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Floristic studies on cryptogams of Achanakmar wildlife sanctuary, Chhattisgarh, India

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Abstract
Floristic studies were conducted in the Achanakmar Wildlife Sanctuary, Chhattisgarh (India) during July 2019 to August 2021 to explore the diversity of cryptogams including algae, bryophytes, lichens and pteridophytes. Specimens of cryptogams were collected from various localities (Gadyahra, Gadohal, Bidi, Parchu, Balh, Ratkel, Tasli nala, Sarkaghat, Barchwar, Longani and Dhagwani) of Sarkaghat region with the help of equipments like knife, spatula, trowel, forceps and also by hands. The specimens were initially stored in containers, plastic bags and paper packets. Field data was recorded in field note book including locality name, collection date and substratum. The specimens were pressed, dried and identified with the help of identification keys and latest literature. During the present investigations, a total of 43 species of cryptogams of families Zygnemataceae, Ulothriaceae, Hydrodictyaceae, Cladophoraceae, Tabellariaceae, Marchantiaceae, Aytoniaceae, Bryaceae, Anthocerotaceae, Funariaceae, Hypnaceae, Polytrichaceae, Fissidentaceae, Candelariaceae, Verrucariaceae, Cladoniaceae, Parmeliaceae, Physciaceae, Calicariaceae, Graphidaceae, Lecanoraceae, Pteridaceae, Aspleniaceae, Dryopteridaceae, Equisetaceae, Athyriaceae, Marseliaceae, Selaginellaceae, Thelypteridaceae, Cheilanthaceae, Lygodiaceae and Polypodiaceae had been identified.

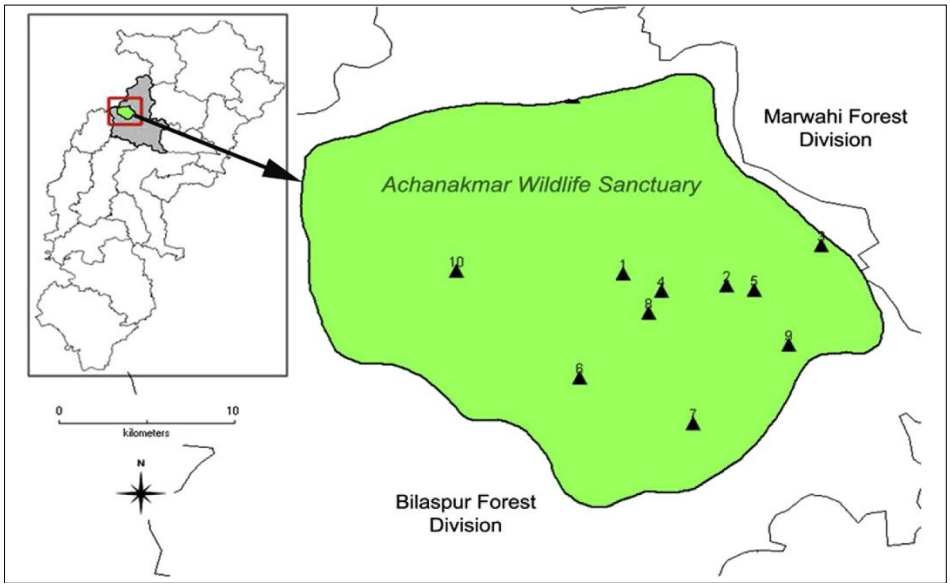
Keywords: Cryptogams, achanakmar wildlife sanctuary, algae, bryophytes, lichens and pteridophytes

