IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 2, February 2021

DOI: 10.17148/IARJSET.2021.8219

A brief review on pharmacological activities of Azolla

T. Ramesh[1], F. Anibriteena[2] and R. Eswaralakshmi[3]

PG & Research Department of Biotechnology, Hindustan College of Arts & Science,
Padur, Kelambakkam – 603 103[1,2,3]

Abstract: Azolla, a free-floating aquatic fern with enormous herbal efficiency in traditional medicine. Azolla species, largest tropical ferns shows very fast growth rate. It was reported that its biomass can grow double in just 10 to 15 days. It can synthesize variety of bioactive components for the benefits of humans. It gains attraction with its wide range of pharmacological activities such as anti-microbial, anti-oxidant, anti-inflammatory, anti-caries activities. Due to the emergence of novel diseases, it is inevitable to find out drugs from plant based source. Plant based medicines are indigenous systems of medicine practiced by physicians for more than hundreds of years. Plant based medicines are now in great demand in the developing world for primary health care not because they are inexpensive but also for better compatibility with the human body system and very low side effects. Because of this reason the present review focused to reveal the pharmaceutical significance of Azolla species.

Keywords*:* Azolla, pharmacological activities, herbal medicine

INTRODUCTION

In the human health care system, medicinal plants have a major contribution. Herbal medicine acquires tremendous attention in the primary health sector, mainly due to its effectiveness and popularity (Gregory M. Wagner, 1997). In traditional medicines herbal prescriptions were claimed to be effective in treating various ailments, hence the development and validation of a new herbal drug are of prime concern (Alschuler, Benjamin & Duke, 1997; Boullata & Nace 2000).

Azolla is the only genus of the family salviniaceae that has worldwide distribution. It can tolerate both temperate and tropical climates. Azolla is a species of feathered fern. It is native to Africa and Asia. It is an aquatic fern consisting of a short, branched, floating ventral colorless lobe of a slightly larger size (Gregory M. Wagner, 1997). Many bio-active compounds such as essential amino acids, minerals, saponin vitamins, β-carotene, and flavonoids were present in Azolla. It is also considered a good source of high-quality protein (Gregory M. Wagner, 1997; Carrapiço, Teixeira & Diniz, 2000; Liu et al., 2008).

Taxonomic classification

Kingdom: Plantae
Class: Polypodiopsida
Order: Salvinales
Family: Salviniaceae
Genus: Azolla

IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 2, February 2021

DOI: 10.17148/IARJSET.2021.8219

Azolla is a pteridophyte having agronomic significance in developing countries. In a comparatively shorter period, it generates full biomass. Azolla acts as a nitrogen biofertilizer and it increases the productivity of rice (Sanders & Fowler, 1993; Wagner, 1997). Besides, Azolla proved to be fit for hyper accumulate an enormous range of overwhelming metal contaminants and purifying ammonium and phosphorous in wastewater besides (Forni et al., 2001). Azolla is used as animal feed, human food, water purifier, green fertilizer, hydrogen fuel, biogas weed, and bug regulator. Azolla possesses antimicrobial and phytochemical activities, there are many fields in which Azolla can act as a fern hero in many areas which can be future enhanced (Gregory M. Wagner, 1997).

ANTI-MICROBIAL ACTIVITY

Antibacterial activity

Farook M.A. *et al.,* (2019) investigated the antibacterial activity of *Azolla pinnata*, with the help of the disc diffusion method by using different solvents and extracts of the plant.

Sathammaipriya N *et al.,* (2018) worked on *Azolla microphylla* using the agar well diffusion method. In this particular study Gram-positive bacteria are more prone to show the high inhibitory effect when compared to Gram-negative bacteria. The highest zone of inhibition was found in Bacillus species against *staphylococcus* species. In Gram-negative bacteria, *Escherichia Coli* shows more diameters of zone of inhibition against *Klebsiella* species.

Abraham G., (2013) evaluated antibacterial activity with methanolic extract against enormous strains of *Xanthomonas* species which is responsible for causing disease in plants. The result reveals that *Azolla microphylla* possesses antibacterial activity against plant pathogenic bacteria.

