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BIRJHORA MAHAVIDYALAYA, BONGAIGAON

Pancha Swahid Path, Barpara, PO- Bongaigaon, Assam PIN-783380
Website: <https://birjhoramahavidyalaya.in/> Email: birjhora1986@gmail.com



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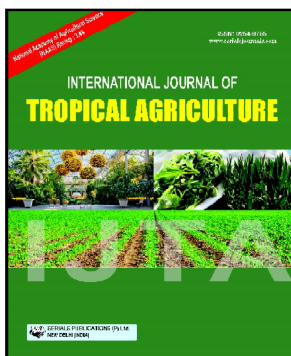


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Traditional Rice Varieties and their Future in Bongaigaon Area of Bongaigaon District, Assam, India

Ranu Roy

Associate Professor, Department of Botany, Birjhora Mahavidyalaya, Bongaigaon -783380, Assam

Abstract: With rapid population growth as well as increased demand of food, the farmers have to adopt new agricultural technology for greater production of crop including rice. A number of improved rice varieties with high productivity are now available in the market. These make the farmers much interested in cultivating the improved rice varieties rather than those of indigenous or traditional rice varieties with less productivity. High Yielding Variety (HYV)s has become more popular among the farmers. As a result cultivation of some traditional varieties has decreased in such a way that if care is not taken or conservation is not done timely, there is every possibilities for being lost of these varieties at any moment. With an aim to study the future of such traditional rice varieties and to know the popularities of HYVs a field study was done for seven consecutive years from 2010-2017 in different localities of Bongaigaon area of Bongaigaon district. Farmers of Bongaigaon area also prefer growing the HYVs, throwing off the traditional variety out of the market as well as existence. As a result a number of traditional varieties of this region are going to be extinct. For conservation of these varieties along with establishment of seed bank everything should be done to encourage the farmers to carry on cultivation of these traditional varieties too along with different HYVs.

Key Words: Bongaigaon, farmer, High Yielding Variety (HYV), traditional variety.

INTRODUCTION

Rice is the staple food of nearly three-fourths of the population in India. As this crop plays a vital role in our National Food Security and is a means of livelihood for millions of households, the slogan

“Rice for life” is most appropriate “as discussed by Panda (3)”. Rice is the principal crop of northeastern region of India, where a considerable range of diversity exists. The germplasm collection has also unfolded the occurrence of large number of rice

Suitability of Drinking Water in Schools of Bengtol Block of Chirang District of Assam, India

Dr. Ranu Roy

Department of Botany

Birjhora Mahavidyalaya, Bongaigaon, India

Abstract— Drinking water is one of the basic needs of life. Most drinking water in all parts is obtained from surface and ground water sources, both of which are being contaminated due to several reasons. Most of the diseases and deaths in the developing countries are caused due to consumption of contaminated water. Water samples from 20 different schools of Bengtol block of Chirang district were studied to assess the suitability of drinking water. A total of 19 different physico-chemical parameters including heavy metals and microbial organisms were studied. Sixty percent water samples were found to be acidic having pH value below 6.5. Thirty five percent of the water samples were found to be more turbid exceeding the permissible limit. In case of iron, 40% water samples had it in its desirable limit but in 25% water samples it was well above the permissible limit. Though in all water samples the heavy metals i.e., Arsenic and Chromium, were found to be below detection limit but Lead was detected in almost 50% water samples and in 20% it was above the permissible limit. Though in 45% water samples Cadmium was found to be below detection limit but in 55% water samples it was detected. Other parameters like TDS, TSS, Total Alkalinity, Calcium Hardness, Electrical Conductivity, Chloride, Sulphate, Fluoride were within the permissible limit.

Key words: Bengtol, Chirang, Drinking water

I. INTRODUCTION

Drinking water is one of the basic needs of life and essential for survival. Still more than one billion people all over the world do not have ready access to an adequate and safe water supply and more than 800 million of those unsaved live in rural areas (Kumar and Puri, 2012). Most drinking water in all parts is obtained from surface or ground water sources; but sadly, both of which can be contaminated. This contamination may come from industrial or waste water treatment plant discharges, agricultural runoff and antiquated infrastructure, severe contamination of soil from hazardous waste dumps and leakage of underground storage tanks. Because of this potential level of contamination, both surface water and underground water usually requires aggressive and sophisticated treatment prior to consumption as the quality of drinking water plays an important role in maintaining sound health. Safe water is one which should be free from faecal contamination and conform to the limits of chemical contamination (Murugesan et al. 2004). Many waterborne diseases like typhoid, dysentery, cholera etc. are caused due to consumption of contaminated water.

Chirang with a population of 481,818 (2011 census) is a relatively new district in the BTC area of the state Assam. It is situated in 26°28' N & 26°54' N longitudes and 89°42' E & 90°06' E latitudes. Out of 6 blocks in Chirang, Bengtol is one of a rural block having 86 villages. From the educational point of view this block is still in poor condition. It has only 41 schools including LPS, ME, MV and HS school in its cluster. Safe drinking water is most important and a very basic provision for school children and even after Government, trying its best to provide safe water; in most schools it is yet to be provided by the civic authority. In most of the schools (mainly LP and JB school), students are using water from hand-pump or tara-pump directly without any treatment. These hand-pump or tara-pumps are the only water source in these regions. Therefore, giving emphasis on the students' health, a study was carried out on the condition of drinking water in LP Schools of the Bengtol block of Chirang district for a period of one year from December 2014 to December 2015.

II. MATERIALS & METHODS

A total of 20 LP schools from Bengtol block had been selected randomly for the study. Two drinking water samples from each of the 20 schools (denoted by S1 to S20, Table 1) were collected in 4 different seasons. Thus, all together 8 samples per school were collected for a period of one year from December 2014 to December 2015. Water samples were collected in clean plastic bottles and stored at 4°C for further analysis. Various physico-chemical characteristics such as pH, Turbidity, Total Dissolved Solids (TDS), Total Suspended Solids (TSS), Total Alkalinity, Calcium Hardness, Total Hardness, Electrical Conductivity (EC), Chloride, Fluoride, Sulphate (SO₄) and heavy metals viz. Arsenic (As), Lead (Pb), Chromium (Cr), Cadmium (Cd), and Sodium (Na), Iron (Fe) were studied following standard analytical methods (APHA 1995, NEERI 1986, 1988).

For microbial analysis Most Probable Number (MPN) of both *Coliforms* and *E.coli* were determined by using MacConkey's broth using multiple tube fermentation technique at 37°C for 48 hours. MPN was expressed in terms of index/100ml by using standard tables (APHA 1995).

III. RESULTS & DISCUSSION

Table-1 and table- 2 shows the different physico-chemical parameters and heavy metal contamination respectively. Table- 3 represents the bacterial contamination of water samples collected seasonally.

Sampling station	pH	Turbidity (NTU)	TDS	TSS	Total alkalinity	Ca hardness	Total hardness	EC $\mu\text{mho/}$	Chloride	SO ₄ ⁺⁺	F
S1	5.6	5.0	96	4	5	11	48	43	47	7.0	BDL
S2	6.0	5.2	11.8	2	32	22	42	106	10	4.5	BDL
S3	5.1	2.2	112	1	30	14	22	301	28	3.0	BDL

Diversity and some phenotypic characters of *Joha rice (Oryza sativa L.)* varieties cultivated in Bongaigaon district of Assam, India

Ranu Roy

Department of Botany, Birjhora Mahavidyalaya, Bongaigaon, Assam, 783380
E-mail: ranuroy_bng@rediffmail.com

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Abstract

Farmers in different localities of Bongaigaon area still cultivate traditional rice varieties in their farming system. Besides different rice varieties, the farmers also cultivate Joha rice, commonly known as 'Bhog dhan'. To see the diversity of Joha rice and its phenotypic characters, a field study was made. Seven different Joha rice varieties were seen which are being cultivated in different localities. In the present study, 16 different phenotypic characters were studied along with protein concentration. It was found that though all the seven varieties of Joha rice were more or less similar but each variety showed some unique characteristics which may be utilized for identification of different varieties.

Key words: Joha rice, Bongaigaon, Phenotypic characters

INTRODUCTION

The North-east India, including Assam, is recognized as a centre of the origin of rice and is endowed with exceptionally rich rice diversity. The indigenous germplasm of North-east India represents a wealth of valuable gene systems (Sharma *et al.* 1971). Variation in ecological conditions, ethnic diversity, diverse cultural practices and different quality preferences contribute to the diversity present in different types of rice. Assam is particularly rich in rice germplasm. About 70 % of total agricultural land of Assam is used for rice cultivation (Das *et al.* 2010). The four categories of rice classified on the basis of the amount of rainfall and zonal distribution are *Ahu* rice (autumn rice), *Sali* rice (winter rice), *Boro* rice (summer rice), and *Bao* rice (deep water rice). Among different categories of rice, scented rice enjoys a special demand and are highly valued. The North-eastern Region is also home to a large number of aromatic and other good quality rice varieties (Choudhury *et al.* 2013). This scented or aromatic rice of Assam is a unique class under *Sali* rice traditionally known as '*Joha*'. The characteristic odor in scented rice is due to a compound named 2-acetyl-1-pyrroline (Buttery *et al.* 1982). Due to this aroma this class of rice has high demand in domestic market and is used mainly for preparation of special dishes like *kheer* and *pulao*. It cooks non-sticky and tasty meals. Aroma of *Joha* rice is as appreciable as for the goodness of *Basmati* rice.

Joha rice is known for its super fine grain, good cooking qualities and excellent deliciousness. The yield from traditional varieties are low but farmers still continue to cultivate, even as they adopt newer varieties, because compared to modern varieties the yield from traditional varieties are reliable and prevents the risk of yield failure (Harwood 1979). The yield of *Joha* rice is also low.

Bongaigaon (26°28'22" N and 89°9'62" E) is an agriculturally rich district of Assam, India (Figure 1). The average annual rainfall is about 4632.2 mm (BGR, IOCL 2010). The large

Solitary kinetic Alfvén waves in a dense electron–positron–ion plasma with degenerate electrons and positrons

Monzurul K AHMED and Om P SAH

Department of Physics, Birjhora Mahavidyalaya, Bongaigaon-783380, Assam, India

E-mail: mnzur_27@rediffmail.com

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Abstract

Through the use of a reductive perturbation technique, solitary kinetic Alfvén waves (KAWs) are investigated in a low but finite β (particle-to-magnetic pressure ratio) dense electron–positron–ion plasma where electrons and positrons are degenerate. The degenerate plasma model considered here permits the existence of sub-Alfvénic compressive solitary KAWs. The influence of r (equilibrium positron-to-ion density ratio), σ_F (electron-to-positron Fermi temperature ratio), β and obliqueness parameter I_z on various characteristics of solitary KAWs are examined through numerical plots. We have shown that there exists a critical value of I_z at which a soliton width attains its maximum value which decreases with an increase in r and σ_F . It is also found that solitons with a higher energy propagate more obliquely in the direction of an ambient magnetic field. The results of the present investigation may be useful for understanding low frequency nonlinear electromagnetic wave propagation in magnetized electron–positron–ion plasmas in dense stars. Specifically, the relevance of our investigation to a pulsar magnetosphere is emphasized.

Keywords: kinetic Alfvén waves, solitons, electron–positron–ion plasma, degenerate plasma, Thomas–Fermi approximation

(Some figures may appear in colour only in the online journal)

1. Introduction

An electron–positron (e–p) plasma is made up of constituents which are, being electrons and positrons, ubiquitous in nature, such as in the solar atmosphere [1, 2], dense celestial objects like neutron stars and white dwarfs [3], near the polar cap of pulsars [4], the active galactic nuclei [5], the early universe [6], etc. However, most astrophysical plasmas are believed to contain ions in addition to the usual electrons and positrons [7]. Ions originate either inside the core of a compact star or from outside through a process of accretion [7]. In laboratory experiments, a two-component electron–ion (e–i) plasma can behave as a three-component e–p–i plasma in which positrons are injected to probe particle transport in Tokamak plasmas [8]. During the last few decades, a great deal of work has been done on the linear and nonlinear behavior of unmagnetized as well as magnetized e–p–i plasmas in order to understand the basic properties of waves excited there and to explain the different aspects of

astrophysical environments where such plasmas exist. Among these works, investigations of nonlinear structures of kinetic Alfvén waves (KAWs) in e–p–i plasmas have also attracted much attention [9–15]. KAWs are dispersive Alfvén waves and can be excited in plasmas for $Q \ll \beta \ll 1$ (β is the particle to magnetic pressure ratio; Q is the electron-to-ion mass ratio) when shear Alfvén waves, modified by perpendicular wave length effects, propagate obliquely in the direction of an ambient magnetic field. The dispersive nature of Alfvén waves balanced with nonlinear steepening may lead to the formation of nonlinear structures like solitons and double layers. The study of nonlinear structures of dispersive Alfvén waves in magnetized plasmas holds great significance because they can play an important role in explaining electromagnetic fluctuations, particle accelerations and solitary structures occurring in space, astrophysical and laboratory plasmas [16]. In the context of different space and astrophysical situations, a number articles [17–20] on dispersive Alfvén waves have been published recently.