Introduction
Cryptogams are the spore producing plants which grows on moist and shady areas (Newmaster and Bell, 2002) [1]. Cryptogams are non vascular plants divided into four groups such as algae, bryophytes, lichens and pteridophytes which are able to fix atmospheric nitrogen and carbon dioxide (Brostoff, 2002) [2]. However, it also includes non – photosynthetic organisms traditionally classified as plants such as Fungi, Slime mould and Bacteria (Isichei, 1990) [3]. Algae are thallophytes that lack roots, stems, leaves and contain Chl 'a' as primary photosynthetic pigment. They are found in fresh and marine habitats and show a great diversity in morphology, pigments and metabolic products. The ninety percent of the atmospheric oxygen is evolved by the algae mainly found in lakes, rivers and oceans (Chapman, 2013) [4]. Bryophytes are the distinct group of primitive plants found in moist and shady places and are considered as the second largest group of the land plants (Marko *et al.* 2001) [5]. These are the first colonized green plants which show a great advancement in morphology and reproduction (Morris *et al.* 2018 and Kenrick and Crane, 1997) [6-7]. Bryophytes are divided into four classes, the two classes of liverworts (Marchantiopsida and Jungermanniales), hornworts (Antheropsida) and the mosses (Bryopsida) (Pant and Tewari, 1990) [8]. These are non flowering plants having gametophytic plant body with haploid and diploid structures (Nair and Prajitha, 2010) [9]. Lichens are thallophytes characterized by the symbiotic association between the fungus and algal group (Ahmadjian, 1995) [10]. The algal component is termed as phycobiont while the fungal component is known as mycobiont. Lichens show great distribution from arctic to tropical and plains to mountains. India has rich pteridophytic flora because of variant micro-climatic conditions (Chadha *et al.* 2008) [11]. Pteridophytes are spore producing lower vascular plants which are intermediate between bryophytes and spermatophytes (Gymnosperm and Angiosperm). Beside food values, these also have medicinal (Homeopathic and Ayuevedic medicines) and aesthetic values (Vasuda, 1999 and Das, 2003) [12-13]. Cryptogams are the lower plants which are used for the treatment of various diseases by the people of tribal areas. For present and past generation, a greater effort should be given to conserve and cultivate the cryptogams.

The detailed review of published record of distribution and diversity of cryptogams revealed that Achankmar wildlife sanctuary region remained unexplored for the floristic diversity of cryptogams (Sharma & Chander, 2020, Kumar & Chander, 2020, Chander *et al.* 2020, Tiwari and Shukla, 2015, Pandey *et al.* 2014, Thakur, 2018, Kittur, *et al.* 2014) [14-20]. Therefore, studies were initiated for floristic enumeration of cryptogams including algae, lichens, bryophytes and pteridophytes from Achankmar wildlife sanctuary of Chhattisgarh.

Study area

The Achanakmar Wildlife Sanctuary is a sanctuary in Mungeli district of Chhattisgarh and in the Anuppur and Dindori districts of Madhya Pradesh in India. It had been established in 1975, under the provisions of the Indian Wildlife Protection Act of 1972, and declared as a Tiger Reserve under Project Tiger, in 2009 (Newmaster & Bell, 2002 and Brostoff, 2002) [1-2]. It is a part of the Achanakmar-Amarkantak Biosphere Reserve.



Around 38.78% of the total area is covered by forest. The southern part of the district is a plain land with gentle slopes covering an area of 48% of the total geographical area in the district. It is also called the Chhattisgarh plains. The land is very fertile and is mostly used for the agriculture purposes with few surface irrigation facilities. The northern part of the district is mostly hilly with highly undulating topography where the agriculture is restricted to few patches only. The net area sown during the year 2011 is around 360195 ha. Paddy is the main crop (88%) followed by pulses. There are three medium and 125 no of small irrigation projects exist in the district.

Material and methods

Cryptogams including algae, bryophytes, pteridophytes & lichens were collected from different region in and around Achanakmar Wildlife sanctuary from various localities. During specimen collection, hammer, knife, spatula, polythene bag, bottles were used. These specimens were preserved as herbarium. The specimens were recorded, photographed and identified on the basis of morphological, anatomical and micro-chemical characteristics after consulting latest literature (Clarke, 1980, Ward & Whipple, 1992, Khullar, 2000, Awasthi 2000a, 2000b and Prasher & Chander, 2006) [21-26].

