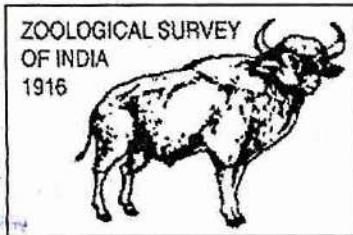




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THE UNIVERSITY OF BURDWAN

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आज़ादी का
अमृत महोत्सव

REGISTRAR
THE UNIVERSITY OF BURDWAN
BURDWAN - 713104

MEMORANDUM OF UNDERSTANDING
FOR SCIENTIFIC AND ACADEMIC COOPERATION
BETWEEN
ZOOLOGICAL SURVEY OF INDIA
AND
THE UNIVERSITY OF BURDWAN, BURDWAN

SL.NO.
50

Zoological Survey of India (ZSI), since its establishment on 1st July, 1916, has been pioneering on taxonomic research on animals, focusing on exploring, collecting, identifying, describing, classifying the animal taxa for inventorying, documentation and digitization of the Indian fauna. It has maintained its primary objectives of taxonomic research, survey and

डा. धृति बैनर्जी
Dr. Dhriti Banerjee
निदेशक / Director
भारतीय प्राणि संरक्षण
Zoological Survey of India
प.व. एवं व. मंत्रालय, भारत सरकार
MoEF&CC, Govt. of India
कोलकाता / Kolkata-700053

ক্রমিক নং 20564 তারিখ 19.6.23

ক্রেতা Susit Chowdhury

সাক্ষর BU BNN

ট্যাক্সের মূল্য 10/-

বর্ধমান টেক্সারী সনং ট্যাক্স বরাদ্দ তারিখ 15.6.23

ট্যাক্স ভেতকার সঙ্গ্রহ আচার্য

জেলা জজ আদালত (বর্ধমান)

সাইলেন্স নং- ১/২০০৪-০৫

Susit Chowdhury

documentation of Indian fauna. The scope and functions of ZSI have been considerably expanded, particularly in the light of the Convention on Biological Diversity, ratified by the Govt. of India in 1994. To meet the challenges of biodiversity conservation, sustainable utilization and dissemination of knowledge on faunal diversity to all stake holders, ZSI acquired modern tools and techniques such as scanning electron microscopes, stereo zoom microscopes, GIS tools, Data basing tools and the DNA barcoding technology, augmenting the research infrastructure of ZSI.

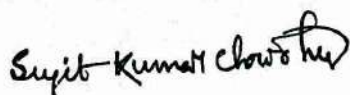
The **University of Burdwan (BU)** with a motto *Learning Leads to Emancipations*, was established on 15th June, 1960, a premier university of eastern India. Since inception it has reached several milestones such as: university NIRF ranking is 86 (2023), and the university has been accredited with Grade 'A' by NAAC in the year 2016 and India Today rank for the year 2021 is 16.

Presently it has 22 Post-graduate departments of faculty of Arts & Humanities and 17 Post Graduate departments, faculty of Science. An engineering college, named as University Institute of Technology, has been established with the approval from All India Council for Technical Education (AICTE). Other Academic Depts: UGC-HRDC, SVARC, NSS, RTC, Sports Board, Life long Learning etc.

Academically, **The University Burdwan** has affiliated colleges: Burdwan district: 26; Hooghly district: 27 and Birbhum district: 19. Its territorial jurisdiction extends over three districts -Purba Burdwan, Hooghly, Birbhum. These constitute the greater part of Rarh Bengal, the cradle of ancient civilization of India. The university now offers courses on diverse disciplines. These include physical education, B.Ed., foreign languages, computer applications, population education, etc. There are also an Adult Continuing Education Center and the Academic Staff College. The university has a museum and art gallery at Rajbati that displays even the pottery of



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Zoological Survey of India
प.व.एच.ब. प. भवन, भारत सरकार
MoEF&CC, Govt. of India
कोलकाता / Kolkata-700063





prehistoric age. The university has its Distance Education wing imparting Post-graduate education in different subjects as well as in some professional courses at Under-graduate level.

With social responsibilities in mind, the university actively patronized the construction of a Science Centre and a Planetarium, named as Meghnad Saha Planetarium. The University has established a Rural Technology Centre to impart vocational training and to create scope of self-employment for the rural youth.

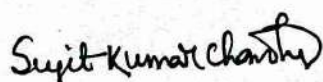
The **Zoological Survey of India** and **The University of Burdwan**, Burdwan, agree that for encouragement and development of cooperation and exchange in areas of mutual academic interest, it is desirable to enhance research and academic processes at both ZSI and the **University of Burdwan** to strengthen mutual understanding between their respective staff, scholars and students. **The Zoological Survey of India**, represented by the **Director, ZSI** and **The University of Burdwan, Burdwan**, represented by the **Vice Chancellor, The University of Burdwan, Burdwan**, hereby, enter into an agreement for academic and educational cooperation and have set forth the following Articles of Mutual Agreement:

Article 1

The **University of Burdwan, Burdwan** and the **Zoological Survey of India** agree on, but is not limited to, the following based on their academic and educational needs:

1. For collaborative research work with the **Zoological Survey of India (ZSI)** or the students intending to pursue research works at ZSI, enrolment to Ph.D programme under the University of Burdwan (BU) will be carried out through the Common Research Eligibility Test (RET) conducted by the BU only.


