Journal of Plant Biota

Review Article: 01 to 04
ISSN: 3048-4863
https://plant.researchfloor.org/

Christella parasitica (l.) Lev.: a potent pharmacological and pesticidal pteridophyte

Swarna Kumar Dash[1], Bishnupriya Hansdah[1*], Jyoti Ranjan Rout[2*] Bhagyajyoti Baral[3] & Santi Lata Sahoo[4]

[1*,1] *Department of Botany, Maharaja Sriram Chandra Bhanja Deo University, Sri Ram Chandra Vihar, Takatpur, Baripada-757003, Odisha, India.*
[2*] *School of Biological Sciences, AIPH University, Bhubaneswar-752101, Odisha, India*
[3,4] *P.G. Department of Botany, Udayanath Autonomous College of Science & Technology, Adaspur, Cuttack-754011, Odisha, India*

Abstract

Pteridophytes are the foremost vascular cryptogam on earth, and hold a unique position in plant evolution. Ferns are one of the prominent representatives of pteridophytes. This group of vascular cryptogams are distributed into 35 families with 568 genera having 13,000 species. The family Thelypteridaceae encompasses around 37 genera and has a diversity comprising 1190 species. Among these Christella parasitica (L.) Lev. (Thelypteridaceae) is one of the fern, which is an invasive vascular cryptogam with potent secondary metabolites, distinct anatomical features, pharmacological attributes along with significant pesticidal characters and anti-microbial properties. Its various applied aspects will be helpful for the researchers to focus on the thrust areas yet to be explored. Comprehensive taxonomic details of the plant have been coming out of various flora books, journals & suggestions from eminent scientists. The plant is highly active against autoimmune & gynecological disorders, food poisoning and sluggishness. However it also contributes for anti-microbial & bio-pesticidal activities. Thus, Christella parasitica holds immense potential as both a pharmacological agent and a natural pesticide. Its dual functionality highlights the importance of deeper investigation into its bioactive compounds, which may lead to innovative developments in both medicinal therapies and sustainable agricultural practices.

Keywords: *Thelypteridaceae, Christella parasitica (L.) Lev., anti-microbial activity, pesticidal properties*

INTRODUCTION

Pteridophytes (the fern & their allies) have an extensive geologic history as pioneer plants that have occupied various parts of this globe since millions of years. This group comprises a huge cluster of seedless vascular plants & occupies a significant place in primary health care because of their cost-effectiveness. There are four particular types of habitats that ferns are found in; moist, shady forests; cervices in rock faces, especially when sheltered from the full sun; acid wetlands with bogs and swamps; and with epiphytic habit. Ferns are widespread in their distribution, with the greatest richness in the tropics, and least in arctic areas. The vast diversity was witnessed in tropical rainforests. New Zealand glorifies it by symbolizing Fern as a national emblem, with 230 species distributed throughout the country. They can be found in all ground habitats such as ravines, forest floors, slopes, grasslands, rocks and crevices, open walls and stone boulders. About 90% of the world's pteridophytes habituated in India which is 2.5% landmass of the world. *Christella parasitica* (L.) Lev. belongs to the family Thelypteridaceae. Thelypteridaceae is a monophyletic cosmopolitan family with an estimated 1190 species and 37 genera [1,2,3]. According to the GBIF (Global Biodiversity Information Facility-Copenhagen, Denmark) report, 2022 native place of *Christella parasitica* (L.) Lev. is in Queensland, Australia. So far as the secondary center of origin is concerned the plant is widely distributed throughout the world specifically in Australia, New Zealand, Denmark, India, China & some parts of Africa. As per the human observational data, this plant is highly available during the month of April (198,968,400), May (271,510,798), June (204,922,225) & July (196,193,852). In the global scenario waste water drainage systems create damp environments conducive to the growth of ferns. Reproduction is generally by means of spore in a coveted position of sporophylls. The characteristics of preridophytes that make them pioneers for their adaptability and wide distribution due to their light spore being carried by the wind so that they can colonize large numbers of degraded areas [4]. A very good example of this fern habituation was obsessed in Hawaii & Papua New Guinea. As per the data of GBIF, this fern was introduced into these two islands through natural process that is by air from the Queensland, Australia. In Odisha, India 4 abundant species of the genus *Christella* have been found such as *Christella dentata, Christella parasitica, Christella semisagittata,* and *Christella subpubescens.* The *Christella dentata* is widely found in Similipal, Batipathar, Mahadevjharan, Gandhamardan, Nrusinghanath, Sambalpur (Odisha) & also in tropics & subtropics of the old world, throughout India. *Christella parasitica* (L.) Lev. is profound in the hill forests of Odisha, particularly in the Berbera, Similipal, and Mahendragiri. It also occupies a diverse habitat throughout India, tropical Asia, Japan, Malaysia, the Pacific Islands & Australia. *Christella semisagittata* is a dominant species of Bengal, Assam, Myanmar,

