

INTRODUCING UNDERGRADUATE STUDENTS TO DATA INFORMATION LITERACY: A REPORT ON A STUDENT RESEARCH PROJECT UNDERTAKEN IN GURUDAS COLLEGE, KOLKATA-54, WEST BENGAL, INDIA

Arpita Roy Chowdhury¹, Sanjoy Nayek¹, Subhomoy Pramanick¹ and Mitu De²

¹Undergraduate student, Department of Botany, Gurudas College, Kolkata 700054,

²Associate Professor, Department of Botany, Gurudas College, Kolkata, 700054,

Corresponding author Email: mitude@rediffmail.com

Abstract

Institutional Library resources both print and digital are of great help to both students and faculty members as an information source. However without proper knowledge of accessing the information sources from either electronic or print sources students are vulnerable to the overloaded information. This knowledge has been termed as data information literacy. In an attempt to introduce undergraduate students to data information literacy, a student project was initiated where participants got a structured introductory training on data retrieval. A survey was embarked upon to document some of the medicinal pteridophytes and gymnosperms present in Gurudas College campus. The students used the college library resources to access data on the phytochemicals present in those medicinal plants available in the college campus.

Keywords: Student research project, Data information literacy, medicinal plants, phytochemicals, Gurudas College

Introduction:

Recent studies suggest that the general knowledge and skills necessary to manage research data are not currently a major part of undergraduate, graduate, and doctoral curriculums [1, 2]. The prerequisite knowledge for this baseline requirement has been positioned as a literacy that Carlson *et al.* in 2011 termed it as “data information literacy.” Basic data information literacy includes methods of data collection or acquisition, data representation, data interpretation, statistical analysis, data manipulation, data management and preservation, and data summarization and presentation among other related skill sets [3].

Data Information literacy

Institutional Library resources both print and digital are of great help to both students and faculty members as an information source. Digital libraries and archiving have significance in preserving and disseminating knowledge in art, culture, education, science, technology, literature and humanities. Launch of Open Source Digital Library Software has added further

fillip in democratizing sharing, distributing and transmitting information/knowledge in the realms of research and development, teaching and learning [4].

Internet has rapidly become one of the most powerful global sources of wide range of information presenting many possibilities for the efficient and unlimited dissemination of information. It has contributed positively in enhancing the search effectiveness. However without proper knowledge of accessing the information sources from either electronic or print sources students are vulnerable to the overloaded information. Information literacy has been defined as ‘a set of abilities requiring individuals to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information [5].

Student project domain

Healing with medicinal plants is as old as mankind itself. Medicinal use has been reported in almost all groups of plants. Apart from the angiosperms the pteridophytes and gymnosperms have been reported to have medicinal value. However the medicinal value of pteridophytes and gymnosperms are not so well known as angiosperms.

In India, herbal therapeutics constitutes a major share of all the officially recognized Indian systems of medicine such as Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Homeopathy [6]. These medicines initially took the form of crude drugs such as tinctures, teas, poultices, powders, and other herbal formulations [7]. The medicinal value of plants lies in these phytochemicals that produce a definite physiological action on the human body. Plant secondary metabolites are known to possess antimicrobial and antioxidant properties.

In recent years, the search for phytochemicals with antioxidant, antimicrobial, or anti-inflammatory properties has been on the rise due to their potential use for the treatment of various chronic and infectious diseases. The phytochemicals present in plants are responsible for preventing disease and promoting health. Plant secondary metabolites are known to possess antimicrobial and antioxidant properties. The most important of these bioactive groups of plants are alkaloids, terpenoids, tannins, saponins and phenolic compounds [8]. Other diverse groups of naturally occurring phytochemicals such as flavonoids, tannins, unsaturated sterols, triterpenoids, essential oils etc. also have been reported [9]. The pteridophytes and gymnosperms were chosen because the medicinal potential of the plants belonging to these groups are not so well known. Accessing and retrieving data on the medicinal uses and phytochemicals responsible for the therapeutic value would be the area for data information literacy.

Objective of the study:

Data information literacy is an important skill for research workers. There is such a vast ocean of digital resources available students which are freely available. The students need to be taught to access and retrieve relevant data from the enormous number of research papers. The main objective of this student research project was the documentation of some medicinal pteridophytes, gymnosperms and angiosperms found in the college campus of Gurudas College. The students also got hands on training on doing reference study on the phytochemicals present in those medicinal plants from the digital resources of the college library.

