



A REVIEW ON MEDICINALLY IMPORTANT TWO PLANTS OF AMARANTHACEAE

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Abstract

Amaranthus spinosus L. and *Achyranthes aspera* L. belonging to the family Amaranthaceae are commonly known as “Kantanote” and “Apang” respectively in West Bengal. Both plants are widely used to cure many diseases all over the world as herbal drugs. *Amaranthus spinosus* L. contains medicinal properties like antioxidant, hepatoprotective, antimicrobial and other activities. *Achyranthes aspera* L. is highly used by traditional healers in the treatment of asthma, bleeding, boils, dysentery etc. as well as it is reported to have antimicrobial activities. Both plants contain different biologically active constituents which provide medicinal values to the plants. The present review describes some botanical characters, distribution chemical constituents and uses.

Keywords: *Amaranthus spinosus*, L. *Achyranthes aspera* L., medicinal properties, herbal drugs, Amaranthaceae.

Introduction

World Health Organization (WHO) identify all medicinal plants in the world and listed more than 20,000 species are drug yielding plants (Srivastav *et al.*, 2011). Vijayan *et al.* (2007) reported that 80% of the world's population use traditional herbal medicine for their primary health care according to WHO. In recent time, the emphasis has been given to the herbal drugs because of the pronounced cumulative and irreversible reaction of the modern drug. However, increasing population and urbanization cause the exploitation of herbal drugs resources day by day (Pande *et al.*, 2007).

The two medicinally important plants of Amaranthaceae i.e. *Amaranthus spinosus* L. and *Achyranthes aspera* L. are annual or perennial herbs, commonly found as a weed at roadsides as the neglected plant. But both plants are well known drug yielding plant in Ayurveda, Siddha, Allopathy, Homeopathy, Naturopathy and home remedies (Dhale and Bhoi 2013; Asha *et al.*, 2016.)

The objectives of this article are to gather knowledge about identification, distribution, medicinal uses, chemical constituents, medicinal uses and to create awareness about the beneficial effects of these plants.

Description

Amaranthus spinosus L. commonly known as Kantanote in West Bengal belongs to the family Amaranthaceae. It is an evergreen, an erect spinous annual herb and xerophytic in nature. The plant is an erect, monoecious, up to 100–130 cm tall. The leaves are simple alternate, exstipulate and with long petiole. The lamina is ovate, lanceolate, 3.5–11 cm × 1–4.5 cm, acute and often obtuse at the base, the margin is entire, glabrous or slightly pubescent on veins when young. The leaves are found to have a characteristic odour and bitter in taste. Flowers found throughout the year and fruit is ovoid and contains compressed, shiny, tiny, dark red to black seeds.

Achyranthes aspera L. is another plant of the family Amaranthaceae, commonly known as Apang in West Bengal. The plant is an erect or annual or perennial herb. The height of the plant is 1-2 meter and often with a woody base. Flowering time of this plant is in summer. The stems are

square and leaves are elliptic or ovate. The inflorescences are 8 - 30 cm long, with many single, white or red flowers.

Distribution

Amaranthus spinosus L. is distributed throughout the tropics and warm temperate regions of Asia, from Japan to India, in the Pacific islands and Australia as a weed or in cultivated lands. On the other hand, *Achyranthes aspera* L. is widespread in the world as a weed. It is distributed in Baluchistan, Cylon, Tropical Asia, Africa, Australia, America and in India (Gupta 2010). In the northern part of India, it is used as a medicinal plant for folk medicine.

Chemical constituent

Amaranthus spinosus L. contains different types of phytochemicals such as 7-p-coumaroyl apigenin 4-o-beta-D-glucopyranoside, spinoside, xylofuranosyl uracil, beta – D-ribofuranosyl adenine, beta-sitosterol glucoside, hydroxycinnamates, quercetin and kemferol glycoside (Stintzing *et al.* 2004). The plant also contains betalins, betaxanthin, betacyanin, amaranthine and isomaranthine, gomphrenin, betanin, stigmasterol, linoleic acid, 0.15% rutin and betacarotene (Blunden *et al.*, 1999; Azhar *et al.*, 2004, 2006).