03 June 2024: Received | 12 July 2024: Revised | 13 August 2024: Accepted | 07 September 2024: Available Online

Citation: Swarna Kumar Dash, Bishnupriya Hansdah, Jyoti Ranjan Rout Bhagyajyoti Baral & Santi Lata Sahoo (2024). *Christella parasitica* (l.) Lev.: a potent pharmacological and pesticidal pteridophyte. *Journal of Plant Biota.*
DOI: https://doi.org/10.51470/JPB.2024.3.2.01

Bishnupriya Hansdah, Jyoti Ranjan Rout | bpriya123_bot@yahoo.com, routjr@aiph.ac.in

and Bangladesh but rarely found in the Koraput district of Odisha. *Christella subpubescens* is worldwide available, in Mahadevjharan, bank of river Brahmani, Samabalpur, Bankura, North-East India, South-West China, Myanmar, Thailand, Vietnam, Malaysia, North Queensland, New Hebrides, Fiji &Samoa. *Christella parasitica* (L.) Lev. act as a producer of the food chain, regulate water management, cover soil, and prevent erosion [5].

PHARMACOLOGICAL IMPORTANCE

*Christella parasitica (*L.) Lev. (Thelypteridaceae); was used to treat two common, chronic & autoimmune disorders, gouts & rheumatoid arthritis [6]. The ecosystem services of pteridophytes in the Southern Western Ghats of Tamilnadu showed that *Christella parasitica* (L.) Lev. has a potent economic value with its ornamentation. The leaf decoction is also used to clean the hair and it is also one of the best ingredients of the herbal formulation against gynaecological disorders [7]. The leaves of the fern along with the seeds of *Coriandrum sativum* L. crushed with salt & water to prepare a herbal drink with a single dose for 7days.

This fern is located abundantly in terrestrial habitat along with partly shaded stream banks or road side. Due to the iconic & beautiful appearance of the fern it attracts the herbivores. These predators generally prefer soft, herbaceous fern species & generally the maximum herbivory has also been recorded in the high-altitude region i.e. 600-1000m. with evergreen forest.

North-East India, the East Khasi Hill district of Meghalaya, traditionally utilizes the leaf & rhizome decoction of *Christella parasitica* (L.) Lev. for food poisoning in cattle by mixing 200ml. of the extract with turmeric & fodder [8].

Christella parasitica (L.) Lev. is also used for the treatment of sluggishness by the Ahoms, Kalitas, Tiwa, Boro, Misings, Kacharis, Hajong and Deoris tribes of Assam [9].

Table 1: Pharmacological uses of Christella parasitica (L.) Lev.

Sl. No.	Parts of the plant	Uses	Region of use
1	Leaves	Relieve two common chronic & autoimmune disorders like gouts & rheumatoid arthritis	Nigeria
2	Leaves along with seeds	Best ingredients of the herbal formulation against gynaecological disorders	Southern Western Ghats of Tamilnadu
3	Leaf & rhizome	Food poisoning in cattle	North-East India the East Khasi Hill district of Meghalaya
4	Leaves	Treatment of sluggishness	Tribes of Assam.

Table 2 : Works done on Antimicrobial properties of Christella parasitica

Sl. No	Experiments	Antimicrobial property	References
1	Preliminary phytochemical analysis and HPLC studies of the gland extract exhibited the presence of diverse types of terpenoids, alkaloids, tannins, saponins and flavonoids in it.	against mosquito larvae and tadpoles of frog.	[11]
2	Extracts of *C. parasitica* were quite significant as an antifungal results agent.	Prominent zone of inhibition was recorded in *Candida albicans*	[12]
3	Methanolic extract of *C. parasitica*	The pathogenic microbe like *Escherichia coli, Proteus vulgaris* and *Pseudomonas aeruginosa* were reasonably susceptible to the extract with a significant zone of inhibition.	[13]

ANTIMICROBIAL ACTIVITIES

Epidermals gland extracts of this fern *Christella parasitica* (L.) Lev. have anti-microbial properties [10]**.** The abaxial side of the compound leaves reveals that the costa, costules & veins were the sights of glands. However, the glands were denser in croziers (coiled young leaves). HPLC analysis revealed the phytochemicals comprising metabolites like terpenes, phenolic, nitrogen-containing secondary metabolites consisting of alkaloids, glucosinolates & cyanogenic glycosides. Which are raw materials for many commercial drugs. Acetone extracts of the glands were active against *Staphylococcus albus, Staphylococcus aureus* and *Pseudomonas aeruginosa.* The activity of the extracts was compared with the broad-spectrum antibiotic, amikacin. It was also quite significant that the plant extract was more potent in comparison to the antibiotic.