डॉ. धृति बैनर्जी
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निदेशक / Director
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Zoological Survey of India
प.व.एन.स.प. मंत्रालय, भारत सरकार
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कोलकाता / Kolkata-700053



REGISTRAR
THE UNIVERSITY OF BURDWAN
BURDWAN - 713104

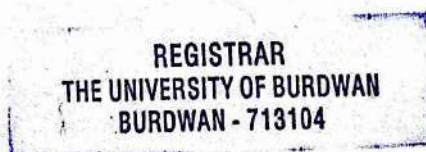
2. The bonafide students and research scholars of both the Institutions will have access to research facilities at **The University of Burdwan**, Burdwan and **Zoological Survey of India**.
3. The scientists of **Zoological Survey of India** conducting research shall be recognised as **Supervisors/Co-supervisors** for Doctoral under **The University of Burdwan**, as per the extant Ph.D regulations of the BU and UGC as adopted by the BU to be amended time to time.
4. In the research publications published from the thesis work of the candidate registered with the **University of Burdwan**, the affiliation of the concerned student should appear as **The University of Burdwan** and **Zoological Survey of India**.
5. Joint Research activities, developing research projects, funding, organising and participating in conferences, academic meetings, courses, seminars, symposia and lectures will be undertaken with due acknowledgement to both institutions.
6. Exchange of biological materials will be subjected to provisions under the Biodiversity Act (2002) and or any other such legal bindings by the Govt. of India.
7. Under this agreement, there will be no financial liability on **The University of Burdwan** or on the **Zoological Survey of India** from either side.

Article 2

The exchange programmes and/or projects are not intended to be legally binding documents. They are meant to describe the nature and suggest the guidelines of the programme or project. Nothing, therefore, shall diminish the full autonomy of either university/ institution, nor will any constraint be imposed by either upon the other carrying out the agreement.

Dr. Dhriti Banerjee
डॉ. धृति बैनर्जी
Dr. Dhriti Banerjee
 निदेशक / Director
 भारतीय प्राणि सर्वेक्षण
Zoological Survey of India
 प.व.एच.ब. प. मंत्रालय, भारत सरकार
MoEF&CC, Govt. of India
 कोलकाता / Kolkata-700053

Sujit Kumar Chandra



Article 3

In order to carry out and fulfil the goals of this agreement both **The University of Burdwan** and **Zoological Survey of India** shall designate a programme coordinator to develop and co-ordinate the specific programmes and projects agreed upon. The programme coordinators will be responsible for the evaluation of activities under this agreement. Letters of agreement will be approved by both sides according to the normal procedures adopted by the signatory parties.

Article 4

This MoU will come into force upon affixing of the signatures of the representatives of the both organizations and will remain in effect for five (5) years. This MoU will be renewed upon its expiry, as per mutual agreement of both organizations. If either organization wishes to terminate the MoU at the end of the five years period or in between the period of five years, it must notify the other organization not less than six months prior to the expiry of the MoU. The event of termination will not affect participants from completing their activities at the host institution already initiated or ongoing unless otherwise mutually agreed. Modifications to MoU will be made by mutual consent and any amendment or extension to the MoU will be formalized by the exchange of letters and or emails between the two institutions.

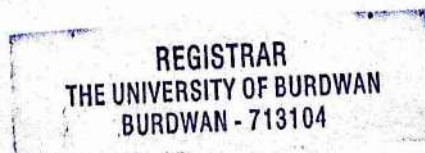
Article 5

In the event of any unforeseen issues or matters not covered herein or any controversy, dispute or difference arising out of or in connection with this MoU, the same shall be resolved amicably by both the organizations. This MoU and further agreements will in all respect be governed by and construed in accordance with the laws of Govt. of India. This MoU shall be signed in counterpart. Each counterpart will constitute an original document

Page 5 of 6


डॉ. धृति बैनर्जी
Dr. Dhriti Banerjee
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Zoological Survey of India
प.व.एल.ब.प. मंत्रालय, भारत सरकार
MoEF&CC, Govt. of India
कोलकाता / Kolkata-700053


Sujit Kumar Chowdhury



and these counterparts taken together, shall constitute *one and the same* MoU.

As witness to their consent to this agreement, the *appropriate authorities* here unto provide their signatures.

For the Zoological Survey of India,
Kolkata, India

For The University of Burdwan,
Burdwan, India

Director (as the case may be)

Registrar (as the case may be)

Dr. Dhriti Banerjee

Dr. Dhriti Banerjee
Director
Zoological Survey of India
Kolkata

डॉ. धृति बैनर्जी
Dr. Dhriti Banerjee
निदेशक / Director
भारतीय प्राणि संरक्षण
Zoological Survey of India
प.व. एवं ज. प. मंत्रालय, भारत सरकार
MoEF&CC, Govt. of India
कोलकाता / Kolkata-700053

Dr. Sujit Kumar Choudhury

Dr. Sujit Kumar Choudhury
Registrar
The University of Burdwan
Burdwan

Date: 01.07.2023

REGISTRAR
THE UNIVERSITY OF BURDWAN
BURDWAN - 713104

Witness 1: *Gopal*

DR. GURUPADA MANDAL
SCIENTIST - 'E' M.Sc., Ph.D
GOVT. OF INDIA
MINISTRY OF ENV. FORESTS & CLIMATE CHANGE
ZOOLOGICAL SURVEY OF INDIA
M - BLOCK, NEW ALIPORE, KOL - 53

Witness 2: *Anaspar*

Dr. Anaspar Naskar
Scientist 'C'
Zoological Survey of India
Ministry of Environment, Forest
& Climate Change
Kolkata - 700053

Witness 1: *Sanjoy Podder*

Dr. SANJOY PODDER
Professor & Head
Department of Zoology
The University of Burdwan
Golapbag, Burdwan-713104

Witness 2: *A. Mazumdar*

Dr. A. Mazumdar
Professor
Department of Zoology
The University of Burdwan
Burdwan-713104, W.B., India





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भारतीय आयुर्विज्ञान अनुसंधान परिषद INDIAN COUNCIL OF MEDICAL RESEARCH