High Electrical Conductivity, Thermal Stability and Gas Sensing Studies on Silver-Polyaniline Nanocomposite

Sanjib Baglari^{1*} and D. Sarkar²

^{1,2}Department of Physics, Gauhati University, Guwahati, India

*Corresponding author Email: sanjibbaglari@gmail.com

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Abstract- This paper reports the synthesis of Polyaniline-Silver (Pani/Ag) nanocomposites by an in-situ chemical polymerization method using ammonium persulphate (APS) as an oxidizing agent. The prepared Pani/Ag nanocomposite were characterized by XRD, EDAX, FESEM, TEM, TGA, UV-vis spectroscopy. The XRD patterns indicated that the crystalline phase of Ag is cubic with average crystallite size of 26 nm. UV-vis spectroscopy analysis indicated that the Ag nanoparticles have some effect on the Pani matrix. The TGA result showed that thermal stability of the nanocomposite was increased after incorporation of Ag nanoparticles. Pani/Ag nanocomposite showed superior DC conductivity when compared to pure Pani. The Pani/Ag nanocomposite also showed excellent chloroform sensing behaviour than pure Pani, which might be due to increase in the surface area of Pani in the presence of Ag nanoparticles.

Keywords: Polyaniline, Nanocomposite, DC Conductivity, Gas Sensing, Thermal Stability, UV Vis.

I. INTRODUCTION

Conducting polymer exhibit both conducting and semi conducting properties. Recently, conducting polymers has received much attentions in research because of their promising optical properties, controllable chemical and electrochemical properties, easy processability, ease of synthesis, inexpensive monomer and environmental stability [1-4]. Among the conducting polymers, polyaniline (PANI) has been studied extensively worldwide for its various applications in the design of sensor [5-6], optoelectronics device [7], secondary batteries, fuel cell [8], super capacitor [9] and catalytic properties [10].

In recent years, composites of polyaniline with different metal oxide for gas sensing applications has received great attention worldwide because of its higher sensitivity, reversible response, quick response time and inexpensive monomer [11]. It has been reported that incorporation of metal nanoparticle to polyaniline exhibits excellent sensing properties with large effective surface area for chemical interaction and hence improve catalytic efficiency [12-13]. It was also reported that incorporation of metal nanoparticle effectively increased electrical, optical and dielectric properties of the polyaniline composite [14-15]. Satish Sharma et al [16] reported that the chemically synthesized Copper/Polyaniline nanocomposite gas sensor exhibited higher sensitivity, faster response time and recovery rates to chloroform vapour than those of a pure PANI sensor.

Mudassir Hasan et al [17] showed that PANI/Au nanocomposite exhibited a better ammonia sensing and recovery response than pure PANI. Athawale et al [18] demonstrated the potential application of the PANI/Pd nanocomposite as a selective methanol sensor. They found that sensor characteristics such as the response time and long-term stability of the PANI/Pd nanocomposite sensor were superior to pure PANI sensor. Therefore, it is hopeful to obtain PANI/Ag nanocomposites would be a novel material in the area of gas sensor with excellent gas sensing behaviour. To the best of our knowledge, the PANI/Ag nanocomposite as chloroform sensing materials have not been reported elsewhere. Chloroform is released into the environment through several anthropogenic sources where industrial sites using it in the production line. Exposure to 50 ppm of chloroform can damage human health [19]. Therefore, the reliable and quick detection of chloroform gas is needed.

The aim of this study was to prepare a Polyaniline/Ag nanocomposite for chloroform gas sensing. The combination of PANI with silver nanoparticle composite is expected to produce synergism between the constituents, which could effectively improve sensitivity and recovery behaviour for chloroform sensing application.

In this present work, PANI/Ag nanocomposites were prepared by an in-situ chemical polymerization method using APS as an oxidizing agent and hence explore the



Review Article

IMPACT OF PLANT GROWTH REGULATORS ON REVERSAL OF REPRODUCTIVE CHARACTER IN SOME CROPS: A REVIEW

NEELANJANA BARUAH^{*1} AND CHANDRA MOHAN SARMA²

¹Department of Botany, Birjhora Mahavidyalaya, Bongaigaon, 783380, Gauhati University, Guwahati, 781014, India

²Department of Botany, Gauhati University, Guwahati, 781014, India

*Corresponding Author: Email - neelanjanabaruah@gmail.com

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Abstract: The Plant Growth Regulators are chemical compounds which can regulate some important metabolic activities in plants. They influence growth and development of plants which is also accompanied by increase in yield, quality of product, flowering and some other parameter. Application of PGR in different concentrations on some economically important crops proved as beneficial. Application of Ethrel, CCC and GA₃ confirm an effect on reproductive character, more specifically in their reversal from male to female. The growth retardant and promoter are equally significant in their performance in some fruit yielding crops.

Keywords: Ethrel, CCC, GA₃, Reproductive character

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Introduction

Plant Growth Regulators are substances which can manipulate growth and development in plants. Many workers from different corners of the world are now concentrating their field of works on higher productivity of agricultural and horticultural crops by using Plant Growth Regulators (PGRs). PGRs can influence plant height, leaf number, leaf area index, dry mass, chlorophyll content, photosynthetic parameters, seed yield, oil yield, nutritional status etc. During the last four decades or more numerous experiments have been done with the application of growth retarding chemicals. There are a lot of reports on extensive works done with conventional retardants like CCC, SADH, AMO 1618, 2, 4-DNC, Phosphon-D etc. but work with dikegulac is rather scanty in the literature. Bocion, Sachs, Purohit, Bhattacharjee and some others contributed variously working on this less explored retardant. The spectacular achievements in sex modification of plants have been reported from several quarters by the application of auxins. It was demonstrated that [1] the early application of IAA and NAA increased the number of female flowers of cucumber (*Cucumis sativus* L.) and pumpkin (*Cucurbita pepo*) at the expense of male flowers. In the squash plant male flowers are produced near the base and female flowers at about 20th node, but treatment with NAA induced female flowers to be formed near the 9th node. Further striking examples were presented by [2] in maize and hemp. In maize treatment with NAA during the period of inflorescence differentiation induced the formation of hermaphrodite or female flowers in the normally wholly male terminal inflorescences [3]. In the dioecious plant hemp (*Cannabis sativa*) surprisingly enough the experiment resulted in converting the male plant to female plant by treatment with NAA in lanoline [4]. The work of [5] confirmed the effect of ethrel and CCC in reversal of reproductive character in *Secium edule* L. which lead to greater yield. They reported that ethrel at 250 µg/ml and CCC at 250 µg/ml were the best treatments for production of maximum female flower in *S.edule* L. The interaction of ethrel and CCC with growth promoter GA₃ exhibited further better result [6]. The aim of the current investigation is to find out the effect of PGRs on plants with reference to reversal of reproductive character.

Effect of PGRs on Reproductive Character

Effect of Ethrel (2-Chloroethyl Phosphonic Acid) on Reproductive Character
General recognition of ethylene, a simple hydrocarbon gas (C₂H₄), as a plant hormone has come about only relatively recently, although it has been known for more than three-fourths of a century that the gas has numerous interesting effects on plant growth and development. It was suggested that 'with very sensitive instruments and very careful technique, it has become possible to show that ethylene is an endogenous growth regulator in plants [7]. Ethylene can regulate ripening, senescence, abscission, epinasty, swelling and elongation, hypertrophy, dormancy, hook closure, leaf expansion, flower induction, sex expression and exudation [8]. Ethylene is a gaseous effector with a very simple structure is patented as "Ethrel" and given the trivial name "Ethepon" the compound is 2-chloroethyl phosphonic acid (CEPA). Ethepon decomposes spontaneously in aqueous solution and in tissues to yield ethylene. The work of [9] observed that ethepon is a potentially effective ripening agent for Saskatoon fruits. The study of [10] revealed the potentiality of using ethepon as a tillering agent for Cardamom. The influence of Ethrel on sex expression has been studied by several investigators. The work on *Luffa cylindrica* L. to find out the effect of Ethrel on sex expression as well as on endogenous auxin content [11]. He found that application of Ethrel caused a shift towards femaleness. Ethrel increased female flowers but hastened the appearance of the first female flowers compared to the control. The effect of Ethrel delayed the appearance of the first male flower along with increase of total number of male flower and as a result the sex ratio is decreased from 12.1:1 to 6.8:1. Application of ethrel caused a shift towards femaleness in other cucurbits also [12], [13]. Increase in female flowers in smooth gourd, snake gourd and bottle gourd due to the application of 2-chloroethyl phosphonic acid were obtained by [14]. The work of [15] revealed that ethrel 100 ppm delayed the appearance of first male and female flowers in bitter melon (*Momordica charantia* L.). Ethrel at 100 ppm induced the first staminate and pistillate flower at the lowest node at 6.5 and 9.5 respectively. According to [15] ethrel decreased the endogenous level of auxins which may be responsible for the late induction of female flowers but produced them at the lowest nodes. The results observed by [16] that ethrel was effective in delaying the male phase in muskmelon.



Research Article

SPECTROPHOTOMETRIC ESTIMATION OF PIGMENT CONTENT IN PGRs APPLIED PLANTS OF *CUCUMIS SATIVUS* L.

BARUAH N.* AND SHARMA B.J.

¹Birjhora Mahavidyalaya, Bongaigaon, 783380, Gauhati University, Guwahati, 781014, Assam, India

²North East Research Institute in Science and Technology, Nirjuli, 791109, Arunachal Pradesh, India

*Corresponding Author: Email - neelanjanabaruah@gmail.com

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Abstract: A field experiment was carried out to determine the effect of Plant Growth Regulators on pigment content in *Cucumis sativus* L. Foliar spray of ethrel, CCC and GA₃ at 50, 100, 250 and 1000 µg/ml were applied to the seedlings of *C. sativus* L. which were grown in a separate experimental plot. Pigment content was estimated by UV spectrophotometric method. GA₃ 250µg/ml, Ethrel 100µg/ml and CCC 250 µg/ml were recorded as optimum for production of maximum pigment contents in *Cucumis sativus* L. The experiment established that application of Plant Growth Regulators has an immense influence on *C. sativus* L to boost up pigment contents which is correlated with enhanced fruit production.

Keywords: CCC, Ethrel, GA₃, *Cucumis sativus* L

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Introduction

In the magnificent process photosynthesis, the chlorophyll of green plants can harvest solar radiation and converted it into chemical energy. The process, thus, depends upon harvesting of the solar energy by these green pigments. Chlorophyll 'a' plays an important primary role in the photosynthetic process. The status of chlorophyll pigments in the leaf tissue is thus determining the overall photosynthetic efficiency of the plants. The photosynthetic efficiency directly influences on growth, development and yield of crops. The carotenoids, are organic pigments and act as passive light filters that would reduce light intercepted by chlorophyll [1] and the protection from reactive oxygen species [2]. Some carotenoids serve as precursor for vitamin A, which plays an essential role in human and animal diets and as antioxidants and also in reducing the risk of certain forms of cancer. Increase in productivity of agricultural as well as horticultural crops is the main objective of plant breeders. During the last four decades many scientists have been concentrating their works in this field by applying Plant Growth Regulators on different plants. There are a lot of reports on extensive works done with conventional retardants like CCC, SADH, AMO 1618, 2, 4-DNC, Phosphone-D etc. Growth retardants have been shown to increase femaleness in many cases [3]. Early flowering due to growth retardants was also reported by Stuart [4] and [5]. Several workers have reported that Plant Growth Regulators imparts a favourable effect on chlorophyll content. It was reported [6] that, GA, CCC, methionine and cysteine applications can significantly increase chlorophyll content in onion varieties. Plant Growth Regulators have an immense influence in the enhancement of pigment contents in Squash [7]. The chief objective of the present work was to study the effects of different plant growth regulators GA₃, Ethrel and CCC on the pigment contents of *Cucumis sativus* L.