PESTICIDAL ACTIVITIES

An outbreak of *Achaea janata* (400-650 larva /plant) was reported during April-May 1996 in the forest division of Madurai, Tamil Nadu, India in Tamarind plantations. *Achaea janata* caterpillars destroy voraciously the leaflets along with buds & flower resulting in a profound loss in fruit setting [14]. Ferns have ecdysone mimics (Phyto ecdysone) in higher quantities [15]. Ecdysteroid-induced necrotic changes both in *Corpora allata* (CA) and neuro-secretory cells (NS) in *Achaea Janata* [16,17]. These ecdysteroids represent a large family of bioactive compound, comprising more than hundred potential metabolites. Research work of *Christella parasitica* (L.) Lev.was focused on the field evaluation of insecticidal properties on *Helicoverpa armigera* and *Spodoptera litura* the causal pathogen of groundnut [18]. The ethanolic extracts of fern were partitioned with hexane and chloroform, the former fraction was separated with waxy impurities. The Chloroform fraction was concentrated, air-dried and sprayed on their respective Plots-Plot A (*Christella parasitica* (L.) Lev.), Plot B (*Pteridium aquilinum*), Plot C (*Hemionitis arifolia*) and Plot D (ethanol as control). The experimental observations were groundnut production was enhanced in the experimental plots than control. The highest production was recorded by *Pteridium aquilinum* (1400 kg/ha) followed by *Hemionitis arifolia* (1370 kg /ha) and *Christella parasitica* (L.) Lev. (1250 kg/ha), and in the control plot it was recorded as 1120 kg/ha. Hence these bio-pesticides are eco-friendly and can be recommended for field trials. The Diamond Back Moth (DBM) i.e. *Plutella xylostella* L. which is hazardous to cabbage only be controlled by synthetic chemical pesticides which are harmful to humans. The biopesticides can be easily replace the chemical pesticides to

control the activity of the pest in cabbage. *Christella parasitica* (L.) Lev. can be used as a broad-spectrum insecticide to control the deadly pests on different veggies. Besides that mosquitos are one of the main vectors carrying disease-causing parasites of Malaria, Chicken guinea, yellow fever & dengue [19]. There are so many synthetic mosquito repellent products available in the markets that creates a havoc on the house keeping systems of humans. The aqueous extract of *Christella parasitica* (L.) Lev. with mosquito larvae signifies 83.3% mortality rate showing a promising result as an alternative to synthetic mosquito repellents [20].

CONCLUSION

With an attention for higher group of plants in forest coverage it is very much essential to explore the potential of lower group of plants. The recent scenario of the world shows various deficiencies in different sectors. If the health sector is taken into consideration, there are many incurable diseases. The reason behind these diseases may be the invisible infection or chemically generated hybrid fruits and vegetables. But in recent days due to the huge uncontrollable population the harshness and productivity of the vegetables and other plant based raw materials are artificially enhanced under compulsion. By hook or crook productivity leads to rampant use of chemical fertilizers, pesticides and other synthetic growth regulators. To avoid these xenobiotics, bio- fertilizers and bio-pesticides are very much essential. The use of various lower groups of plants on cultivated land can be replaced for making the soil healthy . *Azolla* & rhizosphere has been already used as a bio-fertilizer in rice fields. Likewise, there are also some bio-insecticides, which can be used in croplands. Hence forth attempts must be taken to make this vascular pteridophyte *Christella parasitica* (L.) Lev. a promising bio-fertilizer in recent days and as well as in future also. The principal secondary metabolite reported from this plant is an ecdysteroid derivative which is phytoecdysone, the main functional compound in preventing various pests.

REFERENCES

1. Almeida, T.E., Hennequin, S., Schneider, H., Smith, A.R., Batista, J.A.N., Ramaho, A.J., Proite, K. and Salino, A. (2016). Towards a phylogenetic generic classification of Thelypteridaceae: Additional sampling suggests alterations of neotropical taxa and further study of paleotropical genera. Molecular Phylogenetics and Evolution 94: 688–700.

2. Fawcett, S., Smith, A.R., Sundue, M., Burleigh, J.G., Sessa, E.B., Kuo, L.-Y., Chen, C.-W. Testo, W.L., Kessler, M. and Barrington. D.S. (2021). A global phylogenomic study of the Thelypteridaceae. Systematic Botany 46, 891–915.