वी. रामलिंगस्वामी भवन, अन्सारी नगर, पोस्ट बॉक्स 4911, नई दिल्ली - 110 029
 V. RAMALINGASWAMI BHAWAN, ANSARI NAGAR, POST BOX 4911, NEW DELHI - 110 029

F. No.:- 52/10/2022-BIO/BMS

Date: 17.09.2024

To

The Registrar,
 University of Burdwan,
 Rajbati, Burdwan West Bengal-713104

The project entitled "Decoding the role of the transcription factor, Sterol Regulatory element Binding Protein during hepatic stellate cell activation under Dr. Survo Chatterjee, University of Burdwan, Rajbati, Burdwan West Bengal-713104

Sir/Madam,

The Director General of the ICMR sanctions the above mentioned research scheme initially for a period of **One Year** with effect from **20.11.2023** subject to extension up to the total duration as specified in para five below :-

The Director General of the Council also sanctions the budget allotment of **Rs. 11,92,227 /-**

as detailed in the attached statement for the period from **20.11.2023 to 19.11.2024** grant-in-aid will be given subject to the following conditions.

1. The payment of the grant will be made in lump-sum to the Head of the Institute. The first instalment of the grant will be paid generally as soon as report regarding appointment of the staff is received by the Council. The Staff appointed on the project should be paid as indicated in the budget statement.
2. The staff on the project will be recruited as per the rules and procedure of the host institute and second part of the undertaking be obtained from the employees of the project. The staff grant will not be released unless the required undertaking [part-II] from Head of the Institute is received in this office.
3. The Host Institute shall utilize the grant after following the provisions laid down in the GFRs 2017 and TA rules. The demand for payment of the subsequent instalment of the grant should be placed with the Council in the prescribed Performa. The approved duration of the scheme is **Three Years**. The annual extension will be given after review of the work done on the scheme during the previous year.
4. Five copies of the annual progress report in the attached prescribed Performa should be submitted to the ICMR every year after completion of ten months of the project giving complete actual details of the research work done. Failure to submit the report in time may lead to termination of project.
5. Subject to the condition that the grant will be utilize after following the provisions laid down in the GFRs-2017 & TA Rules. Please keep the fund in a separate Saving Bank Account opened for ICMR funded Research Projects so that interest earned thereon is credited in to this account.

The receipt of this letter may please be acknowledged.

Yours faithfully,

Sr. Admn. Officer
 for Director General

Copy together with a copy of the budget statement forwarded to information to :-

Accounts - V

1. Dr. Madan Kumar Perumal, Scientist, Deptt. Of Biochemistry, CSIR-Central Food Technological Institute (CSIR-CFTRI) MYSURU- 570020.
2. Dr. Survo Chatterjee, University of Burdwan, Rajbati, Burdwan West Bengal-713104
3. IRIS ID :- 2021-8886

Sr. Admn. Officer
 for Director General



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वी. रामलिंगस्वामी भवन, अन्सारी नगर, पोस्ट बॉक्स 4911, नई दिल्ली - 110 029
 V. RAMALINGASWAMI BHAWAN, ANSARI NAGAR, POST BOX 4911, NEW DELHI - 110 029

F. No. :- 52/10/2020-BIO/BMS

Date: 17.09.2024

The project entitled "Decoding the role of the transcription factor, Sterol Regulatory element Binding Protein during hepatic stellate cell activation under Dr. Survo Chatterjee, University of Burdwan, Rajbati, Burdwan West Bengal-713104

MEMORANDUM

The Director General of the ICMR sanctions grant of Rs. 11,92,227 /-(Rupees Eleven Lakh, Ninety Two Thousand Two Hundred and Twenty Seven only) as the 1st & 2nd instalment of 1st year grant for the period from 20.11.2023 to 19.11.2024 for incurring expenditure in connection with the above mentioned project.

The amount of Rs. 11,92,227/- may be debited under the provision made of Rs. 11,92,227/- on the above mentioned research project for the year 2023-2024.

A formal bill for Rs.11,92,227/- is sent herewith for payment released by NEFT/RTGS of Rs. 11,92,227/- in favour of the Registrar, University of Burdwan, Rajbati, Burdwan, West Bengal-713104 is issued with the concurrence of the Finance Division, RFC No. BMS/Adhoc/09/2023-2024 dated 26 Sep. 2023, RFC Register for the FY 2023-2024

Project technical support-III for 3 year @28,000/- + HRA 9% = 2520/-	3,66,240
Equipment	2,50,000
consumables	4,00,000
Contingency	1,00,000
Travel	50,000
Over Head(3%)	25,987
Total	11,92,227

17/09/24
 Sr. Admn. Officer
 for Director General

Copy to:-

1. The Registrar, University of Burdwan, Rajbati, Burdwan West Bengal-713104
2. Dr. Madan Kumar Perumal,,CSIR-Central Food Technological Institute (CSIR-CFTRI), MYSURU-570020.
3. Dr. Survo Chatterjee, University of Burdwan, Rajbati, Burdwan, West Bengal-713104
4. Accounts – V
5. IRIS ID :- 2021-8886

Sr. Admn. Officer
 For Director General

Poa leptoclada (Poaceae) - An Afro-Arabian species: First record from India for South Asia

Althaf Ahamed Kabeer K¹, Ravikiran Arigela², Ruma Bhadra^{3*}, J.H.F. Benjamin⁴, Saikat Naskar⁵ and P.V. Prasanna⁶

¹Botanical Survey of India, Central Botanical Laboratory, P.O. Botanic Garden, Howrah - 711103, West Bengal, India

²Botanical Survey of India, Deccan Regional Centre, Rooms 228-238, Kendriya Sadan, Sultan Bazar, Koti, Hyderabad – 500095, Telangana, India

³Botanical Survey of India, Central National Herbarium, P.O. Botanic Garden, Howrah - 711 103, West Bengal India