Materials and Method

The field experiment was conducted at Bongaigaon, Assam, to find out the effect of PGRs on pigment contents of Cucumber (*Cucumis sativus* L.). The crop is very popular not only in northeast but also in all parts of the country.

Experimental plots were well prepared by mixing organic manure before sowing of seeds. The experimental sites received free sunshine. The soil of the field is sandy loam with pH value 5.10.

The healthy seeds of cucumber were collected from the Assam Seed Corporation, Guwahati. Two experimental plots were got ready with six treatments of PGRs including an untreated control. The PGRs selected for experimentation were growth promoter GA₃, and growth retardant Ethrel and CCC. GA₃ prepared in four concentrations namely 50 µg/ml, 100 µg/ml, 250 µg/ml and 1000 µg/ml and one control (distl.water treatment). The same range of concentration was prepared for Ethrel and CCC. The different concentrations of PGRs were applied to the seedlings grown in separate field by foliar spraying of the solutions. The foliar application was carried out with a hand sprayer fitted with a fine nozzle so as to facilitate uniform wetting of leaves with about 20 ml/plant. Each treatment was replicated three times. The leaves from each replication were collected and subjected to estimation of pigments by UV Spectrophotometric method.

Chlorophyll is extracted in 80% acetone and the absorbance is measured at 645 and 663 nm against the solvent blank in a spectrophotometer. The amount of chlorophyll (mg/g) is calculated out by using absorption coefficients. The concentrations of the different chlorophylls were calculated as per Parkin's method as elucidated by Nayek *et al.* (2014).

To determine the carotenoids 100 mg leaf tissue is extracted in 80% acetone and the absorbance is measured at 480 nm in UV spectrophotometer.

The concentrations of the carotenoids were calculated as follows:

$$\text{Amount of carotenoids in 100 mg plant tissue} = 4 \times \text{OD value} \times \frac{\text{Total volume of sample}}{\text{weight of fresh plant tissue}}$$

The data recorded was statistically analysed and presented in a tabular form.

Results and Discussion

The data revealed that, application of PGRs exhibited a considerable variation in pigment content of cucumber.

A Preliminary Survey on the Status of Drinking Water Quality in the Lower Primary Schools in Bongaigaon Block of Bongaigaon District of Assam

Dr. Ranu Roy¹ Alokesh Barman² Dhrubajyoti Mandal³

^{1,2,3}Department of Botany

^{1,2,3}Birjhora Mahavidyalaya, Bongaigaon, India

Abstract— The present study conducted during the months of January to July, 2019 had been aimed at assessing and comparing the drinking water quality with WHO (World Health Organisation) standards in the lower primary schools of different clusters of Bongaigaon block in Bongaigaon district of Assam. Out of 271 lower primary schools of this block; 50% of the schools were selected randomly for collection of water samples to assess eleven parameters – pH, Turbidity, Iron Content, Nitrate, Chloride, Hardness, Fluoride, Arsenic, Manganese, Residual Chlorine and Bacterial content. Out of the 136 schools selected at random; the primary water source for 33, 46, 47 and 10 number of schools is Deep Tube Well, Hand Tube Well, Tara Hand Pump and Ring Well respectively. In all these water samples pH, Chloride, Hardness, Fluoride and residual Chlorine were found within the permissible limit but the other parameters-Turbidity, Iron, Nitrate, Arsenic, Manganese and Bacterial content were found beyond the permissible limit in some water sample. The paper indulges in deep findings and analysis of these water samples and has attempted to display the results as appropriately as possible.

Keywords: Bongaigaon, Contamination, Drinking Water, Primary School

I. INTRODUCTION

Safe drinking water is the basic need for good health and is also the basic right of humans. Unfortunately in developing countries the quality of drinking water is continuously being contaminated due to high growth in population, expansion of industries, careless waste water and chemical effluents disposal into canals and other water sources (Mohsin et al., 2013). Safe water should be free from faecal contamination and conform to the limits of chemical contamination (Murugesan et al., 2004). Many waterborne diseases like typhoid, dysentery, cholera etc. are caused due to consumption of contaminated water.

Schools play an important role in ensuring free access to water and promoting a regular water intake throughout the day for promoting a healthy lifestyle and learning environment. If children do not drink enough water during the day, it might result in dehydration and may lead to severe health issues such as headaches, irritability, poor physical performance and difficulty learning. Therefore provision of safe drinking water in schools has become so important to boost positive outcomes both health-wise and academic-wise.

There is a Supreme Court direction to all the responsible state and central government bodies to provide basic infrastructure for safe drinking water, clean toilets and boundary walls in primary and secondary government – run schools. In Assam, the state's Public Health Engineering department, Education department and Sarba Shiksha

Abhijan has taken up the responsibility to provide these amenities in schools. According to a District Information System for Education (DISE) report, there are 47,792 lower primary and upper primary government and provincialized schools in Assam. Sadly, 5,445 schools out of all do not have any drinking water facility at all. Some 7,266 others had such facilities once, but gone defunct now (www.sentinelassam.com 2016).

Bongaigaon (26°28' N and 89°96' E), the District Headquarters of Bongaigaon district of Assam has a population of 732,639 (2011 census). Out of five, Bongaigaon is a large block covering both urban and village areas. It has 14 clusters with 271 numbers of primary schools. As safe drinking water is the most important and a very basic amenity for the schools to offer to its students so a field study was conducted during the period of January 2019 to July 2019 to see whether the students of primary schools of this block are getting sufficient safe drinking water.

II. MATERIALS AND METHODS

Out of 271 lower primary schools a total of 136 schools from Bongaigaon block had been selected randomly for the study. Two drinking water samples from each of these 136 schools (denoted by S1 to S136) were collected during the period of January 2019 to July 2019. Water samples were collected in clean plastic bottles and stored at 4°C for further analysis. Various physico-chemical parameters including heavy metals such as pH, Turbidity, Iron content, Nitrate, Chloride, Hardness, Fluoride, Arsenic (As), Manganese (Mn), Residual chlorine and Bacterial contents were studied following standard analytical methods (APHA 1995, NEERI 1986, 1988). For Bacterial analysis Most Probable Number (MPN) of both Coliforms and E.coli were determined by using MacConkey's broth using multiple tube fermentation technique at 37°C for 48 hours. MPN was expressed in terms of index/100ml by using standard tables (APHA 1995).

III. RESULTS AND DISCUSSION

Out of the 136 schools selected at random; the primary water sources were Deep Tube Well, Hand Tube Well, Tara Hand Pump and Ring Well and their numbers are 33, 46, 47 and 10 respectively. Table-1, table-2, table-3 and table-4 show the different physico-chemical properties and bacterial contamination of water samples collected from Deep Tube Well (DTW), Hand Tube Well (HTW), Tara Hand Pump (THP) and Ring Well (RW) respectively.

The desirable limit of pH is 6.5-8.5 (WHO, 1997). Low pH causes corrosion and gives a metallic taste while high pH gives bitter/soda taste. In the studied water samples pH ranged from 6.9 to 7.26, 6.85 to 7.29, 6.89 to 7.66 and 6.91 to 7.22 in Deep Tube Well, Hand Tube Well, Tara Hand

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Soret effect on transient hydromagnetic oscillatory channel flow with slip condition in presence of heat source

Sheikh Jahirul Islam*, Chakraborty Shyamatra**, Sah Om Prakash***

*Research Scholar, Department of Physics, Gauhati University, Guwahati, Assam

**UGC-HRDC, Gauhati University, Assam, India

***Birjhora Mahavidyalaya, Bongaigaon, Assam, India

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Abstract

The problem of an oscillatory MHD mass transfer flow through a channel filled in a porous medium in presence of heat source, chemical reaction and thermal diffusion has been discussed. Fluid slip is imposed at the lower wall and the uniform magnetic field is assumed to be imposed transversely to the direction of the flow. The resultant governing equations are solved in closed form. The expressions for the velocity field, temperature field, concentration field, the coefficient of Skin-friction at the walls in the direction of the flow and the coefficient of the heat and mass transfer in term of Nusselt Number and Sherwood Number at the walls are obtained in non-dimensional form. The effects of Velocity slip, Solutal Grashof Number, Schmidt Number, Hartmann Number, Soret Number, Heat source Parameter, Chemical reaction parameter, and Radiation parameter on the flow and transport characteristics are studied through graphs and the results are physically interpreted for conclusions.

Keywords

Magnetohydrodynamic, Oscillatory-channel-Flow, Slip Condition, Heat Source, Skin-friction.

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pH-dependent structure, pattern and hysteresis behaviour of lipid (DMPA)-protein (BSA) monolayer complex

Bijay K. Sah, Kaushik Das, Sarathi Kundu  

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Abstract

Understanding lipid-protein interactions in model membranes is a challenging task. Limited information exist to-date regarding the relative influence of hydrophobic and electrostatic forces on the organization of proteins inside model membranes, while these forces determine the structure of lipid-protein complexes. We measured the surface pressure (π) - molecular area (A) isotherm cycles of protein (BSA) – lipid (DMPA) mixed monolayers below and above the isoelectric point of BSA (≈ 4.8). At $\text{pH} \approx 4.0$, below the isoelectric point, BSA is positively charged, and exposes few hydrophobic groups at its surface, compression-decompression isotherms show a nearly reversible hysteresis. At $\text{pH} \approx 7.0$, above the isoelectric point, BSA is negatively charged and more hydrophobic. At this pH, compression-decompression isotherms show an irreversible hysteresis. This behaviour indicates that the deformation of BSA molecules under pressure is reversible below the isoelectric point, while it becomes irreversible above it. X-ray reflectivity studies for protein-lipid mixed monolayers show that BSA molecules move from the zone close to water and near the lipid polar heads toward the zone occupied by their hydrocarbon tails s when surface pressure increases. Mostly the surface pressure in combinations with hydrophobic and electrostatic interactions is responsible for such structural modifications.



Chemical Physics Letters

Volume 754, September 2020, 137774

Research paper

Chloroaurate ions below organic monolayers: Competitive accumulation and gold nanocrystal growth

Suresh Kumar Soni^{a, b}, Kaushik Das^a, Ashim Chandra Bhowal^a, Raktim J. Sarmah^a,
Philippe Fontaine^c, Sarathi Kundu^a  

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Highlights

- Gold nanocrystals form below octadecylamine (ODA) and octadecanethiol (ODT) monolayers.
- Crystalline gold grows with time as obtained from Au (1 1 1) peak intensity.
- Amorphous gold and chlorine information are obtained from Au M and Cl K_α fluorescence intensities.
- Gold accumulation is less than the chlorine for ODA but is opposite for ODT.

Abstract

Peliosanthes nagalandensis and *P. tobuensis* (Asparagaceae: Nolinoideae)—two new species from Northeastern India



NRIPOMO ODYUO^{1,5}, DILIP KR. ROY^{2,6} *, RIKERTRE LYTAN^{1,7}, NORIYUKI TANAKA^{3,8} & ASHIHO A. MAO^{4,9}



¹ Botanical Survey of India, Eastern Regional Centre, Lower New Colony, Laitumkhrah, Shillong–793 003, Meghalaya, India.



² Department of Botany, Birjhora Mahavidyalaya (Degree Science College), Bongaigaon–783 380, Assam, India.



³ 98-11 Otsuka, Hachioji, Tokyo, 192–0352 Japan.



⁴ Botanical Survey of India, Headquarter, Kolkata–700 064, West Bengal, India.


⁵  nodyuo@yahoo.com;  <https://orcid.org/0000-0001-9711-1150>

⁶  dilipbsierc@gmail.com;  <https://orcid.org/0000-0002-2400-5928>

⁷  angelriker@gmail.com;  <https://orcid.org/0000-0002-4182-8977>

⁸  yukinofude@yahoo.co.jp;  <https://orcid.org/0000-0003-4437-2909>

⁹  aamao2008@gmail.com;  <https://orcid.org/0000-0003-3835-6419>

*Author for correspondence:  dilipbsierc@gmail.com

Abstract

Two new species of Asparagaceae (subfamily Nolinoideae), *Peliosanthes nagalandensis* and *P. tobuensis*, from the state of Nagaland, Northeastern India, are described and illustrated. *P. nagalandensis* is most closely related to *P. arunachalensis*, but differs mainly by the longer leaf blades, distinctly sigmoid flowering stem with a shorter peduncle and longer raceme, more numerous green to purple flowers, distally finely denticulate-erose perianth segments, basally hamately recurved anthers and papillulate pistil with an apically slightly concave ovary and a columnar style. While *P. tobuensis* is close to *P. arunachalensis* and *P. sinica*, but differs mainly by the strongly incurved, entire corona and ovoid pistil with obtusely conical indistinct style.