Nayak, Padhy & Singh (2014) and Mangesh Kumar *et al*., (2016) were evaluated antibacterial activity in *Azolla caroliniana* possessing multi drug-resistant to 17 antibiotics including aminoglycoside, beta-lactam, cephalosporin & fluroquinolone groups. The zone of inhibition up to 20 mm was found against *Staphylococcus aereus* using agar -well diffusion method in the methanolic extract of *Azolla caroliniana*.

Antifungal activity

Sathammaipriya. N *et al.,* (2018) investigated the antifungal activity of *Azolla microphylla* using methanolic & ethanolic extracts. Both extracts were used against *Aspergillus* species in the concentration of 100 ml, 200 ml, 300 ml, 400 ml, 500 ml also ethanolic extract against *Aspergillus* species in the concentration of 100 ml, 200 ml, 300 ml, 400 ml, and 500 ml.

ANTI-OXIDANT ACTIVITY

Farook M.A. *et al.,* (2019) & Amjad Masood *et al*., (2005) were investigated the extracts of *Azolla pinnata* to evaluate the antioxidant activities using solvents such as Acetone, Benzene, ethanol, methanol & water. Antioxidant activity was done using the DPPH method and compared with standard ascorbic acid. The results revealed that the DPPH reagent shows an absorption peak at 517 nm which confirms the presence of antioxidants.

Noor Nawaz *et al.,* (2014) compared *Azolla pinnata* and *Azolla rubra* for their antioxidant property using DPPH radical scavenging assay. *Azolla pinnate* recorded an IC_{50} value of 7.32 mg/ml which is stronger than *Azolla rubra* with scavenging potential of 14.47 mg/ml.

Kunnathupara Bhaskaran Sreenath *et al.,* (2016) evaluated antioxidant activity in *Azolla microphylla* using DPPH. The scavenging potential of *Azolla microphylla* in the methanolic extract was 59.8 mg/ml when compared with Ascorbic acid as 47.5 mg/ml.

Jerine Peter *et al.,* (2019) concluded the radical scavenging activity using DPPH assay as the ethanolic extract shows the high range of 1:2 ratio of radical scavenging activity than methanol extract. Thus it was reported as the ethanolic extract of *Azolla pinnata* shows more free radical scavenging activity.

ANTI-CARIES ACTIVITY

Prashith Kekuda (2014) investigated anti-caries activity in *Azolla pinnata* and *Azolla rubra* against cariogenic bacteria. Using Agar well diffusion method *Azolla pinnata* and *Azolla rubra* were used against *S. mutans* of 6 oral isolates. The results revealed that the anti-caries activity of *Azolla pinnata* was higher than *Azolla rubra*.

ANTI-INFLAMMATORY ACTIVITY

Elrasoul *et al.,* (2020) recorded the reversing effect of Lead acetate on serum levels of IL-1 β, IL-10 & TNF which is responsible for causing inflammation in rats. The level of IL-IB and TNF increases ($p < 0.05$) when lead acetate is injected and simultaneously it is reduced in serum levels of rats when *Azolla pinnata* extract was injected then the controlled rats.

Sreenath K. Bhaskaran & Poornima Kannapan (2015) investigated the reduction of serum levels of pro-inflammatory cytokine in rats using ethanolic extract of *Azolla microphylla*. The pro-inflammatory cytokines such as IL – 6 & IC -8 were elevated by isoproterenol which also induces cardiotoxicity in rate.

IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 8, Issue 2, February 2021

DOI: 10.17148/IARJSET.2021.8219

CONCLUSION

Azolla exhibits various pharmacological activities such as antibacterial, anti-fungal, antioxidant, anti-inflammatory, anti-caries, etc. Therefore a combination of approaches involving basic and applied research should be taken towards making pharmaceutical products from Azolla. In a review on Azolla the researcher, Wagner stated Azolla "a green gold mine ” because of its potential economic importance.