⁴Botanical Survey of India, Sikkim Himalayan Regional Centre, P.O. Rajbhawan, Gangtok - 737 103, Sikkim, India

⁵Department of Botany, The University of Burdwan–703 104, West Bengal, India

⁶C-109, Cyber-e-park, Alkapur, Puppallaguda Manikonda, Hyderabad–500 089, Telangana, India

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पोआ लेप्टोक्लेडा (पोएसी)- एक अफ्रीकी-अरबियन प्रजाति: दक्षिण एशिया के लिए भारत से प्रथम आलेख

अल्ताफ अहमद कबीर के, रविकिरण अरिगेला, रुमा भद्रा, जे.एच.एफ. बेंजामिन, सैकत नसकर एवं पी. वी. प्रसन्ना

सारांश

पोआ लेप्टोक्लेडा होच्ट, एक्स ए. रिच. को तमिलनाडु में पलनी हिल्स स्थित कोडैकनल वन्यजीव अभयारण्य से संग्रहीत किया गया है और इसे दक्षिण एशिया के संकलन में शामिल किया गया है। इस जाति का विस्तृत बाह्य आकृतिकी, क्षेत्रात्मक वितरण तथा फोटो- प्लेट इस शोध में उल्लेख किया गया है।

ABSTRACT

Poa leptoclada Hochst. ex A. Rich., collected from Kodaikanal Wildlife Sanctuary, Palni Hills, Tamil Nadu is reported here as addition to South Asia. Detailed exo-morphology, distribution and plate are provided.

Keywords: New Record, *Poa leptoclada*, Poaceae, Tamil Nadu, South Asia

INTRODUCTION

The genus *Poa* L. (Linnaeus, 1753) belongs to the subfamily Pooideae, supertribe Poodae, tribe Poeae and subtribe Poinae (Soreng & al., 2017) consists 580 species (Soreng & al., 2020) and distributed worldwide in Temperate to Subarctic & Subantarctic and Mountains of Tropics (Clayton & al., 2020). In India, out of 67 taxa (64 spp., 02 subsp. and 01 var. (Prasanna & al., 2020) of *Poa* known to occur, 5 species are reported from Tamil Nadu (Kabeer & Nair, 2009) -*P. annua* L., *P. gamblei* Bor, *P. nemoralis* L., *P. stapfiana* Bor

and *P. trivialis* L. Intensive plant explorations at Kodaikanal WLS, Palni Hills (Western Ghats), Tamil Nadu conducted under the BSI action plan project, yielded a taxon of *Poa*, hitherto unidentified and not reported. Critical study on morphological characters, thorough characterization, herbaria consultation, literature survey (Richard, 1850; Clayton, 1970; Phillips, 1989; Soreng & al., 2020) and type specimen consultation, confirmed the specimen as *Poa leptoclada* Hochst. ex A. Rich. Incidentally, Matthew (1999) collected 13 specimen of *Poa* from Palni Hills. Though his provided description and illustration resemble the

Lectotypification of the Names of *Poa stapfiana* (Poaceae) and Its Variety

Ruma BHADRA¹, P. V. PRASANNA², K. Althaf Ahamed Kabeer³
and Saikat NASKAR^{4,*}

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³Botanical Survey of India, Central Botanical Laboratory,
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*Corresponding author: saikatnaskar@rediffmail.com

(Accepted on April 25, 2022)

The new name *Poa stapfiana* Bor (Poaceae) was proposed for a later homonym *P. tremula* Stapf, non Lam. Bor also proposed a new combination of the variety *P. stapfiana* var. *micranthera* (Stapf) Bor based on *P. tremula* var. *micranthera* Stapf. The names of *P. stapfiana* Bor and *P. stapfiana* var. *micranthera* (Stapf.) Bor are lectotypified here from original material for their precise application.

Key words: India, lectotype, *Poa stapfiana*, *Poa stapfiana* var. *micranthera*.

Poa stapfiana Bor (1949: 239) is widely distributed from Iran and Pakistan to the Eastern Himalayas, including Nepal and Tibet (Clayton et al. 2021) though Zhu et al. (2006) could not confirm its occurrence in Tibet may be in the absence of any recent collections. Zhu et al. (2006) placed this species under *Poa* L. sect. *Homalopoa* Dumort., which was later shifted to *Poa* subgen. *Poa* supersect. *Homalopoa* (Dumort.) Soreng & L.J. Gillespie (Gillapsie et al. 2007: 432). Zhu et al. (2006) stated that *P. stapfiana* has a close affinity with *P. himalayana* Steudel (1854: 256) and *P. hirtiglumis* Hook.f. (1896: 343). The main difference between *P. stapfiana* and *P. himalayana* is that the former one has a longer ligule whereas the latter one has a very short ligule. In addition, *P. stapfiana* mainly

differs from *P. hirtiglumis* by having lower glume shorter than the lowest lemma and leaf sheath shorter than leaf blade, whereas, in *P. hirtiglumis*, the lower glume and leaf sheath is longer than the lowest lemma and leaf blade, respectively.

Stapf (1896) described *P. tremula* Stapf and its variety *P. tremula* var. *micranthera* Stapf. The species was based on the collections mentioned in the protologue as “TEMPERATE & ALPINE HIMALAYA; from Kashmir, alt. 8–15000 ft., Jacquemont, &c., to Garwhal, Duthie. WESTERN TIBET; Ladak, Thomson, Schlagintweit”. Stapf also indicated the specimens as “*P. altaica*, Munro in Herb. Jacquemont (n. 277). *P. nepalensis*, & *nemoralis*, Herb. Ind. Or. Hf. & T. (in part). *P. trivialis* Griseb. in Goett. Nachr. (1868) 75;



Lectotypification of names of three species of *Poa* (Poaceae) and their morphological affinities

RUMA BHADRA¹, P. V. PRASANNA² & SAIKAT NASKAR^{3*}

¹ Botanical Survey of India, Central National Herbarium, P.O. Botanic Garden, Howrah –711 103, West Bengal, India

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Abstract

Poa aitchisonii, *P. falconeri* and *P. wardiana* are lectotypified with nomenclatural notes. In absence of proper icons with analysis, worked out plant parts of two species from voucher specimens are provided as photoplates. Due to high degree of variability and in absence of concrete morphological features to distinguish species, morphological affinities of the three species with that of other close species are provided.