Keywords: flora, south Asia, southeast Asia, taxonomy, monocots

Introduction

Peliosanthes Andrews (1810: 605) belongs to the subfamily Nolinoideae (Chase *et al.* 2009) of Asparagaceae (APG 2016). The genus includes approximately 70 species, distributed widely over subtropical and tropical Asia covering Nepal, Bhutan, India, Bangladesh, Myanmar, China, Cambodia, Laos, Vietnam, Taiwan, Thailand, Indonesia and Malaysia (Jessop 1976, Nguyen *et al.* 2017, Tanaka 2019, Nguyen 2020). Species diversity in the genus *Peliosanthes* is ambiguous in India. In Northeastern India, *Peliosanthes* includes 9 species (Roy *et al.* 2017a, b, Tanaka 2018, 2019, Taram *et al.* 2020): *P. arunachalensis* Roy *et al.* (2017a: 15), *P. griffithii* Baker (1879: 506), *P. khasiana* Tanaka (2018: 38), *P. ligniradicis* Tanaka *et al.* (2020: 44), *P. macrophylla* Wall. ex Baker (1879: 505), *P. macrostegia* Hance (1885: 328), *P. pumila* Tanaka (2019: 298), *P. subspicata* Tanaka (2018: 40) and *P. teta* Andrews (1810: t. 605), of which *P. arunachalensis* (Arunachal Pradesh), *P. khasiana* (Arunachal Pradesh and Meghalaya), *P. ligniradicis* (Arunachal Pradesh) and *P. pumila* (Meghalaya) are Indian endemics.

During field exploration in October 2016 and April 2017 to Tobu Town subdivision of Mon District, Nagaland, Northeastern India under Approved Research Programme “State flora of Nagaland” by the Botanical Survey of India, the authors (NO & DKR) encountered several unusual *Peliosanthes* plants growing in a mixed evergreen hilly terrain forest. Living plants were collected along with field notes and planted in the garden of Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya (India). While the plants were in flowering, the flowers were dissected, and detailed morphological study was carried out based on these living specimens. After consultation of the available literature (Andrews 1810, Baker 1879, Hance 1885, Hooker 1892, Jessop 1976, Wang & Tang 1978, Tanaka 1999, 2004a, b, 2018, 2019, Chen & Tamura 2000, Chen & Shui 2003, Averyanov 2011, Averyanov & Tanaka 2012, 2013,



Peliosanthes ashihoana and *Peliosanthes bipiniana* (Asparagaceae: Nolinoideae) - two new species from Northeastern India

Dilip Kumar ROY^{1,*}, Nripemo ODYUO², Noriyuki TANAKA³

1. Department of Botany, Birjhora Mahavidyalaya (Degree Science College), Bongaigaon - 783 380, Assam, India.

2. Botanical Survey of India, Eastern Regional Centre, Lower New Colony, Laitumkhrach, Shillong - 793 003, Meghalaya, India.

3. 98-11 Otsuka, Hachioji, Tokyo, 192-0352, Japan.

Corresponding author's email: dilipbsierc@gmail.com

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ABSTRACT: Two new species of *Peliosanthes* (Asparagaceae: subfamily Nolinoideae) from northeastern India are described and illustrated here as *P. ashihoana* and *P. bipiniana*.

KEY WORDS: flora, South and Southeast Asia, plant taxonomy, monocots.

INTRODUCTION

Peliosanthes Andrews (1810) belongs to the subfamily Nolinoideae (Chase *et al.*, 2009) of Asparagaceae (APG, 2016). The genus includes approximately 72 species, distributed widely over subtropical and tropical Asia covering Nepal, Bhutan, India, Bangladesh, Myanmar, China, Cambodia, Laos, Vietnam, Taiwan, Thailand, Indonesia and Malaysia (Jessop, 1976; Nguyen *et al.*, 2017, 2020; Tanaka, 2019; Odyuo *et al.*, 2020). In the course of the study of *Peliosanthes* specimens growing in the Garden of Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya (India) some unusual plants were found. These were overlooked during last few decades, however, when these were bloomed recently the flowers were dissected, and detailed morphological study was carried out based on the living specimens. Consultation of literature (Andrews, 1810; Baker, 1879; Hooker, 1892; Jessop, 1976; Wang and Tang, 1978; Tanaka, 1999, 2004a,b, 2018, 2019; Chen and Tamura, 2000; Chen and Shui, 2003; Averyanov, 2011; Averyanov and Tanaka, 2012, 2013; Tanaka *et al.*, 2013; Averyanov *et al.*, 2014, 2015, 2016; Vislobokov, 2016; Nguyen *et al.*, 2017, 2020; Roy *et al.*, 2017a,b; Vislobokov *et al.*, 2018; Nong *et al.*, 2019; Taram *et al.*, 2020; Odyuo *et al.*, 2020) revealed that these plants represent two new members of *Peliosanthes*. They are hence described and illustrated here, with detailed note on their taxonomic relationships.

TAXONOMIC TREATMENT

Peliosanthes ashihoana D.K. Roy, N. Odyuo & N. Tanaka, *sp. nov.*

Figs. 1 & 2

Close to *P. khasiana* N. Tanaka (2018), but differs mainly by the middle 3 longitudinal veins not distinctly converged in advance than the rest, shorter floriferous

stem with fewer flowers, basipetally blooming flowers, basally hexagonal corona not flat proximally and a shorter, more broadly dilated pyramidal style with three narrower wing-like carpellary ridges and three more strongly protruded intercarpellary wings.

Type: India. Type herbarium specimens prepared in 16 December 2019 from plants cultivated in Garden of Botanical Survey of India (Eastern Regional Centre, Meghalaya, East Khasi Hills, Shillong, Woodland Campus), D.K. Roy 128926 (holotype, ASSAM!; Isotype, ASSAM!).

Small acaulescent rhizomatous perennial herb. Rhizome ascending, subterete or nodose, 2–2.5 cm long, 0.5–0.7 mm in diam., apical part covered with remnants of scaly leaves. Roots fibrous, stout filiform, 3–4 mm in diam. Sheath leaves (cataphylls) a few at base of foliar petiole, unequal in length, imbricate, withering into dry fibrous remnants. Leaves 4–6 per plant (1 or 2 produced per year), basal, erect to obliquely spreading; petiole subterete, 4–9 cm long; blade elliptic, 8–15 cm long, 2–3 cm wide, base attenuate, apex acute; longitudinal veins 5–9, middle 3 non-converged in advance than the rest; cross veinlets numerous, more or less parallel, closely spaced. Floriferous stem(s) 1–2, axillary, including peduncle and inflorescence rachis 3–5 cm long, erect, much shorter than petioles. Peduncle slender, 1.5–2 cm long, 2–3 mm in diam., stout, with sterile bracts distally. Sterile bracts 2–3, lanceolate, 1–1.5 cm long, membranous along margins. Raceme 5–7 cm long, 4–6-flowered. Bracts 2 per flower, lanceolate, marginally membranous; outer larger, 4–5 mm long, equal to flowers, inner (bracteole) smaller, 3–4 mm long. Flowers basipetally blooming, solitary in bracteal axil, pedicellate, broadly open, 0.8–1.3 cm across, ascending to the rachis. Pedicel 2–3 mm long, ascending to rachis. Perianths 6-cleft distally; proximal connate part obconical, 1.5–2 mm long; segments broadly ovate-orbicular, with rounded apex, 3.5–4.5 × 4–5 mm, entire, non-crenulated-erose and/or non-erose-denticulate along

RESEARCH ARTICLE

Aglaonema manabendrae (Araceae: Areace): a new species from Northeastern India

Dilip Kumar Roy¹*, Nripemo Odyuo², Rikertre Lytan² and Ashiho A. Mao³

¹Department of Botany, Birjhora Mahavidyalaya (Degree Science College), Bongaigaon-783380, Assam, India

²Botanical Survey of India, Eastern Regional Centre, Lower New Colony, Laitumkhrah, Shillong-793 003, Meghalaya, India

³Botanical Survey of India, Headquarter, Kolkata-700 064, West Bengal, India

*Author for correspondence: dilipbsierc@gmail.com

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ABSTRACT

A new aroid species, *Aglaonema manabendrae* D.K. Roy, N. Odyuo, R. Lytan & A.A. Mao, from Northeastern India is described and illustrated. Taxonomic relationships with closely allied congeners are discussed, and revised keys of Indian *Aglaonema* are provided.

KEYWORDS

Plant diversity, Araceae, Northeastern India, New species, *Aglaonema*.

Introduction

The genus *Aglaonema* (Araceae; Tribe: Areace) was established by H.W. Schott during 1829. It is diversified with 23 species in Southeast Asia from northeastern India across southern China and Indonesia through New Guinea (Nicolson, 1969; Boyce *et al.*, 2012; Truong *et al.*, 2019). In India, *Aglaonema* is so far represented by 5 species namely *A. commutatum* Schott, *A. hookerianum* Schott, *A. nebulosum* N.E. Brown, *A. simplex* Blume and *A. tassai* H. Tag & A. Nangkar (Hooker, 1893; Nicolson, 1969; Karthikeyan *et al.*, 1989; Tag and Nangkar 2018; Singh *et al.*, 2018; Sasikala *et al.*, 2019; Govaerts, 2020).

In course of the study of unidentified plants growing in the Garden of Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya (India), the authors came across a very distinctive specimen of *Aglaonema* Schott. It was overlooked for many decades and its origin could not be ascertained (without collection tag and/or records) as different taxa of plants growing in the garden are introduced from diverse areas of northeastern India. Critical observations on available specimen and consultation with literature (Schott, 1829; Hooker, 1893; Engler, 1898; Nicolson, 1969; Karthikeyan *et al.*, 1989; Hay, 1998; Hara and Hassan 2005; Boyce *et al.*, 2012; Tag and Nangkar, 2018; Singh *et al.*, 2018; Sasikala *et al.*, 2019; Truong *et al.*, 2019) reveal it as a new species morphologically distinct from all its known congeners, which is described and illustrated here.

SYSTEMATIC ACCOUNTS

Aglaonema manabendrae D.K. Roy, N. Odyuo, R. Lytan & A.A. Mao, *sp. nov.* (Fig. 1).

Type: INDIA. 26 June 2020, D.K. Roy 128936 (holotype, ASSAM!; isotype, ASSAM!) prepared from the plant cultivated in Garden of Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya.

Diagnosis: The new species differs from its closely allied congeners, *Aglaonema ovatum* Engler in non-variegated leaf blades, spadix shorter

than spathe by 1.5–2.5 cm or more, staminodia present apically at staminate zone, pistillate flowers contiguous with functional staminate flowers and in obovate fruits and from *A. tassai* in pinkish spathe, spadix 1.5–2.5 cm or shorter than spathe and in staminate zone with several series of staminodia present apically.

Description: Perennial evergreen herb. Stem erect, 5–15 cm tall, 1.5–2 cm in diam., dark green, rarely branching, often rooting at nodes; internodes 0.5–1 cm long. Petiolar sheaths membranous, as long as half of the petiole length, early caducous. Leaves 1–3; petioles 8–23 cm long, ± equal to leaf-blades. Leaf-blades oblong-ovate to broadly ovate or oblong-lanceolate, 12–26 × 4.5–11.5 cm, dark green above, non-variegated, entire along margins; base equal, rounded; apex apiculate, 2–2.5 cm long; venation weakly differentiated into main 8–10 primary lateral veins on either side of midrib. Cataphylls 3, only subtending inflorescence, lanceolate, 3.5–5.5 cm long, 1–1.5 cm wide, apex apiculate. Inflorescence solitary, erect. Peduncle terete, 4–7 cm long, shorter than the subtending petiole. Spathe ovate, boat shaped, erect, 3–4.5 cm long, 1–1.5 cm wide, not differentiated into a tube and blade, convolute in lower 3–5 mm, longer than spadix by 1.5–2.5 cm, pinkish. Stipe absent (adnate to spathe). Spadix sessile, erect, cylindric, 2–3 cm long, 0.5–0.7 cm in diam., included in spathe. Pistillate zone 0.5–0.8 cm long, adnate to spathe; pistils 10–20, green, ovary 1.5–2 mm tall, 2.5–3 mm in diam., unilocular, 1-ovulate, style indistinct, stigma globose, 1.5 mm across, creamy. Staminate zone 0.5–0.7 cm in diam., 1–1.7 cm long including staminodial portion; stamens white or creamy, solitary but tightly compacted, opening in pairs at tops of the four sporangia. Staminodia arranged in 2–3 series apically at staminate zone, green, larger than functional staminate flowers, but resembling pistils. Fruits obovate, 0.5–1 cm long, 1-seeded, green when young. Seed obovate, solitary, almost as large as the fruit.

