levels of the thyroid hormones along with an increase in serum glucose concentration, body weight and hepatic protein content. On the other hand it lowered lipid peroxidation, superoxide dismutase and catalase, without altering the two antioxidant enzymes. Therefore, there was a discussion that the extract has a free radical scavenging efficacy. One can conclude that the leaf extract is both prothyroidic and antiperoxidative (29).
Oral administration of 2, 3, and 4 g/kg of A. aspera powder produced a significant dose-related hypoglycaemic effect in normal as well as in alloxan diabetic rabbits. In the same way the water and methanol extract decreased blood glucose levels. A 7-day acute toxicity study in rabbits did not reveal any further side effects at doses up to 8 g/kg orally. It is possible that the plant could act by providing certain necessary elements like calcium, zinc, magnesium, manganese and copper to the ß-cells (1).

Effects on fertility of animals
The methanolic leaf extract of A.aspera possesses antifertility activity. In ovarectomized rats the methanolic extract showed abortifacient activity and increased pituitary and uterine wet weights. It did not influence serum concentration of the ovarian hormones and various lipids (24).
The n-butanol-fraction of A.aspera prevented pregnancy in mated rats, when administered orally at a daily dose of 75 mg/kg or more on day 1 - 5 post coitum. At the 50 mg/kg dose, a significant reduction ($p<0,001$) in implantation number was observed. No antifertility activity was observed in the aqueous fractions neither in rats or hamsters. In an estrogenic assay the n-butanol fraction induced a dose dependent increase in uterine weight, premature opening of the vagina and cornification of vaginal epithelium. At the contraceptive dose of 75 mg/kg it induced a marked stimulation of uterine weight. It can be compared with a dose of 0.02 mg/kg ethinylestradiol which induced a similar increase of uterine weight. The combination of the same dose of ethinylestradiol and n-butanol fraction did not bring further effects. In hamsters

the extract failed to prevent pregnancy, even at four times of the rat minimum effective contraceptive dose (33).
The ethanolic root extract of A.aspera was tested in proven fertile female albino rats at 200 mg/kg and given on days 1-7 of pregnancy. It yielded an antiimplantation activity of 83.3 %. The rats continuing their pregnancy did not deliver any litters after their full time. Hence the activity of the extract is 100 % active in antiimplantation and abortification. In immature ovariectomized female albino rats the ethanol extract showed estrogenicity, too. But there were no histological studies done (30).
Benzene extracts of the whole A. aspera plant were tested in rabbits, in mice and in rats for abortifacient effects. The drug, 50 mg/kg in olive oil was given orally to rabbits on day 8 after coitum. Laparatomy on day 11 did not show any implantation. However, the ovaries contained prominent corpus luteum, indicating that the drug had prevented pregnancy. In rats the drug was given orally as a single dose of 50 mg/kg at day 6 or 7 after mating. But no results of implantation were observed. In mice single doses 10, 15, 25, 50 mg/kg were given. The maximum abortifacient effect was noted with 50 mg/kg. Progesterone or pituitary extract given along with the drug did not prevent abortions in mice. In an autopsy investigation one month after the application of doses up to 1000 mg/kg all organs were found to be normal. In a long time treatment and teratogenic study doses of 75 mg/kg were given for 21 days. After six month of drug exposure no toxic effects were observed. In the same investigation 3 generations of offsprings showed no malformations (20).
In male rats feeding of 50 % ethanolic extract did not affect the motility of the sperms or the activity of HMG CoA reductase. But the cholesterol level in testes, the incorporation of labelled acetate into cholesterol 17-ketosteroids in urine and hepatic and fecal bile acids were increased. These results suggest that ethanolic extract of A.aspera caused new reproduction in male rat (23).
A 50 % ethanolic extract of A. aspera root and Stephania hernandifolia handicapped the motility of sperms. Concentration of 0.08 /ml affected the motility and 0.16 /ml reduced it to 20 % in 20 seconds, 0.32 g/ml immobilized the sperms within 2 minutes after application. This effect was irreversible. A low concentration of 0.04 /ml was ineffective (21).

Results of clinical studies

No results were available

Toxic effects

The following single comment reports about cardiac toxicity caused by A. aspera.
A 57 year old man drank 1000 ml decoction made from A. aspera and was found unconscious in his bathroom. Hypotension and bradycardia were noted. He recovered four days later after supportive care with dopamine. In the serial cardiac examinations further cardiac abnormalities were not noted. A. aspera may cause a transient dose-related cardiovascular toxicity (12).

Evaluation

From the compounds of A. aspera the saponines A and B, and free oleanolic acid are the most active ones. They mainly act on membranes and cause a lot of effects, like antibacterial, antifungal, anti-oedematic, anti-ulcerogenic, anti-inflammatory, and anti-diarrhoeic ones. In long term experiments they may show toxic effects. The different long chain chemical compounds may support these effects.

The experiments with animals show a high activity on the fertility. There are no common prescriptions on doses which can be recommended.

Therefore must be argued against the use of this plant in family planning.

Achyranthes aspera

For the family planning	**- - -**
Use of decoctions against diarrhoea	**(*)**

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