Keywords: India, lectotypification, *Poa aitchisonii*, *P. falconeri*, *P. wardiana*

Introduction:

With over 500 species, the *Poa* Linnaeus (1753: 67) is one of the largest genus within Poaceae. Gillespie & Soreng (2005) indicated 575 species of *Poa* which are distributed worldwide in temperate, boreal, and arctic habitats and in many regions a high degree of its endemism is evident. According to Clayton *et al.* (2020+), 63 species of *Poa* occur in Indian subcontinent of which 13 species are endemic to this region. Bor (1952a, 1952b) reported 49 species of *Poa* in his revisionary work on the genus in India where he included some species which occur nearing the border areas of India in other countries (Afghanistan, Bhutan, China, Nepal and Pakistan) to assume that sooner or later these species will be recorded from Indian territory as there has no physical barrier to prevent their dispersal. In India, the species of *Poa*, mainly occur in high altitudes of Himalaya, Khashi hills and Western Ghats.

After a gap of almost 70 years, we have initiated revisionary work on *Poa* in India under the *Flora India Project*. In the meantime some works (Chowdhery & Wadhwa 1984, Karthikeyan *et al.* 1989, Gaur & Nautiyal 1995, Gaur & Nautiyal 1996, Hajra & Verma 1996, Gaur & Nautiyal 1997, Kandwal *et al.* 2003, Kandwal & Gupta 2009, Nautiyal & Gaur 2017) also focused on the species of *Poa* in India without sufficient detailing especially for nomenclatural issues and typification. Besides, Rajbhandari (1991) also dealt with Himalayan *Poa* and provided a descriptive and illustrative account of the species but did not explicitly cite the type specimens of the names except for few without proper justifications. Recently, Kellogg *et al.* (2020) have prepared a ‘Checklist of the grasses of India’ but it lacks any new lectotype designation of the species of *Poa*.

The widespread occurrences of apomixis and introgression in *Poa* make it a taxonomic difficult genus (Bor 1952a). Soreng (1990) assumed that many species are possibly of hybrid origin. Extensive polyploidy and hybridization added to a few useful morphological characters making *Poa* taxonomically very complicated (Gillespie & Soreng 2005). Gillespie & Boles (2001) also found significant infraspecific cpDNA variation in some species. Hitherto, no morphological basis of classification of *Poa* of the world is available since no one person involved in the revision of the *Poa* from the world (Gillespie & Soreng 2005). Bor (1952a) proposed 14 sections of Indian *Poa* based on morphological parameters. Gillespie & Soreng (2005) recognized three subgenera within *Poa* to make the genus monophyletic based on a molecular phylogenetic study. They take into consideration only 98 species and significant omission of Indian taxa. Consequently, the species of *Poa* in India are principally unplaced in phylogenies.

Водные биоресурсы и среда обитания

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Биология и экология гидробионтов

УДК 504.064.36:574

PHYTOPLANKTON-BASED BIOMONITORING IN ASSESSING THE POLLUTION LEVEL OF A LENTIC FRESHWATER BODY IN HOOGHLY DISTRICT, WEST BENGAL, INDIA

© 2020 S. Pore¹, S. Ghosh², J. P. Keshri³, S. S. Barinova^{4*}¹*Bandel Vidyamandir High School, India*²*Mahadevananda Mahavidyalaya of the West Bengal State University, India*³*CAS, The University of Burdwan, India*⁴*Institute of Evolution, University of Haifa, Haifa 3498838, Israel**E-mail: sophia@evo.haifa.ac.il

Abstract. Phytoplankton is the base of every aquatic food web. During the assessment of the trophic status of the investigated lentic water body (within Lake City Housing Complex, Mankundu, Hooghly, West Bengal, India), phytoplankton composition and its temporal variation are proved to be the most important. In this study, 30 phytoplankton taxa have been recorded in various arrangements throughout the season. The maximum number of phytoplankton species with the highest Shannon–Weaver diversity index value represented the pre-monsoon season, whereas the least number of phytoplankton taxa and the lowest diversity indicators characterized the post-monsoon season. The development of algal bloom by one specific taxon, *Botryococcus braunii*, in the post-monsoon season indicates the change in the trophic status of this particular water body. As a criterion for the beginning of the algal bloom, an exceedance of 1 mg/L in nitrate concentration can be considered. The phytoplankton composition, values of various diversity indices, its density and species distribution pattern, and selected environmental parameters have been investigated, as well as the results of the analysis of rank abundance curves, which allowed for evaluation of the ecological status of this lentic water body. This study describes the change or shift in the ecosystem of the investigated water body towards eutrophication and establishes its pollution level as moderate to light.

Keywords: phytoplankton, diversity, biomonitoring, climatic seasons, West Bengal, India

sl.no. 53

Effective lectotypification of three names in *Poa* (Poaceae), proposed by N.L. Bor

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Bhadra R., Naskar S., Kabeer A.A. & Prasanna P.V. 2023: Effective lectotypification of three names in *Poa* (Poaceae), proposed by N.L. Bor. — *Ann. Bot. Fennici* 60: 197–201.