On the other hand, *Achyranthes aspera* L. contains A and B saponins, D-glucuronic acid and β-D-galactopyranosyl ester of D-glucuronic acid Oleanolic acid, amino acids and hentriacontane were also isolated from *Achyranthes aspera* L.

The chemical constituents like 10-tricosanone, 10-octacosanone & 4 tritriacontanone (Azhar *et al.*, 2006) are present in seeds. The roots of *Achyranthes aspera* L. contain nhexacos-14-enoic acid (Sharma and Ali, 2009). The root also contained alkaloids, flavonoids, terpenoids and saponines. Narayana *et al.* (2001) reported that flavonoids have anticancerous activity.

Traditional Uses

The leaves of *Amaranthus spinosus* L. are boiled without salt and consumed for 2-3 days to cure jaundice and also employed to cure some kind of rheumatic pain and stomachache. The leaves and roots are applied as a poultice to relief bruises, abscesses, burns, wounds, inflammation, monorrhagia, gonorrhoea and eczema. It is also used as a sudorific and febrifuge. In Nepal, *Amaranthus spinosus* L. is

used to induce abortion. In Ayurvedic, the plant is used as a diuretic, and purgative, as an enema for a stomach problem, piles and against cholera. A decoction of the plant increases digestion and also used for kidney complaints and mouth wash for toothache. The leaves are boiled and the root is given to the children for a laxative. The whole plant is used for the treatment of snake bite, and thus acts as an antidote to snake venom. The root paste in an equal volume of honey is used to control vomiting (Kirtikar and Basu, 2001). *Achyranthes aspera* L. is used in the treatment of asthma, bleeding, boils, bronchitis, cold, cough, colic, dropsy, dog bite, dysentery, ear complication, headache, pneumonia, etc. It is also used in renal complications, scorpion bite, snake bites, and skin disease (Jain 1991). Whole plant ash is a good remedy for bleeding piles and abdominal problems. The root is used as a tooth brush to clean the mouth and to cure halitosis. Infusion of the twig is also used as a wash for toothache. Root extract is used as an eye drop at bedtime for night blindness (Raji, 2013).

Antioxidant and Hepatoprotective activity

According to a few authors (Zeashen *et al.*, 2010) *Amaranthus spinosus* L. have potent hepatoprotective and antioxidant activities. This might be due to the presence of antioxidant defense factors such as flavonoids and phenolics compound present in the *Achyranthes spinosus* L. They also reported that 50% ethanolic extract of *Amaranthus spinosus* L. showed antioxidant and hepatoprotective activity *in vitro*. The authors revealed that *Amaranthus spinosus* L. extract showed a significant protection against d-galactosyl/lipopolysaccharide (d-GalN/LPS) – induced hepatocellular injury.

The presence of compounds such as amino acids, flavonoids and phenolic compounds in the methanolic extract of *Achyranthes aspera* L. The methanolic extract of *Achyranthes aspera* L. showed the presence of amino acids, flavonoids and phenolic compounds which were responsible for chemoprotection and antioxidant activities. These activities were noticed in paracetamol induced liver damage in Wistar rats. Srinivasa *et al.* (2010) also reported on the non-enzymatic haemoglycosylation. The result showed that rutin and quercetin showed the inhibition of haemoglycosylation as maximum as 42% and 52% respectively at two different concentrations; 0.5 and 1 mg/ml. using α -tocopherol (Vitamin E) as a standard.

Antioxidant activities of hexane extract of *Achyranthes aspera* L. for different parts of the plant was varied from parts to parts and it increased as the time and the concentration increased and the order was: root > stem > inflorescences > leaf (Beulah *et al.*, 2011). Antioxidant activity of Chloroform extract of *Achyranthes* showed high radical scavenging potential in the stem and it almost closer to standard Ascorbic acid (Jaya kumar *et al.*, 2010). The Inflorescence exhibited a higher activity (82 %) and the order of activity was: Stem > Inflorescences > leaf. Root did not show any antioxidant activity and this may be due to the interference of individual chemical components present in the chloroform extract (Beulah *et al.*, 2011).

Antioxidant activity of Ethyl acetate extract of *Achyranthes aspera* L. showed 65% root 51% stem in 71% inflorescences and the order followed was inflorescences > leaf > root > stem and they were concentration and time dependant.