Material & Methods:

This investigation was part of a Student Project of the 3rd Semester students conducted in August & September, 2019. The main purpose of this survey was documentation of some medicinal pteridophytes and gymnosperms found in the college campus of Gurudas College. Then the students had to search and retrieve data on the medicinal uses of these plants and phytochemicals responsible for their medicinal value.

Study area: Gurudas College

Gurudas College, established in 1956, is an undergraduate college in Kolkata, West Bengal, India. It is affiliated with the University of Calcutta. The coordinates of the college are 22.5712° N, 88.3905° E. The college is named after Sir Goorodas Banerjee, the first Indian Vice Chancellor of the University of Calcutta and tireless champion of the spread of education.

Survey and selection of plants

A team of three undergraduate students (all co authors of this paper) were selected as members of the Student Project team under the mentorship of the corresponding author. These students were of Semester III from the Department of Botany, Gurudas College. A survey was done in August – September 2019 to document some of the medicinal plant species among the pteridophytes and gymnosperms present in Gurudas College campus. After the survey of the college campus for medicinal plants the students chose 6 plants for their investigation taking three plants each from the pteridophytes and gymnosperms. The names of the plants are given in Table 1.

Data information collection

The group was then asked to use the college library resources for data information on use of these various groups of plants in treatment of diseases. The group did a short literature review on the use of these medicinal plants by earlier workers. They also searched research papers to gather information on the phytochemicals found in those plants which were responsible for their medicinal properties.

Results

Table 1. List of medicinal plants used in this student project

Sl. no.	Name of the plant	Common name	Family	Plant group
1	<i>Adiantum incisum</i> Forssk	Maiden hair fern	Adiantaceae	Pteridophyte
2	<i>Araucaria araucana</i> (Molina) K. Koch	Monkey puzzle tree	Araucariaceae	Gymnosperm
3	<i>Dryopteris filix-mas</i> (L.) Schott.	Knotty brake fern,	Dryopteridaceae)	Pteridophyte

4	<i>Platycladus orientalis</i> (L.) Franco	Chinese <i>thuja</i>	Cupressaceae	Gymnosperm
5	<i>Pteris vittata</i> L.	Ladder Brake fern	Pteridaceae,	Pteridophyte
6	<i>Zamia furfuracea</i> L. f. ex Aiton	Cardboard palm	Zamiaceae	Gymnosperm

Medicinal Pteridophytes

Pteridophytes have been successfully used in the Ayurvedic, Unani, Homeopathic and other systems of medicines as well as in the human history [10]. Pteridophytes are used by the physicians in Unani system of medicine [11]. Many Pteridophytes are prescribed by local doctors in the Chinese system of medicine too [12]. In 1957 B. K. Nayar wrote an article on the medicinal ferns of India. [13]. 16 fern species belonging to 11 families were reported to be used as herbal remedies by local tribes of Chandauli, Uttar Pradesh in 2017 [10]. Pteridophytes belonging to Adiantaceae, Azollaceae, Lygodiaceae, Marslieaceae, Polypodiaceae, Pteridaceae, Thelypteridaceae are widespread in Hooghly district [14]. Mukherjee, & Bandyopadhyay in 2014 reported that 14 species of fern have been used by the inhabitants of Howrah district for various purposes [15].

Medicinal potential and phytochemicals found among the three selected pteridophytes are as follows.

1. *Adiantum incisum* Forssk

According to the literature, *Adiantum* species are a rich source of triterpenes with various structural skeletons. Besides, flavonoids, phenyl propanoids and sterols have been isolated from the genus *Adiantum* sp [16]. A study in North East India reported that some people of Manipaur used the powdered fronds of *Adiantum incisum* Forssk as herbal tea [17].

2. *Dryopteris filix-mas* (L.) Schott.

It is one of the oldest anthelmintic drug known and has been used since ancient times for expelling worms from the intestines of man and animals [18]. This fern has many and varied ethno-medicinal uses especially its use in the treatment of worm infections and diarrhoea [19].

3. *Pteris vittata* L.