Poa asperifolia Bor, *P. lhasaensis* Bor and *P. nitidespiculata* Bor are lectotypified (second-step lectotypification), as Norman L. Bor cited gatherings rather than a single specimen as their type. Notes are given to clarify the rationale of the second-step lectotypifications.

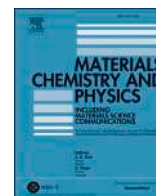
The genus *Poa* (Poaceae) comprises over 580 species (Soreng *et al.* 2020) distributed worldwide from temperate to subarctic and subantarctic zones, and in the mountains of the tropics (<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:30001404-2>). Norman Loftus Bor (1893–1972), an Irish-born British botanist who served in Indian Forest Service from 1921 to 1948 (Stafleu & Mennega 1993), described 16 genera, 188 species and 25 infraspecific taxa in the family Poaceae, including 31 species in *Poa*, 20 of which are from India (https://www.ipni.org/?f=f_specific&q=family%3APoaceae%7Cgenus%3APoa%7Cname%20author%3ABor). While revising the genus *Poa* in India, we found that three *Poa* species described by Bor, viz. *P. asperifolia*, *P. lhasaensis* and *P. nitidespiculata*, required a second-step lectotype designation according to Art. 9.17 of Turland *et al.* (2018), as Bor indicated gatherings rather than a single specimen as their type. We obtained

the protologues from BHL (<https://www.biodiversitylibrary.org>). Information on Bor and his collections were obtained from TL-2 (<https://www.sil.si.edu/DigitalCollections/tl-2/browse.cfm?vol=9#page/337>). Type specimens from CAL (sheets), DD (sheets) and K (digital images) were consulted. Lectotypes (second-step) were designated following Turland *et al.* (2018). Herbarium acronyms follow *Index Herbariorum* (<https://sweetgum.nybg.org/science/ih/>).

Poa asperifolia Bor

Kew Bull. 7: 130. 1952. — TYPE: China. Xizang, Pemba La, 10–15 miles north of Lhasa, September 1904 H.J. Walton s.n. — LECTOTYPE (designated here): K barcode K000789517 image! (Fig. 1); isolectotypes: CAL barcodes CAL0000002469! & CAL0000033988!, K barcodes K000789516 image! & K000789518 image!.

Bor (1952: 130) described *P. asperifolia* based



Improved thermoelectric performance of nanostructured Bi₂Te₃ fabricated by solvent-free mechanical alloying

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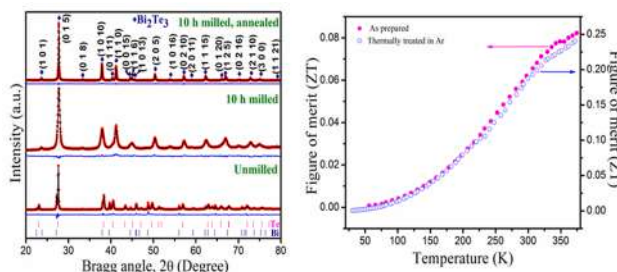
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sl.no. 54

HIGHLIGHTS

- Nanostructured Bi₂Te₃ has been synthesized by facile mechanical alloying method.
- Microstructures of the samples are characterized by XRD and FESEM.
- The semiconducting nature of the sample changes to metallic after annealing.
- Grain growth and associated band gap reduction is noticed after annealing at 573K.
- About three times increase in thermoelectric figure of merit owing to annealing.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:

Nanostructures
Microstructure
X-ray diffraction
Thermoelectrics

ABSTRACT

Thermoelectric materials convert waste heat energy efficiently to electricity in an eco-friendly manner. Bi₂Te₃ is a known thermoelectric material, which can convert waste heat and solar energy into electricity in the 200–400 K temperature range. Bi₂Te₃ nanocrystals are prepared in powder form by solvent-free mechanical alloying of elemental Bi and Te powder mixtures under an inert Ar atmosphere. The crystallite size and composition of the Bi₂Te₃ nanocrystals are analyzed using X-ray diffraction, field-emission scanning electron microscope and energy-dispersive X-ray spectroscopy. Thermal and electrical behaviours and the effect of thermal annealing are studied on the 10 h ball-milled sample in a physical properties measurement system in the 30–375 K temperature range. It is observed that the high-temperature thermal annealing induces significant grain growth, reduces lattice strain, along with a reduction of bandgap energy of the mechanically alloyed Bi₂Te₃ nanostructures. Thermoelectric properties and the figure of merit of the nanostructures have improved significantly upon thermal annealing. Enhanced thermoelectric performance of the annealed nanostructures has been explained considering the change in their thermal conductivity, electrical resistivity, and crystallite size induced by thermal treatment.

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Grain size mediated electrical and thermoelectric performances of mechanically alloyed Sb_2Te_3 nanoparticles

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Mechanical alloying

Sintering

Microstructure

X-ray diffraction

Thermoelectric properties

ABSTRACT

Antimony telluride (Sb_2Te_3) nanoparticles of different sizes were fabricated by mechanical alloying (MA) of elemental Sb and Te powders for different durations. The powder nanostructures were pelletized, annealed in Ar ambient, and characterized by XRD, FESEM, TEM to study the effect of milling time and thermal treatment on particle size, grain growth, and crystallinity. The annealed and unannealed pelletized nanostructures were analyzed in a PPMS to study the effect of grain growth on their electrical and thermoelectric properties. Room temperature electrical conductivity of the p-type semiconductor nanostructures improved significantly (from $\sim 10^3$ to $\sim 10^5$ mho/m) due to thermal annealing and results in the considerable improvement in thermoelectric figure of merit (ZT). Thermal annealing-induced grain growth also transforms the semiconducting nature of the sample to metallic. The reduced thermal conductivity of the nanostructures with reduced grain size improves the ZT. The temperature-dependent Lorenz number ($L_{\text{effective}}$) is used to find the electronic contribution of total thermal conductivity, and it is explained by the non-parabolic Kane model.