Phenology: Flowering in May–June and fruiting starts in July.



УДК 582.583+581.95(540)

***Stadiochilus* R. M. Sm. (Zingiberaceae: Zingibereae), a new generic record for India**

D. K. Roy^{1, 3*}, R. Lytan^{2, 4}, D. L. Biate^{2, 5}, N. Odyuo^{2, 6}

¹ Department of Botany, Birjhora Mahavidyalaya (Degree Science College), Bongaigaon, Assam, 783380, India

² Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya, 793003, India

³ E-mail: dilipsierc@gmail.com; ORCID iD: <https://orcid.org/0000-0002-2400-5928>

⁴ ORCID iD: <https://orcid.org/0000-0002-4182-8977>

⁵ ORCID iD: <https://orcid.org/0000-0002-8641-4436>

⁶ ORCID iD: <https://orcid.org/0000-0001-9711-1150>

*Corresponding author

Keywords: flora of India, floristic record, ginger, *Stadiochilus burmanicus*, Zingiberaceae.

Summary. The monotypic ginger genus *Stadiochilus* R. M. Sm. with *S. burmanicus* R. M. Sm. earlier known from Myanmar is reported here as a new record for India from the state of Nagaland. A detailed taxonomic description along with photographic illustrations of *S. burmanicus* is given. For conservation purposes, the IUCN status of this species has been evaluated as Endangered. The present field study ascertained that extraction of timber and non-timber forest products, forest fires and shifting cultivation are the major threats to the species in the locality in Nagaland reported here.

***Stadiochilus* R. M. Sm. (Zingiberaceae: Zingibereae) – новый род во флоре Индии**

Д. К. Рой¹, Р. Литан², Д. Л. Биате², Н. Одюо²

¹ Кафедра ботаники, Бирджхора Махавидьялая (Высший научный колледж), Бонгайгаон, Ассам, 783380, Индия

² Ботаническое обследование Индии, Восточный региональный центр, Шиллонг, Мегхалая, 793003, Индия

Ключевые слова: имбирные, флора Индии, флористическая находка, *Stadiochilus burmanicus*, Zingiberaceae.

Аннотация. Единственный вид рода *Stadiochilus* R. M. Sm. – *S. burmanicus* R. M. Sm. (сем. Имбирные – Zingiberaceae), ранее известный только из Мьянмы, приводится в качестве новинки для Индии из штата Нагаланд. Представлены подробное таксономическое описание и фотоиллюстрации *S. burmanicus*. Природоохранный статус этого вида по критериям МСОП оценивается как находящийся под угрозой исчезновения. Проведенное полевое исследование подтвердило, что вырубка леса и сбор недревесных лесных ресурсов, лесные пожары и подсечное земледелие являются основными факторами сокращения численности *S. burmanicus* в штате Нагаланд.



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Original Article

A comprehensive checklist of threatened plants of Meghalaya, Northeast India



Khrote-u Lasushe^a, Aabid Hussain Mir^{a,b}, Prem Prakash Singh^c, Kanhaiya Lal Chaudhary^d, Hiranjit Choudhury^e, Chaya Deori^f, Dilip Kumar Roy^g, Bikarma Singh^h, Krishna Upadhaya^{e,*}

^a Department of Environmental Studies, North-Eastern Hill University, Shillong, 793022, Meghalaya, India

^b Centre of Research for Development, University of Kashmir, Hazratbal Srinagar, 190006, India

^c Department of Botany, North-Eastern Hill University, Shillong, 793022, Meghalaya, India

^d Department of Botany, Lady Keane College, Shillong, 793001, Meghalaya, India

^e Department of Basic Sciences and Social Sciences, North-Eastern Hill University, Shillong, 793022, Meghalaya, India

^f Botanical Survey of India, Eastern Regional Centre, Shillong, 793003, Meghalaya, India

^g Department of Botany, Birjhora Mahavidyalaya, Bongaigaon, 783380, Assam, India

^h Council of Scientific and Industrial Research, Lucknow, 226001, Uttar Pradesh, India

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ABSTRACT

In this era of rapid biodiversity decline, creating a checklist of threatened taxa is a prerequisite as it appraises the conservationists about the current status of species, thereby enabling the enforcement of necessary measures to prevent them from extinction. The present study was carried out to develop a comprehensive list of threatened species of Meghalaya using both the global and regional lists viz., International Union for Conservation of Nature Red List, Red Data Book of Indian Plants and Conservation Assessment and Management Plan. The analysis revealed the presence of 385 plant taxa belonging to 274 genera and 108 families in the state under various threatened categories. The dominant life form consisted of trees (40.26%), followed by herbs (35.84%), shrubs (13.25%), climbers (5.45%), epiphytes (4.94%) and parasites (0.26%). Fabaceae with 34 species was the largest family and *Magnolia* with 14 species was the dominant genera. The distribution of the threatened species showed that 24 species are exclusively endemic to Meghalaya and 70 species were restricted to Northeastern India, Indo-Burma or the Eastern Himalaya region. The present study has enabled the compilation of data on threatened plants of Meghalaya spread across literature with an update on their distributional area.

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Introduction

The world is challenged by a surprising increase in the number of species considered to be rare or threatened in response to growing human-generated disturbances and ever-increasing pressure on natural resources (Myers and Kent 2003). The threat to biodiversity is increasing due to a number of factors such as overexploitation, invasion by invasive species, pollution, climate change, habitat loss, and fragmentation (Corlett 2016; Pao and Upadhaya 2017). It has been estimated that one-third of all flowering plant species are at the risk of extinction. The rate of

extinction has been estimated to be 1000 to 10,000 times the background rate (Pimm and Joppa 2015). The issue related to extinction seems to be critical as many species are yet to be described (Corlett 2016) that may have restricted distributional ranges, and or maybe rare and endemic (Pimm and Joppa 2015; Mir et al. 2019). The loss of plant diversity has a detrimental impact because of the direct and indirect benefits humans gain from their existence and use (Murray 2017).

Several international and national conservation organizations have taken initiatives to mitigate the loss of species and improve the global and regional biodiversity scenarios. According to the Global Strategy for Plant Conservation 2011–2020 of the Convention on Biological Diversity, one of the key objectives is the preliminary assessment of the conservation status of the flora of entire Earth (CBD 2012). In this regard, the International Union for Conservation of Nature (IUCN) Red List criteria for threatened species

* Corresponding author. Tel.: +91 94 3611 9857.

E-mail address: upkri@yahoo.com (K Upadhaya)

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Original Article

An Inventory of the Pteridophytic Flora of Balpakram-Baghmara Landscape, South Garo Hills, Meghalaya, India

Dilip Kumar Roy^{1*} and Jintu Sarma²

¹Department of Botany, Birjhora Mahavidyalaya (Degree Science College), Bongaigaon 783380, Assam, India

Email: dilipbsierc@gmail.com

²Department of Botany, Guwahati College, Guwahati 781021, Assam, India Email: jsarma88@gmail.com

Abstracts

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Correspondence:

dilipbsierc@gmail.com

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In the present study the Pteridophytic flora of Balpakram-Baghmara Landscape (BBL) of South Garo Hills district, Meghalaya (India) is systematically inventoried containing 76 taxa belong to 43 genera and 19 families. Out of these, seven species, namely *Asplenium filipes* Copel., *Bolbitis aspleniifolia* (Bory) K. Iwats., *Dicranopteris taiwanensis* Ching & P.S. Chiu, *Pleocnemia submembranacea* (Hyata) Tagawa & K. Iwats., *Polystichum pseudotsus-simense* Ching, *Pteris camerooniana* Kuhn, *Thelypteris caudipinna* Ching, and *Trichomanes campanulatum* Roxb. are recorded as new additions to the flora of Meghalaya. Moreover, nine species, namely *Bolbitis nodiflora* Fraser-Jenk., *Cephalomanes javanicum* (Blume) Bosch, *Cyathea andersoni* (Scoot ex Bedd.) Copel., *Dipteris wallichii* (R. Br.) G. Moore, *Helminthostachys zeylanica* (L.) Hook., *Hymenophyllum denticulatum* Sw., *Lindsaea himalaica* K.U. Kramer, *Pleocnemia submembranacea* (Hyata) Tagawa & K. Iwats. and *Pteris quadriaurita* Retz. fall under different conservation status. The current accepted name of each species is provided here along with author citation, publication references, basionym (if any), distribution details in north-eastern India and conservation status (if relevant).

Roy, D. K. & Sarma, J. 2022. An Inventory of the pteridophytic flora of Balpakram-Baghmara landscape, South Garo Hills, Meghalaya, India. *Mong. J. Biol. Sci.*, 20(1): 73–85.

Introduction

India is one of the 17 mega biodiversity countries of the world concentrated by three globally recognized hotspots namely Eastern Himalayas, Western Ghats and Indo-Burma Region. The state of Meghalaya comes under the Indo-Myanmar biodiversity hotspot, is host to a remarkable biodiversity that includes a high proportion of endemic, rare and endangered species (Singh *et al.*, 2018; Mir *et al.*, 2014, 2019). It consists of the three hill regions, east to west of Jaintia, Khasi and Garo Hills. Balpakram-Baghmara Landscape (BBL) spreading over 740 km², is situated in the heart of South Garo Hills district of the state and enriched with five protected/reserve areas managed by

the Meghalaya State Forest Department, namely Balpakram National Park (BNP; 352 km²), Siju Wildlife Sanctuary (SWS; 5.2 km²), Baghmara Pitcher Plant Wildlife Sanctuary (BPPS; 2 km²), Baghmara Reserve Forest (BRF; 44.29 km²) and Rewak Reserve Forest (RRF; 6.48 km²), and rest falls under 36 tribal community lands (~330 km²) (Kumar & Marcot, 2010; Roy, 2018).

Pteridophytic flora is of little economic significance to humankind as compared to other groups of plants, more particularly angiosperms and hence this group of plant is ignored many times by the workers. Nevertheless, their role in the ecosystem cannot be neglected as it plays a significant role in biodiversity (Khare & Punetha,

Article

Fixed Point Results for a Family of Interpolative F -Contractions in b -Metric Spaces

Nabanita Konwar ¹ and Pradip Debnath ^{2,*} 

¹ Department of Mathematics, Birjhora Mahavidyalaya, Bongaigaon 783380, Assam, India

² Department of Applied Science and Humanities, Assam University, Silchar, Silchar 788011, Assam, India

* Correspondence: debnath.pradip@yahoo.com

Abstract: In this paper, we introduce a new generalized concept, namely, extended interpolative Ćirić–Reich–Rus-type F -contraction in b -metric space. In addition, we put forward the notion of interpolative Kannan-type F -contractions. Fixed point results for these new interpolative contraction mappings are established, and non-trivial examples involving finite and infinite sets are provided to validate the results.

Keywords: Ćirić–Reich–Rus type mapping; Kannan-type mapping; fixed point; contraction; b -metric space



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1. Introduction

Following the most celebrated fixed point results of Banach [1] in 1922, fixed point theory has witnessed breakthrough developments in different directions. One such direction is the replacement of the contraction condition with extended versions; another direction is the development of the metric space itself by inducing advanced properties. In the current research, we follow the first direction, i.e., the enhancement of the contraction condition.

For our work, we consider the F -contraction introduced by Wardowski [2] in 2012. Major improvements to Banach's contraction principle were accomplished by Boyd and Wong [3], Chatterjea [4], Ćirić [5], Kannan [6], and Meir and Keeler [7]. For developments in interpolative contractions, we refer to [8–11].

Bakhtin [12] and Czerwik [13] introduced the b -metric space, which non-trivially extended the class of metric spaces. Subsequently, tremendous improvement in fixed point theory in the framework of b -metric space have taken place [14–23].