Pteris vittata L. is widely used in traditional Chinese medicine for diverse therapeutic applications, such as the treatment of influenza, dysentery, rheumatism, injury and scabies [20]. Phytochemical screening studies on *P. vittata* L. have showed a substantial amount of flavonoids [21, 22].

Medicinal Gymnosperms

Gymnosperms have been used in traditional medicine in India over the ages [23]. The ethnobotanical data of total 12 gymnosperms belonging to four families was collected from

the local people of the Kaghan Valley, Pakistan in 2006 [24]. *Pinus roxburgii*, *P. wallichiana*, *Cedrus deodara*, *Abies pindrow* and *Taxus wallichiana* are prominent gymnosperms of Kaghan Valley which are not only source of timber but also utilized as fuel wood and for medicinal purposes.

Medicinal potential and phytochemicals found among the three selected gymnosperms are as follows.

1. *Araucaria araucana* (Molina) K. Koch

The most common pharmacological activity of *Araucaria sp* in modern medicines is anti-inflammatory. It also possesses other pharmacological activities such as antiulcer, antiviral, neuro-protective, anti-depressant and anti-coagulant [25]. Biflavones have been found from the leaves of *Araucaria araucana* [26].

2. *Platycladus orientalis* (L.) Franco (synonym *Thuja orientalis* L.)

Antioxidant and Antibacterial activity of *Thuja orientalis* essential oil was reported by Wajaht and Mahpara in 2014 [27]. *Platycladus orientalis* (L.) Franco is used for treatment of bronchial catarrh, enuresis, cystitis, psoriasis, uterine carcinomas, amenorrhea and rheumatism in traditional medicine [28].

Thuja occidentalis is used in Homeopathic medicine and has been reported to successfully remove ovarian cysts [29]. This medicinal gymnosperm has been used in treatment of many diseases for its diuretic, anticancer, anticonvulsant, stomachic, antipyretic, analgesic and anthelmintic properties [30].

Zamia furfuracea L. f. ex Aiton

This plant is cultivated as an ornamental plant in the college campus. Ornamental gymnosperms viz, *Araucaria heterophylla*, *Cycas circinalis*, *Thuja occidentalis* and *Zamia furfuracea* were analyzed for their wealth of phytoconstituents by using preliminary qualitative phytochemical tests [31]. The cycad *Zamia furfuracea* L. f. ex Aiton is a toxic plant. All parts of the plant are poisonous to animals and humans. The toxicity causes liver and kidney failure, as well as eventual paralysis. The primary toxins in the *Zamia* species are the glycosides cycasin and macrozamin, found in all parts of the plant but especially in the seeds. Despite the toxicity this plant was consumed by indigenous people after an elaborate process of detoxification [32].

Discussion

Active engagement of students is essential to the learning process [33]. College students usually do not come to college prior skill and knowledge about research papers. Many do not know how and when to use journal literature. Information Literacy (IL) is increasingly important in the present context of the information explosion and concomitant uncertainty about its authenticity, validity, and reliability [34].

Indian traditional medicine is based on different systems such as Ayurveda, Siddha and Unani which are still used by various communities where medicinal plants are used for treatment [35]. (Gadgil, 1996). Apart from the angiosperms other plant groups have medicinal potential viz. the pteridophytes and gymnosperms. Many phytochemicals with a

therapeutic value are being discovered on a regular basis based on the huge number of research papers on this topic.

The students got hands on training on different approaches to modify search options for optimum results. They also got acquainted with reliable sites like National Digital Library of India from where they could access data.

Conclusion

The interaction with students during the student research project may be seen as an introductory step towards digital literacy among the students. Training students to improve their data information literacy should be an ongoing process. This skill is a pre-requisite if some of the students opt for a career in research. The present investigation has brought to light some interesting data on the pteridophytes and gymnosperms in the college campus which form a potential source of phytochemicals of therapeutic value.

Limitations of the study

Data information literacy cannot be developed within a short period of time. There are several steps to test the authenticity of the information accessed. Research papers were not screened on the basis of peer reviewed articles. Important aspects of publication such as plagiarism were not dealt with in this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this work.

Acknowledgment:

The authors thank the Principal, Gurudas College, Kolkata 700054 for encouraging the students to take part in this project. We thank the College Librarian and other staff of the college library for rendering help to the students in using the library resources. The authors also thank all teaching and non teaching members of the Department of Botany for support and encouragement.