3. Fawcett, S. and Smith, A.R. (2021). A Generic Classification of the Thelypteridaceae. Sida, Botanical Miscellany 59. BRIT Press, Botanic Garden | Botanical Research Institute of Texas, U.S.A.: Fort Worth.

4. Dwisutono, A. N., Budi, S. W., and Istomo, I. (2019). Plant Diversity in Different Land Use Types at The Peat Hidrological Unit (PHU) of Mendahara – Batanghari River, Jambi Province. Media Konservasi, 24(2), 141–151.

5. Ulfah, M., Santoso, L. P., Alamsyah, R., Setyaningrum, S., and Kurniawati, S. (2023). Types of diversity and ecological functions of pteridophytes in the Lawe Secepit Waterfall Kendal. Biogenesis: Jurnal Ilmiah Biologi, *11*(2), 160-167.

6. Babayemi, O.J. (2003). Growth, nutritive value and dry matter degradability of three *Tephrosia species*. Nigerian Journal of Animal Production 30:62-70.

7. Singh, V., Bhattacharjya, D. K., and Gogoi, J. (2019). Phyto restoratives against irregular Menstrual cycle and painful menstruation in Barpeta district of Assam (India). Pramana Research Journal 1-15.

8. Bhat, N. A., Jeri, L., Karmakar, D., Mipun, P., Bharali, P., Sheikh, N. and Kumar, Y. (2023). Ethnoveterinary practises of medicinal plants used for the treatment of different cattle diseases: A case study in East Khasi Hill district of Meghalaya, North East India. *Heliyon*, *9*(7).

9. Jha, K. K. and Radhika, J. H. A. (2023). Uncodified system of animal health care in Eastern Himalaya and Indo-Burma hotspots of India: Plant use and their distribution. *Nova Geodesia*, *3*(4), 155-155.

10. Irudayaraj, V. (1996). Studies on intraspecific variation in South Indian ferns VI: preliminary phytochemical analysis of epidermal glands in *Christella parasitica* (L.) Lev. Flora Fauna; 2(2) , 155-157.

11. Paul, K. R., Irudayaraj, V., Johnson, M. and Patric, D. R. (2011). Phytochemical and anti–bacterial activity of epidermal glands extracts of *Christella parasitica* (L.) H. Lev. Asian Pacific Journal of Tropical Biomedicine, 1(1), 8-11.

12. Vijayakumari, J., Rajand, T. L. S. and Saravanan, P. G. (2022). Evaluation of Phytochemicals and Antimicrobial potential of Aerial part of *Christella parasitica* (L.) H. Lév. Journal of Xi'an Shiyou University, Natural Science Edition, 18, 258-265.

13. Nath, K., Bhattacharya, M. K. and Kar, S. (2018). Antimicrobial potential of ethnomedicinal ferns of southern Assam, India. *Indian J. Pharm. Sci*, *80*, 556-560.

14. Singh, R. Jeeva, R. and Mahalakshmi, R. (1997). An outbreak of *Achaea janata* linn (Lepidoptera: Noctuidae) on *Tamarindus indica* in Tamilnadu. Insect environment.3(2) ,30-31.

15. Chandrakala, M., Shetty, V. and Jyothi, H. (1998). Application of phytoecdysteroids in sericulture. Current science.7494,341-345.

16. Muraleedharan, D., Varghese, A., Abraham, G., and Mathews. R.A. (1986). Effect of prcocene II on endocirnes, feeding and digestion in the semilooper caterpillar, *Achaea janata.* Insect Neurochemistry and Neurophysiology (A.B Borkovec and D.B. Gelman Eds.). The Humana Press New Jersey. 307-314.

17. Muraleedharan, D. and Abraham, G. (1990). Role of *Corpus allatum* on the modulation of feeding rhythm in the semilooper caterpillar *Achaea janata* (L.). chronobiology International.7,419-424.

18. Selvaraj, P. and Sahayaraj, K. (2005). Effect of chosen fern extracts on the development of *Spodoptera litura* Fab.: Green pesticides for insect & pest management (Eds. *S. lgnacimuthu* & *S. jeyaraj*). Narosa Publishing house, Chennai. .85-90.

19. Murasing, J., Vignesh, M., and Gupta, M. K. (2019). Bio-efficacy study on alcoholic extracts of fern plants against diamondback moth, *Plutella xylostella* L. in cabbage. *Pharm Innov. J*, *8*(7), 05-07.

20. Buragohain, P. and Moran, J. (2020). Effects of Plant Extracts against Mosquito Larvae, Proceedings of NRMSA. 92-98.