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1. Introduction

Thermoelectric materials are efficient converters of waste heat into useable electrical energy due to their high Seebeck coefficients [1,2]. Thermoelectric figure of merit ZT defines the performance of a thermoelectric material in converting thermal energy to electricity. The ZT is defined as, $ZT = S^2\sigma T/K$, where S , σ , and K represent the Seebeck coefficient, electrical conductivity, the thermal conductivity of the material, respectively, and T is the temperature in K [3]. The $S^2\sigma$ term is defined as the power factor. Owing to the demand for alternative energy sources, the quest for new materials with an improved figure of merit (ZT) has increased globally at a rapid rate [4,5].

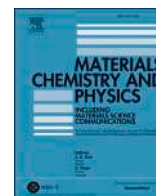
In general, semiconductors are better thermoelectric materials compared to metals [6]. According to Wiedemann-Franz law [7], most metals have a nearly constant electrical to thermal conductivity ratio, and increasing electrical conductivity is difficult without increasing their thermal conductivity. However, a good ZT value requires a high electrical conductivity and simultaneously a lower thermal conductivity. Hence, for metals or metallic alloys, the

only possible way to obtain a significant figure of merit is to have a high value of the Seebeck coefficient. Unfortunately, most metals show very small Seebeck coefficients (~ 10 $\mu\text{V/K}$), and their thermoelectric efficiencies are only fractions of a percent. On the other hand, semiconductors with comparatively higher Seebeck coefficient values (~ 100 $\mu\text{V/K}$) had drawn strong attention as thermoelectric materials since 1920 [8]. Low bandgap semiconductors possess high electrical conductivity, comparable to metals. Compared to bulk materials, nanomaterials have low thermal conductivity because of lower lattice thermal conductivity resulting from the increased phonon scattering due to smaller grain size [9–12]. Thus, nanostructured semiconductors of smaller bandgaps are considered the most favorable thermoelectric materials as they produce a reasonably higher figure of merit values.

Antimony telluride (Sb_2Te_3), a low bandgap semiconductor, has been considered as one of the promising thermoelectric materials for low-temperature applications [13–15]. Nano-structured Sb_2Te_3 thin films fabricated by physical vapor deposition [16], metal-organic chemical vapor deposition [17,18], thermal co-evaporation [19], flash evaporation [20], electrochemical method [21], ion beam sputtering [22], molecular beam epitaxy [23] etc. have shown good thermoelectric conversion efficiency. On the other hand, single-phase Sb_2Te_3 nanoparticles synthesized by microwave-assisted

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Microstructural, electrical and mechanical characterizations of green-synthesized biocompatible calcium phosphate nanocomposites with morphological hierarchy

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sl.no. 55

^a Department of Physics, National Institute of Technology, Durgapur, 713209, India

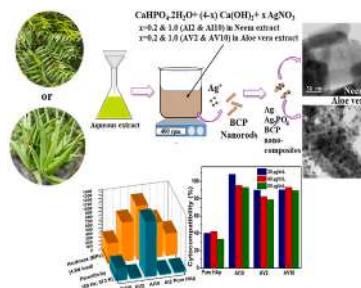
^b Materials Science Division, Dept. of Physics, The University of Burdwan, Golapbag, Burdwan, 713104, India

^c Department of Biotechnology, National Institute of Technology, Durgapur, 713209, India

HIGHLIGHTS

- Ag–Ag₃PO₄–BCP nanocomposites hydrothermally synthesized in neem and aloe vera media.
- Epitaxial attachments of metallic phases to mesoporous uniaxial BCP nanorods.
- Biocompatibility and stability up to high dosage for 72 h studied on healthy cells.
- High interfacial polarization and surface charge retention ability for osteoconduction.
- Bulk porosity and unique structure-dependent dielectric and mechanical properties.

GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:

Nanocomposites
Electron microscopy
Porosity
Dielectric properties
Impedance
Mechanical properties

ABSTRACT

The present work reports the development of novel ternary silver-silver phosphate-biphasic calcium phosphate nanocomposites by plant-extract mediated hydrothermal route. Unique epitaxial morphological growth of the Ag–Ag₃PO₄ core-shell structure influences the internal grain-grain boundary arrangement. The green-assisted development of the constituent phases helps significant biocompatibility enhancement (~89–93% for 50 µg/mL; 72 h). Hence long-term bone-replacement purposes and polar fluid osmosis are favorable due to higher cell attachment on the rough surface of the mesoporous nanocomposites. The heterogeneous attachment between the three phases creates defect states indicating intense interfacial polarization, as elucidated by the dielectric spectroscopic studies. The surface charge essential for bone regeneration is likely to be developed. Besides, the porous nanocomposite compacts exhibit superior phase-composition-dependent mechanical (Hardness ~1.3 GPa; load 4.9 N) and dielectric properties (permittivity $\sim 1.2 \times 10^3$; 200 Hz, 613 K) helping in conduction through bones. Thus the green-synthesized ternary nanocomposites exhibit the essential aspects of a promising bone-implant material.

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Senior Member, URSI; Fellow, IETE; Member, ASI; IGSS
Chairman, IETE Burdwan Sub Centre
Principal Investigator, ITR-DRDO sponsored Project
Convenor, Industry-Institute Partnership Cell (IIPC)

The University of Burdwan
Vice-Chancellor's Secretariat
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Memo No. FI-1198 Date 31/03/21



No: AB/ 2021/17

sl.no. 56

To
The Registrar
The University of Burdwan
Rajbati, Burdwan 713 104

Through: Head of the Department of Physics, The University of Burdwan

Sub: Offer from M/S NTLab, Belarus for providing hardware support for Research

Dear Sir,

This is for your kind information and necessary action please. M/S NTLab having their Head Office at 4th floor, 41 Surganova str., 220013 Minsk, Republic of Belarus is a major manufacturer of GNSS hardware including NavIC. We have contact with M/S NTLab as a vendor and knowing our expertise in the field of GNSS/ NavIC research, they offered for collaborative research and signing of MoU. The proposal for signing of MoU has been sent to Govt of West Bengal for necessary approval.