Reference

1. Carlson, J., Fosmire, M., Miller, C. C., & Sapp Nelson, M. 2011. Determining data information literacy needs: A study of students and research faculty. *portal: Libraries and the Academy*, 11(2), 629-657.
2. Scaramozzino, J. M., Ramírez, M. L., & McGaughey, K. J. 2012. A study of faculty data curation behaviors and attitudes at a teaching-centered university. *College & Research Libraries*, 73(4), 349-365.
3. Mooney, Hailey, Collie, W. Aaron, Nicholson, Shawn W. and Sosulski, Marya R. 2014. Collaborative Approaches to Undergraduate Research Training: Information Literacy and Data Management *Advances in Social Work* Vol. 15 No. 2 (Fall 2014), 368-389.
4. Mohanlal E.K, N. Krishnaswami. 2017, Digital Archiving of Medicinal Plants with the Open Source Digital Library Software Greenstone. *International Journal of Library & Information Science*, 6(5), 49–62.

5. American Library Association. 1989. Presidential Committee on Information Literacy. Final Report. Chicago: American Library Association,
6. Vaidya AD, Devasagayam TP. 2007. Current status of herbal drugs in India: An overview. *J Clin Biochem Nutr.*; 41: 1-11.
7. Archana, Jatav S, Paul R, Tiwari A. 2011. Indian Medicinal Plants: A rich source of natural immune-modulator. *Int J Pharmacol* 7(2): 198- 205.
8. Edeoga HO, Okwu DE and Mbaebie BO, 2005. Phytochemical constituents of some Nigerian medicinal plants. *Afr J Biotech.*, 4: 685-688.
9. Nandagoapalan, V., Doss, A. and Marimuthu, C. 2016. Phytochemical Analysis of Some Traditional Medicinal Plants. *Bioscience Discovery*, 7(1): 17-20.
10. Singh, Shashank Kumar and Rajkumar, S. Dominic. 2017. Biodiversity and Indigenous Use of Medicinal Ferns in Chandraprabha Wildlife Sanctuary, Chandauli, Uttar Pradesh. *International Journal of Research Studies in Biosciences (IJRSB)* Volume 5, Issue 11, 19-25.
11. Uddian Gias, M.D. and Pasha, M.K. 1998. Ferns of Bangladesh IV. Maratiaceae, Blechnaceae, Stenoclaenaceae and Pekiaceae, *Chittagong Univ. J. sci.* 23 (I): 119 – 128.
12. Kirnura, K. and Nero, Y. 1965. Pharmacognostical studies on Chinese drug “Gu-sui—bu”: 1. Consideration on “gu-sui-bu” in old herbals (Pharmacognostical studies on fern drugs Xi). *Syoyakugaku zasshi* 19:25 31. *In Biol. Abstr.* 49: 86830.
13. Nayar, B. K. 1957. Medicinal ferns of India. *Bull. Nat. Bot. Gard. Lucknow*, 29, 1-36 pp.
14. Deb, Santanu, Paul, Ripan, Sen, Tuhinsri and Sen, U. 2018. Biodiversity of pteridophytes and their pattern of distribution in Hooghly district. *Indian Fern J.* 35: 255-300.
15. Mukherjee, Sobhan & Bandyopadhyay, Subhajit. 2014. A contribution to the fern Flora of Howrah district in West Bengal, India. *International Journal of Pharmacological Screening Methods*, ISSN-22497749. 4(1): 1-3.
16. Gupta M, Bagchi A, Roy SK, Ray AB. 1990. Chemical constituents of a member of *Adiantum caudatum* complex. *J Indian Chem Soc.*; 67: 86-88.
17. Yumkham, Sanatombi Devi & Elangbam, Meena & Nongmaithem, Rita & Premita Devi, Naorem & Singh, Potsangbam. 2018. Maiden hair ferns (*Adiantum* L., Pteridaceae–Vittarioideae) of North East India: diversity, phytochemistry and utilization. *Genetic Resources and Crop Evolution*. 10.1007/s10722-018-0612-y.
18. Mandal, Asim and Mondal, Amal Kumar. 2011. Studies on antimicrobial activities of some selected ferns and lycophytes in Eastern India with special emphasis on ethno-medicinal uses. *African Journal of Plant Science* Vol. 5(7), July, 412-420.
19. Uwumarongie, H. O., Enike, M. A. and Bafor, E. E.. 2016. Pharmacognostic evaluation and gastrointestinal activity of *Dryopteris filix-mas* (L.) Schott. (Dryopteridaceae). *Ewemen Journal of Herbal Chemistry & Pharmacology Research*. 2. 19-25.
20. Xie WZ. 1996. Compilation of national Chinese herbal medicine. *People Health Press*, Beijing, 646–647
21. Ding LJ, Su GL 2009. Extraction of flavonoids from ladder brake with microwave and its antioxidative activity. *J Food Sci Bio.* 28(5): 623–626
22. Zhou XJ, Yang ZQ, Jing HY, Gao YX. 2010. Study on optimization of total flavonoids extraction technology in *Pteris vittata* L. *Res Dev Mark.* 26(3): 210–211.
23. Chaturvedi, Shonali and Dass, Saily. 2011. Traditional Medicinal and Economic uses of Gymnosperms. *Bulletin of Environment, Pharmacology & Life Sciences*. Volume 1, Issue 1, (Dec): 70 -72.