REFERENCES

1. Abraham, G. (2013). Evaluation of antimicrobial activity of methanolic extracts of Azolla microphylla. Vegetos 26, 200–204.
2. Alschuler L, Benjamin SA, Duke JA (1997). Herbal medicine -what works, what is safe. Patient Care, 31, 48-103.
3. Amjad Masood, Nisar Ahmad Shah, Mohd. Zeeshan, G., & Abraham. (2005). Differential response of antioxidant enzymes to salinity stress in two varieties of Azolla (Azolla pinnata and Azolla filiculoides), Environmental and Experimental Botany 58, 216–222.
4. Boullata JI and Nace AM (2000). Safety issues with herbalmedicine. Pharmacotherapy, 20, 257-69.
5. Carrapiço, F., Teixeira, G. and Diniz, M.A. (2000). Azolla as Biofertiliser in Africa. A Challenge for the Future, Revista de Ciências Agrárias. 23, 120-138.
6. Elrasoul ASA, Mousa AA, Orabi SH, Mohamed MAE, Gad-Allah SM, Almeer R, Abdel-Daim MM, Khalifa SAM, El-Seedi HR, Eldaim MAA. (2020). Antioxidant, Anti-Inflammatory, and Anti-Apoptotic Effects of Azolla pinnata Ethanolic Extract against Lead-Induced Hepatotoxicity in Rats. Antioxidants (Basel)., 9(10):1014. doi: 10.3390/antiox9101014.
7. Farook M.A., Muthu Mohamed H.S., Santhosh Kumar G., Subash S., Paranjothi M., Muhammed Naveez V., Naveen Kumar M., Muhammed Shariq K. and Aadil Ahmed I. (2019). Phytochemical screening, Antibacterial and Antioxidant activity of Azolla pinnata. International Journal of Research and Analytical Reviews, 6(2): 240-247.
8. Forni, C., Chen, J., Tancioni, L. and Caiola, M.G. (2001) Evaluation of fern A. for growth, nitrogen and phosphorus removal from wastewater. Water Research. 35, 1592-1598.
9. Gregory M. Wagner (1997). Azolla: A review of its biology and utilization. The botanical review, 63(1): 1-26.
10. Kunnathupara Bhaskaran Sreenath, Sowmya Sundaram, Velliyur Kanniappan Gopalakrishnan, Kannappan Poornima (2016). Quantitative phytochemical analysis, in vitro antioxidant potential and gas chromatography-mass spectrometry studies in ethanolic extract of Azolla microphylla. Asian J Pharm Clin Res, 9(2): 318-323.
11. Jerine Peter S., Sanjay V., Muruganandham L. and Evan Prince Sabina (2019). Identifying the potential activity of Azolla pinnata through in vitro and SEM. Songklanakarin Journal of Science and Technology.
12. Liu, X., Min, C., Xia-shi, L. and Chungchu, L. (2008) Research on some functions of Azolla in CELSS system. Acta Astronautica. 63, 1061-1066.
13. Mangesh Kumar, Tamanna Talreja, Dinesh Jain, Dhuria, R.K., Asha Goswami & Tribhuwan Sharma, (2016). Comparative evaluation of in vitro antibacterial activity of several extracts of Achyranthes aspera, Azolla pinnata, Cissus quadrangularis and Tinospora cordifolia. International Journal of Chemical Studies. 5(1), 154-157.
14. Nayak, N., Padhy, R.N. and Singh, P.K. (2014). Evaluation of antibacterial and antioxidant efficacy of the fern Azolla caroliniana symbiotic with the cyanobacterium Anabaena azollae. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences DOI 10.1007/s40011-014-0370-3.
15. Noor Nawaz A.S., Syed Junaid, Dileep N., Rakesh K.N. & Prashith Kekuda T.R (2014). Antioxidant Activity of Azolla Pinnata and Azolla Rubra- A Comparative Study. Scholars Academic Journal of Biosciences, 2(10): 719-723.
16. Prashith Kekuda T.R. (2014). Anticaries Activity of Azolla pinnata and Azolla rubra. Science, Technology and Arts Research Journal, 3(3): 119-121.
17. Sanders R.M.K., Fowler K (1993). The supraspecific taxonomy and evolution of the fern genus Azolla (Azollaceae) Pl. Syst. Evol., 184:175–193.
18. Sathammaipriya, N., Thamilmaraiselvi, B., Steffi, P.F., Sangeetha, K. (2018). Investigation of phytochemical constituents in Azolla microphylla for antibacterial activity National Journal of Physiology, Pharmacy and Pharmacology, 8(11):1500-1504.
19. Sreenath K. Bhaskaran and Poornima Kannapan (2015). Nutritional composition of four different species of Azolla. European Journal of Experimental Biology, 5(3):6-12.
20. Wagner G.M. (1997). Azolla: a review of its biology and utilization. Bot. Rev., 63:1–26.