Recently, M/S NTLab has sent us an offer to provide us few hardware free of cost as a part of active cooperation (email dt 26 March, 2021 is attached along with). They have offered us to provide NTL 102.1, NTL 103.1, NTL 107 and NTL Eva Boards complimentary for research. In a subsequent email dt 30 March, 2021 they also offered to pay the delivery cost. For the purpose we only need to send them a formal letter requesting for free samples of the above-mentioned modules.

It would be beneficial for us and the researchers if we get the modules for our research because, as of now, NTLab is the only manufacturer of L5+S Band compact NavIC modules and the cooperation would support our research. In this respect, I would request you to:

Kindly approve the proposal for receiving the complimentary hardware from M/S NTLab, so that I can send the formal letter requesting them to send free samples of the modules.

I hope, you will kindly consider the proposal and would permit us favourably.

With best regards,

Encl: a.a.

Sincerely Yours

Anindya Bose
(Anindya Bose)

DR ANINDYA BOSE
SENIOR SCIENTIFIC OFFICER
DEPARTMENT OF PHYSICS
BURDWAN UNIVERSITY, GOLAPBAG
BURDWAN-713 104, INDIA

Approved
31.03.2021
Professor & Head
Department of Physics
The University of Burdwan
Burdwan-713104

Hon'ble V.C.
"A" - May be permitted.
31.03.2021

F.O.
Please opine
31.03.21

Physics Department, Burdwan University, Golapbag, Burdwan 713 104, INDIA
Cell: +91 94 34 00 44 78, FAX: +91 342 2530 452
Email: abose@phys.buruniv.ac.in; anibose@gmail.com; Twitter: @dranibose
Web: http://bugnss.in

NTLab is a fabless microelectronic company located at Belarus. If University policy permits free offer from foreign company, this is kindly may be permitted as proposed.
31.03.21
Hon'ble Vice-Chancellor pl.
Place before E.C.
31.03.21

SL NO. 31THE UNIVERSITY OF BURDWANExtract from the minutes of the meeting of the Executive Council held on 17.07.2020Item no-74

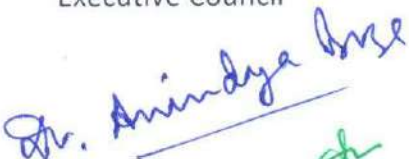
To consider the application of Dr Anindya Bose, Senior Scientific Officer, Department of Physics to consider the proposal for signing of Memorandum of Understanding and Collaboration with M/S NTLabsUAB, LITHUANIA for collaborative research work in radionavigation.

Resolution

The Council considered the application of Dr Anindya Bose, Senior Scientific Officer, Department of Physics to consider the proposal for signing of Memorandum of Understanding and Collaboration with M/S NTLabsUAB, LITHUANIA for collaborative research work in radionavigation. It was resolved that the proposal of signing of Memorandum of Understanding and Collaboration with M/S NTLabsUAB, LITHUANIA for collaborative research work in radionavigation be approved in principle and the matter be referred to the Higher Education Department, Govt. of West Bengal for necessary permission for the purpose.


Draft for approval


17.07.2020
Registrar (officiating) & Secretary
Executive Council


Dr. Anindya Bose


20/07/2020

Approved


17.07.2020
Vice-Chancellor & Chairman
Executive Council

SL NO. 56



Invoice

DATE	INVOICE NO
August 24, 2021	IC-D01-210824
DATE	PURCHASE ORDER NO
21 April, 2021	AB/ 2021/19

RECIPIENT:

Department of Physics, University of Burdwan,
Golapbag, Burdwan 713104, West Bengal,
INDIA
Attn.: Dr. Anindya Bose
Tel: M: +91 6295766760/ 9434004478

SHIPPER:

NTLab-IC, LLC
Tax ID number:191060307
415, No. 41, Surganova Str., 220013 Minsk,
Republic of Belarus
Tel.: +375 17 300 0408
Fax: +375 17 300 0444

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							NET	GROSS	
2	Promo sample of Demonstration Kit HTMP.468993.073 NTL107.2	8529909700	1	5.00	5.00	0.06	0.06	0.26	
GRAND TOTAL					5.00		0.06	0.26	1

Exactly Five US Dollars only.

FREE SAMPLE. VALUE FOR CUSTOMS PURPOSES ONLY.

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Delivery terms: CPT, Golapbag, Burdwan, INDIA (according to the Incoterms 2020)

Payment terms: FREE PROMO SAMPLES.

Country of origin: Belarus

Marking: NTLab

Reason for export: final shipment according to the "Request for free promo samples" No. AB/ 2021/19 dated 2 April, 2021 for using in the university as promotional demonstration sample.

I declare that the cargo transferred according to this invoice, are packed and handed over to the carrier in compliance with all safety rules. This cargo does not contain objects and substances that are prohibited for transportation by an aircraft (explosives, firearms and ammunition radioactive, corrosive, depriving of viability or capacity substances). The contents of the consignment fully comply with the enclosed documents. We are aware that incorrectly provided data on the nature of the cargo may be subject to administrative and criminal liability. In case of the dangerous goods transportation, all substances and components are declared in accordance with ICAO and IATA regulations. The airline or its agent has the right to inspect the cargo for hidden dangerous goods, request additional documents or refuse to transport the incorrectly declared cargo.

Production Deputy Director



Sergei Reutovich