24. Hussain, Manzoor & Shah, Ghulam & Khan, Mir. 2006. Traditional Medicinal and Economic Uses of Gymnosperms of Kaghan Valley, Pakistan. *Ethnobotanical Leaflets*, 10, 72-81.
25. Aslam, M. Shahzad, Choudhary, Bashir A., Uzair, M and Ijaz, A. Subhan. 2013. Phytochemical and Ethno-Pharmacological Review of the Genus *Araucaria* – Review. *Tropical Journal of Pharmaceutical Research*, ISSN: 1596-5996 (print); 1596-9827 (electronic); (August); 12 (4): 651-659.
26. Parveen N, Taufeeq HM, Khan N. 1987. Biflavones from the Leaves of *Araucaria araucana*, *J. Nat. Prod*; 50(2): 332–333.
27. Wajaht A. Shah and Mahpara Qadir. 2014. Chemical composition, Antioxidant and Antibacterial activity of *Thuja orientalis* essential oil. *World Journal of Pharmaceutical Sciences*, 2(1): 56-61.
28. Dash, A. K., Mishra, J. and Dash, D. K. 2014. Phytochemical investigation and Pharmacological screening of *Platycladus orientalis*. *International Journal of Pharmaceutical Science and Health Care*, ISSN 2249 – 5738, Issue 4, Vol 1. Feb, 94-102.
29. Das D, Saiful H, Asmita S, Saroj Kumar K, Rahman A, et al. 2016. Removal of Large Sized Ovarian Cysts in Three Patients by Administration of a Single Remedy, *Thuja occidentalis*: Hormonal Assay and Ultrasonographic Images. *J Integrative Med Ther.*; 3(1): 9.
30. Dash, A. K., Mishra, J. 2015. A comparative study on phytochemical investigation and pharmacological screening of *Platycladus orientalis* and *Ocimum canum* with review of literature. *International Journal of Phytopharmacy Research*, ISSN: 2277-2928 (Online,) Article Vol. 5 (6), Nov-Dec , 130-138.
31. Gurav, KD, Patil DT, Thite SV, Patil PR, Kore BA and Aparadh VT. 2013. Preliminary Investigation of Various Secondary Metabolites from Some Gymnosperm species. *International Journal of Pharmaceutical and Chemical Sciences*. ISSN: 2277-5005. Vol. 2 (2) Apr-Jun, 841-843.
32. Bonta, M., Pulido-Silva, M.T., Diego-Vargas, T. et al. 2019. Ethnobotany of Mexican and northern Central American cycads (Zamiaceae). *J Ethnobiology Ethnomedicine* 15:4, 1-34.
33. Murray, H. G. 1985. Classroom teaching behaviors related to college teaching effectiveness. *New Directions for Teaching and Learning*, 23, 21-34.
34. Keshalu, P. and Srinivasulu, V. 2016. Awareness of Information Literacy among undergraduate students of Paritala Sriramulu Government Degree College: Penukonda. *International Journal of Research in Library Science*. Volume 2, Issue 2 (July-December), 109-115.
35. Gadgil M. 1996. Documenting diversity: An experiment. *Curr. Sci.*; 70(1): 36.