Results and discussion

In the present investigation, an attempt has been made for the collection, identification and preservation of cryptogams from the different sites of Achanakmar Wildlife Sanctuary. Out of total 182 specimens, Forty three species of cryptogams have been identified (Table 1). Bryophytes play important role in ecosystem functioning such as soil development, water retention and nitrogen fixation. Lichens are used as a source of dye, fragrances, medicines whereas some provide nutrients to the diet due to high concentration of calcium and iron. Ferns are used by local people in the form of vegetable, powder, decoction, extracts and ornamental purposes.

The cryptogams of Achanakmar Wildlife Sanctuary still remain unexplored and therefore, there is a need to explore the status and indigenous uses of cryptogams. The documentation and preservation of medicinally important cryptogams of the Achanakmar Wildlife Sanctuary should be necessary step for future research.

Table 1: List of cryptogams of Achanakmar Wildlife Sanctuary in Chhattisgarh.

Sr. No.	Cryptogram Group	Species
1.	Algae	*Cladophora glomerata*
2.	Algae	*Hydrodictyon reticulatum*
3.	Algae	*Spirogyra porticalis*
4.	Algae	*Spirogyra varians*
5.	Algae	*Ulothrix zonata*
6.	Bryophyte	*Anthoceros erectus*
7.	Bryophyte	*Asterella californica*

8.	Bryophyte	*Funaria hygrometrica*
9.	Bryophyte	*Marchantia polymorpha*
10.	Bryophyte	*Plagiochasma appendiculatum*
11.	Bryophyte	*Polytrichum commune*
12.	Bryophyte	*Polytrichum juniperinum*
13.	Bryophyte	*Polytrichum juniperinum*
14.	Lichen	*Chrysothrix candelaris*
15.	Lichen	*Chrysothrix chlorina*
16.	Lichen	*Cladonia coniocraea*
17.	Lichen	*Dermatocarpon vellereum*
18.	Lichen	*Graphis scripta*
19.	Lichen	*Lecanora chlarotera*
20.	Lichen	*Parmotrema andinum*
21.	Lichen	*Parmotrema austrosinense*
22.	Lichen	*Parmotrema praesorediosum*
23.	Lichen	*Phaeophyscia hispidula*
24.	Lichen	*Physcia crispa*
35.	Lichen	*Physcia dubia*
25.	Lichen	*Physcia integrata*
26.	Pteridophyte	*Adiantum capillusveneris*
27.	Pteridophyte	*Adiantum incisum*
28.	Pteridophyte	*Adiantum phillipense*
29.	Pteridophyte	*Athyrium schimperi*
30.	Pteridophyte	*Cheilanthes anceps*
31.	Pteridophyte	*Diplazium maximum*
32.	Pteridophyte	*Dryopteris cochleata*
33.	Pteridophyte	*Dryopteris wallichiana*
34.	Pteridophyte	*Equisetum diffusum*
35.	Pteridophyte	*Equisetum ramosissimum*
36.	Pteridophyte	*Lygodium japonicum*
37.	Pteridophyte	*Marselia minuta*
38.	Pteridophyte	*Polystichum discretum*
39.	Pteridophyte	*Pteris cretica*
40.	Pteridophyte	*Pteris vittata*
41.	Pteridophyte	*Selaginella bryopteris*
42.	Pteridophyte	*Selaginella chrysocaulos*
43.	Pteridophyte	*Thelypteris dentata*

Conclusion

A total of about forty-three species of cryptogams were identified on the basis of botanical description. Many species of cryptogams are used for the treatment of various diseases like fever, asthma, typhoid, stomach ulcer etc. Cryptogams are used as medicine in the form of paste, powder and extract. The documentation, preservation and recording of medicinally important cryptogam's species should be the necessary step for conservation of cryptogam species. The traditional knowledge associated with them must pass to future generation. The taxa are deposited in Botany Department, D.P. VIPRA College, Bilaspur (C.G.).

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