In this paper, we put forward the concept of extended interpolative Ćirić–Reich–Rus type (CRR-type) F -contraction and interpolative Kannan-type F -contraction in a b -metric space (b MS). These new interpolative results provide a new direction in the area of integral equations to find new solutions. We establish a number of important results while investigating this connection, and provide examples to validate our results. Finally, we present an application of the newly established results towards the solution of a particular type of integral equations.

2. Preliminaries

Several important results in the present context are listed below:

Definition 1 ([12,13]). Consider a mapping $Y : M \times M \rightarrow [0, \infty)$ where $M \neq \emptyset$ is a set. When Y satisfies the following conditions:

(bM1) $Y(\iota_1, \iota_2) = 0$ if and only if $\iota_1 = \iota_2$;

(bM2) $Y(\iota_1, \iota_2) = Y(\iota_2, \iota_1)$ for all $\iota_1, \iota_2 \in X$;

(bM3) There exists a real number $s \geq 1$ such that $Y(\iota_1, \iota_3) \leq s[Y(\iota_1, \iota_2) + Y(\iota_2, \iota_3)]$ for all $\iota_1, \iota_2, \iota_3 \in X$; then, Y is known as a b -metric on M and (M, Y) is b -metric space (b MS) having coefficient s .

Article

Some New Results for a Class of Multivalued Interpolative Kannan-Type Contractions

Nabanita Konwar ¹, Rekha Srivastava ^{2,*}, Pradip Debnath ^{3,*} and Hari Mohan Srivastava ^{4,5,6,7}

¹ Department of Mathematics, Birjhora Mahavidyalaya, Bongaigaon 783380, Assam, India; nabnitakonwar@gmail.com

² Department of Mathematics and Statistics, University of Victoria, Victoria, BC V8W 3R4, Canada

³ Department of Applied Science and Humanities, Assam University, Silchar 788011, Cachar, Assam, India

⁴ Department of Mathematics and Statistics, University of Victoria, Victoria, BC V8W 3R4, Canada; harimsri@math.uvic.ca

⁵ Department of Medical Research, China Medical University Hospital, China Medical University, Taichung 40402, Taiwan

⁶ Department of Mathematics and Informatics, Azerbaijan University, 71 Jeyhun Hajibeyli Street, Baku AZ1007, Azerbaijan

⁷ Section of Mathematics, International Telematic University Uninettuno, I-00186 Rome, Italy

* Correspondence: rekhas@math.uvic.ca (R.S.); debnath.pradip@yahoo.com (P.D.)

Abstract: In this paper, we introduce the notion of multivalued interpolative Kannan-type contractions. We also introduce a more general version of this notion by relaxing the degrees of freedom of the powers arising in the contractive condition. Gaba et al. (2021) recently pointed out a significant error in the paper of Gaba and Karapinar (2019), showing that a particular type of generalized interpolative Kannan-type contraction does not possess a fixed point in general in a complete metric space. Thus, the study of generalized Kannan-type mappings remains an interesting and mathematically challenging area of research. The main aim of this article is to address such existing results for multivalued mappings. We also investigate common fixed points for this type of contractions. Our results extend and unify some existing results in the literature.

Keywords: fixed point; Kannan-type contraction; interpolative map; multivalued map; contraction map; common fixed point; differential equation; integral equation; metric space

AMS Subject Classification: 47H10; 54H25; 54E50



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1. Introduction

Some well-known fixed point results obtained for multivalued mappings were established by Nadler [1] in 1969. This generalization is based on the idea of the Hausdorff concept—i.e., the distance between two arbitrary sets. The concept of Hausdorff metric space is defined as follows:

Consider a complete metric space (MS) (\mathfrak{X}, η) and the class of all nonempty closed and bounded subsets $CB(\mathfrak{X})$ of the nonempty set \mathfrak{X} . Then, construct a map $\mathcal{H} : CB(\mathfrak{X}) \times CB(\mathfrak{X}) \rightarrow [0, \infty)$, such that for $S_1, S_2 \in CB(\mathfrak{X})$,

$$\mathcal{H}(S_1, S_2) = \max\left\{\sup_{\xi \in S_2} \Delta(\xi, S_1), \sup_{\delta \in S_1} \Delta(\delta, S_2)\right\},$$

where $\Delta(\delta, S_2) = \inf_{\xi \in S_2} \eta(\delta, \xi)$. The pair $(CB(\mathfrak{X}), \mathcal{H})$ is known as Pompeiu–Hausdorff metric space, which is induced by η .

Definition 1 ([1]). Suppose $Y : \mathfrak{X} \rightarrow CB(\mathfrak{X})$ is a multivalued map. Then, $v \in \mathfrak{X}$ is said to be a fixed point of Y if $v \in Yv$ and $\text{Fix}(Y)$ denotes the set of all fixed points of Y .

Stabilization of ZnO Nanoparticles Using Water Extract of Waste Coconut Husk and Photocatalytic Activity

Riu RiuWary¹, Sanjib Baglari¹, Dulu Brahma², Ujjal K Gautam³, Pranjal Kalita²
Manasi Buzar Baruah^{1,*}

¹Department of Physics, Central Institute of Technology Kokrajhar (Deemed to be University, MoE, Govt. of India), Kokrajhar-783370, Assam, India

²Department of Chemistry, Central Institute of Technology Kokrajhar (Deemed to be University, MoE, Govt. of India), Kokrajhar-783370, Assam, India

³Indian Institute of Science Education and Research Mohali, Department of Chemical Sciences, Knowledge City, Sector 81, SAS Nagar, Manauli-140306, India

*Corresponding author

Email: mbbaruah@cit.ac.in

Abstract

Here, we report the synthesis of highly photoactive zinc oxide nanoparticles using water extract of waste coconut husk ash as a precipitating agent in a green approach which is a potential source of natural alkaline media. The formation of zinc oxide nanoparticles at different pH of the solution of coconut husk ash was confirmed through powder XRD, SEM-EDX, UV-Vis, FTIR and photoluminescence spectroscopy. The photocatalytic performance of the samples was evaluated through the degradation of methylene blue (MB) and methyl orange (MO) under solar irradiation which undergoes degradation around 98% and 56% within 120 min, respectively. The high photocatalytic activity and rate constant could be attributed to the large surface area due to small particle size that could provide quicker photon absorption and reduction of charge carrier recombination. This current work introduces a new method to reduce energy consumption for the synthesis of highly photoactive low-cost zinc oxide nanoparticles.

Keywords: Photocatalysis . Coconut husk ash . Methyleneblue . Methyl orange . Rate constant

Introduction

Semiconductor materials have gained significant attention in the scientific community due to their various applications for the past decades (Theerthagiri et al. 2019). There are various kinds of semiconductors such as CeO₂, ZnO, CuO, WO₃, Fe₂O₃ and TiO₂ have been studied widely for diverse technical applications. Among them, ZnO has been attracting more attention due to its good optoelectronic properties, inexpensive, stability, catalytic and nontoxic behavior. ZnO is an n-type semiconductor of group II-IV with high optical band gap energy of 3.37 eV and excitation binding energy of 60 meV which ensures efficient emission depending upon the situation set up at room temperature and the materials come into existence in three different structures *viz.*, Rocksalt, Zinc blende and Wurtzite (Ong et al. 2018). Wurtzite is the most thermodynamically stable form of zinc oxide at ambient conditions. The materials exist unique optical and electrical properties in their nanoscale order and these are becoming responsible for potential applications in the field of solar cell (Saboor et al. 2019), laser diode (Deng et al. 2020), photocatalysis (Das








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Studies on the feeding habit and digestive enzyme activities in three small indigenous fish species from Assam, India

Soumita Roy¹ , Sanraja Muchahary¹ , Heikham Dayami² ,
Bichitra Narzary¹ , Bronson Kumar Khangembam^{1*} 

¹Department of Zoology, Bodoland University, Kokrajhar, Assam-783370, India

²Department of Life Sciences, Manipur University, Canchipur, Manipur-795003, India

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Small indigenous fish

Relative gut length

Gastro-somatic index

Digestive enzyme

ABSTRACT

Knowledge of the feeding habit and the digestive physiology of a fish is important in making appropriate strategies for feed development and successful culture. Nutrient-rich small indigenous fish species (SIFs) are abundant in Assam, India. *Puntius sophore*, *Mystus tengara*, and *Trichogaster fasciata* of Gossaigaon, Assam are important SIFs for the local rural population, and also potential candidates for ornamental fish culture. The present study aims to evaluate the feeding habit and digestive enzyme activities of these species. Data obtained from the relative gut length and gut content analysis suggested that *M. tengara* is a carnivorous fish and the rest two fishes are omnivorous in habit. Further, the relative gut length was highest in *T. fasciata* (4.20 ± 0.45) and lowest in *M. tengara* (0.55 ± 0.11). Digestive enzyme activity indicates a correlation with the dietary habit of the fish. Further, total protease, trypsin, and amylase activity was reported highest in *P. sophore*. Acid protease pepsin was found to be significantly higher in *M. tengara* complementing its carnivorous habit and gut anatomy. The present study has established some important information on the digestive enzyme characteristics and feeding habits of the three fish species. This information might be useful in the development of suitable feed for the fish species for their culture.

* Corresponding author

E-mail: kbronson173@gmail.com (Bronson Kumar Khangembam)

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Research Article

In Vitro* Digestibility Study: Evaluating Plant Proteins Digestibility in *Anabas testudineus* and *Channa punctata

Rita Devi ¹, Monika Basumatary ¹, Bichitra Narzary ¹, Heikham Dayami ², Sanraja Muchahary ¹, Bronson Kumar Khangembam ^{1*}

¹ Department of Zoology, Bodoland University, Kokrajhar, Assam-783370, India

² Department of Life Sciences, Manipur University, Imphal-795003, Manipur, India

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**Corresponding author:*

E-mail: kbronson173@gmail.com

ABSTRACT

Protein is the most important component of any fish feed for its role in growth, especially during the larval stages, and its high cost. Fish meal continues to be a major source of protein in fish feed production. But its supply cannot keep pace with ever-expanding aquaculture production, leading to its high cost. Plants are being considered as potential replacements in the search for new alternatives to fish meals. But their application depends significantly on their digestibility in target species. The present study aims to determine the protein content of four locally available plants *Moringa oleifera*, *Ipomoea aquatica*, *Lemna minor* and *Salvinia natans*, and test their digestibility in vitro by using the pH drop method in two important food fish *Anabas testudineus* and *Channa punctata*, of Assam, India. The crude protein in all plants ranged from 19-29%, and the highest crude protein was observed in *Lemna minor* (29.9 ± 2.34%). The in vitro digestibility was estimated by calculating the RPD% (relative protein digestibility) using casein as a standard reference. Digestibility of the plant proteins exhibited species-specific variations. The RPD% ranged from 50.39% to 75.39% in *A. testudineus*, and 41.38% to 54.02% in *C. punctata* compared to that of casein (100%). The highest RPD% was observed in *I. aquatica* (75.39%) for *A. testudineus*, and the lowest (50.39%) in *L. minor* whereas, in *C. punctata*, the highest RPD% was observed in *L. minor* (54.02%) and the lowest in *I. aquatica* (41.38%). The digestibility of all plant proteins was comparatively higher in *A. testudineus* than in *C. punctata*. Our results indicate that *I. aquatica* and *L. minor* may be a suitable replacement for animal protein in the diet of *A. testudineus* and *C. punctata*, respectively, because of their good protein content and high digestibility. *Moringa* may be considered for utilization in the fish feed as it recorded good protein and digestibility. This information may be useful in developing a cost-effective, plant-based protein diet for the two fish species for their mass production.