Antimicrobial activity

Maiyo *et al.* (2010) utilized different solvents like hexane, ethyl acetate, dichloromethane and methanol leave extracts of three plant species *Amaranthus hybridus*, *Amaranthus spinosus* and *Amaranthus caudatus* for antimicrobial activity. The leaves extract of plant species, extraction fraction and various concentrations showed antimicrobial activity. Maiyo *et al.* (2010) further reported that *Amaranthus spinosus* L. whole plant extract has antimicrobial activity against some bacterial and fungal strains (*Escherichia coli*, *Staphylococcus*, *Klebsiella*, *Paracoccus*, *Fusarium*, *Aspergillus* and *Alternaria*). The plant extracts (stem and flower) showed the maximum zone of inhibition on *E. Coli Pseudomonas*, *Staphylococcus*, *Paracoccus* and *Klebsiella*. According to Harsha Vardana (2011), the antimicrobial activity of *Amaranthus spinosus* L. the ethanol extract showed better results than the methanol extract. The chloroform extracts of the root of *Amaranthus spinosus* L. Inhibited the growth of *S. aureus* at 25 mg concentration. On the other hand the methanolic extracts of the root of this plant acted against *E. coli* also at 25 mg concentration, but the zone of inhibitions was 22 mm and 18 mm respectively. On the other hand, the root extracts of *Achyranthes aspera* L. showed maximum inhibition against *S. aureus* as well as in *E. coli*. the methanolic extracts of stems and leaves of that plant does not inhibit the *E. coli*. Both the chloroform and methanolic extracts of *Achyranthes aspera* L. root, stem and inflorescence results against *E.coli*. However, ethyl acetate extracts did not show any antimicrobial activity against *E. coli*. Such behaviour of the antibacterial action was also showed by Alam (2009).

Bronchodilator and spasmolytic activity

It has also spasmolytic effect which was assessed *in vitro* *Amaranthus spinosus* L. also act as bronchodilator and as laxative. The bronchodilator activity was mediated through a combination of β -adrenergic and CCB pathways (Chaudhary *et al.*, 2012). Ethanolic extract of *Achyranthes aspera* L. showed bronchoprotective effect in Wistar rats as reported by Goyal *et al.* (2007). The total and differential leucocytes were counted in blood and bronchoalveolar fluid.

Conclusion

The two road side weeds like *Amaranthus spinosus* L. and *Achyranthes aspera* L. in the family Amaranthaceae distributed throughout the world. Both plants are used in the treatment of different diseases. Therefore, more conservation and awareness is required protect these two valuable medicinal herb plants.

References

- Srivastav, S.; Singh, P.; Mishra, G.; Jha, K.K. and Khosa, R.L. (2011). *Achyranthes aspera*-An important medicinal plant: A review. *J. Nat. Prod. Plant Resour*, 1(1): 1-14.
- Vijayan, A.; Liju, V.B.; Reena John, J.V.; Parthipan B. and Renuka C. (2007). Traditional remedies of Kani tribes of Kottoor reserve forest, Agasthyavanam, Thiruvananthapuram, Kerala *Indian Journal of Traditional Knowledge*, 6(4): 589-594.
- Pande, P.C.; Tiwari L. and Pande H.C. (2007). *Ethnoveterinary Plants of Uttaranchal-A Review*. *Indian Jour Traditional Knowledge*. 6(3):444-458.