Keywords: *Anabas testudineus*, *Channa punctata*, *In vitro* digestibility, *Ipomoea aquatica*, Plant proteins

Introduction

Aquaculture is a fast-growing sector projected to grow by about one-third by the year 2030 [1]. Productive aquaculture depends upon the availability of high nutritional quality, low-cost feeds, contributing nearly 50% of total production cost [2]. Among many factors, a nutrient-rich diet is essential for the high growth rate of the fish required for its successful culture. Protein is the most important component of any fish feed for its role in growth, especially during the larval stages, and

also due to its high cost. The aquaculture industry is facing an increasing demand for a protein-rich diet, and the major challenge is to find economically and nutritionally suitable protein sources. Fish meal remains a major source of protein in fish feed, especially for carnivorous species [3]. Currently, it provides the largest supply of dietary protein in the fish feed industry which is considered unsustainable aquaculture as much of the fish meal is obtained from wild catch fishery [4]. The high

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Aspidistra mokochungensis (Asparagaceae: Nolinoideae), a new species from India

Dilip Kumar Roy^{1*}, Rikertre Lytan², David L. Biate², Nripemo Odyuo², Tiatemsu Punatemjen³ and Ashiho A. Mao⁴

¹Department of Botany, Birjhora Mahavidyalaya (Degree Science College), Bongaigaon - 783 380, Assam, India

²Botanical Survey of India, Eastern Regional Centre, Lower New Colony, Laitumkhrah, Shillong - 793 003, Meghalaya, India

³Department of Botany, Fazl Ali College, Mokochung - 798 601, Nagaland, India

⁴Botanical Survey of India, Headquarter, Kolkata - 700 064, West Bengal, India

*Corresponding author: dilipbsierc@gmail.com

आसपीडीस्ट्रा मोकोकचुंगेंसिस (एस्पेरगेसी: नोलिनोईडी), भारत से ज्ञात एक नवीन जाति

दिलीप कुमार रॉय, रिकेर्ट्रे लिटन, डेविड. एल. बियाते, नृपेमो ओडियो, तिप्टेम्सु पुनतेमजेन एवं ए. ए. माओ

सारांश

इस शोधपत्र में पूर्वोत्तर भारत के नागालैंड राज्य से ज्ञात एक नवीन जाति आसपीडीस्ट्रा मोकोकचुंगेंसिस डी. के. रॉय, एन. ओडियो, आर. लिटन, डी. एल. बियाते, टी. पुनतेमजेन तथा ए. ए. माओ (एस्पेरगेसी: उपकुल नोलिनोईडी) का वर्णन तथा सचित्र व्याख्या किया गया है।

ABSTRACT

New species of *Aspidistra* (Asparagaceae; subfamily Nolinoideae), *A. mokochungensis* D.K. Roy, N. Odyuo, R. Lytan, D.L. Biate, T. Punatemjen & A.A. Mao, is described and illustrated from the state of Nagaland in North Eastern India.

Keywords: Asia, *Aspidistra longifolia*, floristic diversity, monocots, plant taxonomy

INTRODUCTION

The genus *Aspidistra* Ker-Gawler (1822) belonging to Asparagaceae-subfamily Nolinoideae (APG 2016; Chase & al., 2009), includes over 200 species (Trinh & al., 2021). These taxa are widely distributed in tropical and subtropical forests of Asia, with the highest concentration in China and Vietnam and to some extent in Laos, Thailand and Malay Archipelago (Liang Tamura, 2000; Wang & al., 2021; Trinh & al., 2021). In India, *Aspidistra* is represented so far by *A. longifolia* Hook. f. (1892).

In course of the study of the subfamily Nolinoideae in India, one very distinctive plant of *Aspidistra* was encountered from the collections made during field exploration in November 2019 to Mongchen village of Mokochung district in Nagaland, northeastern India. The flowers were dissected, and detailed morphological

study was carried out based on the living specimens. Afterward, reviewing of relevant literature (Hooker, 1892; Chun & How, 1977; Peng, 1989; Liang & Tamura, 2000; de Wilde & Vogel, 2005; Tillich, 2005, 2006, 2008; Tillich & al., 2007; Tillich & Averyanov, 2012; Phonsena & de Wilde, 2010; Cai & al., 2018, 2019, 2020; Averyanov & al., 2018, 2019, 2021; Vislobokov & al., 2019a, 2019b, 2019c; Xi & al., 2020; Deng & al., 2021; Ding & al., 2021; Wang & al., 2021; Trinh & al., 2021), revealed that the plant resembles *A. yingjiangensis* L.J. Peng (1989), but differs clearly from it in many significant diagnostic characters. Therefore, it is described here as a new species with detailed photographic illustrations.

MATERIALS AND METHODS

Collection, pressing and preparation of herbarium specimen of the *Aspidistra* plant were done in accordance



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Aspidistra yingjiangensis (Asparagaceae: Nolinoidae), a new species record for the flora of India

D. K. Roy^{1, 3*}, R. Lytan^{2, 4}, N. Odyuo^{2, 5}

¹ Birjhora Mahavidyalaya (Degree Science College), Bongaigaon, Assam, 783380, India

² Botanical Survey of India, Eastern Regional Centre, Shillong, Meghalaya, 793003, India

³ E-mail: dilipsierc@gmail.com; ORCID iD: <https://orcid.org/0000-0002-2400-5928>

⁴ ORCID iD: <https://orcid.org/0000-0002-4182-8977>

⁵ ORCID iD: <https://orcid.org/0000-0001-9711-1150>

* Corresponding author

Keywords: *Aspidistra longifolia*, flora, monocots, Southeast Asia, taxonomy.

Summary. *Aspidistra yingjiangensis* L. J. Peng (Asparagaceae: Nolinoidae) earlier known from Yunnan province in China is reported here as a new record for India from the state of Nagaland. A detailed taxonomic description along with photographs of the diagnostic characters is presented. Detailed comparison of the morphological characters of *A. yingjiangensis* with *A. longifolia* Hook. f., the only known Indian *Aspidistra*, has been given.

Aspidistra yingjiangensis (Asparagaceae: Nolinoidae) – новый вид флоры Индии

Д. К. Рой¹, Р. Литан², Н. Одюо²

¹ Биржора Махавидьялая (научный колледж), г. Бонгайгаон, Ассам, 783380, Индия

² Ботаническая служба Индии, Восточный региональный центр, г. Шиллонг, Мегхалая, 793003, Индия

Ключевые слова: однодольные, таксономия, флора, Юго-Восточная Азия, *Aspidistra longifolia*.

Аннотация. *Aspidistra yingjiangensis* L. J. Peng (Asparagaceae: Nolinoidae), ранее известный из провинции Юньнань в Китае, найден в Индии в штате Нагаленд. Представлено подробное таксономическое описание вида с фотографиями диагностических признаков. Дано детальное сравнение морфологических признаков *A. yingjiangensis* с *A. longifolia* Hook. f. – единственным известным индийским видом *Aspidistra*.

Introduction

The genus *Aspidistra* Ker-Gawler belonging to Asparagaceae subfamily Nolinoideae (Chase et al., 2009; APG, 2016), includes over 200 species (Trinh et al., 2021). These taxa are widely distributed in tropical and subtropical forests of Asia, with the

highest concentration in China and Vietnam, and some extend to Laos, Thailand and Malay Archipelago (Liang, Tamura, 2000; Trinh et al., 2021; Wang et al., 2021). In India, *Aspidistra* is represented so far by *A. longifolia* Hook. f.

While carrying out botanical surveys in April and May 2016 in Fakim Forest Village areas under

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Recent development of modified fluorescent carbon quantum dots-based fluorescence sensors for food quality assessment

Review Published: 17 May 2022

Volume 32, pages 1131–1149, (2022) [Cite this article](#)**Carbon Letters**[Aims and scope](#)[Submit manuscript](#)**Manash Jyoti Deka** , **Devasish Chowdhury** & **Bhabesh Kumar Nath** **1215** Accesses  **38** Citations [Explore all metrics](#) →

Abstract

Food toxins are regarded as a major source of health risks, serious illnesses susceptible to even death. These dangerous pathogens may lead to significant economic impact worldwide. The food production chain undergoes different stages like harvesting, processing, storage, packaging, distribution, and lastly preparation, and consumption. Therefore, each step is susceptible to risks of environmental contamination. Nowadays, the carbon quantum dots (CDs) are regarded as one of the most widely used hybrid carbon nanomaterials due to their different magical physical and chemical properties. The CDs have a size below 10 nm and show the fluorescent property. The CDs find vast applications in different fields like sensing, food safety, drug delivery, bioimaging, catalyst, energy conversion, etc. Compared to other available methods, the fluorescence

ORIGINAL ARTICLE

A study on the length-weight relationship and condition factor of five small indigenous fish species of Sareswar Beel in lower Assam, Northeast India

Bichitra NARZARY[✉], Bronson Kumar KHANGEMBAM^{*}

Department of Zoology, Bodoland
University, P. O. Rangalikhata,
Debargaon, Kokrajhar, Assam, India.

Correspondence
kbronson173@gmail.com

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Abstract

Length-weight relationship (LWR) and relative condition factor are significant in fishery science as it provides information on fish wellbeing and biological data. The present study describes the LWR and condition factor of five small indigenous fish species of Sareswar Beel, Kokrajhar, Assam of Northeast India for the first time. A total of 443 specimens of five species viz. *Nandus nandus*, *Glossogobius giuris*, *Puntius sophore*, *Pethia conchonius* and *Trichogaster fasciata* were sampled from May 2021 to April 2022. All samples were collected using gill nets, bamboo traps, net traps and lift net. The total length and body weight were measured to determine the LWR and Fulton's condition factor (K). The statistical parameters a , b , and K_n (Relative Condition factor) were also analysed. All species recorded $K > 1$ except *Glossogobius giuris* (0.909 ± 0.178), and the highest value was recorded in *T. fasciata* (2.023 ± 0.687). The values of ' b ' for all five species ranged from 1.643 to 2.961, indicating negative allometric growth pattern. This study is a first report on the LWR and condition factor of these species from Sareswar Beel, Assam. These results may be useful for sustainable management and comparison with future studies.

Keywords: *Glossogobius giuris*, Fultons's condition factor, *Nandus nandus*, Sustainable fishery.

INTRODUCTION

The physical growth is an important feature of all the living forms during development. When fish get suitable environment their length and weight increase as a part of overall physical development. Length-weight relationship is one of the most important tools used for analyzing the health conditions of fishery management (Türker et al. 2018) and its assessment helps in understanding the fundamental biological details that serve as vital tool for fishery science (Sheikh & Ahmed 2019; Roul et al. 2020). The study of length and weight relationship (LWR) is functional in sustainable resource management and fishery researches (Sonowal et al. 2019; Ergüden 2021). It is used to understand the biomass, condition factor, growth of fish species, fish stocks evaluation, the life cycle in fisheries and ontogenetic changes (Jafari et al. 2016; Salvador et al. 2018; Jafari-Patcan et al. 2018; Mouludi-Saleh & Eagderi 2019; Abbasi et al. 2019; Eagderi et al. 2020). In addition to the estimation of weight from length, it also has other uses such as

comparison of morphological and biometric parameters between varied species or population from different geographical regions (Roul et al. 2018; Roul et al. 2019) and seasonal changes in growth pattern and conditions indices (Safran 1992; Richter et al. 2000; Zuev et al. 2018).

The condition factor (K =Fulton's condition factor) and relative condition factor (K_n) are vital aspects which indicates welfare, robustness of ichthyofauna in their ecosystem (Paswan et al. 2012; Datta et al. 2013; Singh & Serajuddin 2017; Kurbah & Bhuyan 2018). The condition factor of a fish helps to understand its health status in its environment (Froese 2006). It is an index considering interconnection between abiotic and biotic factors in fish's physiological state. Fulton's condition factor (K) of a fish varies due to various factors like physical maturity, accessible food sources, sex and age of individual fishes in their environment (Anibeze 2000). Consequently, condition factor is a vital parameter for the assessment of fish health condition and is, therefore, widely used in fish

Diversity and traditional ethnozoological uses of ichthyofauna by the Bodo Tribes of Kokrajhar, Assam, Northeast India

GANDOLI BASUMATARY, BICHITRA NARZARY, BRONSON KUMAR KHANGEMBAM*

Department of Zoology, Bodoland University. P.O. Rangalikhata, Debargaon, Kokrajhar, Assam-783370, India.
Tel./Fax.: +919899046204, ✉email: kbbronson173@gmail.com

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Abstract. Basumatary G, Narzary B, Khangembam BK. 2023. Diversity and traditional ethnozoological uses of ichthyofauna by the Bodo Tribes of Kokrajhar, Assam, Northeast India. *Nusantara Bioscience* 15: 49-57. Fish is an important component of ethnomedicine for treating many diseases in many tribal cultures worldwide. Traditional medicine remains the primary healthcare system in most rural populations worldwide, and ethnomedicine is the foundation of many modern-day disease management. The use of fish in traditional healthcare could be a potent source for finding new compounds with therapeutic prospects. Studies on ethnoichthyology have indicated fish as an important component for treating many diseases. However, such studies are yet to be fully documented in the northeastern states of India, especially in Kokrajhar, Assam. The Bodos are one of the largest tribal groups of Assam in Northeast India, with a rich traditional knowledge system. The study explores the traditional uses of fish for various ethnomedicinal properties and health benefits by the Bodos of Kokrajhar, Assam. The study was conducted in eight villages of Kokrajhar District from March 2019 to February 2020 through personal interviews and semi-structured questionnaires with 150 informants. Thirty-four different fish species from 20 different families were identified to be used for their health benefits and therapeutic properties. The highest number of fish species belonged to the family Cyprinidae (20.59%), followed by Channidae (11.76%) and Ambassidae (8.82%). The highest use value (0.58) and relative frequency of citation (0.37) was recorded for *Heteropneustes fossilis*. Anaemia, gastrointestinal and integumentary disorders, and body weakness were the most commonly mentioned ailments treated. The present study also reported some small indigenous fish species for their health benefits. The study also found some unique traditional methods for preparing and applying fish species (*Xenentodon cancila*, *Chitala chitala*, *Glossogobius giuris*, *Leiodon cutcutia*, etc.) not reported earlier. Identification and detailed study of the biochemical profile of these different species may be recommended to develop suitable alternatives to synthetic medicines. This study may be a valuable addition to the rich traditional knowledge of Northeast India.