- Dhale, D.A. and Bhoi, S. (2013). Pharmacognostic Characterization and Phytochemical Screening of *Achyranthes Aspera* Linn, Current Agriculture Research Journal, 1(1): 51-57.
- Asha S., Rekha, R. and Mohamed, S.A. (2016). *Amaranthus spinosus*- A review. Bull. Env. Pharmacol. Life Sci., 5(9): 102-107.
- Stintzing, F.C.; Kammerer, D.; Schieber, A.; Hilou, A.; Nacoulma, O. and Carle, R. (2004). Betacyanins and phenolic compounds from *Amaranthus spinosus* and *Boerhavia erecta*. Zeitschrift fur Naturforschung. 59(1-2): 1-8.
- Blunden, G.; Yang, M.; Janicsak, G.; Mathe, L. and Carabot-cuervo, A. (1999). Betaine distribution in the Amaranthaceae. Biochemical systematic and ecology. 27(1): 87-92.
- Azhar-ul-Haq, Mailk, A.; Afra, N.; Khan, A.U.; Shah, M.R. and Muhammad, P. (2004). Spinocide, new coumaroyl flavones glycoside from *Amaranthus spinosus* Linn. Archives of Pharmacal Research. 27(12): 1216-1219.
- Azhar-ul-Haq, Malik, A.; Afra, N.; Khan, S.B. and Muhammad, P. (2006). Coumaroyl adenosine and lignin glycoside from *Amaranthus spinosus*. Polish J Chem. 80: 259-263.
- Sharma, S.K.; Vasudeva, N.M.A. (2009). Post coital antifertility activity of *Achyranthes aspera*. Indian Journal of Chemistry-Section B Organic and Medicinal Chemistry. 48(8): 1164-1169.
- Narayana, R.K.; Reddy, S.M.; Chaluvadi, M.R. and Krishna, D.R. (2001). Bioflavonoids: classification, pharmacological, biochemical effects and therapeutic potentials. Indian J. Pharmacol. 33: 2-16
- Kirtikar, K.R. and Basu, B.D. (2001). Indian Medicinal Plants, (2nd ed), vol. I, Oriental Enterprises, New Connaught Place, Dehradun, Uttaranchal, India. 2832-2836.
- Jain, S.K. (1991). Dictionary of Indian folk medicine and ethnobotany. Deep Publications, New Delhi, India.
- Raji, R. (2013). *Achyranthes aspera*- Medicinal plant: A review. Int Jour Pharma and Bio Sciences. 4(1)(B): 719-724.
- Zeashen, H.; Amresh, G.; Singh, S. and Rao, C.V. (2010). Protective effect of *Amaranthus spinosus* against dgalactosamine/lipopolysaccharide – induced hepatic failure. Pharm. Biol., 48(10): 1157-1163.
- Srinivasa, B.; Kumar, B.A.; Lakshman, K.; Jayaveera, K.N.; Shekhar, D.S.; Nandeesh, R. and Velmurugan, C. (2010). Chemoprotective and antioxidant activities of methanolic activities of *Amaranthus spinosus* leaves on paracetamol induced liver damage in rats. Acta Medica Saliniana. 39(2): 68-74.
- Beaulah, A.G.; Mohamed, S.A. and Jaya, S.R. (2011). Antioxidant and antibacterial activity of *Achyranthes aspera* : An in vitro study. Annals of Biological Research, 2(5): 662-670.
- JayaKumar, D.; Jhancy, M.S. and Jaya, S.R. (2010). Indian Journal of Science and Technology. 3(7): 720-723.
- Maiyo, Z.C.; Ngunre, R.M.; Nigure, J.C.; Matasyoh, C. and Chepkoru, R. (2010). Phytochemical constituents and antimicrobial activity of leaf extracts of three amaranthus plant species. African J Biotechnol. 9(21): 3178-3182.
- Harsha, V.S. (2011). *In vitro* antibacterial activity of *Amaranthus spinosus* root extracts. Pharmacophore. 2: 266-270.
- Alam, M.T.; Karim, M.M. and Shakila, N.K. (2009). Antibacterial activity of different organic extracts of *Achyranthes aspera* and *Cassia alata*. Journal of Scientific Research. 1(2): 393-398.
- Chaudhury, M.A.; Imran, I.; Basir, S.; Mehmood, M.H.; Rehman, M.U. and Gilani, A.H. (2012). Evaluation of gut modulatory and bronchodilator activities of *Amaranthus spinosus* L. BMC Complementary and Alternative Medicine, 12: 166.
- Goyal, B.R.; Mahajan, S.G.; Mali, R.G.; Goyal, R.K. and Mehta, A.A. (2007). Bronchoprotective effect of *Achyranthes aspera* extract in toluene diisocyanate (TDI) induced occupational asthma in wistar rats', Global Journal of Pharmacology, 1(1): 6-12.