Keywords: Bodo Tribes, ethnozoology, ichthyofauna, Kokrajhar

INTRODUCTION

Traditional medicine refers to health practices, approaches, knowledge, and beliefs incorporating plant, animal, and mineral-based medicines, spiritual therapies, manual techniques, and exercises, applied singularly or combined to treat, diagnose, and prevent illnesses or maintain well-being (Adnan et al. 2022; WHO 2022). Plants and animals having medicinal properties are being used throughout the world. Traditional medicine remains the most common and affordable form of therapy in low-income countries. About 70-80% of the world's rural population depends on it for primary healthcare, most of which reside in developing countries (Chhetri et al. 2020). Animals and animal-derived products have always been a source of traditional medications and have vital significance in some religions and cultures (Prakash and Prakash 2021). In modern medical science, about half of modern medicines are reported to be derived from biological sources. The traditional knowledge of the ethnic community worldwide has contributed to recognizing living organisms used for treating diseases in livestock and human beings. Consequently, it is important to document the traditional knowledge of different tribal communities on the verge of socioeconomic and cultural deprivation

(Laishram and Dey 2021). Though popular worldwide, many of the reported cases of ethnomedicine are restricted to ethnobotany. While compared to medicinal plants, there is insufficient research and data on the use of animals for medicinal purposes (Alves and Rosa 2013). However, recent studies have revealed the use of animals and their products as natural remedies in folk medicinal practices worldwide (Zanvo et al. 2021).

Fish as a cheap protein source also plays a major role in preventing and curing many diseases, including coronary disease, asthma, mental illness, low birth weight, and nutrient deficiencies which underlines the importance of fish in our diet (Naranje and Mishra 2015). Ethnoichthyology focuses on local knowledge, linguistic expressions, nutritious importance, folk practices, material evidence and cognitive perceptions of fish, and the environmental consequences of these interactions (Svanberg and Locker 2020). Some studies have documented the role of ichthyofauna in traditional medicines, mainly in the indigenous rural and fishing community (Vallejo and González 2014; Altaf et al. 2020).

The northeastern region of India is a biodiversity hotspot, and 185 species of fish have been recorded in Assam alone (ASBB 2022). Biodiversity has always been paramount for providing and discovering medical



RESEARCH PAPER

OPEN ACCESS

Digestive enzyme activities in four diverse small indigenous fish species from Sareswar beel of Kokrajhar, Assam in Northeast India

Bichitra Narzary, Sanraja Muchahary, Bronson Kumar Khangembam*

Department of Zoology, Bodoland University, Rangalikhata, Debargaon, Kokrajhar, Assam, India

Article published on January 12, 2023

Key words: Digestive enzymes, Small indigenous fish species, Relative gut length, Gastro-somatic index, Sareswar beel, Kokrajhar

Abstract

Small indigenous fish species (SIFs) are important source of protein and micronutrients for the local population and hence considered as potential for aquaculture expansion. *Pethia conchoni*, *Glossogobius giuris*, *Nandus nandus* and *Trichogaster fasciata* are such SIFs found in Sareswar beel of Kokrajhar, Assam, India. This is an important beel with potential for development of fisheries in the region. Information on the food habit and digestive physiology are important in understanding the nutritional biology of a fish species essential for designing appropriate diet and feeding strategy for its successful culture. The present investigation aims to study and compare the feeding habit and digestive enzyme profile of these species. Relative gut length data suggested that *P. conchoni* and *T. fasciata* were herbivores, while *N. nandus* and *G. giuris* were omnivore and carnivore, respectively. Ga.SI varied in all the species (2.65 ± 1.39 to 4.66 ± 2.14) and the result indicated good or high feeding intensity in all the species. The highest amylase and lipase activity was observed in *T. fasciata*, and significantly lower activity was recorded in *G. giuris* and *N. nandus*, respectively. Pepsin was found to be highest in *N. nandus* while total protease was greatest in *P. conchoni*. Plasticity in the food intake in the natural environment seems to influence the enzyme activities. The present study has established vital information on the digestive enzyme properties and feeding nature of the four SIFs which may be useful in the development of suitable feed for their mass production for their successful culture.

*Corresponding Author: Bronson Kumar Khangembam ✉ kbronson173@gmail.com



RESEARCH PAPER

OPEN ACCESS

Effect of partial replacement of Fish meal by *Lemna minor* on the growth and immune response of *Heteropneustes fossilis*

Sanraja Muchahary, Bichitra Narzary, Bronson Kumar Khangembam*

Department of Zoology, Bodoland University, Kokrajhar, Assam, India

Key words: *Heteropneustes fossilis*, *Lemna minor*, Growth, Immune response

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Abstract

Aquaculture research in recent times has been focused on finding more affordable sources of plant protein for inclusion in the fish diet. *Lemna minor* is a widely reported alternative protein source in fish feed but its effect on the immune system of fish especially catfish is not yet fully understood. This study, therefore, evaluated the effect of dietary inclusion of *L. minor* on the growth, immune response and catalase activity of *Heteropneustes fossilis*. The fry of *H. fossilis* was fed five iso-nitrogenous diets containing graded percentage inclusion levels of *L. minor* as 0% (Control), 5% (T1), 10% (T2), 15% (T3) and 20% (T4) for 60 days. The final weight, body mass gain and specific growth rate were significantly higher in T3 diet-fed fish than in others. The feed conversion ratio was lowest in the T3 group. Total muscle protein, mucus protein and total immunoglobulin content did not differ significantly between the control group and plant-fed fish. The lysozyme and alkaline phosphatase activity was significantly higher in T1. Antioxidant enzyme catalase activity did not differ significantly in all the treatments. This study shows that *L. minor* can be incorporated up to 20% in the feed of *H. fossilis* without a negative effect on its growth and immune response of *H. fossilis*. *L. minor* may be a potential protein source in fish feed for sustainable aquaculture.

*Corresponding Author: Bronson Kumar Khangembam ✉ kbrownson173@gmail.com

A NEW EXTENSION OF BANACH-CARISTI THEOREM AND ITS APPLICATION TO NONLINEAR FUNCTIONAL EQUATIONS

NABANITA KONWAR¹, PRADIP DEBNATH², STOJAN RADENović³, AND HASSEN AYDI⁴

ABSTRACT. In this paper, we present a new extension of Banach-Caristi type theorem for multivalued mappings. We show that our result is not a consequence of multivalued version of Banach contraction principle due to Nadler. We provide an application of our result to the solution of functional equations.

1. PRELIMINARIES

Caristi [4] introduced an important generalization of the Banach contraction principle as follows.

Theorem 1.1 ([4]). *Let (Λ, η) be a complete metric space (MS, in short) and $\mathfrak{S} : \Lambda \rightarrow \Lambda$ be a self-map satisfying*

$$\eta(\varsigma, \mathfrak{S}(\varsigma)) \leq \phi(\varsigma) - \phi(\mathfrak{S}(\varsigma)),$$

for all $\varsigma \in \Lambda$, where $\phi : \Lambda \rightarrow [0, \infty)$ is a lower semicontinuous mapping. Then \mathfrak{S} admits a fixed point.

Caristi's theorem has a close connection with Ekeland's variational principle [7, 8]. Weston [20] established a characterization for the metric completeness in terms of Caristi's theorem. Agarwal and Khamsi [1] extended Caristi's result to vector valued metric spaces.

In 1969, Nadler [17] established a number of very significant fixed point results for multivalued maps using the Hausdorff concept, i.e., by considering the distance

Key words and phrases. Fixed point, Banach contraction principle, nonlinear functional equation, metric space, Caristi's theorem.

2010 *Mathematics Subject Classification.* Primary: 47H10. Secondary: 54H25, 54E50.

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An account of the family Orchidaceae at Balpakram-Baghmara Landscape, South Garo Hills, Meghalaya, India

Dilip Kumar Roy^{1*}, Jintu Sarma² and Khyanjeet Gogoi³

¹Department of Botany, Birjhora Mahavidyalaya (Degree Science College), Bongaigaon 783380, Assam, India

²Department of Botany, Guwahati College, Guwahati 781021, Assam, India.

³TOSEHIM, Regional Orchids Germplasm Conservation & Propagation Centre (Assam Circle),
Daisa Bordoloi Nagar, Talap, Tinsukia- 786156, Assam, India

*Corresponding author: dilipbsierc@gmail.com

बलफकरम-बाघमारा भूदृश्य, दक्षिण गारो हिल्स, मेघालय, भारत के आर्किडेसी कुल का वर्णन

दिलीप कुमार रॉय, जितू शर्मा व ख्यानजीत गोगोई

सारांश

वर्तमान अध्ययन में दक्षिण गारो हिल्स जिला, मेघालय (भारत) के बलफकरम-बाघमारा भूदृश्य (बीबीएल) की आर्किड वनस्पतिजात को व्यवस्थित रूप से सूचीबद्ध किया गया है। उक्त सूची में 41 वंशों से संबंधित 79 प्रजातियां शामिल हैं। वंशों पर कुजी के साथ, उल्लिखित प्रजातियों की चेकलिस्ट दी गई है।

ABSTRACT

In the current study the Orchid flora of Balpakram-Baghmara Landscape (BBL) of South Garo Hill district, Meghalaya (India) is systematically inventoried containing 79 species belong to 41 genera. A checklist of the recorded species is provided here, along with the key to genera.

Keywords: Flora, Orchids, Balpakram-Baghmara Landscape, South Garo Hills, Meghalaya.

INTRODUCTION

India is one of the 17 mega-biodiversity countries of the world concentrated by three globally recognized hotspots, namely the Eastern Himalayas, the Western Ghats and the Indo-Burma region. The state of Meghalaya is part of the Indo-Myanmar biodiversity hotspot and is home to remarkable biodiversity that includes a high proportion of endemic, rare and endangered species (Singh & al., 2012; Mir & al., 2014, 2019; Lasushe & al., 2022). It comprises of the three hill regions, east to west of Jaintia, Khasi and Garo Hills. Balpakram-Baghmara Landscape (BBL) spreading over 740 km² is situated in the heart of South Garo Hills district of the state (Fig. 1) and enriched with five protected/reserve areas managed by the Meghalaya State Forest Department, viz. Balpakram National Park (BNP; 352 km²), Siju Wildlife Sanctuary (SWS; 5.2 km²), Baghmara Pitcher Plant Wildlife Sanctuary (BPPS; 2 km²), Baghmara Reserve Forest (BRF; 44.29 km²) and

Rewak Reserve Forest (RRF; 6.48 km²), and rest falls under 36 tribal community lands (~330 km²) (Kumar & Marcot, 2010; Roy, 2018; Roy & Sarma, 2022).

The Orchidaceae, one of the most advanced and the largest flowering plant families is represented by ca. 25,000 species under 800 genera distributed worldwide except Antarctica, concentrated over the tropics and subtropics (Chen & al., 2009). Rao & Singh (2015) published “Wild Orchids of Meghalaya: A Pictorial Guide” containing 284 species and 86 genera. During 2020, Singh & Sneha (2020) reported 127 species of orchids under 56 genera from Nokrek Biosphere. Most recently, Singh & al. (2019) enlisted 1,256 species under 155 genera from India, out of which about 446 species under 102 genera are reported from Meghalaya mentioning 36 endemics to the state. After the detailed review of literature, it was found that a major part of Meghalaya was somehow escaped from botanical exploration, and the Balpakram-Baghmara